The cost of a case of subclinical ketosis in Canadian dairy herds

Economic value of ionophores and propylene glycol to prevent disease and treat ketosis in Canada

Comparison of intraoperative and postoperative pain during canine ovariohysterectomy and ovariectomy

Evolution of *in vitro* antimicrobial resistance in an equine hospital over 3 decades

Presumed masitinib-induced nephrotic syndrome and azotemia in a dog

Hypoadrenocorticism mimicking protein-losing enteropathy in 4 dogs

Total laryngectomy for management of chronic aspiration pneumonia in a myopathic dog

*Citrobacter freundii* induced endocarditis in a yearling colt

Equine motor neuron disease in 2 horses from Saskatchewan

Diagnostic performance of an indirect enzyme-linked immunosorbent assay (ELISA) to detect bovine leukemia virus antibodies in bulk-tank milk samples

Congenital nutritional myodegeneration in a neonatal foal

2015 CVMA ANNUAL REPORT
RAPPORT ANNUEL 2015 DE L’ACMV
When you’re evaluating a diet, science matters. It matters to us, too. That’s why our NEW UR Urinary® Ox/St™ Canine Formula, along with our entire urinary therapeutic diet portfolio, is backed by a comprehensive dual-validation process, measuring both the concentration and activity of the minerals that produce sterile struvite and calcium oxalate crystals. It’s the nutrition your clients need, backed by science and expertise you can trust.

Learn more about our complete line at ProPlanVeterinaryDiets.ca
Available exclusively to members of the Canadian Veterinary Medical Association, the specialized CVMA Insurance Program offers the most comprehensive and cost-effective insurance protection for you, your practice and your employees.

Members save an average of 10% when joining either the Commercial Insurance or Employee Benefits programs!

866-860-CVMA (2862)
www.cvmainsurance.com
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
## CONTENTS

### SCIENTIFIC RUBRIQUE SCIENTIFIQUE

<table>
<thead>
<tr>
<th>Page</th>
<th>Title</th>
<th>Authors</th>
</tr>
</thead>
<tbody>
<tr>
<td>728</td>
<td>The cost of a case of subclinical ketosis in Canadian dairy herds</td>
<td>Khaled Gohary, Michael W. Overton, Michael Von Massow, Stephen J. LeBlanc, Kerry D. Lissemore, Todd F. Duffield</td>
</tr>
<tr>
<td>733</td>
<td>Economic value of ionophores and propylene glycol to prevent disease and treat ketosis in Canada</td>
<td>Khaled Gohary, Michael W. Overton, Michael Von Massow, Stephen J. LeBlanc, Kerry D. Lissemore, Todd F. Duffield</td>
</tr>
<tr>
<td>741</td>
<td>Comparison of intraoperative and postoperative pain during canine ovariohysterectomy and ovariectomy</td>
<td>Amanda Tallant, Barbara Ambros, Carol Freire, Sherisse Sakals</td>
</tr>
<tr>
<td>747</td>
<td>Evolution of <em>in vitro</em> antimicrobial resistance in an equine hospital over 3 decades</td>
<td>Annie Malo, Caroline Cluzel, Olivia Labrecque, Guy Beauchamp, Jean-Pierre Lavoie, Mathilde Leclere</td>
</tr>
<tr>
<td>761</td>
<td>Total laryngectomy for management of chronic aspiration pneumonia in a myopathic dog</td>
<td>Karen M. Vernau, Stanley L. Marks, Maggie A. Kuh, William T.N. Culp, Tammy J. Owens, G. Diane Shelton, Tausif Siddiqui, Rachel Pollard, Peter C. Belafsky</td>
</tr>
<tr>
<td>767</td>
<td><em>Citrobacter freundii</em> induced endocarditis in a yearling colt</td>
<td>Eleonora E.A. Guidi, Aurélie Thomas, Jean-Luc Cadoré, Agnès Benamou Smith</td>
</tr>
<tr>
<td>771</td>
<td>Equine motor neuron disease in 2 horses from Saskatchewan</td>
<td>Michelle L. Husulak, Katharina L. Lohmann, Kamal Gabadage, Chris Wojnarowicz, Fernando J. Marqués</td>
</tr>
</tbody>
</table>

### CASE REPORTS RAPPORTS DE CAS

<table>
<thead>
<tr>
<th>Page</th>
<th>Title</th>
<th>Authors</th>
</tr>
</thead>
<tbody>
<tr>
<td>752</td>
<td>Presumed masitinib-induced nephrotic syndrome and azotemia in a dog</td>
<td>Lauren Devine, David J. Polzin</td>
</tr>
<tr>
<td>757</td>
<td>Hypoadrenocorticism mimicking protein-losing enteropathy in 4 dogs</td>
<td>Janne G. Lyngby, Rance K. Sellon</td>
</tr>
<tr>
<td>687</td>
<td>QUIZ CORNER TEST ÉCLAIR</td>
<td></td>
</tr>
</tbody>
</table>

### BRIEF COMMUNICATION COMMUNICATION BRÈVE

<table>
<thead>
<tr>
<th>Page</th>
<th>Title</th>
<th>Authors</th>
</tr>
</thead>
<tbody>
<tr>
<td>778</td>
<td>Diagnostic performance of an indirect enzyme-linked immunosorbent assay (ELISA) to detect bovine leukemia virus antibodies in bulk-tank milk samples</td>
<td>Omid Nekouei, Jean Durocher, Greg Keefe</td>
</tr>
</tbody>
</table>

### STUDENT PAPER COMMUNICATION ÉTUDIANTE

<table>
<thead>
<tr>
<th>Page</th>
<th>Title</th>
<th>Authors</th>
</tr>
</thead>
<tbody>
<tr>
<td>781</td>
<td>Congenital nutritional myodegeneration in a neonatal foal</td>
<td>Jessie MacQuarrie</td>
</tr>
</tbody>
</table>
The only way to treat both obesity and arthritis is to work together.

PRESCRIPTION DIET®
Metabolic+Mobility

Meet the world’s only proven single solution for both. Together we can help all of your patients at risk.

For more information, talk to your Hill’s Veterinary Account Manager.

©2016 Hill’s Pet Nutrition Canada, Inc. ®/™ Trademarks owned by Hill’s Pet Nutrition, Inc.
Contents Table des matières

FEATURES RUBRIQUES SPÉCIALES

PRESIDENT'S MESSAGE LE MOT DE LA PRÉSIDENTE
681 Collaboration/Collaboration
Nicole Gallant

683 VETERINARY MEDICAL ETHICS DÉONTOLOGIE VÉTÉRINAIRE

703 2015 CVMA ANNUAL REPORT RAPPORT ANNUEL 2015 DE L’ACMV

VETERINARY PRACTICE MANAGEMENT GESTION D’UNE CLINIQUE VÉTÉRINAIRE
785 Veterinary diet pricing: Competing with the pet food store/Prix des aliments vétérinaires : comment faire concurrence aux animaleries
Chris Doherty

789 DIAGNOSTIC OPHTHALMOLOGY OPHTALMOLOGIE DIAGNOSTIQUE
Bianca S. Bauer, Bruce H. Grahn, Lynne S. Sandmeyer

BOOK REVIEW COMPTE RENDU DE LIVRE
746 Small Animal Soft Tissue Surgery, 2nd edition
Melissa Knowles

NOTICES ANNONCES

770 New Product
Nouveaux produit

756 Index of Advertisers
Index des annonceurs

791 Classifieds
Petites annonces

689 NEWS NOUVELLES
Heather Broughton, Isabelle Vallières

Contributors

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

Introducing Simparica™ (sarolaner) Chewables

Safe, monthly chewables for dogs that offer persistent protection from fleas and ticks. 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 ≥96.9% effective for 35 days against weekly reinfestations of 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. ©2016 Zoetis Inc. All rights reserved. SIM-002
DON'T LET TICKS AND FLEAS KEEP THEM APART.

Provide your canine patients with the tick and flea protection they need, with the extraordinary 12-week efficacy of BRAVECTO® Chewable Tablets.

BECAUSE THE BOND THEY SHARE IS EXTRAORDINARY...

BRAVECTO® is a registered trademark of Intervet International B.V. Used under license.
EXPECT THE EXTRAORDINARY™ is a trademark of Intervet International B.V. Used under license.
MERCK® is a registered trademark of Merck Canada Inc. © 2016 Intervet Canada Corp. All rights reserved.
CA/BRV/1215/0031
The world is becoming so much smaller and change continues to happen. As veterinarians, we must be ready to be part of these changes and not be left behind. Collaboration within our profession and with other stakeholders is absolutely necessary going forward. As I think of all the work over the last few years that resulted in the imminent changes in antibiotic stewardship, it is obvious that collaboration and communication among stakeholders must happen to achieve our future goals and ensure the voice of our profession is heard.

As veterinarians, we tend to be independent and that can work on a small scale. However, on the larger scale, I have learned that we must work together for the good of our profession and, dare I say, the good of humans also as we think of the “One Health” concept.

Last August I attended National Veterinarian Day in Mexico City. This was fascinating to watch. The country brings together veterinarians and those with whom they work, such as colleagues in the Department of Agriculture and other government officials. This large group then proceeds to celebrate all aspects of veterinary medicine together. We have work to do to get to this level of interaction in Canada, where things are still a bit fragmented with different veterinary and related groups. We must continue to work with other stakeholders, as we have so successfully done in bringing forward the changes in antibiotic usage. There will be many other issues to collaborate on, such as the evolving problem of rescue groups bringing in dogs from different parts of the world. Foreign diseases that these dogs can potentially introduce to our country, as well as the welfare concern for their transport are issues that require attention.

When compared to many countries, we are so fortunate to have the level of organized medicine that we have in Canada, but we still fall a bit short in some ways. Strong provincial associations are important as it is a national voice for the profession; one doesn’t negate the other. Collaboration and mutual understanding are crucial going forward as we become more involved in the international veterinary community. We can’t

Le monde rétrécit de plus en plus et les changements continuent de se produire. À titre de vétérinaires, nous devons être prêts à épouser ces changements afin de ne pas tirer de l’arrière. À l’avenir, la collaboration au sein de notre profession et avec d’autres intervenants sera absolument nécessaire. Je crois que le travail qui a été réalisé au cours des dernières années et qui a donné lieu à des changements imminents pour l’antibiogouvernance des antibiotiques témoigne du fait que les intervenants doivent collaborer et communiquer afin d’atteindre leur buts futurs et de veiller à ce que la voix de la profession soit entendue.

En tant que vétérinaires, nous avons tendance à être indépendants et cela peut fonctionner à petite échelle. Cependant, à grande échelle, j’ai appris que nous devons travailler ensemble pour le bien de notre profession et, j’oserais même dire, pour le bien des humains dans l’optique du concept d’« Une santé ».

En août dernier, j’ai assisté à la Journée vétérinaire nationale dans la ville de Mexico. C’était un événement fascinant à observer. Le pays rassemble les vétérinaires et les personnes avec qui ils travaillent, dont des collègues du ministère de l’Agriculture et d’autres représentants gouvernementaux. Ce grand groupe célèbre ensuite tous les aspects de la médecine vétérinaire ensemble. Nous devons travailler pour parvenir à ce niveau d’interaction au Canada, où la situation est toujours un peu fragmentée avec différentes groupes vétérinaires et autres regroupements connexes. Nous devons continuer de travailler avec les autres intervenants, comme nous l’avons fait avec tant de succès lors de la mise en œuvre de changements pour l’utilisation des antibiotiques. Il y aura beaucoup d’autres enjeux sur lesquels nous pourrions collaborer, comme le problème des groupes de secours qui amènent des chiens provenant de diverses régions du monde. Les maladies exotiques que ces chiens peuvent potentiellement introduire dans notre pays, ainsi que les préoccupations de bien-être relatives à leur transport, exigent notre attention.

Comparativement à de nombreux autres pays, nous sommes vraiment fortunés de posséder le niveau de médecine organisée

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.
continue to compete among ourselves. We all need members to exist but we must reach an understanding and vision of what is going on within and outside of Canada. The fact that Canada is well regarded internationally has become apparent to me in this past year and I thank you for the opportunity to see this international face of Canadian veterinary medicine. We are getting there; let’s work together to make organized veterinary medicine in Canada strong at all levels.

Nicole Gallant

que nous avons ici au Canada, mais certains secteurs présentent toujours des lacunes. Il est important de posséder des associations provinciales fortes et une voix nationale pour la profession et ces deux positions ne sont pas forcément contradictoires. La collaboration et la compréhension mutuelle représenteront des éléments cruciaux tandis que nous élargirons notre participation au sein de la collectivité vétérinaire internationale. Nous ne pouvons pas continuer à compétitionner entre nous. Nous avons besoin de la présence de tous les membres, mais nous devons aussi parvenir à une compréhension et à une vision de ce qui se passe à l’intérieur et à l’extérieur du Canada. Au cours de la dernière année, j’ai pu prendre connaissance du fait que le Canada possède une excellente réputation internationale et je vous remercie de l’occasion que vous m’avez accordée de voir ce visage international de la médecine vétérinaire canadienne. Nous nous approchons du but. Travaillons ensemble pour assurer la force de la médecine vétérinaire à tous les niveaux.

Nicole Gallant
Ethical question of the month — July 2016

A nearby successful veterinary practice provides state-of-the-art veterinary medicine and surgery to a large and dedicated clientele. This clinic also offers alternative therapies for conditions that do not respond to conventional treatments. In the past, these therapies were primarily vitamin and herbal products. Owners signed a consent form recognizing that the treatments were unconventional. There is no evidence that these therapies are effective but the clinic has not charged exorbitantly for these services and some of your best clients have gone to this clinic when you have had nothing left to offer but palliative care.

A board-certified surgeon at this clinic who performs complex orthopedic surgeries has recently begun to surgically implant special magnets and other “positive energy” devices in patients in which conventional therapies were ineffective. The implants are accompanied by vague claims that they “could help.” The practice charges several thousand dollars for these surgeries, but this deters fewer clients than you would have predicted. You believe this clinician is using the trust created through the success of his conventional treatments to convince clients to try expensive and unproven “alternative” therapies when in desperate straits. You tolerated the selling of false hope when it was low cost and non-invasive, but this new high cost and invasive approach troubles you. Are you justified in your change in attitude towards the unconventional treatments offered by this practice?

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.

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.

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.
as we have so often done in the past, it is helpful to hark back to some of the wisdom that may be found in the writings of Plato. Two related Platonic points are relevant here. When discussing the wise ruler, Plato makes the point that the job of a ruler, or for that matter, a shepherd, or a craftsman, comprises two distinct aspects: first and foremost one is obliged to improve and protect whatever one exercises one’s professional authority over — secondarily, one is functioning as a wage earner. As we pointed out in a recent column, a medical professional functions first and foremost to treat, fix, heal, and cure, and only, conceptually, secondarily and derivatively to make money.

I am reminded of the story told to me by my dear friend, veterinarian Brian Forsgren. Early on in his practice, an impoverished street person showed up at his clinic with a dog who had been run over by a truck and sustained a crushed pelvis. Dr. Forsgren asked when this occurred. The owner replied a few hours ago. Dr. Forsgren then asked why he had waited so long to seek help. The client responded that this had occurred miles away, and he had indeed approached the nearest veterinarian,
who had replied that it would cost many thousand dollars for
diagnostics and surgical treatment, and that nothing could be
done for less. Brian pondered the absurdity of the previous cli-
nician’s narrative. He pointed out that he could cast the animal
for a few hundred dollars. He did so, and the animal recovered
well. He then resolved to help financially challenged people treat
their animals as his life’s work. “After all, who could be myopic
enough to think that a poor person’s animal meant less to them
than a rich person’s?” Gratifyingly, he built a very successful
practice. He is currently in semi-retirement, and continues to
stress to his peers the need to place care and empathy before
financial limitations.

The lesson here should be obvious. As I have said ad nauseam
in this column, the veterinarian’s primary obligation is to the
patient. And it is dogma in veterinary circles to affirm that a
vet is obliged to administer stabilizing care even to an
unowned animal brought in by a good Samaritan not willing
to assume financial responsibility. For the veterinarian in this
case to start talking money even before looking at the animal is
at the very least sleazy and borders on obscene.

First and foremost he or she should insist that the animal be
brought to the clinic immediately. There is plenty of time to talk
money after the animal is looked at. And there are also many
ways of establishing payment protocols as the animal is being
worked on. As a worst-case, the veterinarian can suggest that
the owner surrender the animal, and then he or she can treat
the animal and adopt it out. As Dr. James Wilson has informed
me, he can then provide the newspapers or other media with a
touching human interest story that will buy him far more favor-
able publicity than he could acquire in any other way. Members
of the public will be clamoring to adopt the animal!

Giving priority to the payment even as one is told that the
animal is “seriously injured” is hardly the mark of a compas-
sionate and committed veterinarian. While I am certainly aware
that veterinarians cannot work for nothing, and have repeatedly
made this point in my writings, one must be wise enough to
recognize exceptional situations and the opportunities they
present. To act otherwise is not only unprofessional in the
sense identified by Plato, but is also in the end contrary to the
veterinarian’s interest and is thus imprudent.

I am grateful to Drs. Brian Forsgren and James Wilson for teach-
img me their ways of, as Plato says, “making a virtue of necessity.”

Bernard E. Rollin, PhD
1. A 6-year-old boxer dog presents with a skin mass over the lateral thorax. The owner notices that it increases and decreases in size regularly and the dog seems to scratch at the mass. On fine-needle aspiration of the mass, a homogeneous population of round cells containing granules is noted. The most likely diagnosis is which of the following?
   A. Cutaneous mast cell tumor
   B. Fibrosarcoma
   C. Lymphoma
   D. Mammary gland tumor
   E. Cutaneous hemangiosarcoma

2. The most common cause of urinary incontinence in a 3-month-old female dog is which of the following?
   A. Ectopic ureter(s)
   B. Bladder neoplasia
   C. Urinary tract infection (UTI)
   D. Primary sphincter mechanism incompetence (PSMI)
   E. Cystic urolithiasis

3. Which of the following is a simple technique to determine whether a stray cat has intra-abdominal testicles?
   A. Measure the length of the canine teeth.
   B. Palpate the abdomen deeply.
   C. Examine the base of the penis for androgen-responsive spines.
   D. Examine the footpads for evidence of hyperkeratosis.
   E. Measure scrotal thickness.
4. After unilateral ovariectomy for a granulosa cell theca tumor in a mare, which of the following is correct?
   A. Surgery should be scheduled to remove the contralateral ovary because these tumors tend to be bilateral.
   B. The mare will be unable to conceive and maintain a pregnancy to full term.
   C. The mare should be carefully observed for any clinical abnormalities because tumor metastasis will have occurred.
   D. The mare can be expected to resume her normal estrus cycle, although it may take up to 12 months after surgery.
   E. The mare can be bred immediately after suture removal, 2 weeks after surgery.

5. Which of the following methods would be most useful for determining the etiology of an outbreak of BRD in a group of 550-lb feedlot calves?
   A. Nasal swab submitted for bacterial culture
   B. Thoracic ultrasound
   C. Serum samples from affected calves submitted for viral serology
   D. Necropsy of calves that died of chronic pneumonia or were euthanized because of it
   E. Transtracheal lavage

(See p. 788 for answers.)
Special promotion for your summer getaway!

Check out the CVMA hotel discount program! In addition, when you book your accommodations between May 1st and September 30th, you’ll be entered into a draw to win your booking for free. To start planning your getaway, go to the CVMA website (www.canadianveterinarians.net) and click on the Hotel Discounts link under the tab Value of Membership (member log-in required).

CVMA’s Emerging Leaders Program

Programme des futurs leaders de l’ACMV

I am a 4th year veterinary student at the Faculté de médecine vétérinaire, in Saint-Hyacinthe, Quebec, and, last year, I participated in one of the veterinary profession’s most enriching and informative workshops on leadership, communications and teamwork: CVMA’s Emerging Leaders Program (ELP).

This workshop took place on July 16, 2015 at the Fairmont Palliser Hotel in Calgary, Alberta, during the CVMA’s Annual Convention. This workshop would not have been possible without the generous support of sponsors Virox, The Personal Insurance Company, Western Financial Group Insurance Solutions, and Zoetis.

Promotion spéciale pour votre escapade estivale!

Découvrez le programme de rabais hôteliers de l’ACMV. De plus, réservez votre hébergement entre le 1er mai et le 30 septembre et vous serez inscrit à un tirage pour gagner le remboursement de votre réservation. Pour débuter la planification de votre escapade, allez sur le site Web de l’ACMV (veterinairesaucanada.net) et cliquez le lien « Rabais hôtelier » sous l’onglet « Avantages et services aux membres » (les membres devront ouvrir une session).
Pour les vétérinaires récemment diplômés et les vétérinaires chevronnés, le PFL a pour objectif de donner les outils essentiels pour maintenir un équilibre sain entre la vie professionnelle et la vie personnelle.

Cet atelier nous a permis de nous arrêter un instant et de prendre le recul nécessaire pour évaluer sous un autre angle la pratique vétérinaire et nos interactions avec les collègues, les employés, les clients et les patients. Le Dr DeBowes encourage les participants à réfléchir et à travailler sur eux-mêmes pour développer les qualités qui les aideront à devenir de meilleurs leaders.

Au cours des dernières années, les participants au PFL de l’ACMV ont décrit cette expérience comme étant « revigorante » ou « rafraîchissante » qui leur permet d’attaquer leur journée en clinique de façon plus positive et optimiste.

Pour les étudiants en médecine vétérinaire, la précision et la délicatesse en chirurgie sont des aptitudes bien développées dans le cursus de médecine vétérinaire et elles sont importantes pour être un bon vétérinaire. Cependant, l’intelligence émotionnelle, l’empathie et la communication sont toutes aussi importantes mais souvent reléguées en second plan. Le PFL représente un atout considérable pour les participants et il leur permet d’être plus efficaces et attentifs lors des travaux d’équipe, des laboratoires et des exercices chirurgicaux... et bien sûr en stage clinique!

Le prochain atelier aura lieu lors du congrès 2016 de l’ACMV qui se déroulera à Niagara Falls, les 7 et 8 juillet prochains. Cet atelier incomparable est ouvert à tous les membres de l’ACMV et de TTVAC. Pour plus de renseignements et pour vous inscrire, visitez le site Web de l’ACMV : (veterinairesaucanada.net/science-knowledge/emerging-leaders-program).

(par Hélène Rembeaux, représentante sénior sortante et étudiante à la Faculté de médecine vétérinaire de l’Université de Montréal)
SCVMA President Farewell

I would like to start my farewell by thanking everybody who has allowed me to hold this position for the last year; all Canadian veterinary students for allowing me to be your Students of the CVMA (SCVMA) president, my fellow SCVMA Committee members for your hard work and dedication, and to the CVMA Council, Executive, and staff for being incredibly supportive, helpful, and informative.

In my 2 years with the Students of the CVMA I have gained great insight into the inner workings of our national veterinary medical association, the CVMA. The support that the CVMA provides to Canadian students is unparalleled; assisting us in hosting our annual student Symposium, providing services to all students online, and supporting our new graduates as they transition into the next stage of their veterinary career. I encourage all students to learn more about what the CVMA has to offer. Browse the student section of the CVMA website, read the student edition of the CVMA’s e-newsletter “Online from 339,” contact your college’s SCVMA representatives to learn more about what the SCVMA, and the CVMA, can do for you and your career.

I will miss working with our SCVMA Committee members and I admire their dedication and tireless work to better every Canadian veterinary student’s experience. The endless hours planning Symposium, writing articles for The CVJ, coordinating the New Graduate Survey, publishing our VetRap newsletter, and fundraising for our new Student Leadership Workshop (which will debut this fall at the Faculté de Médecine Vétérinaire in Saint-Hyacinthe, Quebec) are just some of the proud accomplishments tackled by our Committee every year.

While my time with the SCVMA is ending, I am excited to leave my position in the very capable hands of our incoming SCVMA president, Elizabeth Hartnett from the Ontario Veterinary College. Elizabeth will lead a capable and motivated Committee, with representatives from all 5 Canadian colleges.

Congratulations to all 2016 graduates, and best of luck to all students in your current studies!

(by Justin R. Kristjansson, Western College of Veterinary Medicine, Class of 2017, 2015–2016 Students of the CVMA President)
Meet your 2016–17 SCVMA Committee Representatives!

The Students of the Canadian Veterinary Medical Association (SCVMA) Committee represents the CVMA at all 5 Canadian veterinary colleges, strengthening the links between the Association and its student members.

Sarifa Lakhdhir, SCVMA representative at the University of Calgary — Faculty of Veterinary Medicine (UCVM), was born and raised in Calgary, Alberta. Her love of animals became apparent at a very young age, as her favorite movie growing up was The Lion King. While in grade school, Sarifa travelled extensively throughout North America where she visited several world-famous zoos and animal parks such as the San Diego Zoo and Safari Park. During her visits, she went behind-the-scenes and learned about the role of the veterinarian in ensuring the health and well-being of the animals, all the while enjoying feeding animals such as okapis, rhinos, and lions. During the first 2 years of her undergraduate program, Sarifa travelled to Costa Rica and Namibia with ucalgarycares. Through these cross-cultural experiences, she had the opportunity to learn about ethical international development on a local and global scale. In addition, she has volunteered at the Calgary Zoo and at a small animal clinic in Calgary. Last summer, Sarifa spent 10 weeks in Kenya interning with Veterinarians without Borders Canada to build on their mission of helping to improve the lives of Kenyans, their communities, and their animals. While there, she worked with small-holder dairy farmers to assess and improve the welfare, comfort, nutrition, and production of dairy cows. Being the senior SCVMA representative for UCVM for the upcoming academic year, Sarifa is looking forward to chairing the 2017 SCVMA Symposium, themed “Take the bull by the horns. Take charge of your actions.” She hopes the symposium will encourage students to take responsibility for their actions especially when it comes to animal handling, animal welfare, and environmental stewardship.

Elizabeth Hartnett, SCVMA representative for the Ontario Veterinary College (OVC), decided she wanted to be a veterinarian at the age of 5 and has always been fascinated by the natural world. Growing up in a military family, she lived in several different places — from Germany to Manitoba to Québec — before her family settled in Kingston, Ontario. She completed her undergraduate studies in Environmental Biology at Queen’s University and received a Master in Environmental Studies degree from York University, where she focused on humane education and environmental ethics.

Rencontrez vos représentants 2016–2017 du Comité des ÉACMV!

Le Comité des Étudiants de l’Association canadienne des médecins vétérinaires (ÉACMV) représente l’ACMV et les cinq collèges de médecine vétérinaire canadiens afin de renforcer les liens entre l’Association et ses membres étudiants.

Sarifa Lakhdhir, représentante des ÉACMV à la Faculté de médecine vétérinaire de l’Université de Calgary (UCVM), est née et a grandi à Calgary, en Alberta. Son amour pour les animaux s’est manifesté à un très jeune âge et, dans sa jeunesse, son film favori était Le Roi lion. Pendant qu’elle était à l’école élémentaire, Sarifa a beaucoup voyagé en Amérique du Nord et elle a visité plusieurs zoos et parcs d’animaux célèbres, comme le Zoo de San Diego et le Parc Safari. Durant ses visites, elle s’est rendue dans les coulisses et s’est renseignée sur le rôle des vétérinaires afin d’assurer la santé et le bien-être des animaux tout en s’amusant à nourrir des animaux comme des okapis, des rhinocéros et des lions. Durant les deux premières années de programme de premier cycle, Sarifa s’est rendue au Costa Rica et en Namibie avec ucalgarycares. Dans le cadre de ces expériences multiculturelles, elle a eu l’occasion de se renseigner à propos du développement international éthique à une échelle locale et internationale. De plus, elle a fait du bénévolat au Zoo de Calgary et dans une clinique pour petits animaux à Calgary. L’été dernier, Sarifa a passé dix semaines au Kenya lors d’un internat avec Vétérinaires sans frontières Canada afin d’appuyer sa mission en vue d’améliorer la vie des Kényans, de leurs collectivités et de leurs animaux. Pendant ce séjour, elle a travaillé avec de petits producteurs laitiers afin d’évaluer et d’améliorer le bien-être, le confort, la nutrition et la production des vaches laitières. À titre de représentante sénior des ÉACMV à l’UCVM pour l’année à venir, Sarifa se réjouit à la pensée de présider le Symposium des ÉACMV 2017 dont le thème sera «Prenez le taureau par les cornes. Soyez responsable de vos actes». Elle espère que le Symposium encouragera les étudiants à assumer la responsabilité de leurs actes, particulièrement en ce qui concerne la manipulation des animaux, le bien-être animal et la gestion responsable de l’environnement.

Elizabeth Hartnett, représentante des ÉACMV à l’Ontario Veterinary College (OVC), a décidé qu’elle désirait être vétérinaire à l’âge de cinq ans et elle a toujours été fascinée par le monde naturel. Elle a grandi dans une famille militaire et a vécu dans plusieurs endroits différents — allant de l’Allemagne au Manitoba, en passant par le Québec — avant que sa famille ne s’installe finalement à Kingston, en Ontario. Ses études de premier cycle à l’Université Queen’s ont porté sur la biologie environnementale et elle a ensuite obtenu une maîtrise en études environnementales à l’Université York, où elle s’est concentrée sur l’éducation humanitaire et l’éthique environnementale.

Pendant plusieurs années, Elizabeth a travaillé dans le domaine des recherches et des politiques environnementales, tout en se portant bénévole au Toronto Wildlife Centre les fins de semaine. Elle s’est rendue compte que ses intérêts dans l’environnement, les politiques publiques et la santé faunique étaient compatibles avec une carrière en médecine vétérinaire et elle s’est décidée à finalement présenter une demande à l’école de médecine.
For several years, Elizabeth worked in environmental research and policy, while volunteering at the Toronto Wildlife Centre on weekends. Realizing that her interests in the environment, public policy and wildlife health were compatible with a career in veterinary medicine, she decided to finally apply to veterinary school. Being accepted into the OVC Class of 2018 was truly a dream come true.

Elizabeth enjoys being involved at the OVC and in the wider community, and loves to practice her clinical skills by volunteering with Community Veterinary Outreach. A highlight of this past school year was helping to plan the 2016 SCVMA Symposium “The Elephant in the Room,” hosted by the OVC, and having the opportunity to meet fellow students from across Canada. Elizabeth is honored to be representing Canadian veterinary students as the 2016–2017 SCVMA president, and is committed to fostering student collaboration and engagement at a national level.

Mélissa Gohier, SCVMA representative from the Faculté de médecine vétérinaire (FMV), moved to Sainte-Hyacinthe after living in Montréal her whole life, and found this to be a big but worthwhile change since she had always dreamed of studying at FMV. Like many students in this field, being a veterinarian was something she wanted from a young age. However, this did not stop her from enjoying fields other than science and health, which include being a member of a hip-hop dance group at her Cégep and by hosting and organizing the annual prestigious national talent show “Cégep en Spectacle.” Mélissa has travelled to several countries such as Australia and Costa Rica, which were full of biodiversity and cultural resources. These visits helped cement her dream of having a career in veterinary medicine. After she was accepted to FMV, Mélissa wanted to continue being involved in student affairs so she applied and was chosen to be the SCVMA student representative, a role which she holds very dear. Despite the required 5 years of studies, Mélissa finds that time is flying by and she is happy to work hard in order to have an impact on students during her time at the FMV. She considers that these are the best years to develop true friendships, discover her own path, and define her future dreams and ambitions.

Traci Henderson, SCVMA representative for the Western College of Veterinary Medicine (WCVM), was raised on a beef farm in southeastern Saskatchewan, from which her interest in livestock medicine stemmed. Growing up, Traci was heavily involved with the herd, and knew that she wanted a career involving livestock production. After realizing the impact that her veterinarian had on their production system, she developed an interest in herd health, and decided to pursue a career in veterinary medicine. After high school, Traci attended the University of Saskatchewan’s College of Agriculture and Bio Resources, pursuing a degree in Animal Science. After vétérinaire. L’admission à la promotion 2018 de l’OVC était la réalisation d’un rêve.

Elizabeth aime participer aux activités de l’OVC et de la collectivité en générale et elle adore exercer ses compétences cliniques en faisant du bénévolat avec Community Veterinary Outreach. Un fait saillant de la dernière année scolaire a été sa contribution à la planification du Symposium 2016 des ÉACMV «L’éléphant dans la pièce» qui a été organisé par l’OVC et qui lui a donné l’occasion de rencontrer des collègues étudiants provenant de toutes les régions du Canada. Elizabeth est honorée de représenter les étudiants en médecine vétérinaire canadiens à titre de présidente 2016–2017 des ÉACMV et elle s’est engagée à favoriser la collaboration et l’engagement des étudiants à un niveau national.

Mélissa Gohier, représentante de la Faculté de médecine vétérinaire (FMV) de l’Université de Montréal, a déménagé à Saint-Hyacinthe après avoir vécu à Montréal pendant toute sa vie et c’était un grand changement qui en valait la peine, car elle avait toujours rêvé d’étudier à la FMV. Comme plusieurs étudiants dans ce domaine, elle envisageait une carrière de vétérinaire depuis un très jeune âge. Toutefois, cela ne l’a pas empêché de s’épanouir dans des sphères autres que la science et la santé et elle a notamment été membre d’un groupe de danse hip-hop à son Cégep et a organisé le prestigieux spectacle de talent «Cégep en spectacle». Mélissa a voyagé dans de nombreux pays comme l’Australie et le Costa Rica, qui débordaient de biodiversité et de ressources culturelles. Ces visites ont consolidé son rêve de devenir médecin vétérinaire. Une fois acceptée à la FMV, Mélissa souhaitait continuer de s’impliquer et c’est ainsi qu’elle a été choisie pour être la représentante étudiante des ÉACMV, un rôle qui lui tient grandement à cœur. Malgré les cinq années d’études requises, Mélissa trouve que le temps passe très vite et elle est heureuse de travailler fort afin de pouvoir avoir un impact auprès des étudiants durant son passage à la FMV. Elle considère qu’il s’agit des meilleures années pour développer des amitiés sincères, découvrir sa propre voie et définir ses futurs rêves et ambitions.

Traci Henderson, représentante des ÉACMV à le Western College of Veterinary Medicine (WCVM), a grandi dans une ferme d’élevage de bovins dans le sud-est de la Saskatchewan, et c’est de là que provient son intérêt envers la médecine du bétail. Pendant son enfance, Traci participait intensivement au travail auprès du troupeau et elle savait qu’elle désirait une carrière dans le domaine de l’élevage du bétail. Après avoir constaté l’impact que son vétérinaire avait sur le système de production, elle a développé un intérêt envers la santé du troupeau et elle a décidé de poursuivre une carrière en médecine vétérinaire. Après l’école secondaire, Traci a fréquenté le College of Agriculture and Bio Resources de l’Université de la Saskatchewan et elle a obtenu un diplôme en sciences animales. Après avoir terminé son cours de trois ans, elle a été acceptée au WCVM et elle entamera sa troisième année à l’automne. Au cours des deux dernières années, elle s’est fixée l’objectif de participer aux affaires étudiantes du WCVM et elle s’est portée bénévole pour des postes au sein de l’exécutif de la promotion, de l’association étudiante ainsi que divers autres postes bénévoles dans les clubs. Traci a vécu une expérience incroyable l’année dernière en tant que représentante
In 2015, The CVJ staff held 2 focus groups to tap into Canadian veterinarians’ thoughts about the 2 peer-reviewed science journals, The Canadian Veterinary Journal (The CVJ) and the Canadian Journal of Veterinary Research (CJVR), published by the Canadian Veterinary Medical Association. One discussion was held in Halifax, Nova Scotia during the Atlantic Provinces Veterinary Conference and the other was held in Calgary, Alberta at the CVMA Convention; there were 10 and 9 participants, respectively.

At the March Committee weekend, the Editorial Committee reviewed the comments made at the focus groups and decided to take action on certain recommendations.

Meredith Versteeg

Meredith Versteeg is née et a grandi dans une ferme laitière dans une région rurale de la Nouvelle-Écosse et elle a développé un amour pour les vaches et tous les animaux de ferme à un très jeune âge. Après avoir terminé son cours secondaire, Meredith a fréquenté l’Université Dalhousie en tant qu’étudiante au Programme de sciences intégrées avant de s’inscrire à l’Université St. Francis Xavier à Antigonish, en Nouvelle-Écosse, où elle a terminé son cours avec une spécialisation en biologie. Après l’obtention de son diplôme et tout en faisant du bénévolat auprès de la SPCA, Meredith a décidé de s’inscrire au programme de médecine vétérinaire de l’Atlantic Veterinary College (AVC). Elle a été entourée de mentors et de vétérinaires extraordinaires toute sa vie et, vu qu’elle s’intéressait vivement à l’industrie laitière et à la santé des animaux destinés à l’alimentation, elle savait qu’il s’agissait du bon cheminement de carrière pour elle et elle a été ravie d’être acceptée à la promotion 2019. En raison de l’esprit communautaire et des expériences extraordinaires qu’elle a pu vivre lors de sa première année à l’AVC, elle a maintenant vraiment hâte de voir ce qui l’attend en tant qu’étudiante et de nouvelle représentante sénior des ÉACMV. Meredith transmet ses meilleurs vœux de succès à tous ses camarades de classe, à tous les étudiants en médecine vétérinaire ainsi qu’à la nouvelle promotion de 2020 pour une année qui s’avérera assurément excitante.
While participants enjoyed review articles they are difficult to get; they need to be solicited and focus on a desirable subject as they take up many published pages, which is not good for the backlog of The CVJ. Dr. Carlton Gyles, editor-in-chief of The CVJ will write to university clinical chairs to invite people to write review articles after identifying appropriate subjects. Some people mentioned the usefulness of a journal “app” but this doesn’t seem necessary as the current pdf can easily be downloaded to a phone or computer and forwarded to a tablet.

There is demand for practice-based articles but it was noted that we can only publish the articles we receive. More practitioners need to be encouraged to write, but many find it to be an onerous job, particularly with the demands on practitioners’ time; should CVMA put pressure on educational curriculum to include how to write a scientific article? One current student said her class uses The CVJ as an example of how to write an article. Focus group attendees suggested that the journals provide writing mentors to make the process less intimidating. While this is a good idea it would be difficult to find such people. We will informally put together a list of retired individuals who might have time and the talent.

The need for more disease surveillance articles such as the current feature, Cross-Canada Disease Report was also noted, as well as ask an expert-type feature, and articles on mental health. A new feature titled Veterinary Wellness was started a few issues ago and we will develop a filler ad that will contain provincial/national lab reports and various species-specific disease information/newsletters. This ad could be used in issues when space allows. This would ensure existing information is not duplicated and would allow science articles to be more quickly published as the current backlog would not be increased.

The use of filler ads was also suggested to attract reviewers, encourage practitioners to write articles, and provide tips on how to write and get feedback on an article idea before starting to write.

Mentorship information would be interesting to include in The CVJ, particularly for new graduates; such material could be taken from the CVMA Mentorship Program after the program gets established.

The suggestion of including continuing education (CE) components within the journals was mentioned but it was noted that there is considerable CE in the journals and veterinarians discussion and it a décidé d’agir afin de mettre en œuvre certaines des recommandations.

Même si les participants aimaient lire les articles de rétrospective ils sont difficiles à obtenir, car ils doivent être sollicités et leur sujet doit être souhaitable, car ils occupent plusieurs pages de la publication, ce qui nuira à l’arrière de La RVC. Le D’ Carlton Gyles, le rédacteur en chef de La RVC écrira aux responsables cliniques des universités afin d’inviter les personnes à rédiger des articles de rétrospective après avoir identifié des sujets appropriés. Certaines personnes ont mentionné l’utilité d’une «appl» de la revue, mais cela semble inutile car le format pdf actuel peut facilement être téléchargé sur un téléphone ou un ordinateur et être acheminé à une tablette.

Il existe une demande pour des articles portant sur la pratique, mais il a été signalé que nous pouvons seulement publier les articles que nous recevons. Il faut encourager plus de praticiens à écrire des articles, mais beaucoup d’entre eux considèrent que c’est un travail pénible, particulièrement compte tenu de l’horaire chargé des praticiens. Est-ce que l’ACMV devrait exercer des pressions sur le curriculum afin d’inclure des notions sur la rédaction d’un article scientifique? Une étudiante a dit que sa classe utilisait La RVC comme modèle pour la rédaction d’un article. Les participants aux groupes de discussion ont suggéré que les revues fournissent des mentors de rédaction afin de rendre le processus moins intimidant. Même s’il s’agit d’une bonne idée, il sera difficile de trouver de telles personnes. Nous complierons une liste informelle de personnes à la retraite qui pourraient avoir les temps et les qualifications requises.

On a aussi signalé le besoin d’articles sur la surveillance des maladies comme la rubrique actuelle, Rapport des maladies diagnostiquées au Canada, ainsi que d’une chronique et des articles sur la santé mentale. Une nouvelle rubrique intitulée Bien-être vétérinaire a été inaugurée il y a quelques numéros et nous créerez de courtes annonces qui contiendront des rapports de laboratoires provinciaux et nationaux ainsi que divers bulletins d’information sur les maladies des espèces. Ces annonces pourront être utilisées dans les numéros lorsque l’espace le permet. Cela garantira que les renseignements existants ne sont pas reproduits et permettra aux articles scientifiques d’être publiés plus rapidement, car l’arrière actuel n’augmentera pas.

Le recours à des annonces a aussi été suggéré pour attirer des évaluateurs, encourager des praticiens à écrire des articles, fournir des conseils sur la façon d’écrire et obtenir de la rétroaction sur une idée d’article afin de commencer la rédaction.

Il serait intéressant d’inclure des renseignements sur le mentorat dans La RVC, particulièrement pour les finissants; cette information pourrait être tirée du Programme de mentorat de l’ACMV après l’établissement du programme.

On a mentionné la suggestion d’inclure des éléments de formation continue dans les revues, mais il a été signalé qu’il y a déjà beaucoup de formation continue dans les revues et que les vétérinaires obtiennent déjà des crédits de formation auprès des organismes de réglementation en lisant des revues comme la nôtre.

On a réitéré lors des deux réunions que les revues sont disponibles en ligne sur le site Web de l’ACMV et qu’elles sont archivées sur PubMedCentral.

Les participants aimeraient l’utilisation de la couleur, la reliure sans couture, les nouvelles (particulièrement la nouvelle
Animal Health + Human Health + Planet Health = One Health

Working together for the health of all

Animal Health Week – October 2 to 8, 2016

Santé animale + Santé humaine + Santé de la planète = Une santé

«Travaillons ensemble pour Une seule santé»

Semaine de la vie animale – Du 2 au 8 octobre 2016

The Canadian Veterinary Medical Association has been running the Animal Health Week campaign for over 30 years and this year we want to emphasize the importance of One Health. Animal health is intrinsically tied to the health of humans and that of the environment. This year we want to showcase how important it is that we all work together to protect the health of animals, people and the planet wholly and globally.

During Animal Health Week, from October 2 to 8, 2016, we are reminding animal owners that ensuring the health of their animals not only protects their animals, but ensures the health of humans and the environment as well. Every step you take to protect the animals in your care contributes to the global health of the population and the planet: Animal Health + Human Health + Planet Health = One Health.

We’d like to remind animal owners that:

• The concept of ONE HEALTH involves groups of professionals, including veterinarians, physicians, and scientists, working together to attain optimal health for animals, people, and the environment.

It was reinforced at both meetings that the journals are available online via the CVMA website and are archived on PubMedCentral.

Participants liked the use of color, the perfect binding, the news (especially the redesign), ethics, highlighting CJVR articles within The CVJ, the quiz, and topics covered within The CVJ (most participants were practitioners). They like the advertising, which is something that can be used to attract additional advertising. The value and perception of the journals have increased, and it was mentioned that the backlog is not a bad thing if it can be kept under control, which we are still striving to do for The CVJ and have achieved for CJVR.

The possibility of having more sponsored features, such as in the current case with the quiz, was recommended. The advertising manager will look into the possibility of getting additional sponsors for other features.

Additional focus groups and readership surveys will be forthcoming to get input on reader/author expectations and recommendations for the future direction of both journals. The journal staff and the Editorial Committee appreciate the time and effort these meetings and surveys take and would like to thank each participant for their input.

We’d like to remind animal owners that:

• The concept of ONE HEALTH involves groups of professionals, including veterinarians, physicians, and scientists, working together to attain optimal health for animals, people, and the environment.

LA association canadienne des médecins vétérinaires organise la campagne de la Semaine de la vie animale depuis plus de 30 ans et, cette année, nous désirons insister sur l’importance d’UNE SANTÉ. La santé animale est inextricablement liée à la santé des humains et à celle de l’environnement et, cette année, nous désirons mettre en lumière l’importance de travailler tous ensemble afin de protéger complètement la santé des animaux, des personnes et de la planète à l’échelle mondiale.

Durant la Semaine de la vie animale, qui se déroulera du 2 au 8 octobre 2016, nous rappellerons aux propriétaires d’animaux qu’en préservant la santé de leurs animaux, ils protègent non seulement leurs animaux mais aussi la santé des humains et de l’environnement. Tous les gestes que vous posez pour protéger les animaux confiés à vos soins contribuent à la santé mondiale de la population et de la planète. Santé animale + Santé humaine + Santé de la planète = UNE SANTÉ.

Nous aimerions rappeler aux propriétaires d’animaux que:

• Le concept d’UNE SANTÉ nécessite la participation des groupes de professionnels, notamment les vétérinaires, les médecins et
• The health of humans, animals and ecosystems is interconnected. Keeping one healthy requires that all are healthy.
• Everyone can contribute to ONE HEALTH for the betterment of health in people, animals and the planet.
• The health of your animal can have an important influence on your health and global health.
• Veterinarians play a critical role in ONE HEALTH as they manage the connection between animal health, human health and the state of the environment.
• Responsible animal ownership includes regular veterinary visits, vaccinations, parasite prevention, exercise and optimal nutrition, protecting the health of people and our global environment for ONE HEALTH.

Celebrate Animal Health Week
We invite veterinary health teams to celebrate Animal Health Week with us. Each year veterinary teams rank waiting room displays as the most popular way of celebrating Animal Health Week, followed closely by client contests. In addition to the official campaign poster, the following items will engage your entire healthcare team and help celebrate Animal Health Week:
• Biodegradable Balloons
• Temporary tattoos
• Pet rescue window decals
• CVMA Activity Book “Big or Small, We Help Them All!”
• Paws N’ Claws Sports Pack (puppy), which can be used for a variety of activities like carrying sports gear or beach apparel
• Kid-Friendly Cow-Themed Paper Hat
• T-shirts (available in men’s and women’s sizes)
• V-neck pullover scrub shirts (available in a range of sizes)

Place your order before the early bird deadline on July 22, 2016 for a chance to win a $100 Subway gift card (enough to treat the whole team to lunch!) and other fun prizes. Placing your order online (instead of faxing or mailing it) at www.canadianveterinarians.net also gives you a chance to win a $50 Tim Horton’s gift card (treat your hardworking team to some morning steam)! The last day to place your order for Animal Health Week materials is August 5, 2016.

Our generous supporters
Generous support of the 2016 Animal Health Week campaign is provided by Principal Sponsor Petsecure Pet Health Insurance, and Program sponsors iFinance Canada (Petcard), and Merial. This month, we invite you to learn more about our Principal sponsor, Petsecure Pet Health Insurance.

Petsecure Pet Health Insurance has embraced the concept of One Health since its inception over 25 years ago. Petsecure recognizes the strong bond that exists between owners and pets and the impact animals have on humans’ daily lives and well-being. The concept of One Health recognizes that animals affect the health of humans, animals and the environment. Keeping one healthy requires that all are healthy.

La santé des humains, des animaux et des écosystèmes est interconnectée. La santé d’un groupe exige la santé de tous les groupes.

Le santé des humains, des animaux et des écosystèmes est interconnectée. La santé d’un groupe exige la santé de tous les groupes.

Célébrez la Semaine de la vie animale
Nous invitons les équipes vétérinaires à célébrer la Semaine de la vie animale avec nous. Chaque année, les équipes considèrent que les expositions dans la salle d’attente sont la façon la plus populaire de célébrer la Semaine de la vie animale, suivies de près par les concours à l’intention de la clientèle. En plus de l’affiche officielle de la campagne, les articles suivants inviteront toute l’équipe vétérinaire à célébrer la Semaine de la vie animale:
• Ballons biodégradables
• Tatouages temporaires
• Décalques de secours pour les fenêtres
• Album d’activités de l’ACMV “Petits et grands, ce sont nos patients”!
• Sac à dos sport (chiot) qui peut être utilisé pour toutes sortes d’activités comme le transport d’équipement de sport ou d’accessoires de plage
• Chapeau de papier pour enfants – Vache
• T-shirts (disponibles en tailles pour hommes et femmes)
• Blouses chirurgicales avec encolure en V (offertes dans diverses tailles)

Placez votre commande avant la date limite hâtive du 22 juillet 2016 pour courir la chance de gagner une carte-cadeau de 100 $ chez Subway (assez pour sortir toute l’équipe à manger le midi) et d’autres prix épatants. Lorsque vous placez votre commande en ligne (au lieu d’envoyer le bon de commande par télécopieur ou par la poste) au veterinairesaucanada.net, vous pourrez aussi gagner une carte-cadeau de 50 $ chez Tim Hortons (gâtez les membres de votre équipe travaillante en leur servant une boisson chaude le matin)! La dernière journée pour placer votre commande d’articles de la Semaine de la vie animale est le 5 août 2016.

Nos généreux commanditaires
Un généreux soutien de la Semaine de la vie animale 2016 est offert par notre commanditaire principal Petsecure assurance maladie pour animaux et par les commanditaires de programmes iFinance Canada (Petcard) et Merial. Ce mois-ci, nous vous invitons à en apprendre davantage à propos de notre commanditaire principal, Petsecure assurance maladie pour animaux.
us mentally, emotionally and physically, and that their health and the health of our planet are intimately intertwined and directly impacts our own health.

In order to meet the goal of One Health, Petsecure feels we all have a moral obligation to ensure the health and well-being of all animals under our care. By insuring pets, Petsecure empowers owners to contribute to One Health by ensuring early diagnosis and treatment of zoonotic diseases. Pet health insurance can help prevent the spread of disease by allowing pet owners to seek early veterinary attention when needed. As partners in the management of a pet’s health, a pet owner and veterinarian can prevent certain diseases from occurring and contribute to the health of all of us who share this planet. Pet insurance enables pet owners to seek medical attention for their pets when they need it and enables veterinarians to choose the optimal medical treatment a pet needs.

Pets also play a critical role in our own health, especially when it comes to therapy and service animals. By providing physical, mental or emotional support to those who need it, they contribute to One Health.

Studies have shown the many positive benefits we derive from animals. The simple act of petting a dog or cat creates a connection that improves blood pressure, heart health and overall well-being. Individuals with pets are typically more physically engaged, more active, walk more, and socialize with other owners.

Petsecure is heavily involved in community and charitable events. Petsecure supports shelters, breeders, and veterinary clinics through fundraisers, trade shows and educational initiatives across Canada. This support also extends to organizations such as the Canadian Red Cross and animal welfare programs that help pets and their owners. Supporting these organizations and programs contributes to One Health, as they benefit all people and animals involved, in turn creating a healthy environment.

**Petsecure Pet Health Insurance can be accessed a number of ways:**
- Call 1-800-268-1169
- Email (info@petsecure.com)
- Chat live at (www.petsecure.com)

Petsecure is unique in that there are 12 territory managers who provide customer support and assistance to veterinary clinics and owners across Canada who carry Petsecure coverage for their pets.

With an award-winning Customer Care Centre, licensed insurance advisors provide quality support to customers and partners. Certified animal health technologists in the claims and underwriting department adjudicate claims and assist veterinarians and veterinary staff through an exclusive Vet Line phone number.

Petsecure offers 4 plans to suit the needs of owners and their pets. The advantages of having Petsecure coverage include: up to 80% of veterinary bills covered for any accident or illness; one annual deductible; and coverage of exam fees and taxes, in addition to prescriptions, hospitalization and much more.

**Petsecure assurance maladie pour animaux épouse le concept d’Une santé depuis sa création il y a 25 ans. Chez Petsecure, nous reconnaissons le solide lien qui existe entre les propriétaires et leurs animaux ainsi que l’impact des animaux sur notre vie quotidienne et notre bien-être. Le concept d’Une santé reconnaît que les animaux exercent sur nous une influence mentale, émotionnelle et physique et que leur santé et la santé de notre planète sont intimement liées et ont un impact direct sur notre propre santé.

Afin d’atteindre le but d’Une Santé, Petsecure estime que nous avons tous l’obligation morale d’assurer la santé et le bien-être de tous les animaux confiés à nos soins. En fournissant de l’assurance pour les animaux de compagnie, Petsecure habilite les propriétaires à contribuer à Une santé en assurant un diagnostic précoce ainsi que le traitement des zoonoses. L’assurance maladie pour animaux de compagnie peut aider à prévenir la propagation des maladies en permettant aux propriétaires d’animaux de solliciter l’attention des vétérinaires dès qu’elle devient nécessaire. En tant que partenaires dans la gestion de la santé d’un animal de compagnie, un propriétaire d’animal et un vétérinaire peuvent prévenir certaines maladies et contribuer à la santé de toutes les personnes qui partagent cette planète. L’assurance maladie pour animaux permet aux propriétaires d’animaux de solliciter des soins médicaux pour leurs animaux en cas de besoin et elle permet aux vétérinaires de choisir le traitement médical optimal pour répondre aux besoins d’un animal de compagnie.

Les animaux de compagnie jouent aussi un rôle crucial en ce qui concerne notre propre santé, particulièrement dans le cas des animaux de thérapie et d’assistance. En offrant un soutien physique, mental et émotionnel à ceux qui en ont besoin, ils contribuent à Une santé.

Des études ont confirmé les nombreux bienfaits positifs que nous dérivons des animaux. Le simple geste de flatter un chien ou un chat crée un lien qui permet d’améliorer l’hypertension, la santé cardiaque et le bien-être général. Les personnes avec des animaux de compagnie ont habituellement plus d’interactions physiques, elles sont plus actives, elles marchent plus et elles socialisent avec d’autres propriétaires.

Petsecure s’implique activement au sein de la collectivité et dans le cadre d’activités de bienfaisance. Petsecure soutient des refuges, des éleveurs et des cliniques vétérinaires par l’entremise d’activités de financement, de salons d’exposition et d’initiatives d’éducation à l’échelle du Canada. Ce soutien est aussi offert à des organisations comme la Croix-Rouge canadienne et à des programmes de bien-être animal qui portent assistance aux animaux de compagnie et à leurs propriétaires. L’appui de ces organisations et de ces programmes contribue à Une santé parce que ces derniers profitent à l’ensemble des personnes et des animaux concernés, ce qui crée ensuite un environnement sain.

**On peut accéder à l’assurance maladie pour animaux Petsecure de plusieurs façons :**
- Appelez-nous au 1-800-268-1169
- Envoyez-nous un courriel à info@petsecure.com
- Claverdez avec nous en direct au petsecure.com

Petsecure offre un service unique car la compagnie dispose de douze gestionnaires de territoire qui offrent un soutien à la clientèle.
et de l’assistance aux cliniques vétérinaires et aux propriétaires du Canada possédant une couverture Petsecure pour leurs animaux de compagnie.

Grâce à un centre de service à la clientèle primé, nos conseillers agréés en assurance offrent un soutien de qualité aux clients et aux partenaires. Les technologues vétérinaires agréés du service des réclamations et de la souscription règlent les réclamations et portent assistance aux vétérinaires et au personnel vétérinaire sur une ligne téléphonique qui leur est réservée.

Petsecure offre quatre régimes pour répondre aux besoins des propriétaires et de leurs animaux de compagnie. Les avantages d’une couverture Petsecure incluent notamment : le remboursement jusqu’à concurrence de 80% des factures du vétérinaire pour un accident ou une maladie; une seule franchise annuelle; et la couverture des frais d’examen et des taxes, en plus des prescriptions, de l’hospitalisation et plus encore.

---

**CVMA Business Management Program**

One of the CVMA’s prime objectives is to help veterinarians achieve “a successful career and a balanced life.” Although achieving this state of balance may be considered a luxury by many practitioners, it is more easily attainable in profitable practices. The CVMA’s Business Management Program can help all members, regardless of employment type, achieve a successful career and a balanced life. Here’s how:

- Data collected from the provincial veterinary economic surveys help practices benchmark their financial performance and competitiveness, establish fees, and determine compensation and benefits levels for associate veterinarians and non-DVM staff.
- Periodic practice management articles and national benchmarking reports are published in *The Canadian Veterinary Journal*.
- Economic success in private practice translates into higher salaries, which raises the bar for veterinarians employed in government, academic, or corporate sectors.
- Economic success also translates into quality medicine by allowing practices to provide optimal staffing and service, better equipment and facilities, and overall higher level patient care.

---

**Programme de gestion commerciale de l’ACMV**

L’un des grands objectifs de l’ACMV consiste à aider les vétérinaires à obtenir «une carrière prospère et une vie équilibrée». Même si l’atteinte de cet équilibre peut être considérée comme un luxe par beaucoup de praticiens, il est plus facile à atteindre dans les pratiques rentables. Le Programme de gestion commerciale de l’ACMV peut aider tous les membres, sans égard à leur type d’emploi, à obtenir une carrière prospère et une vie équilibrée. Voici comment :

- Les données recueillies dans les sondages économiques provinciaux auprès des pratiques vétérinaires aident les pratiques à évaluer leur rendement financier et leur compétitivité, à établir des tarifs et à déterminer le niveau de la rémunération et des avantages sociaux des vétérinaires salariés et du personnel non-vétérinaire.
- Des articles périodiques sur la gestion commerciale et des rapports sur l’évaluation comparative du rendement à l’échelle nationale sont publiés dans *La Revue vétérinaire canadienne*.
- Le succès financier des pratiques privées se traduit par des salaires supérieurs, ce qui permet de rehausser la barre pour les vétérinaires travaillant au gouvernement, dans les universités et dans le secteur privé.
- Le succès financier se traduit aussi par une médecine de qualité qui permet aux pratiques d’offrir un personnel qualifié et un service optimal, de l’équipement et des installations améliorées ainsi qu’un meilleur niveau général de soins pour les patients.

Le Programme de gestion commerciale aide les propriétaires et les associés des pratiques à l’aide des services suivants :

- la communication de normes comparatives de rendement pour les revenus, la production, la dotation en personnel, les dépenses et les tarifs.
- la présentation d’un rapport personnalisé, après avoir répondu au Sondage auprès des propriétaires de pratique, qui fournit des recommandations générales afin d’aider à améliorer la rentabilité.
- la présentation d’une estimation de la valeur de la pratique, après avoir répondu au Sondage, qui fournit une estimation de la valeur de la pratique basée sur la rentabilité.
- l’élaboration des guides tarifaires suggérés provinciaux pour les interventions pour les animaux de compagnie et les grands
The Business Management Program helps practice owners/partners by:
- providing practice benchmarks for revenue, production, staffing, expenses and fees.
- giving a detailed personalized report, upon completion of the Practice Owners Survey, that provides general recommendations to help improve practice profitability.
- providing a practice value estimate, upon completion of the Survey, that provides an estimate of their practice worth based on profitability.
- developing Provincial Suggested Fee Guides for Companion and Large Animal Procedures, and Wage Reports for Non-DVM Staff and for Associate Veterinarians.

The Business Management Program helps associate veterinarians by:
- investigating all aspects of compensation and benefits through the Associate Survey, which also evaluates the impact of elements such as type of practice, years in practice, location, and types of compensation.
- producing the resulting Annual Report on Compensation and Benefits for Associate Veterinarians is an important benchmarking tool to compare hours worked, incomes and benefits across the province and across Canada.

Where can you access this service?
To access the most recent veterinary economic reports and previously published practice management articles:
- Go to the website (www.canadianveterinarians.net);
- Open a session by logging in using your first name, last name and password (if you do not know your password, you can request it from the CVMA);
- Click on Practice & Economics and then Business Management Program.

The CVMA Business Management Program services are provided to members across the country with the collaboration of the provincial veterinary medical associations and corporate sponsors.

Your CVMA Membership Means More. Take Full Advantage.

The Canadian Veterinary Medical Association (CVMA) works hard to bring members new, relevant and exclusive benefits, discounts and services. In many instances, the savings enjoyed more than cover the cost of your annual membership fee.

Clinician's Brief and Plumb's Veterinary Drugs
The CVMA has 2 new, exclusive member benefits: Clinician's Brief and Plumb's Veterinary Drugs. Aligned with CVMA's values, the mission of Clinician's Brief and Plumb's Veterinary Drugs is to provide small animal veterinary teams the tools they need to develop successful practices, build lasting client relationships, and deliver gold-standard patient care.

Le Programme de gestion commerciale aide les vétérinaires salariés en leur offrant les services suivants:
- une étude de tous les aspects de la rémunération et des avantages sociaux dans le cadre du Sondage auprès des vétérinaires salariés, qui évalue aussi l’impact d’éléments comme le type de pratique, les années d’expérience, l’emplacement et les types de rémunération.
- la production du Rapport annuel sur la rémunération et les avantages sociaux des vétérinaires salariés qui se fonde sur les résultats du sondage et représente un outil important pour l’évaluation comparative des heures travaillées, des bénéfices et des avantages sociaux dans les provinces et à l’échelle du Canada.

Où pouvez-vous avoir accès à ce service?
Pour accéder aux plus récents rapports économiques vétérinaires et aux articles qui ont déjà été publiés sur la gestion commerciale :
- Allez au site Web (www.veterinairesaucanada.net);
- Ouvrez une session sur le site Web à l’aide de votre prénom, nom de famille et mot de passe (si vous ne connaissez pas votre mot de passe, vous pouvez le demander à l’ACMV);
- Cliquez sur Pratique et finances et ensuite sur Programme de gestion commerciale.

Les services du Programme de gestion commerciale sont fournis aux membres à l’échelle du pays en collaboration avec les associations provinciales de médecins vétérinaires et les commanditaires.

Votre adhésion à l’ACMV vous offre encore plus. Profitez-en pleinement.

L’Association canadienne des médecins vétérinaires (ACMV) travaille avec diligence pour offrir aux membres de nouveaux avantages, rabais et services qui sont pertinents et exclusifs. Dans beaucoup de cas, les économies réalisées dépassent largement le coût de la cotisation annuelle.

Clinician’s Brief et Plumb’s Veterinary Drugs
L’ACMV offre deux nouveaux avantages aux membres exclusifs : Clinician’s Brief et Plumb’s Veterinary Drugs. La mission de Clinician’s Brief et Plumb’s Veterinary Drugs, qui correspond à celle de l’ACMV, consiste à fournir aux équipes vétérinaires pour petits animaux les outils dont elles ont besoin pour gérer des pratiques prospères, établir des relations de longue date avec les clients et offrir des soins de calibre supérieur aux patients.
Dans le cadre de vos avantages de membre de l’ACMV, vous avez droit gratuitement à une édition mensuelle numérique mondiale de Clinician’s Brief ou à un tarif réduit sur l’abonnement en version imprimée. Voici quelques-uns des avantages de Clinician’s Brief :

- Des renseignements pratiques et pertinents sur les actualités en médecine vétérinaire.
- Des renseignements présentés dans un format concis pour les praticiens à l’horaire chargé.
- Vous pouvez accéder à Clinician’s Brief en tout temps et n’importe où — sur votre ordinateur, votre tablette ou votre appareil mobile.

Pour demander votre abonnement numérique gratuit, allez à la page Web des Avantages et services aux membres de l’ACMV et cliquez sur Clinician’s Brief (il faudra ouvrir une session).

De plus, dans le cadre de vos avantages de membre de l’ACMV, vous recevez un rabais de 30% sur l’abonnement en ligne individuel ou de la pratique ou sur la version imprimée de Plumb’s Veterinary Drugs™. Voici quelques-uns des avantages de Plumb’s Veterinary Drugs :

- Une ressource numérique conviviale pour accéder à des renseignements sur les médicaments vétérinaires.
- Fournit aux vétérinaires à l’horaire chargé des renseignements posologiques structurés qui reflètent les dernières recommandations fondées sur des données probantes ainsi qu’une expertise clinique.
- Plumb’s mobile app vous fournit l’accès instantané et hors ligne aux renseignements posologiques des médicaments, en tout temps et n’importe où.

Contactez l’ACMV au 1-800-567-2862 ou par courriel (admin@cvma-acmv.org) pour obtenir votre code de rabais de membre de l’ACMV dont vous aurez besoin pour profiter du rabais.

Plumb’s Veterinary Drugs et Clinician’s Brief représentent deux autres avantages de l’ACMV qui peuvent aider à positionner votre pratique à l’avant-garde de la médecine vétérinaire.
YOUR CVMA MEMBERSHIP MEANS MORE...

MORE KNOWLEDGE
Leading-edge research, education and information to enhance your career and lifelong learning.

The Canadian Veterinary Journal
Canadian Journal of Veterinary Research
Clinician’s Brief™ free global digital edition
CVMA national Convention
CVMA Veterinary Summit
CVMA Emerging Leaders Program
CVMA Canadian Veterinary Reserve
Member e-newsletter ‘Online from 339’
CVMA continuing education portal
VetFolio® Educational Resource subscription discount

MORE INFLUENCE
Advancing your issues, your concerns and your professional interest.

Government relations to influence policy decisions
International relations to provide the Canadian veterinary perspective
Media and public relations to provide balanced and trustworthy information and promote veterinary professionals
Formulation of position statements on animal welfare and national veterinary issues
Codes of practice for Canadian kennel and cattery operations
Member consultations and online discussions on key veterinary issues

MORE SAVINGS
CVMA’s national purchase power delivers more value to increase your profitability

Hotel discounts worldwide
National and Enterprise Rent-a-Car discounts
The Personal home and auto group savings
Scotiabank® business banking and lending solutions
The CVJ classified ads discount
Staples Advantage™ business products
Adtel® telephone hold service and digital signage
Petro-Canada SuperPass™ fuel/diesel/car wash discount
WSAVA World Congress discounted registration fee
Plumb’s Veterinary Drugs™ subscription discount

MORE RESOURCES
Practice tools and resources to support you and your practice team.

Early career DVM resource hub
CVMA web store MyVetStore.ca™
Practice owner’s economic survey
Practice diagnostic and valuation report
Provincial suggested fee guide
Associate compensation and benefits report
Compensation report for non-DVM staff
Compensation report for DVMs outside private practice
Practice management articles
CVMA group management program
CVMA mentoring program
VetLaw Online™ legal advice column
CVMA Green Veterinary Practice and self-audit tool
Antimicrobial SmartVet mobile app
Veterinarians health and wellness resources
Guidelines for the successful employment of new veterinary graduates
Sedative, anaesthetic and pain management protocols posters
Guidelines for the legitimate use of compounded drugs in veterinary practice
Antimicrobial prudent use guidelines for beef cattle, dairy cattle, poultry and swine
Therapeutic decision cascade poster
Animal abuse resources for practitioners faced with this issue
Preventive healthcare, nutritional assessment and client education tools and resources
Animal health week annual awareness campaign

Learn MORE about your benefits and privileges as a member of the Canadian Veterinary Medical Association. Visit canadianveterinarians.net, or contact the CVMA at 1.800.567.2862, or at admin@cvma-acmv.org.
Some of the CVMA’s strengths include:

- Canada’s only national veterinary multi-species organization.
- Well-recognized national and internationally.
- A national facilitator.
- The only national multi-species veterinary organization engaged in national and international issues, and animal welfare.
- Publishing the only national, general or multi-species, peer-reviewed veterinary journals in Canada.
- The only national, multi-species Convention offering continuing education (CE).
- The only national student Symposium.
- Offering national exams to Canadian and international veterinary graduates.
- Accrediting veterinary technician & technologists programs across Canada.
- Large number (close to 500) of dedicated volunteers from across Canada.

The Future of the CVMA identified the CVMA’s Core Competencies: animal welfare, and national and international issues, while the journals, the CVMA Convention, the SCVMA Symposium and the programs on career & life balance enhance these core competencies each in their respective way. The national exams, college accreditation and accreditation of veterinary technician programs ensure professional standards.

CVMA’s Core Competencies

Some of the many considerations for the CVMA’s future are:

- Continue developing useful practice tools to help veterinarians with decision-making, e.g. Smart Vet app for prudent use of antimicrobials in companion and food animals; continue targeted advocacy according to member needs; increase work with national species associations on key advocacy issues; increase

Some of the many considerations for the CVMA’s future are:

- Continue developing useful practice tools to help veterinarians with decision-making, e.g. Smart Vet app for prudent use of antimicrobials in companion and food animals; continue targeted advocacy according to member needs; increase work with national species associations on key advocacy issues; increase

Some of the many considerations for the CVMA’s future are:

- Continue developing useful practice tools to help veterinarians with decision-making, e.g. Smart Vet app for prudent use of antimicrobials in companion and food animals; continue targeted advocacy according to member needs; increase work with national species associations on key advocacy issues; increase

The Future of the CVMA identified the CVMA’s Core Competencies: animal welfare, and national and international issues, while the journals, the CVMA Convention, the SCVMA Symposium and the programs on career & life balance enhance these core competencies each in their respective way. The national exams, college accreditation and accreditation of veterinary technician programs ensure professional standards.

Some of the many considerations for the CVMA’s future are:

- Continue developing useful practice tools to help veterinarians with decision-making, e.g. Smart Vet app for prudent use of antimicrobials in companion and food animals; continue targeted advocacy according to member needs; increase work with national species associations on key advocacy issues; increase

The Future of the CVMA identified the CVMA’s Core Competencies: animal welfare, and national and international issues, while the journals, the CVMA Convention, the SCVMA Symposium and the programs on career & life balance enhance these core competencies each in their respective way. The national exams, college accreditation and accreditation of veterinary technician programs ensure professional standards.

Some of the many considerations for the CVMA’s future are:

- Continue developing useful practice tools to help veterinarians with decision-making, e.g. Smart Vet app for prudent use of antimicrobials in companion and food animals; continue targeted advocacy according to member needs; increase work with national species associations on key advocacy issues; increase

The Future of the CVMA identified the CVMA’s Core Competencies: animal welfare, and national and international issues, while the journals, the CVMA Convention, the SCVMA Symposium and the programs on career & life balance enhance these core competencies each in their respective way. The national exams, college accreditation and accreditation of veterinary technician programs ensure professional standards.

Some of the many considerations for the CVMA’s future are:

- Continue developing useful practice tools to help veterinarians with decision-making, e.g. Smart Vet app for prudent use of antimicrobials in companion and food animals; continue targeted advocacy according to member needs; increase work with national species associations on key advocacy issues; increase

The Future of the CVMA identified the CVMA’s Core Competencies: animal welfare, and national and international issues, while the journals, the CVMA Convention, the SCVMA Symposium and the programs on career & life balance enhance these core competencies each in their respective way. The national exams, college accreditation and accreditation of veterinary technician programs ensure professional standards.

Some of the many considerations for the CVMA’s future are:

- Continue developing useful practice tools to help veterinarians with decision-making, e.g. Smart Vet app for prudent use of antimicrobials in companion and food animals; continue targeted advocacy according to member needs; increase work with national species associations on key advocacy issues; increase

The Future of the CVMA identified the CVMA’s Core Competencies: animal welfare, and national and international issues, while the journals, the CVMA Convention, the SCVMA Symposium and the programs on career & life balance enhance these core competencies each in their respective way. The national exams, college accreditation and accreditation of veterinary technician programs ensure professional standards.

Some of the many considerations for the CVMA’s future are:

- Continue developing useful practice tools to help veterinarians with decision-making, e.g. Smart Vet app for prudent use of antimicrobials in companion and food animals; continue targeted advocacy according to member needs; increase work with national species associations on key advocacy issues; increase

The Future of the CVMA identified the CVMA’s Core Competencies: animal welfare, and national and international issues, while the journals, the CVMA Convention, the SCVMA Symposium and the programs on career & life balance enhance these core competencies each in their respective way. The national exams, college accreditation and accreditation of veterinary technician programs ensure professional standards.

Some of the many considerations for the CVMA’s future are:

- Continue developing useful practice tools to help veterinarians with decision-making, e.g. Smart Vet app for prudent use of antimicrobials in companion and food animals; continue targeted advocacy according to member needs; increase work with national species associations on key advocacy issues; increase

The Future of the CVMA identified the CVMA’s Core Competencies: animal welfare, and national and international issues, while the journals, the CVMA Convention, the SCVMA Symposium and the programs on career & life balance enhance these core competencies each in their respective way. The national exams, college accreditation and accreditation of veterinary technician programs ensure professional standards.

Some of the many considerations for the CVMA’s future are:

- Continue developing useful practice tools to help veterinarians with decision-making, e.g. Smart Vet app for prudent use of antimicrobials in companion and food animals; continue targeted advocacy according to member needs; increase work with national species associations on key advocacy issues; increase

The Future of the CVMA identified the CVMA’s Core Competencies: animal welfare, and national and international issues, while the journals, the CVMA Convention, the SCVMA Symposium and the programs on career & life balance enhance these core competencies each in their respective way. The national exams, college accreditation and accreditation of veterinary technician programs ensure professional standards.

Some of the many considerations for the CVMA’s future are:

- Continue developing useful practice tools to help veterinarians with decision-making, e.g. Smart Vet app for prudent use of antimicrobials in companion and food animals; continue targeted advocacy according to member needs; increase work with national species associations on key advocacy issues; increase

The Future of the CVMA identified the CVMA’s Core Competencies: animal welfare, and national and international issues, while the journals, the CVMA Convention, the SCVMA Symposium and the programs on career & life balance enhance these core competencies each in their respective way. The national exams, college accreditation and accreditation of veterinary technician programs ensure professional standards.
advocating for companion animal issues; increase engagement of members on national issues and relate advocacy issues to current and future veterinary practice, e.g., the impact of antimicrobial stewardship on veterinary practice; increase media engagement; and connect national stakeholders and their efforts, e.g., on issues of animal abuse.

**CVMA representation and partnerships:** In order to fulfill its mission as the national and international voice of veterinarians, the CVMA is formally engaged in 27 representations with government agencies and interest groups. The CVMA also represents Canadian veterinarians in numerous undertakings whether this is to provide input into government policy or working with other stakeholders. Formal partnerships such as with the Canadian Council of Veterinary Registrars (CCVR), Registered Veterinary Technologists and Technicians of Canada (RVTTTC), the Federation of Veterinarians of Europe (FVE) and the American Veterinary Medical Association (AVMA), and Veterinarians Without Borders (VWB) enhance the Association’s strength in achieving common goals.

**Antimicrobial resistance:** For the better part of the last 20 years, one of the CVMA’s focal points has been advocacy for the prudent use of antimicrobials. The year 2015 was a breakthrough year with Health Canada’s announcement on regulatory changes resulting in more veterinary oversight, particularly for the use of antimicrobials in feed and water along with regulations for own-use importation of drugs and active pharmaceutical ingredients. On behalf of its members, the CVMA has had a significant stake in this development. In order to prepare the profession for the regulatory changes, the CVMA, in conjunction with the CCVR, has drafted the document entitled: “Veterinary Oversight of Antimicrobial Use — A Pan-Canadian Framework of Professional Standards for Veterinarians.” During the 2016 CVMA Summit in Niagara Falls, a broad range of stakeholders, including CVMA members, will provide input to this document.

The following report provides a summary of the main activities undertaken by the CVMA in 2015.

---

la prise de décisions, p. ex., l’appli **Intelli-Vet** pour l’administration judiciaire des antimicrobiens aux animaux de compagnie et aux animaux destinés à l’alimentation; la poursuite de la défense des intérêts ciblée en fonction des besoins des membres; l’accroissement du travail avec les associations nationales sur les espèces en lien avec les principaux enjeux de défense des intérêts; l’augmentation des activités de défense des intérêts sur les enjeux liés aux animaux de compagnie; l’élargissement de l’engagement des membres sur les enjeux nationaux et l’établissement d’un lien entre les enjeux de défense des intérêts et la pratique vétérinaire actuelle et future, p. ex., l’impact de l’antibigoussance sur la pratique vétérinaire; l’intensification de l’engagement avec les médias; et l’établissement d’un lien entre les intervenants nationaux et leurs efforts, p. ex., relativement aux enjeux liés à la violence envers les animaux.

**Représentation et partenariats de l’ACMV:** Afin d’accomplir sa mission à titre de voix nationale et internationale des vétérinaires, l’ACMV participe officiellement à 27 représentations auprès d’organismes gouvernementaux et de groupes d’intérêts. L’ACMV représente aussi les vétérinaires canadiens dans plusieurs projets, notamment en vue de fournir de la rétroaction en lien avec les politiques gouvernementales et de travailler avec les autres intervenants. Les partenariats officiels, comme celui avec le Conseil canadien des registraires vétérinaires (CCRV), les Technologues et techniciens vétérinaires agréés du Canada (TTVEC), la Fédération des vétérinaires d’Europe (FVE) et l’American Veterinary Medical Association (AVMA) ainsi que Vétérinaires sans frontières (VSF) améliorent la force de l’Association en vue d’atteindre les buts communs.

**Antibiorésistance:** Pendant la majeure partie des vingt dernières années, la défense des intérêts de l’ACMV s’est concentrée entre autres sur l’administration judiciaire des antimicrobiens. En 2015, une percée a d’ailleurs été enregistrée lors de l’annonce des modifications réglementaires de Santé Canada qui exigent une surveillance vétérinaire accrue, particulièrement pour l’utilisation des antimicrobiens dans les aliments et l’eau, ainsi que de nouveaux règlements pour l’importation des médicaments et des ingrédients pharmaceutiques actifs pour utilisation personnelle. Au nom de ses membres, l’ACMV a joué un rôle important dans ce projet. Afin de préparer la profession aux modifications réglementaires, l’ACMV, en collaboration avec le CCRV, a rédigé le document intitulé : «Surveillance vétérinaire de l’utilisation des antimicrobiens — Un cadre de travail pancanadien pour les normes professionnelles régissant les vétérinaires». Durant le Sommet 2016 de l’ACMV qui aura lieu à Niagara Falls, un vaste groupe d’intervenants, y compris les membres de l’ACMV, se réunira afin de fournir de la rétroaction sur ce document.

Le rapport suivant présente un sommaire des principales activités entreprises par l’ACMV en 2015.

---

704
Corporate Partnership Program (CPP)
Programme de commandite par des entreprises (PCE)

The CVMA Corporate Partnership Program (CPP) is a comprehensive sponsorship program that was implemented in 2007 to better recognize a company's overall financial contribution to the Association. The CPP evolves each year and takes into account the various programs and events that are corporately sponsored, allowing companies that support the CVMA in various aspects to get better recognition for their overall contributions. The 3 levels of sponsorship in 2015 were Platinum (> $80 000), Gold ($48 000–$79 999) and Silver ($27 000–$47 999).

The CVMA would like to extend recognition to the following sponsors for their overall contribution to the Association for 2015:

Gold: Scotiabank
Silver: IDEXX Laboratories
Merck Animal Health
Merial Canada Inc.
Petsecure Pet Health Insurance

Policy & Advocacy
National and international leadership efforts that advance the concerns and professional interests of members.

Politiques et défense des intérêts
Des efforts de leadership à l’échelle nationale et internationale qui font valoir les préoccupations et avancent les intérêts professionnels des membres.

Animal Welfare
Bien-être animal

The 15 members of the Animal Welfare Committee (AWC) deal with a wide range of issues of concern to veterinarians and the Canadian public in respect to the humane treatment of animals. Position statements are developed by the AWC through diligently accessing current science and carefully considering the ethical dimensions to topics under consideration. The AWC recommended a number of positions to CVMA Council that subsequently received approval including those on Humane Slaughter of Animals; Humane Training Methods for Dogs; Humane Mass Depopulation; Seal Hunt in Atlantic Canada; and Use of Animals for Scientific Purposes. Under review by the AWC are position statement statements on Electro-immobilization; Induced Molting of Poultry; Castration of Piglets; Cutting Canine Teeth in Dogs; Disbudding and Dehorning of Cattle; Firing of Horses; Tail Docking of Dairy Cattle; Transportation of Pets; Use of Animals in Entertainment and Recreation; and
-Onychectomy (Declawing) of the Domestic Feline. The CVMA is seeking input from members on a position statement on Devocalization of Dogs. The AWC is finalizing the revision of Code of Practice for Canadian Kennel Operations in consultation with external stakeholders.

Regarding actions concerning government legislation, the CVMA continues to monitor various private members bills that are being tabled to address the need for updated federal animal cruelty legislation. New initiatives are expected given the change in government as a result of the October 2016 federal election. The CVMA wrote to the Minister of Agriculture expressing concern regarding the slow progress on the proposed regulatory amendment of the humane transport requirements of the Health of Animals Regulations. In addition a letter was written to Health Canada expressing concern regarding the animal welfare implications of the use of beta-adrenergic agonist drugs in food animals. Internationally, the CVMA wrote a letter to the World Veterinary Association and the World Small Animal Veterinary Association in support of their opposition to the re-scheduling of ketamine by the United Nations, which might have meant reduced availability of this important drug to veterinarians.

The CVMA was represented on the National Farmed Animal Care Council (NFACC) Executive and Board and continues to provide representation on the code and scientific committees as well as the Animal Care Assessment Program Committees. Internationally, the CVMA was represented at the annual meeting of the American Veterinary Medical Association (AVMA) Animal Welfare Committee.

A number of animal welfare resources continue to be available on the CVMA website including pain management posters; Kennel and Cattery Codes; animal abuse information; and animal welfare news items and articles. The CVMA initiated a national working group focused on providing educational material on humane transport of compromised cattle through the CVMA website.

Plusieurs ressources sur le bien-être animal continuent d’être disponibles sur le site Web de l’ACMV, dont des affiches sur la gestion de la douleur, des codes pour les chenils et les chateries, des renseignements sur la violence envers les animaux ainsi que des nouvelles et des articles sur le bien-être animal. L’ACMV a aussi formé un groupe de travail national chargé de la présentation de matériel pédagogique sur le transport sans cruauté du bétail fragilisé par l’entremise du site Web de l’ACMV.
The 5 members of the National Issues Committee (NIC) considered a wide range of issues of concern to the veterinary profession in Canada. The NIC revised position statements on issues including Legislation Concerning Dangerous Dogs; Extra-Label Drug Use (ELDU); and Aquatic Animal Veterinary Medicine, all of which were approved by CVMA Council. A new position that is being developed by the NIC on the Transboundary Movement of Dogs will be the focus of the NIC Forum at the 2016 Convention.

A major focus of NIC deliberations continues to be antimicrobial stewardship of veterinary drugs given anticipated changes to federal regulations during 2016. The NIC drafted a response to the Minister of Health regarding the 2014 Canada Federal Framework on Anti-Microbial Resistance (AMR) and is continuing efforts to urge Health Canada to act on regulatory modernization to address regulatory voids related to active pharmaceutical ingredients (API) and own use importation (OUI). The CVMA has released a public statement on the findings of the Office of the Auditor General on Anti-Microbial Resistance (AMR). Furthermore, the CVMA represented veterinarians at a roundtable hosted by the Federal Minister of Health that brought together 30 human and animal stakeholders to discuss antimicrobial stewardship.

The CVMA’s Veterinary Pharmaceutical Stewardship Advisory Group (VPSAG) developed a draft paper entitled “Antimicrobial stewardship — A call to action” focusing on developing key questions around stewardship of antimicrobials by veterinarians in Canada. This led to a paper entitled “Veterinary oversight of antimicrobial use — A pan-Canadian framework of professional standards for veterinarians” that was presented to stakeholders including Health Canada, Public Health Agency and the Canadian Food Inspection Agency. The VPSAG provided input into the development of communication tools to highlight the key role veterinarians play in pharmaceutical stewardship. The CVMA continues to promote the Prudent Use Guidelines for anti-microbial use for food animals and the

Les cinq membres du Comité sur les enjeux nationaux (CEN) se penchent sur un vaste éventail d’enjeux qui préoccupent la profession vétérinaire au Canada. Le CEN a révisé les énoncés de position suivants sur des enjeux qui incluaient notamment : Lois concernant les chiens dangereux; Utilisation des médicaments en dérogation des directives de l’étiquette (UMDDE); et Médecine vétérinaire des animaux aquatiques, qui ont tous été approuvés par le Conseil de l’ACMV. Une nouvelle position qui est en voie d’élaboration par le CEN sur le Mouvement transfrontalier des chiens sera étudiée lors du Forum du CEN qui aura lieu au congrès 2016.


L’ACMV a assuré une représentation lors des réunions avec l’Institut canadien de la santé animale (ICSA); le Comité consultatif canadien sur la réglementation des produits de santé animale (CCCRPSA); le Conseil canadien des registres vétérinaires (CCRv); le Comité ad hoc sur la gestion responsable des antimicrobiens vétérinaires; le Conseil national sur la santé et le bien-être des animaux d’élevage (CNSBFAE); le Groupe de travail sur l’importation des chiens du Conseil canadien
Antimicrobial Smartvet app for companion animals aiming to develop new tools and applications to support antimicrobial stewardship.

The CVMA provided representation at meetings with the Canadian Animal Health Institute (CAHI); the Canadian Animal Health Products Advisory Committee (CAHPAC); Canadian Council of Veterinary Registrars (CCVR); Ad Hoc Committee on Veterinary Antimicrobial Stewardship; National Farmed Animal Health and Welfare Council (NFAHWC); Council of Chief Veterinary Officers (CCVO) Task Force on Dog Importation; and the American Veterinary Medical Association (AVMA). The CVMA continued supporting the Canadian Global Food Animal Residue Avoidance Databank (CgFARAD) by participating in the sub-committee tasked to reorganize the CgFARAD structure and by serving on the new CgFARAD Advisory Board. The CVMA communicated to attendees at the NFAHWC meeting the Association’s activities that support the National Animal Health Strategy. The NIC continues to monitor the activity of the NFAHWC Council and seeks opportunities to provide input on issues that are important to the veterinary community (e.g. disease surveillance, Codes of Practice incorporation into provincial regulations, and antimicrobial stewardship/resistance).

The CVMA submitted questions of importance to veterinarians in Canada to political candidates in the October federal election following which a letter was forwarded to the Ministers of International Trade and Foreign Affairs expressing the position that importation of products under international trade agreements must occur under conditions where animal health and welfare, public health and food-safety are fully protected both at source and within Canada.

The CVMA is developing a forward action plan for the Environmental Advisory Group aiming to build on the Green Practice Initiative from 2014 and examining new areas of focus including waste disposal in veterinary practices.

**International Relations**

**Relations internationales**

Veterinary medicine does not have any borders. For example importation or exportation of dogs or livestock comes with the potential risks of disease transmission. Antimicrobial resistance must be addressed globally and by every jurisdiction and every veterinary practitioner. The CVMA represents its members by participating in international networks and organizations with the goal of sharing expertise and tools, learning from each-other, and developing joint strategies, positions and actions where applicable.

Here are the groups with which the CVMA has formal ties and examples of the strategies and actions undertaken: the World Organization for Animal Health (OIE): The CVMA is part of the Canadian Government’s delegation to the OIE’s General Assembly and, last year, participated in the OIE annual World Assembly of the Organization for Animal Health Delegates, as well as the roundtable on OIE’s council.

La médecine vétérinaire n’a pas de frontières. Par exemple, l’importation ou l’exportation de chiens ou du bétail comporte des risques potentiels de transmission de maladie. L’antibiorésistance doit être abordée à l’échelle internationale ainsi que par tous les territoires et les praticiens vétérinaires. L’ACMV représente ses membres en participant à des organisations et à des réseaux internationaux dans le but de partager de l’expertise et des outils, d’apprendre l’un de l’autre et d’élaborer des stratégies, des positions et des actions conjointes au besoin.

Voici les groupes avec lesquels l’ACMV possède des liens officiels ainsi que des exemples des stratégies et des initiatives qui ont été entreprises : l’Organisation mondiale de la santé animale (OIE) : L’ACMV fait partie de la délégation du gouvernement canadien à l’Assemblée générale annuelle de l’OIE et, l’an dernier, elle a participé à l’Assemblée mondiale annuelle de l’OIE pour les délégués de la santé animale ainsi qu’à la table ronde de l’OIE.
try assessment of veterinary services. The World Veterinary Association (WVA): The CVMA is represented on the WVA Council and has participated in the development of a global AMR position. Furthermore, the CVMA participated in the WVA’s global initiative on the eradication of rabies. The World Small Animal Veterinary Association (WSAVA): The CVMA is represented on the WSAVA Council. Our WSAVA membership provided significant advantages in negotiating exclusive terms for the new CVMA member benefits such as VetFolio and Clinician’s Brief. The Federation of Veterinarians of Europe/American Veterinary Medical Association (FVE/AVMA): The CVMA, FVE and AVMA maintain a formal agreement of collaboration. These associations developed joint position statements on: Global Control of Canine Rabies; The Essential Role of Veterinarians in Protecting Animal, Human, Public & Environmental Health; Responsible and Judicious Use of Antimicrobials; and Veterinary Education.

For decades, the CVMA has had a special, mutually beneficial working relationship with the AVMA. The AVMA and the CVMA share the veterinary college accreditation and the national exams. We enjoy a reciprocity agreement in terms of recognition of each other’s veterinary technician and technologist program accreditation. We maintain representation on each other’s Animal Welfare Committees. The CVMA also holds a seat on the PANVET. The CVMA is a founding member of the International Veterinary Officers Coalition (IVOC), comprising the presidents and CEOs of the national veterinary associations of the United States, Canada, Britain, New Zealand, Australia and South Africa. Within this group, we share our experience, position, programs and benchmark our organizations. The CVMA’s new Mentorship Guide is based on an Australian VMA tool.

Communications & Public Relations

The CVMA received 84 media inquiries during 2015, resulting in the Association being highlighted in such stories ranging from Flight Tips for Furry Friends to Antibiotic Resistance: A Growing Problem for Pets. The 2015 CVMA Convention in Calgary saw successful media coverage resulting in a print and online article about antibiotic resistance in pets, radio interviews with 2 Convention speakers, as well as 2 TV interviews with Dr. Nicole Gallant, 2015–16 CMVA president. The CVMA continues to increase social media channel activity. By the end of 2016, the CVMA’s Facebook page is expected to hit 5000 likes and its combined English and French Twitter followers to be over 8500. Its YouTube Channel featured a number of informative animal health videos, thanks to Dr. Bob
Facebook de l’ACMV atteindra 5000 J’aime et que le nombre combiné de suiveurs de Twitter, en français et en anglais, de l’ACMV dépassera 8500 personnes. Son canal YouTube a présenté plusieurs vidéos informatives sur la santé animale, grâce au Dr Bob Bellamy qui a créé les vidéos avec l’aide de Wow Factor Media.

En 2015, l’ACMV a mené une campagne de sensibilisation qui a ciblé des publics sur Facebook et Twitter afin de promouvoir la valeur des soins vétérinaires et de rehausser la compréhension quant aux nombreux rôles des vétérinaires. À l’aide de #VétérinairesPartenaires ou #VetCareEverywhere, une série de déclarations sur les soins vétérinaires a attiré l’attention sur divers sujets, dont la santé des animaux de compagnie et des grands animaux, la santé publique, l’antibiogouvernance, le lien humain-animal, les options de soins préventifs et plus encore. La campagne de sensibilisation se poursuit en 2016.

La Semaine de la vie animale s’est déroulée du 4 au 10 octobre 2015 et a marqué le 30e anniversaire de la campagne. Le thème de 2015, «Des partenaires hors pair en matière de soins vétérinaires préventifs», a insisté sur le fait que, malgré les progrès de la technologie médicale et des soins vétérinaires, le lien entre l’équipe vétérinaire et le client demeure l’une des plus importantes facettes des soins vétérinaires. L’utilisation du mot-clic #célébronslaSVA a facilité la promotion et le partage des célébrations des participants durant cette semaine. Un généreux soutien a été fourni pour la campagne de la Semaine de la vie animale 2015 par les commanditaires principaux Petsecure assurance maladie pour animaux, le commanditaire de programme plus IDEXX et les commanditaires de programme iFinance Petcard et Merial.

Des bulletins de masse ont été envoyés par courriel et par télécopieur et des nouvelles dans les médias sociaux, des articles dans les publications provinciales, des renseignements sur le site Web de l’ACMV et le cyberbulletin mensuel de l’ACMV ont fourni aux membres des mises à jour sur les programmes et l’actualité vétérinaire en général. Des outils pour la pratique, comme ceux qui sont disponibles dans le cadre de la collaboration de l’ACMV avec la Pet Nutrition Alliance, Partners for Healthy Pets et Soins des chats, ont aussi été mis en lumière.

Prix 2015 de l’ACMV

Depuis plus de 20 ans, l’ACMV reconnaît fièrement ses membres pour leurs contributions exceptionnelles à la profession vétérinaire ainsi qu’à la santé et au bien-être des animaux.
2015 CVMA Awards
The CVMA has proudly recognized its members for their exceptional contributions to the veterinary profession and to animal health and welfare for over 20 years. In 2015, the following individuals were honored at the CVMA Awards Ceremony in Calgary, Alberta, during the 2015 CVMA Convention.
Dr. Susan Kilborn — Small Animal Practitioner Award
Dr. Yves Tarte — CVMA Industry Award
Dr. Timothy Blackwell — CVMA Humane Award
Dr. Doug MacDougald — Merck Veterinary Award
Veterinary Agri-Health Services Ltd. — CVMA Practice of the Year Award
Dr. Michelle Lem — 2015 CVMA President’s Award
Dr. Timothy H. Ogilvie — CVMA Life Membership

Recognition was also given to the president of the Students of the CVMA, Ms. Guylène Kheirkhah. The Registered Veterinary Technologists and Technicians of Canada (RVTTC) joined the Awards Ceremony to present one of its members, Ms. Nadine Schueller, with its 2015 Animal Health Technologist/Veterinary Technician of the Year Award.

Science and Knowledge
Leading-edge research, education, news and information that enhances the lifelong learning and career development of members.

Science et connaissances
De la recherche, de la formation, des nouvelles et de l’information de pointe qui améliorent l’apprentissage continu et le développement de la carrière des membres.

Journals
Revues

The Canadian Veterinary Journal (The CVJ) and Canadian Journal of Veterinary Research (CJVR) are the only national, general or multi-species, peer-reviewed veterinary journals in Canada. The number of manuscripts submitted to The CVJ in 2015 was 311; the number submitted to the CJVR in 2015 was 124. Efforts are ongoing to reduce the backlog of CVJ manuscripts. The CJVR backlog was addressed successfully in 2015 with the installment of $15 000 approved by CVMA Council; the time from submission to publication decreased from 16.3 months at the beginning of 2015 to 8.6 months at the beginning of 2016. The extra funds were used to prepare and publish additional manuscripts for the online issues of the CJVR; policy adjustments are in place to prevent future backlogs. Both journals will continue to promote the relevance of journal articles to practice, and build demand for the knowledge delivered.

Journal staff conducted 2 focus group discussions in 2015 with the intention of involving veterinarians and getting quali-
En 2015, le personnel des revues a tenu deux groupes de discussion dans le but de faire participer les vétérinaires et d’obtenir des données qualitatives afin d’améliorer les deux revues et de faire en sorte qu’elles répondent aux besoins des vétérinaires canadiens.

Le Comité de la rédaction est heureux d’annoncer que la Dr. Eva Nagy a accepté de rester en poste en tant que rédactrice de la CJVR. La Dr. Debbie Haines a aussi accepté de continuer en tant que rédactrice associée pour la RCVR et un autre vétérinaire s’est aussi porté bénévole pour travailler en tant que rédacteur associé et une motion sera présentée sous peu au Conseil de l’ACMV aux fins d’approbation.

Chaque année, le service des revues envoie une lettre aux doyens des écoles de médecine vétérinaire canadienne, de la part de l’ACMV, au nom des rédacteurs. Le travail des rédacteurs auprès des revues est reconnu par les écoles afin de déterminer l’avancement et la permanence dans les universités.

En tant qu’avantage aux membres de l’ACMV, les auteurs de l’ACMV profitent de tarifs de publication inférieurs pour La RVC ainsi que de frais inférieurs par page pour la RCVR. Les deux revues continueront de travailler en vue d’équilibrer le budget.

Readers and CVMA members are reminded that all issues, except the most recent 6 months, of both The CVJ and the CJVR are available to the public on the PubMed Central archive (www.pubmedcentral.com); a link is also available through the CVMA website (www.canadianveterinarians.net). CVMA members can view the most recent 6 months of the journals on the member-only section of the CVMA website.

---

**Conventions**

**Congrès**

Le congrès 2015 de l’ACMV s’est déroulé du 16 au 19 juillet à Calgary, en Alberta, et a attiré 809 délégués. Le congrès a été organisé en collaboration avec l’Alberta Veterinary Medical Association (ABVMA) et with the Registered Veterinary Technicians and Technologists of Canada (RVTTC).

Grâce aux plus de 40 conférenciers provenant du Canada, des États-Unis et de la France, plus de 100 ateliers ont été offerts dans les volets suivants : animaux de compagnie, équidés, bovins, ruminants, bien-être animal, animaux exotiques et faune, pleine conscience et résilience en médecine vétérinaire ainsi que...
dentistry to ophthalmology, from endocrine and metabolic diseases to nutrition and clinical pharmacology.

The Convention provided an opportunity for many ancillary groups and organizations to hold meetings onsite including the RVTTC Board, and the Alberta Association of Animal Health Technologists (AAAHT), Canadian Council of Veterinary Registrars, Registered Veterinary Technologists and Technicians of Canada (RVTTC), deans of the veterinary medicine faculties, as well as the Christian Veterinary Missions of Canada. The AAAHT hosted a luncheon for almost 100 RVTS with the “Wardens” as entertainment. The Atlantic Veterinary College and Western College of Veterinary Medicine held alumni receptions. A tour of the Faculty of Veterinary Medicine at the University of Calgary was organized as an evening activity and Vets Without Borders — Canada held a fundraising golf tournament and dinner.

For the first time, the CVMA applied to be a RACE (Registry of Approved Continuing Education) provider and submitted the Convention program for RACE Approval. As a result, DVMs were able to earn up to 28 hours of CE from a potential of 136 RACE-approved hours.

New in 2015, a one-hour showcase featuring 5 faculty members from the University of Calgary, Faculty of Veterinary Medicine was introduced. This session addressed 5 specific issues allowing for small group, in-depth discussion.

For the première fois, l’ACMV a présenté une demande pour devenir un fournisseur de formation approuvé par RACE (Registry of Approved Continuing Education) et elle a soumis le programme du congrès aux fins d’approbation par RACE. Par conséquent, les vétérinaires ont pu accumuler jusqu’à 28 heures de formation continue parmi 136 heures potentielles de formation approuvée par RACE.
For the 2nd year, the CVMA Quest game was part of the mobile app. In 2015, 40% of the total delegates participated in the challenge and earned from one to 799 points for completing activities and winning prizes. Double Dutch, a native (housed on your phone) app, had better engagement of attendees as well as other administrative functions that we wanted to use. App ambassadors provided one-on-one demonstrations and funky animal stickers were given to those who have APPtitude!

The CVMA Professional Development Committee ran a fundraiser onsite to raise money for a local charity Tails of Help; a total of $406.70 was raised.

On Saturday, July 18, the fun run had 25 runners and the yoga session had 16 participants. The “Western Hoedown” attracted 175 attendees who were white-hatted and sworn in as honorary Calgarians. The group walked to the casino grounds where a western-style dinner was served in the Melrose restau-

Pour la première fois en 2015, une présentation d’une heure présentant cinq professeurs de la Faculté de médecine vétérinaire de l’Université de Calgary a été organisée. Cet atelier a abordé cinq enjeux particuliers et a permis une discussion approfondie en petits groupes.

Pour la deuxième année, le jeu de la Quête de l’ACMV faisait partie de l’appli mobile. En 2015, 40 % des délégués ont participé au défi et ont accumulé de 1 à 799 points en s’adonnant aux activités et en gagnant des prix. L’appli «Double Dutch», une application native (qui se trouve sur votre téléphone), a suscité une meilleure participation de la part des délégués et offrait aussi d’autres fonctions administratives que nous voulions utiliser. Les ambassadeurs d’applis ont fourni des démonstrations individuelles et des autocollants d’animaux cocasses étaient donnés aux délégués qui manifestaient de l’APPlitude!

Le Comité de perfectionnement professionnel de l’ACMV a organisé une activité de financement pour recueillir des fonds pour l’organisme de bienfaisance local Tails of Help; un total de 406,70 $ a été amassé.

Le samedi 18 juillet, la course folle a réuni 25 coureurs et la session de yoga a rassemblé 16 participants. Quant à elle, la soirée «Western Hoedown» a attiré 175 participants qui portaient le chapeau blanc et ont été assermentés en tant que Honorary Calgarians. Le groupe a marché jusqu’aux terres de l’hôtel de jeu où un dîner western a été servi au Melrose restaurant.
The purpose of the CVR is to provide veterinary surge capacity resources to first-responders in case of large-scale emergencies involving animals, in order to address animal health and welfare.

In 2015, there were 474 CVR members in the CVMA database of which 245 have been formally trained.

Over the past 12 months, some reservists were given the opportunity to participate in a provincial exercise and a workshop: Exercise Angus was organized by Alberta’s provincial government. The aim of this exercise was to practice the response to a serious outbreak of a livestock disease in cattle.

The Ontario Livestock & Poultry Council, in conjunction with the Ontario Equestrian Federation, the Ontario Ministry of Agriculture, Food and Rural Affairs, the CFIA and the Animal Health Laboratory at the University of Guelph, held an Equine Foreign Animal Disease Workshop. The objective was to improve the preparedness of the equine sector for an animal disease outbreak.

Over the past year, the CVR has liaised with the US Department of Health and Human Services, Office of Emergency Management with the goal of enabling CVR members to access this department’s 16 online emergency response training modules. This access is planned for early 2016.

A broad call-up drill is planned for March 2016. This drill is designed to test the responsiveness of CVR members to a call up and to test the CVR management and administrative process and procedures.

Canadian Veterinary Reserve (CVR)

La RVC a pour mandat de fournir des ressources vétérinaires d’appoint aux premiers intervenants dans l’éventualité de situations d’urgence à grande échelle touchant les animaux et afin de gérer les enjeux liés à la santé et au bien-être des animaux.

En 2015, il y avait 474 membres de la RVC dans la base de données de l'ACMV et 245 d'entre eux avaient reçu une formation officielle.

Au cours des douze derniers mois, certains réservistes ont eu l’occasion de participer à un exercice provincial et à un atelier. En effet, l’exercice Angus a été organisé par le gouvernement provincial de l’Alberta. Cet exercice avait pour but de pratiquer une intervention lors d’une écllosion grave d’une maladie du bétail.


Au cours de la dernière année, la RVC a effectué la liaison avec le Bureau de la gestion des urgences du ministère de la Santé et des Services humains des États-Unis dans le but de permettre aux membres de la RVC d’accéder aux seize modules de formation en ligne sur les interventions d’urgence de ce ministère. Cet accès est prévu pour le début de 2016.

Un vaste exercice de mobilisation est prévu pour mars 2016. Cet exercice est conçu afin de tester la réaction des membres de la RVC lors d’un appel de mobilisation et de mettre à l’épreuve les processus et les procédures de gestion et d’administration de la RVC.
Practice and Economics

Veterinary practice tools and resources that have been developed to support members and their healthcare teams.

Pratique et finances

Des outils et des ressources pour la pratique vétérinaire qui ont été conçus pour appuyer les membres et leurs équipes de soins vétérinaires.

Business Management

Gestion commerciale

In 2015, the CVMA continued its unique benchmarking program that included valuable economic and practice management tools and resources such as provincial suggested fee guides, compensation and benefits reports for associate veterinarians, non-DVM wage reports, provincial economic reports, and individual practice reports. The data for these reports come from the annual economic surveys that the CVMA conducts in partnership with the provincial veterinary medical associations, Idexx Laboratories, Petsecure, Merck Animal Health and Scotiabank who co-sponsor this program together with the CVMA.

The CVMA and the Association des médecins vétérinaires du Québec en pratique des petits animaux (AMVQ) collaborated to deliver the 2015 economic survey of small animal practitioners in Québec, which provided added value to our respective members.

In 2015, the CVMA published 6 veterinary practice management articles in *The CVJ* that can also be found in the Business Management Program section of the CVMA website.

The Business Management track at the 2015 CVMA Convention in Calgary, Alberta, “A Successful Career: A Balanced Life,” was comprised of 6 50-minute sessions. Kelly Lynn Cronin tackled practice economics showing how to price shop competitors and how to get employees on board with pricing, and Dr. Jason Coe explored communication skills that can help you better understand your client’s perspective.

Provincial veterinary medical association (VMA) representatives attended the yearly Economic Forum, hosted by the CVMA at the Annual Convention, and were given an overview of the scheduling and delivery of annual surveys and reports to all members. Mr. Darren Osborne, CVMA’s economic consultant, presented national data comparisons and discussed ways to improve the program and its delivery.

En 2015, l’ACMV a continué d’offrir son programme d’évaluation comparative du rendement unique en son genre qui comprenait des outils et des ressources utiles pour la gestion des finances et de la pratique, comme les guides tarifaires suggérés provinciaux, les rapports sur la rémunération et les avantages sociaux des vétérinaires salariés, les rapports sur les salaires des employés non-vétérinaires, les rapports économiques provinciaux et les rapports individuels des pratiques. Les données utilisées pour ces rapports proviennent des sondages économiques annuels réalisés par l’ACMV en partenariat avec les associations provinciales de médecins vétérinaires, Idexx Laboratories, Petsecure, Merck Santé animale et la Banque Scotia qui cocommanditent ce programme de concert avec l’ACMV.

L’ACMV et l’Association des médecins vétérinaires du Québec en pratique des petits animaux (AMVQ) ont collaboré pour la livraison du sondage économique 2015 auprès des praticiens pour petits animaux du Québec, ce qui a fourni une valeur ajoutée à nos membres respectifs.

En 2015, l’ACMV a publié six articles sur la gestion commerciale d’une pratique vétérinaire dans *La RVC* qui peuvent aussi être consultés dans la section du Programme de la gestion commerciale du site Web de l’ACMV.

Le volet sur la gestion commerciale du congrès 2015 de l’ACMV à Calgary, en Alberta, «Une carrière prospère et une vie équilibrée» comportait six ateliers de 50 minutes. Kelly Lynn Cronin s’est penchée sur les finances de la pratique en montrant comment déterminer le prix des concurrents et rallier les employés aux prix établis et le Dr Jason Coe a exploré les aptitudes de communication qui peuvent vous aider à mieux comprendre le point de vue de votre client.

Les représentants des associations provinciales de médecins vétérinaires (AMV) ont assisté aux Forum économique annuel, qui a été organisé par l’ACMV lors du congrès annuel, et où l’on a présenté un aperçu sur le calendrier et la livraison des sondages et des rapports annuels à tous les membres. M. Darren Osborne, le consultant économique de l’ACMV, a présenté des comparaisons des données nationales et a discuté les façons d’améliorer le programme et sa mise en œuvre.
Veterinarians Wellness

Bien-être des vétérinaires

In May, the CVMA Wellness Advisory Group distributed a national survey to the provincial VMAs and veterinary colleges to identify the wellness services and programs currently being offered to veterinarians and veterinary students in Canada, measure their utilization, identify gaps, and consider how the CVMA could fill some of those gaps based on the information gathered.

The Advisory Group recommended the creation of a wellness microsite, part of the CVMA website, to provide open access to a wide range of personal and professional health and wellness resources. This microsite will be created in 2016. The CVMA continues to offer a track in veterinary wellbeing at the CVMA Convention, maintain an online listing of relevant help lines and support services, and support the wellness of recent graduates through its Mentoring Program.

CVMA Web Store Program — ‘MyVetStore.ca’

Le programme de boutique Web de l’ACMV — «MaVitrineVeterinaire.ca»

In May, the CVMA introduced its new Web Store Program, a powerful tool that enables veterinary practices to offer the ultimate in customer service. With their own branded web store, practices can offer their clients the convenience of 24/7 online shopping, enhance the product offering without the cost of carrying inventory, reduce their staff’s administration and obtain payment tracking reports for clients who may not be able to pay for the entire amount at the time of its occurrence. The CVMA Web Store Program is available to practices owned in whole or in part by CVMA members for whom CVMA has negotiated the most favorable financial terms. The service is provided by Acumenex, a Canadian web store provider to the professional market.
Group Insurance Program

Professional Liability and Commercial Protected Self-Insurance Program (PSIP)
In 2015, 1470 practices were insured. The PSIP model is the greatest selling feature for new participants. The average annual rate increased 2% across all practices; this was only the 2nd increase in the 9-year history of the program. The proven rate stability in comparison to competing products differentiates the CVMA program from competitors.

Employee Group Benefits Program (EGBP)
In 2015, participation increased by 6%. The EGBP offers flexible options for health and dental coverage, life insurance, accidental death and dismemberment, and disability. Optional wellness benefits such as professional referral and counseling services for insured members and family members, and business assistance and coaching for the practice are also available. Insured clinics benefit from the rate stability generated by spreading claims over the entire TotalGUARD™ /CVMA pool.

Other insurance solutions available include: Affinity program, Veterinary student & graduate program, Personal automobile, home, and travel insurance. The CVMA Insurance Program is available exclusively to CVMA members.

Initiatives for Early Career DVMs

Starting a new career and adjusting to life in private practice can be a very exciting, yet challenging time. The CVMA has developed a number of new initiatives to support new veterinarians and help meet their personal and professional needs.

CVMA Mentoring Program
Since the launch of this new program in February 2015, 33 mentors and 8 mentees have registered to participate in the program. This program is open to CVMA members. Mentor profiles are posted in the mentor roster on the CVMA website. Mentees can self-search a potential mentor and initiate communication directly whenever they are ready to do so. A mentoring guide and FAQ document are also available online.

In July, the CVMA participated in a meeting to learn about the Western College of Veterinary Medicine’s (WCVM) new Mentee Skills Building Program. The CVMA and WCVM are collaborating to further leverage these 2 programs and strengthen the impact of our mentorship efforts to benefit the profession.

Programme de responsabilité professionnelle et d’assurance auto-protégée commerciale
En 2015, 1470 pratiques étaient assurées. Le modèle de l’assurance auto-protégée est le principal avantage pour les nouveaux participants. Le tarif annuel moyen a augmenté de 2% pour l’ensemble des pratiques et il s’agissait de la deuxième hausse depuis la création du programme il y a neuf ans. C’est la stabilité éprouvée des tarifs qui distingue le programme de l’ACMV de ceux de ses concurrents.

Programme collectif d’avantages sociaux pour les employés
En 2015, la participation a augmenté de 6%. Ce programme offre des options souples en matière de protection d’assurance maladie et dentaire, d’assurance vie, d’assurance en cas de décès et de mutilation par accident et d’assurance invalidité. Des avantages facultatifs relatifs au bien-être, comme les services d’aiguillage professionnel et le counseling pour les membres assurés et les membres de la famille admissibles, ainsi qu’une assistance et un encadrement d’affaires pour l’organisation de l’employeur sont également offerts. Les cliniques assurées profitent de la stabilité des tarifs assurée par l’étalement des réclamations sur l’ensemble du bassin TotalGUARDMD/ACMV.

Les autres solutions d’assurance disponibles incluent : le programme Affinité, le programme d’assurance pour étudiants et diplômés et l’assurance automobile, habitation et voyage. Le Programme d’assurance de l’ACMV est offert exclusivement aux membres de l’ACMV.

Initiatives pour les vétérinaires en début de carrière

Le début d’une nouvelle carrière et l’ajustement au travail en pratique privée peut être une expérience très stimulante qui peut aussi comporter des moments difficiles. L’ACMV a élaboré plusieurs nouvelles initiatives afin d’appuyer les nouveaux vétérinaires et de répondre à leurs besoins personnels et professionnels.

Programme de mentorat de l’ACMV
Depuis le lancement de ce programme en février 2015, 33 mentors et 8 menteurs se sont inscrits pour participer au programme. Ce programme est ouvert aux membres de l’ACMV. Les profils des mentors sont affichés dans la liste des mentors sur le site Web de l’ACMV. Les menteurs peuvent effectuer eux-mêmes la recherche pour un mentor potentiels et initier la communication directement lorsqu’ils sont prêts à le faire. Un guide de mentorat et un document de FAQ sont aussi disponibles en ligne.

En juillet, l’ACMV a participé à une réunion pour se renseigner à propos du nouveau programme de création de compétences des
CVMA Emerging Leaders Program (ELP)

In its 6th year, the 2015 CVMA Emerging Leaders Program welcomed 31 participants from across Canada. The participants included 15 selected ELP candidates sponsored by CVMA/VMAs; 5 students sponsored by the CVMA, as well as the program chair, Dr. Melodie Chan, and 10 paid participants. Similar to the 2014 program, facilitator Dr. Rick DeBowes used didactic and experiential learning techniques to help participants gain insight into how they lead, communicate with others, and can become better leaders. To learn more about the CVMA, ELP participants sat with a CVMA Council member during the CVMA Annual General Meeting and Awards Luncheon. At the end of the day, a 30-minute interactive “Mingle Mingle” session was planned with the CVMA Council. This format allowed CVMA Council members to receive direct and personal feedback from the ELP participants to the questions posed. This was well received and provided an opportunity to network in a relaxed and casual atmosphere.

Early Career DVM Resource Hub

In 2015, when the CVMA conducted its annual survey of recent graduates, the new veterinarians identified the following top 3 challenges encountered in their first year in practice: 1) lack of mentoring and lack of confidence in their clinical skills, 2) difficult client communications, and 3) financial issues and debt repayment. To support early career DVMs and help set them on the path to a successful career, the CVMA created a dedicated web section on its website that contains useful information, tools and resources. This web section includes 3 main categories: financial planning and budgeting, communications, and career development. Some of the tools and resources include student loan repayment estimators, a budgeting app for mobile devices, guidelines for successful employment, and instructional communications videos. Over time, more resources will be added to the hub.

mentorés du Western College of Veterinary Medicine’s (WCVM). L’ACMV et le WCVM collaborent afin de mettre ces deux programmes à contribution ainsi que d’accroître l’impact de notre travail de mentorat pour renforcer la profession.

Programme des futurs leaders (PFL) de l’ACMV

Le Programme des futurs leaders 2015 de l’ACMV, qui en était à sa sixième année, a accueilli 31 participants provenant de toutes les régions du Canada. Les participants incluaient 15 candidats du PFL sélectionnés pour une commandite par l’ACMV et les AMV; cinq étudiants commandités par l’ACMV ainsi que la présidente du programme, la Dr Melodie Chan, et dix participants payants. Comme lors du programme 2014, l’animateur Dr Rick DeBowes a puissé dans un répertoire d’approches d’apprentissage didactiques et expérientielles pour aider les participants à découvrir comment ils dirigent et communiquent avec les autres et la façon dont ils peuvent devenir de meilleurs leaders. Pour en apprendre davantage à propos de l’ACMV, les participants au PFL se sont assis avec un membre du Conseil de l’ACMV durant l’Assemblée générale annuelle et déjeuner de remise des prix de l’ACMV. À la fin de la journée, une session interactive de 30 minutes appelée «Mingle» a été organisée avec le Conseil de l’ACMV. Ce format a permis aux membres du Conseil de l’ACMV de recevoir une rétroaction directe et personnelle présentée par les participants au PFL sur les questions qui avaient été posées. Cette rencontre a été fort appréciée et elle a fourni l’occasion de réseauter dans une ambiance détendue.

Carrefour des ressources pour les vétérinaires en début de carrière

En 2015, lorsque l’ACMV a réalisé son sondage annuel auprès des diplômés récents, les nouveaux vétérinaires ont identifié les trois défis suivants qu’ils avaient vécus pendant la première année de pratique : 1) absence de mentorat et manque de confiance envers leurs compétences cliniques, 2) difficulté à communiquer avec les clients et 3) problèmes financiers et remboursement de la dette. Afin d’appuyer les vétérinaires en début de carrière et de faciliter le lancement d’une carrière prospère, l’ACMV a créé une section sur son site Web qui contient des renseignements, des outils et des ressources utiles. Cette section du site Web comprend trois catégories principales : gestion du budget et finances personnelles, communications et évolution de carrière. Parmi les outils et les ressources offerts dans cette section, citons des calculateurs de remboursement des prêts étudiants, une appli de gestion du budget pour les appareils mobiles, des directives sur l’emploi des finissants et des vidéos de formation sur la communication. De nouvelles ressources seront ajoutées au carrefour à l’avenir.
VALUE OF MEMBERSHIP

Membership

As the national professional Association, the CVMA is a powerful, unified voice for Canada’s veterinarians. Our strength is in sharing veterinary science and knowledge, influencing policy decisions that matter most to the profession, and providing services and resources to help meet the needs of veterinarians. In 2015, 6799 veterinarians and student members supported CVMA’s work and leadership by joining as members.

The CVMA is always looking to deliver more value to members to increase their profitability and professional success. Members can take advantage of the broadest suite of benefits available, including practice tools and resources, position statements and research, continuing education, powerful advocacy, and a wide array of discounts and savings on important products and services to help support veterinarians and the practice team.

In 2015, the CVMA introduced a number of new member benefits and services including:

Clinician’s Brief: Members receive a complimentary subscription to the monthly Global Digital Edition of Clinician’s Brief, which provides practical clinical information to companion animal practitioners. Members who prefer the print edition are entitled to a discounted subscription price.

Plumb’s Veterinary Drugs®: Members receive a 30% discount on the individual or practice online subscription. In addition, the Plumb’s mobile app is available exclusively with this subscription.

VetFolio®: As a benefit of our association membership with the WSAVA, CVMA members receive a 20% discount on an individual or practice subscription. In addition, Students of the CVMA are eligible for a free subscription.

Students of the Canadian Veterinary Medical Association (SCVMA)

Étudiants de l’Association canadienne des médecins vétérinaires (ÉACMV)

The Students of the Canadian Veterinary Medical Association (SCVMA) represent over 1600 student veterinarians from the 5 Canadian veterinary colleges.

The student-led 2015 SCVMA Symposium, held January 15 and 16 in Guelph at the Ontario Veterinary College, was a huge success with over 250 students attending.

The SCVMA conducted its annual New Graduate Survey to gather useful information for future veterinary graduates and the profession. Results were published in the March 2016 edition of The CVJ and can be found in the SCVMA section of the CVMA website.

Les Étudiants de l’Association canadienne des médecins vétérinaires (ÉACMV) représentent plus de 1600 étudiants en médecine vétérinaire dans les cinq collèges de médecine vétérinaire du Canada.

Le Symposium 2015 des ÉACMV, qui est organisé par les étudiants et s’est déroulé les 15 et 16 janvier à Guelph à l’Ontario Veterinary College, a remporté un énorme succès et plus de 250 étudiants y ont participé.

Les ÉACMV ont réalisé leur sondage annuel auprès des finissants afin de recueillir des renseignements utiles pour les futurs diplômés en médecine vétérinaire et la profession. Les
SCVMA members received the annual *VetRap* student newsletter that showcases articles from each college, as well as 2 student e-newsletters. Throughout the year, the SCVMA section of the website and the SCVMA Facebook group provide updated information.

First-year students received CVMA-branded lab coats and name badges during each college’s welcome ceremony and the CVMA Awards and the Teacher of the Year Awards were presented.

In the fall, each college hosted the CVMA One Voice Presentation to introduce students to the CVMA and discuss a current animal welfare or national veterinary issue. A CVMA Council member and the SCVMA representative delivered the presentation and facilitated the discussions.

CVMA’s group insurance partner, Western Financial Group Insurance Solutions, hosted an Insurance presentation at each college providing an overview of insurance risks that students may face in their career and explaining the various insurance products and coverages available.

In 2015, the CVMA piloted an international student program and welcomed 42 veterinary student affiliate members from St. George’s University in Grenada.

**Student Liaison Advisory Group**
Members of the CVMA Student Liaison Advisory Group represent the CVMA at each of the 5 Canadian veterinary colleges and strengthen the link between the CVMA and its student members. The Advisory Group, comprised of 1 faculty member from each college, provides guidance to SCVMA representatives at their respective colleges. Members also participate in annual CVMA initiatives including the One Voice presentation, lab coat ceremony, and the SCVMA Symposium.

The 2015/16 SCVMA Committee reps at the SCVMA Symposium closing banquet.

Les représentants du Comité des ÉACMV 2015-2016 au banquet de clôture du Symposium des ÉACMV.
CVMA-SBCV Chapter Annual Report

The CVMA-SBCV Chapter continues to grow its profile among British Columbia veterinarians and throughout its stakeholder base, including media, government, pet owners, and the public. We do this by focusing on providing service to our Chapter members, promoting the veterinary profession, and recognizing and offering education on human/animal welfare. Despite this, we continue to encounter lower than desired membership numbers, and we are constantly vigilant about protecting (and not diluting) our benefits of membership.

The Chapter continually renews and strengthens its beneficial relationships with decision-makers and influencers. In addition to being responsive to media requests, the Chapter consulted on a pet travelling initiative with BC Ferries and was credited in its release of improved pet policies just recently. The Chapter is growing its relationship with the College of Veterinarians of BC through an enhanced sharing program, especially with its Council. Additionally, the province’s Chief Veterinarian and University of BC’s Animal Welfare Program chair both have columns in our magazine so our members can be alerted and educated on trends, cautions, and new research.

Last year’s Fall Conference and Trade Show was held at a different venue and had an intensive 2-day program; all of which was well-received and lauded. We heard from Conference delegates that they want to implement what they learn immediately at their practices. We have asked 2016 presenters (in animal behavior, neurology, pet nutrition, and emergency and critical care) to provide our delegates with new information and ways to immediately implement it.

Our flagship product, West Coast Veterinarian magazine, offers both education for our members and economic benefits for the Chapter. To enhance our 3rd-largest source of revenue, we developed a “Prescription for a Subscription” to offer paid subscriptions to the public and to industry. Our Fall Conference and Trade Show included a practice management session, and all sessions for 2016 will include a focus on tips to incorporate new knowledge immediately into practice. We continue to be pleased at the support our Chapter receives from industry at our Fall Conference, in terms of sponsorships, and trade show tables which, again this year, have already sold out.

La Section de l’ACMV-SBCV continue de rehausser son profil parmi les vétérinaires de la Colombie-Britannique et parmi les groupes d’intervenants, dont les médias, le gouvernement, les propriétaires d’animaux et le public. Nous nous acquittons de cette tâche en travaillant afin d’offrir des services à nos membres, en faisant la promotion de la profession vétérinaire ainsi qu’en identifiant et en offrant de l’éducation sur le bien-être des humains et des animaux. Malgré cela, nous continuons d’afficher un effectif inférieur aux attentes et nous sommes constamment vigilants afin de protéger (et non de diluer) les avantages de l’adhésion.

La Section renouvelle et renforce constamment ses relations bénéfiques avec les décideurs et les leaders d’opinion. En plus de répondre aux demandes d’information des médias, la Section a agi comme consultant lors d’une initiative sur le transport des animaux de compagnie auprès de BC Ferries et on a reconnu sa contribution lors de la publication récente de politiques améliorées sur les animaux de compagnie. La Section travaille à l’amélioration de sa relation avec le Collège des vétérinaires de la Colombie-Britannique dans le cadre d’un programme de partage amélioré, particulièrement avec son Conseil. De plus, le médecin vétérinaire en chef de la province et le président du programme de bien-être animal de l’Université de la Colombie-Britannique ont tous deux des rubriques dans notre magazine afin que nos membres puissent être informés et sensibilisés à l’égard des tendances, des mises en garde et de la nouvelle recherche.

La Conférence d’automne et Salon des exposants de l’an dernier ont eu lieu dans un endroit différent et offraient un programme intensif de deux jours. L’événement a été bien accueilli et apprécié. Les délégués à la conférence nous ont dit qu’ils désiraient mettre immédiatement en œuvre les nouveaux apprentissages dans leurs pratiques. Nous avons demandé aux présentateurs 2016 (sur le comportement animal, la neurologie, la nutrition des animaux de compagnie ainsi que les soins d’urgence et critiques) de fournir de nouveaux renseignements et méthodes à nos délégués afin qu’ils puissent mettre les apprentissages immédiatement en œuvre.

The CVMA’s Animal Health Technologist/Veterinary Technician Program Accreditation Committee (AHTVTAPAC) is responsible for accrediting veterinary technician training programs that meet the minimum standards for educating and training qualified personnel who may join the veterinary health care team. Graduates of such accredited programs benefit by having their competence recognized and prospects for employment and mobility enhanced and the veterinary team benefits from well trained technicians and technologists.

The CVMA maintains a reciprocity agreement with the American Veterinary Medical Association that allows for the mutual recognition of our respective accreditation processes.

In 2015, the CVMA Council approved accreditation for one new program, the Maritime Business College in Dartmouth, Nova Scotia. This brings the total number of accredited institutions in Canada to 19:

• Algonquin College, Ottawa, Ontario
• Dalhousie University (formerly Nova Scotia Agricultural College), Truro, Nova Scotia
• Douglas College, New Westminster, British Columbia
• Georgian College, Orillia, Ontario
• Grand Prairie Regional College, Fairview Campus, Fairview, Alberta
• Lakeland College, Vermilion, Alberta
• Maritime Business College, Dartmouth, Nova Scotia
• Northern Alberta Institute of Technology, Edmonton, Alberta
• Northern College, Haileyburg, Ontario
• Olds College (on-campus and distance learning), Olds, Alberta
• Oulton College, Moncton, New Brunswick
• Red River College, Winnipeg, Manitoba
• St. Clair College, Windsor, Ontario
• St. Lawrence College, Kingston, Ontario
• Saskatchewan Institute of Science and Technology, Saskatoon, Saskatchewan
• Seneca College, King City, Ontario
• Thompson Rivers University (on-campus and distance learning), Kamloops, British Columbia
• University of Guelph, Ridgetown Campus (on-campus and distance learning), Ridgetown, Ontario
• Vanier College, St-Laurent, Quebec

Le Comité d’agrément des programmes de technologie en santé animale et de techniques vétérinaires (CAPTSATV) est responsable de l’agrément des programmes de formation des techniciens vétérinaires qui satisfont aux normes minimales pour l’éducation et la formation d’un personnel qualifié qui pourrait faire partie de l’équipe de soins vétérinaires. Les diplômés de ces programmes agréés profitent du fait que leur compétence est reconnue et que leurs perspectives d’emploi et de mobilité sont améliorées et l’équipe vétérinaire profite de techniciens et de technologues bien formés.

L’ACMV maintient une entente de réciprocité avec l’American Veterinary Medical Association qui permet la reconnaissance mutuelle de nos processus d’agrément respectifs.

En 2015, le Conseil de l’ACMV a approuvé l’agrément d’un nouveau programme, celui du Maritime Business College à Dartmouth, en Nouvelle-Écosse, ce qui fait passer le total des établissements agréés au Canada à 19 :

• Algonquin College, Ottawa (Ontario)
• Douglas College, New Westminster (Colombie-Britannique)
• Georgian College, Orillia (Ontario)
• Grand Prairie Regional College, Fairview Campus, Fairview (Alberta)
• Lakeland College, Vermilion (Alberta)
• Maritime Business College, Dartmouth (Nouvelle-Écosse)
• Northern Alberta Institute of Technology, Edmonton (Alberta)
• Northern College, Haileyburg (Ontario)
• Olds College (sur le campus et téléapprentissage), Olds (Alberta)
• Oulton College, Moncton (Nouveau-Brunswick)
• Red River College, Winnipeg (Manitoba)
• St. Clair College, Windsor (Ontario)
• St. Lawrence College, Kingston (Ontario)
• Saskatchewan Institute of Science and Technology, Saskatoon (Saskatchewan)
• Seneca College, King City (Ontario)
• Université Dalhousie (anciennement Nova Scotia Agricultural College), Truro (Nouvelle-Écosse)
• Université de Guelph, Campus Ridgetown (sur le campus et téléapprentissage), Ridgetown (Ontario)
• Université Thompson Rivers (sur le campus et téléapprentissage), Kamloops (Colombie-Britannique)
• Vanier College, Saint-Laurent (Québec)
**National Exams**

**Examens nationaux**

The National Examining Board (NEB) is the first point of contact for foreign trained veterinarians wishing to practice veterinary medicine in Canada. Passing the NEB exams and obtaining a Certificate of Qualification (CQ) allows them to apply for a license in any Canadian province.

The NEB works closely with its counterparts in the United States, namely the Educational Commission for Foreign Veterinary Graduates (ECFVG) and National Board of Veterinary Medical Examiners (NBVME), to ensure that the examination process is fair and relevant.

**NEB examination process**

The NEB approved a new step in the examination process that will become a mandatory step for all candidates taking the Clinical Proficiency Examination (CPE) after January 1, 2017. The Preliminary Surgical Assessment (PSA) has been developed to ensure candidates can demonstrate basic surgical techniques as a prerequisite for CPE registration. A pilot session for the PSA was successfully run for 12 candidates at AVC in Charlottetown, Prince Edward Island on October 3, 2015.

In 2015 the NEB accepted applications from 279 new candidates and issued 494 CQs (338 Canadian students, 18 graduates from AVMA-accredited veterinary schools, 138 graduates of non-accredited veterinary schools).

**Veterinary college accreditation**

The CVMA, in collaboration with the American Veterinary Medical Association — Council on Education (AVMA-COE), is accrediting university programs designed to educate students to become veterinarians. All Canadian veterinary colleges are AVMA/CVMA-COE accredited.

In 2015 AVMA/CVMA-COE site visits were conducted at:

- University of Wisconsin
- University of Tennessee
- Montana State University Cooperative
- Colorado State University
- University of Copenhagen
- Midwestern University
- University of Florida
- University of Guelph
- University of Edinburgh
- Texas A&M University
- Lincoln Memorial University

---

**Processus d’examen du BNE**

Le BNE a approuvé une nouvelle étape dans le processus d’examen qui deviendra une étape obligatoire pour tous les candidats qui subissent l’Examen de compétences cliniques (ECC) après le 1er janvier 2017. L’Évaluation chirurgicale préliminaire (ÉCP) a été conçue afin d’assurer que les candidats puissent démontrer les techniques chirurgicales de base comme préalable à l’inscription à l’ECC. Une séance d’examen pilote pour l’ÉCP a été tenue avec succès le 3 octobre 2015 pour 12 candidats de l’AVC à Charlottetown, à l’Île-du-Prince-Édouard.

En 2015, le BNE a accepté des demandes provenant de 279 nouveaux candidats et émis 494 CC (338 à des étudiants canadiens, 18 à des diplômés d’écoles de médecine vétérinaire agréées par l’AVMA, 138 à des diplômés d’écoles de médecine vétérinaire non agréées).

**Agrément des collèges de médecine vétérinaire**

L’ACMV, en collaboration avec l’American Veterinary Medical Association — Council on Education (AVMA-COE), procède à l’agrément des programmes universitaires conçus pour enseigner la médecine vétérinaire aux étudiants. Tous les collèges de médecine vétérinaire canadiens sont agréés par l’AVMA/ACMV-COE.

En 2015, des inspections de l’AVMA/ACMV-COE ont été réalisées dans les établissements suivants :

- Université du Wisconsin
- Université du Tennessee
- Montana State University Cooperative
- Université d’État du Colorado
- Université de Copenhague
- Université Midwestern
- Université de Floride
- Université de Guelph
- Université d’Édimbourg
- Université Texas A&M
- Université Lincoln Memorial
INDEPENDENT AUDITORS’ REPORT

To the Members,

Canadian Veterinary Medical Association:

We have audited the accompanying financial statements of the Canadian Veterinary Medical Association, which comprise the statement of financial position as at December 31, 2015, and the statement of changes in net assets, operations and cash flows for the year then ended, and a summary of significant accounting policies and other explanatory information.

Management’s responsibility for the financial statements

Management is responsible for the preparation and fair presentation of these financial statements in accordance with Canadian accounting standards for not-for-profit organizations, and for such internal control as management determines is necessary to enable the preparation of financial statements that are free from material misstatement, whether due to fraud or error.

Auditors’ responsibility

Our responsibility is to express an opinion on these financial statements based on our audit. We conducted our audit in accordance with Canadian generally accepted auditing standards. Those standards require that we comply with ethical requirements and plan and perform the audit to obtain reasonable assurance about whether the financial statements are free from material misstatement.

An audit involves performing procedures to obtain audit evidence about the amounts and disclosures in the financial statements. The procedures selected depend on the auditor’s judgment, including the assessment of the risks of material misstatement of the financial statements, whether due to fraud or error. In making those risk assessments, the auditor considers the entity’s internal control relevant to the preparation and fair presentation of the financial statements in order to design audit procedures that are appropriate in the circumstances, but not for the purpose of expressing an opinion on the effectiveness of the entity’s internal control. An audit also includes evaluating the appropriateness of accounting policies used and the reasonableness of accounting estimates made by management, as well as evaluating the overall presentation of the financial statements. We believe that the audit evidence we have obtained is sufficient and appropriate to provide a basis for our audit opinion.

Opinion

In our opinion, the consolidated financial statements present fairly, in all material respects, the financial position of the Canadian Veterinary Medical Association as at December 31, 2015, and the results of its operations and its cash flows for the year then ended in accordance with Canadian accounting standards for not-for-profit organizations.

OUSELEY HANVEY CLIPSHAM DEEP LLP
Licensed Public Accountants

Ottawa, Ontario
March 29, 2016
## Statement of Financial Position

### As at December 31, 2015

<table>
<thead>
<tr>
<th></th>
<th>2015</th>
<th>2014</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Current Assets</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cash</td>
<td>$378,682</td>
<td>$471,921</td>
</tr>
<tr>
<td>Accounts receivable</td>
<td>157,293</td>
<td>158,986</td>
</tr>
<tr>
<td>Interest receivable</td>
<td>52,829</td>
<td>60,621</td>
</tr>
<tr>
<td>Prepaid expenses</td>
<td>85,955</td>
<td>73,215</td>
</tr>
<tr>
<td></td>
<td>674,759</td>
<td>764,743</td>
</tr>
<tr>
<td><strong>Investments</strong></td>
<td>2,353,969</td>
<td>2,221,091</td>
</tr>
<tr>
<td><strong>Capital Assets</strong></td>
<td>643,000</td>
<td>665,105</td>
</tr>
<tr>
<td></td>
<td><strong>3,671,728</strong></td>
<td><strong>3,650,939</strong></td>
</tr>
<tr>
<td><strong>Current Liabilities</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Accounts payable and accrued liabilities</td>
<td>$117,739</td>
<td>$98,506</td>
</tr>
<tr>
<td>Government remittances payable</td>
<td>18,497</td>
<td>7,629</td>
</tr>
<tr>
<td>Deferred revenue</td>
<td>768,805</td>
<td>708,291</td>
</tr>
<tr>
<td></td>
<td><strong>905,041</strong></td>
<td><strong>814,426</strong></td>
</tr>
<tr>
<td><strong>Net Assets</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Invested in capital assets</td>
<td>643,000</td>
<td>665,105</td>
</tr>
<tr>
<td>Internally restricted net assets:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Operational contingency</td>
<td>1,281,713</td>
<td>1,233,280</td>
</tr>
<tr>
<td>Program contingency</td>
<td>841,974</td>
<td>938,128</td>
</tr>
<tr>
<td>Unrestricted</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td></td>
<td><strong>2,766,687</strong></td>
<td><strong>2,836,513</strong></td>
</tr>
<tr>
<td></td>
<td><strong>3,671,728</strong></td>
<td><strong>3,650,939</strong></td>
</tr>
</tbody>
</table>

Approved on behalf of the Board

President
<table>
<thead>
<tr>
<th>2015</th>
<th>2014</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>REVENUE</strong></td>
<td><strong>REVENUS</strong></td>
</tr>
<tr>
<td>Communications Program</td>
<td>$58,962</td>
</tr>
<tr>
<td>Professional development</td>
<td>458,130</td>
</tr>
<tr>
<td>Journal – CJVR</td>
<td>85,603</td>
</tr>
<tr>
<td>Journal – CVJ</td>
<td>646,665</td>
</tr>
<tr>
<td>Membership services</td>
<td>1,280,151</td>
</tr>
<tr>
<td>National Examination Board</td>
<td>1,383,455</td>
</tr>
<tr>
<td>Canadian Veterinary Reserve</td>
<td>64,051</td>
</tr>
<tr>
<td>AHTVTP Accreditation</td>
<td>40,500</td>
</tr>
<tr>
<td>Secretariat</td>
<td>407,210</td>
</tr>
<tr>
<td>Students Program</td>
<td>71,328</td>
</tr>
<tr>
<td>Special projects</td>
<td>111,135</td>
</tr>
<tr>
<td>Interest</td>
<td>43,130</td>
</tr>
<tr>
<td><strong>Total Revenues</strong></td>
<td><strong>Total Revenues</strong></td>
</tr>
<tr>
<td>$4,650,340</td>
<td>$4,564,332</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>2015</th>
<th>2014</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>EXPENSES</strong></td>
<td><strong>DÉPENSES</strong></td>
</tr>
<tr>
<td>Communications Program</td>
<td>192,444</td>
</tr>
<tr>
<td>Professional development</td>
<td>449,739</td>
</tr>
<tr>
<td>Council and committees</td>
<td>328,976</td>
</tr>
<tr>
<td>Journal – CJVR</td>
<td>82,660</td>
</tr>
<tr>
<td>Journal – CVJ</td>
<td>718,227</td>
</tr>
<tr>
<td>Membership services</td>
<td>414,313</td>
</tr>
<tr>
<td>National Examination Board</td>
<td>1,346,916</td>
</tr>
<tr>
<td>Canadian Veterinary Reserve</td>
<td>64,051</td>
</tr>
<tr>
<td>AHTVTP Accreditation</td>
<td>29,354</td>
</tr>
<tr>
<td>Secretariat</td>
<td>806,238</td>
</tr>
<tr>
<td>Students Program</td>
<td>125,977</td>
</tr>
<tr>
<td>Special projects</td>
<td>164,871</td>
</tr>
<tr>
<td><strong>Total Expenses</strong></td>
<td><strong>Total Expenses</strong></td>
</tr>
<tr>
<td>$4,720,166</td>
<td>$4,654,830</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>2015</th>
<th>2014</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>NET EXPENSE FOR THE YEAR</strong></td>
<td><strong>DÉPENSES NETTES POUR L'EXERCICE</strong></td>
</tr>
<tr>
<td>$(69,826)</td>
<td>$(90,498)</td>
</tr>
</tbody>
</table>
The cost of a case of subclinical ketosis in Canadian dairy herds

Khaled Gohary, Michael W. Overton, Michael Von Massow, Stephen J. LeBlanc, Kerry D. Lissemore, Todd F. Duffield

Abstract — The objective of this study was to develop a model to estimate the cost of a case of subclinical ketosis (SCK) in Canadian dairy herds. Costs were derived from the default inputs, and included increased clinical disease incidence attributable to SCK, $76; longer time to pregnancy, $57; culling and death in early lactation attributable to SCK, $26; milk production loss, $44. Given these figures, the cost of 1 case of SCK was estimated to be $203. Sensitivity analysis showed that the estimated cost of a case of SCK was most sensitive to the herd-level incidence of SCK and the cost of 1 day open. In conclusion, SCK negatively impacts dairy herds and losses are dependent on the herd-level incidence and factors included in the calculation.

Résumé — Coût d’un cas d’acétonémie subclinique dans les troupeaux laitiers canadiens. L’objectif de cette étude consistait à développer un modèle pour estimer le coût d’un cas d’acétonémie subclinique (ASC) dans les troupeaux laitiers canadiens. Les coûts ont été dérivés des valeurs par défaut et comprenaient l’incidence accrue de maladie clinique attributable à l’ASC, 76 $; un délai plus long avant la gestation, 57 $; la réforme et la mort au début de la lactation attributable à l’ASC, 26 $; la perte de production laitière, 44 $. Compte tenu de ces chiffres, le coût de 1 cas d’ASC a été estimé à 203 $. Une analyse de sensibilité a montré que le coût estimé d’un cas d’ASC était le plus sensible à l’incidence de l’ASC au niveau du troupeau et au coût d’une journée ouvrable. En conclusion, l’ASC a un impact négatif sur les troupeaux laitiers et les pertes dépendent de l’incidence au niveau du troupeau et des facteurs inclus dans le calcul.

Introduction

After calving, all lactating dairy cows go through an inevitable phase of negative energy balance (1) that results from the lag of dry matter intake behind milk production, rendering cows susceptible to metabolic diseases (2). Ketosis (clinical and subclinical), a widespread condition in dairy herds across North America, is one such metabolic disease (3). Subclinical ketosis (SCK) results in reduced milk production (4–6) and decreased reproductive performance (4,7) relative to similar cows not diagnosed with the condition. In addition, affected cows are more likely to develop other diseases including displaced abomasum (DA), clinical ketosis (CK), and metritis (5,8,9), and are more likely to be culled in early lactation (10). As a consequence, the negative effects of SCK will impact herd performance as a whole (11,12). Therefore, the impacts of SCK on health, reproductive performance, and production can be costly for each affected cow, and can affect profitability of a dairy enterprise.

There have been previous attempts to quantify economic losses associated with SCK. One Canadian study estimated a cost of $78 for a case of SCK (13). This figure might be an underestimate of the actual cost of SCK, not only because the input costs have increased over time, but also because the authors: i) accounted for only 2 diseases on which SCK can have an impact (DA and CK); ii) did not incorporate the increased risk of culling into their calculations; and iii) considered milk loss due to SCK for only 2 wk. Another study estimated that a case of SCK can cost €735 ($1031.00 CDN) (14). This figure might be an overestimation, as some overlapping effects such
Table 1. Inputs used to calculate the cost of 1 case of subclinical ketosis (SCK; defined as elevated serum BHBA ≥ 1400 μmol/L in either of the first 2 weeks following calving in a cow not showing clinical signs)

<table>
<thead>
<tr>
<th>Item</th>
<th>Value</th>
<th>Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Price/cost</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Average milk price in Canada ($/L)</td>
<td>0.81 (22)</td>
<td></td>
</tr>
<tr>
<td>Cost ($/kg of TMR (dry matter basis) to produce 1 L of milk)</td>
<td>0.3 (20)</td>
<td></td>
</tr>
<tr>
<td>Average value of a cow in a herd ($)</td>
<td>2100 (20)</td>
<td></td>
</tr>
<tr>
<td>Cost of pregnant replacement heifer ($)^a</td>
<td>2500 (23)</td>
<td></td>
</tr>
<tr>
<td>Cull cow value ($)^b</td>
<td>1680 (23)</td>
<td></td>
</tr>
<tr>
<td>Cost of 1 day open beyond 100 days ($)</td>
<td>3 (21)</td>
<td></td>
</tr>
</tbody>
</table>

Herd/cow data

<table>
<thead>
<tr>
<th>Item</th>
<th>Value</th>
<th>Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Herd annual turnover rate (%)</td>
<td>35</td>
<td></td>
</tr>
<tr>
<td>Median time to pregnancy (d) in cows without SCK</td>
<td>108 (7)</td>
<td></td>
</tr>
<tr>
<td>Median time to pregnancy (d) in cows with SCK</td>
<td>124 (7)</td>
<td></td>
</tr>
<tr>
<td>in 1st or 2nd wk postpartum</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Median time to pregnancy (d) in cows with SCK</td>
<td>130 (7)</td>
<td></td>
</tr>
<tr>
<td>in 1st and 2nd wk postpartum</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dairy efficiency^c</td>
<td>2.3</td>
<td></td>
</tr>
<tr>
<td>Milk reduction (kg) for 30 days due to SCK</td>
<td>65 (4.5)</td>
<td></td>
</tr>
</tbody>
</table>

^a Pregnant replacement heifer price is based on average weight of 454 kg and $250/cwt.

^b Cull cow price is based on average weight of 635 kg and $120/cwt.

^c Milk yield (kg) produced as a result of a cow consuming 1 additional kg of dry matter above maintenance requirements (24); this calculation accounts only for the energy required to produce marginal milk after considering that NEL concentration of 0.75 Mcal/kg of 4% milk and 1.73 Mcal/kg of feed on a dry matter basis (25).

The first test date is at 30 days in milk (DIM). The marginal loss of milk production ($) was calculated by subtracting the feed cost (dry matter basis) saved due to the reduction in milk production caused by SCK from the total loss ($) incurred due to the reduction in milk production associated with SCK.

Losses due to increased disease incidence attributable to subclinical ketosis

The overall loss due to increased clinical disease (CK, DA, and metritis) in cows with SCK is a function of the cost of a clinical case of each disease and the attributable risk (the increment in clinical disease incidence attributed to SCK) for the associated diseases.

The cost of CK was calculated using inputs listed in Table 2, and was $233. The costs of both DA ($707) and metritis ($396) were obtained from McArt et al (15). All disease costs except CK were in US dollars and converted to Canadian dollars using an exchange rate of 1.28. To calculate the attributable risk of increased disease incidence due to SCK, the lactational incidence risk (LIR; the number of cows affected with a certain disease during a lactation divided by the number of cows that calved in the same time period) of CK (3), DA, and metritis (8), and...
the increased risk of developing CK (5,16), DA (5,16,17), and metritis (5) due to SCK were obtained from previous studies. The Basal risk (clinical disease incidence for cows not affected with SCK) and the attributable risk (clinical disease incidence for cows affected with SCK) were then calculated (Table 3).

### Losses due to culling and death attributable to subclinical ketosis

To calculate the loss resulting from culling due to SCK, the following steps were performed. First, the cost of premature culling was calculated based on a culling depreciation model (J. Fetrow, University of Minnesota, St. Paul, Minnesota, USA, personal communication, 2014) to estimate current predicted value of a cow in lactation based on the herd's parity-specific culling risk and current lactation among other input variables. Second, the turnover rate in the first 60 DIM (LIR of culling in the first 60 DIM) was calculated by multiplying the average culling percent until 60 DIM (18,19) by an assumed annual herd turnover rate of 35%. Third, the risk of culling in early lactation for cows with SCK was obtained (10), and the basal and attributable risk of culling due to SCK were calculated. Finally, loss resulting from culling due to SCK is a function of the cost of premature culling and the attributable risk of culling due to SCK (Table 3).

Considering death associated with SCK, calculations were based on an attributable risk of death due to SCK of 2.2% (J.A. McArt, Cornell University, Ithaca, New York, USA, personal communication, 2015). Assuming an average value of $2100 for a lactating cow within a herd (20), loss from death due to SCK is a function of attributable risk of death due to SCK, average value of a lactating cow, and the incidence of SCK in a herd.

### Losses due to reduced reproductive performance attributable to subclinical ketosis

The cost of 1 d open beyond 100 DIM was assumed to be $3 (21). All information on the difference in time to pregnancy between cows diagnosed with SCK and cows without SCK was retrieved from a previous report (7). From this, an average cost of days open for cows with SCK was estimated.

### Sensitivity analysis

Holding all other inputs constant, by changing the value of 1 input from its baseline (default) level, the change in the cost of a case of SCK was calculated. In an attempt to standardize the change in inputs for sensitivity analysis, the following inputs were altered by adding or subtracting 50% of the baseline: cost of 1 d open, cost of 1 kg of feed, labor costs, average value of a cow in a herd, cost of a replacement heifer, price of a cull cow, and the turnover rate. The range used for the incidence of SCK was based on Duffield (29), and the range in incidence of CK,
metritis, and displaced abomasum was based on Guard (30). Finally, the range used for milk price was based on adding or subtracting $0.10/L from the baseline used in the analysis.

**Results**

Loss resulting from SCK in the current model was $203 per case. The breakdown of the cost of 1 case of SCK is shown in Figure 1. The calculated estimate is lower than the $289.00 US ($370.00 CDN) average cost of a case of ketosis reported by McArt et al (15). Although milk price in Canada is higher than in the US, several differences beyond milk price affected the estimate. For example, reproductive loss due to SCK was based on extended time to pregnancy for subclinically ketotic cows, while in the US study it was based on an increased risk of ovarian dysfunction and pregnancy to first insemination (15). In addition, our calculations modelled SCK separately from clinical ketosis. While McArt et al (15) did not include the cost of clinical ketosis separately, they still factored treatment costs and other downstream impacts in the total cost of ketosis. However, if the cost of CK and SCK calculated in this study are summed together they will yield a comparable cost of $430.00 CDN to that obtained by McArt et al (15).

**Discussion**

While there is an association between clinical disease incidence and SCK (5,8,9), it is not necessarily true in all herds that clinical disease incidence will increase if the incidence of SCK increases. That being the case, in contrast to McArt et al (15) we modelled clinical disease incidence (DA, CK, and metritis) separately from SCK (i.e., we did not tie the incidence of SCK to the incidence of the associated clinical diseases). Yet, and due to the method of calculation used, an increase in herd incidence of SCK was associated with the increase of the cost of a case of SCK due to its direct impact on the basal and attributable risk of other clinical diseases and culling. However, sensitivity analysis did not show the variation in clinical disease incidences to be influential (Figure 2).

The estimate obtained in the current study was lower than the loss of €735 ($1031.00 CDN) for a case of SCK reported in another recent study (14). The current study attempted to limit the overestimation and double counting in cost estimate calculations by accounting only for the attributable risk of clinical disease incidence due to SCK, but there might still have been some overlap of costs that were impossible to disentangle from interrelated diseases in the fresh period.

Loss calculated in the current study, however, is higher than what was calculated in an earlier Canadian study (13) that estimated the cost of a case of SCK to be $78. The authors of that study only estimated a loss of milk for 2 wk, while in the current study milk loss was estimated to be over 30 d. The authors also used a lower risk for developing disease than used herein; for example, a 3-fold increase in the risk of DA and CK was used, compared to a 6.5 and a 5.5-fold increase in the odds of developing each disease, respectively, in the current study. In addition, culling was not accounted for and milk price in Canada now is 2.7 times higher. It is worth mentioning that the authors of the older study also overestimated the losses due to developing other diseases, as they included basal disease incidence in their calculations. This means that losses due to SCK were actually lower than reported.

Losses in the current model were based on using a cut-point for blood BHBA concentrations of 1400 μmol/L. The cut-point was chosen based on the negative impact SCK can have on health and production of lactating dairy cattle (5). Losses will

---

**Figure 2.** A Tornado plot to depict sensitivity analysis for estimation of the cost of a case of subclinical ketosis. The plot depicts the change in the cost of a case of SCK due to an increase or decrease of the value of an input. Values in parentheses are baseline values used in building the model while values on the sides of the bars are the minimum and maximum values used for sensitivity analysis. The line in the middle of the plot separating minimum and maximum bars represents loss due to a case of SCK using the baseline (default) values of inputs ($203).
vary by changing the cut-point value, whether SCK is diagnosed in the first or second week after calving, or both. Modeling such thresholds and patterns would have added value to the model; however, this was not done because such a model is prohibitively complex, and data to support the differential impacts of SCK at that level of detail are sparse. Sensitivity analysis showed that the incidence of SCK was the input to which the estimates were most sensitive (Figure 2). The sensitivity was a result of the wide variation in the incidence of SCK among Canadian dairy herds.

In conclusion, the average cost of a case of SCK generated by our model was $203, and varied depending on the herd-level cumulative incidence of SCK to be 40%; herd-level costs of SCK are substantial. This analysis supports the importance of implementing prevention, monitoring, and treatment programs during the transition period.

References
Economic value of ionophores and propylene glycol to prevent disease and treat ketosis in Canada

Khaled Gohary, Michael W. Overton, Michael Von Massow, Stephen J. LeBlanc, Kerry D. Lissemore, Todd F. Duffield

Abstract — A partial budget model was developed to evaluate the economic value of Rumensin Controlled Release Capsule (CRC) boluses when administered before calving to reduce disease and increase milk production. After accounting for disease incidences in a herd and the percentage by which Rumensin CRC can reduce them, and the increase in milk production attributable to administration of Rumensin CRC, the return on investment (ROI) per lactation was 4:1. Another partial budget model was developed to estimate the economic value of propylene glycol (PG) to treat ketosis when diagnosed by 3 different cow-side tests or when administered to all cows without using any cow-side testing. After accounting for the sensitivity and specificity of each test, ROI per lactation ranged from 2:1 to 4:1. The ROI was 2:1 when no cow-side testing was used. In conclusion, prevention of diseases that occur in the postpartum period and treatment of ketosis after calving yielded a positive ROI that varies based on disease incidence and method of diagnosis.

Résumé — Valeur économique des ionophores et du propylèneglycol pour prévenir la maladie et traiter l’acétonémie au Canada. Un modèle de budget partiel a été développé pour évaluer la valeur économique des bolus de capsules à libération contrôlée (CLC) de Rumensin lors de l’administration avant le vêlage afin de réduire les maladies et d’accroître la production de lait. Après avoir tenu compte de l’incidence des maladies dans un troupeau et du pourcentage par lequel la CLC de Rumensin peut les réduire et de l’augmentation de la production de lait attribuable à l’administration de la CLC de Rumensin, le rendement du capital investi (RCI) par lactation était de 4:1. Un autre modèle de budget partiel a été développé pour estimer la valeur économique du propylèneglycol (PG) afin de traiter l’acétonémie lors du diagnostic par 3 tests différents pour les vaches ou lors de l’administration à toutes les vaches sans le recours à des tests auprès des vaches. Après avoir tenu compte de la sensibilité et de la spécificité de chaque test, le RCI par lactation s’échelonnait de 2:1 à 4:1. Le RCI était de 2:1 lorsqu’aucun test auprès des vaches n’était utilisé. En conclusion, la prévention des maladies qui se produisent dans la période postpartum et le traitement de l’acétonémie après le vêlage a donné un RCI positif qui varie selon l’incidence de maladies et la méthode de diagnostic.

Can Vet J 2016;57:733–740

Introduction

The “classic” transition period has been defined as the 3 wk prior to and following calving (1) and is a critical period in the lactation cycle of a dairy cow. During this phase cows start to experience a decrease in dry matter intake (DMI) (2) that reaches its nadir at calving and then gradually increases until a peak at 10 to 12 wk after calving (3). The peak in DMI is preceded by the peak in milk production at 7 to 9 wk following calving, and as a consequence cows will go through a period of negative energy balance (NEB). Cows respond to NEB by mobilizing their body fat to meet the energy requirements, resulting in an increase in blood ketones (4). The period of NEB is also associated with depression in immune function (5). As a result,
almost half of the cows in this phase are affected by infectious or metabolic diseases (6), which in turn will influence their well-being and the profitability of the dairy enterprise.

One of the management approaches commonly used during the entire non-lactating period and extending into lactation is the administration of ionophores such as monensin to help reduce health problems and increase milk production (7). Administration of ionophores to dairy cattle resulted in an improvement in energy metabolism (8), milk production (9), and health, including a reduction in the risk of ketosis and displaced abomasum (DA), but not reproductive performance.

On the treatment side, one of the effective protocols used to treat ketosis is oral administration of propylene glycol (PG) (10,11). However, the number of cows that will or will not receive treatment depends on the underlying risk of hyperketonemia and the sensitivity and specificity of the cow-side test used to diagnose ketosis (6), which in turn can affect the outcome of a treatment program and impact its economic value.

The objective of this study was to model the economic value of using Rumensin Controlled Release Capsule (CRC) to reduce disease incidence and increase milk production. Value listed for each clinical disease is the percentage by which CRC can reduce it whereas values in parentheses are the median incidences used as a default input for each disease in the model.

### Materials and methods

The economic value of Rumensin CRC to reduce disease incidence and increase milk production was estimated using a partial budget model in which the increased revenues, decreased revenues, and increased expenses associated with its administration before calving were compared to when not administered. Following the same approach, a different partial budget model was developed to evaluate the economic value of treating ketotic cows with PG when diagnosed using 3 different cow-side tests and when given to all cows without diagnosis with cow-side testing. For both models, increased revenue was a result of an increase in milk production, decreased revenue was a result of an increase in disease incidence, whereas increased expenses were...
associated with extra labor used to administer treatments, cost of treatments, and cow-side testing in case of treatment with PG.

Cost of clinical diseases
Costs of DA and metritis were obtained from a recent study (12). The costs of mastitis and retained placenta were obtained from 2 other studies, respectively (13,14), whereas the costs of ketosis and clinical ketosis (CK) were estimated previously (28). Costs of clinical diseases retrieved from the literature were used after excluding milk losses, drug costs, and veterinary fees from total disease costs to avoid double counting in current calculations. Disease costs used in the current analysis are listed in Table 1.

Model for estimating the economic value of Rumensin CRC for disease reduction
A partial budget was developed in Excel (Microsoft office 2010; Microsoft, Redmond, Washington, USA) to estimate the economic value of Rumensin CRC boluses administered in the close-up period to decrease the incidence of disease after calving and to increase milk production. Inputs and assumptions used in the model are listed in Table 2.

The economic benefits of using Rumensin CRC are a function of both the reduction in economic impact of peri-parturient disease and an increase in revenue due to more efficient milk production during lactation. Reduction in economic impact of peri-parturient disease is achieved by a reduction in disease incidence after administration of Rumensin CRC. The percent-

---

**Table 4. Assumptions and inputs used in the partial budget model to evaluate the economic benefit of using propylene glycol (PG) to treat cows with ketosis when diagnosed by different cow-side tests**

<table>
<thead>
<tr>
<th>Item</th>
<th>Value</th>
<th>Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Effect of PG on disease/culling reduction</td>
<td></td>
<td></td>
</tr>
<tr>
<td>when administered to ketotic cows</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Clinical ketosis</td>
<td>46%</td>
<td>10</td>
</tr>
<tr>
<td>Ketonis</td>
<td>50%</td>
<td>10</td>
</tr>
<tr>
<td>Displaced abomasum</td>
<td>37.5%</td>
<td>11</td>
</tr>
<tr>
<td>Culling</td>
<td>52.4%</td>
<td>11</td>
</tr>
<tr>
<td>LIR of each event affecting cows with ketosis that PG can impact</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Clinical ketosis</td>
<td>6.2%</td>
<td>28</td>
</tr>
<tr>
<td>Ketonis</td>
<td>40%</td>
<td>26</td>
</tr>
<tr>
<td>Displaced abomasum</td>
<td>3.3%</td>
<td>28</td>
</tr>
<tr>
<td>Culling</td>
<td>1.8%</td>
<td>27</td>
</tr>
<tr>
<td>Effect of PG on milk yield when administered to ketotic cows</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Increase in milk production</td>
<td>0.69 kg/d</td>
<td>10</td>
</tr>
<tr>
<td>Time period milk is increased</td>
<td>30 d</td>
<td>10</td>
</tr>
<tr>
<td>Loss due to premature culling</td>
<td>$500</td>
<td>28</td>
</tr>
<tr>
<td>Milk price</td>
<td>$0.81</td>
<td>21</td>
</tr>
<tr>
<td>Dairy efficiency</td>
<td>2.3</td>
<td></td>
</tr>
<tr>
<td>Cost of 1 kg of TMR (dry matter basis)</td>
<td>$0.3</td>
<td>22</td>
</tr>
<tr>
<td>Labor wages/h</td>
<td>$15</td>
<td>23</td>
</tr>
<tr>
<td>Number of cows administered with PG/h</td>
<td>15</td>
<td></td>
</tr>
<tr>
<td>Number of times PG will be administered</td>
<td>4</td>
<td>10</td>
</tr>
</tbody>
</table>

* a Lactational incidence risk = the number of cows affected with a certain event during a lactation divided by the number of cows that calved in the same time period.

* b Milk yield (kg) produced as a result of a cow consuming 1 additional kg of dry matter above maintenance requirements (24); this calculation accounts only for the energy required to produce marginal milk after considering a NE, concentration of 0.75 Mcal/kg of 4% milk and 1.73 Mcal/kg of feed in dry matter basis (25).

---

The reduced disease incidence was multiplied by the respective cost of each disease and then compared to costs when Rumensin CRC was not administered. Increased revenue due to increased milk production after administration of Rumensin CRC for cows within each body condition score (BCS) (range: 3.25 to 3.75 and ≥ 4 in a 5-point scale) was calculated based on a marginal increase in milk production for 90 d (15) by deducting the cost of extra feed consumed after administration of Rumensin CRC from the extra revenue obtained from selling more milk after using Rumensin CRC. Total cost of labor to administer Rumensin CRC was calculated based on hourly wages and the number of Rumensin CRC boluses administered/hour. The net revenue of using Rumensin CRC was compared to not using it and then the return on investment (ROI) was calculated using the following formula:

\[ \text{ROI} = \frac{\text{net revenue after not using Rumensin CRC} - \text{net revenue after using Rumensin CRC}}{\text{increased expenses due to using Rumensin CRC}} \]

Because it is difficult to disentangle how much of the increase in milk production was due to the direct effect of Rumensin CRC or to the reduction in ketosis, a sensitivity analysis specific to milk production was performed. Hypothetical scenarios starting with an assumption that 100% of the milk increase (i.e., 0.85 kg/d and 1.2 kg/d for cows with a BCS ranging from 3.25 to 3.75 and with a BCS ≥ 4, respectively) (15) is attributed to the direct effect of Rumensin CRC, and then allowing for...
Another partial budget model was built to estimate the economic value of using oral PG to treat ketosis after being diagnosed using 1 of 3 different cow-side tests, and after treating all cows without cow-side testing. The 3 tests used were: Precision XTRA (Abbott Laboratories, Abbott Park, Illinois, USA) using a blood sample, Ketto-Test (Elanco Animal Health) using a milk sample, or Ketostix (Bayer Animal Health, Shawnee Mission, Kansas, USA) using a urine sample (Table 3). The sensitivity and specificity of each method of diagnosis of ketosis was incorporated into calculations. Other inputs, assumptions, and calculations used in building the model are listed in Tables 3 and 4.

Two studies were referenced to evaluate the impact of PG on disease and culling reduction (10,11). One study (11) reported risk ratios for culling and developing DA in control cows. According to this study, control cows were 2.1 times more likely to be culled than cows treated with PG. Therefore, treated cows will be 0.476 (1/2.1) times less likely to be culled than control cows, which means that PG decreases culling by 52.4% (1 − 0.476). Using the same approach, the percentage of DA will decrease by 37.5% after administration of PG to ketotic cows. The other study (10) reported hazard ratios for developing CK and resolving ketosis for cows treated with PG. Following the same approach as above it can be calculated that CK will decrease by 46% (1 − 0.54), and ketosis will be resolved by 50% in cows treated with PG.

Sensitivity and specificity, in addition to the cost of each test used to diagnose ketosis, were obtained from a review by LeBlanc (6). Sensitivity and specificity of Ketostix were multiplied by the assumed percent of cows from which a urine sample can be easily obtained (60%). After assuming a cumulative incidence of ketosis, true positive, true negative, false negative, and false positive numbers for each test were calculated. It was assumed that cows will be treated orally with 300 g of PG for 4 d (11). Total cost of PG was calculated by summing true positive and false positives and then multiplying them by the cost of 1.2 kg of PG. Labor costs were calculated based on hourly wages and the number of cows that can be treated/hour.

The economic value of clinical disease/culling reduction as a consequence of using PG to treat ketosis was calculated for each cow-side test by multiplying disease reduction/culling in ketotic cows treated with PG and the respective cost of each clinical disease/culling. In addition, the cost of increased disease/culling risk in cows diagnosed as false negatives using each cow-side test was calculated by multiplying the number of false negatives resulting from each cow-side test, the attributable risk of clinical disease/culling due to ketosis, and the cost of each clinical disease/culling (28).

### Figure 1
A Tornado plot depicting the change in the return on investment after using Rumensin controlled release capsule (CRC) in Canada. Values in parentheses are baseline values used in building the model, while values on the sides of the bars are the minimum and maximum values used for sensitivity analysis. The line in the middle of the plot separating minimum and maximum bars represents the return on investment (indicated by $3.95 of return for $1 invested) resulting from using the baseline values of different inputs.
For 1 cow with ketosis both marginal increased (if treated) and decreased (if not treated) milk production after administering (if treated) or not administering (if not treated) PG were calculated. These values were multiplied by the number of true positives and false negatives of each cow-side test, respectively, to calculate the marginal revenue for increased milk production when treated and the opportunity cost for milk not produced if not treated.

The net revenue of using PG after diagnosing ketosis with each cow-side test was compared to that of not treating cows with ketosis and then ROI was calculated as described for Rumensin CRC. Finally, a sensitivity analysis was done to study the impact of the change of an input on the ROI of each diagnostic test.

**Results**

**Model for estimating the economic value of Rumensin CRC for disease reduction**

The ROI after using Rumensin CRC was 4:1. Sensitivity analysis varying how much of the increase in milk production could...
be due to the direct effect of Rumensin CRC or the reduction in the incidence of ketosis showed an ROI ranging from 4:1 when 100% of the increase in production is attributed to the administration of Rumensin CRC to 2:1 when 100% of the increase in production is attributed to the reduction of disease. Regarding the general sensitivity analysis, change in the price of Rumensin CRC and the incidence of ketosis had the greatest impact on ROI, followed by the percent of cows with a BCS of 3.25 to 3.75 (Figure 1). 

**Model for estimating the economic value of propylene glycol for treatment of ketosis**

Returns on investment for treatment based on testing using Precision XTRA, Keto-Test, or Ketostix, and for treatment without testing were 4:1, 4:1, 2:1, and 2:1, respectively. Figures 2 to 4 show Tornado plots representing the sensitivity analysis for each of the cow-side tests. The incidence of ketosis and the cost of treatment were the most sensitive inputs for the 3 tests. In addition, the percent of cows providing a urine sample was among the sensitive inputs for the Ketostix test. Figure 5 shows the results of hypothetical scenarios of different incidences of ketosis where all cows were treated with PG without being tested.

**Discussion**

The current model for estimating the economic value of Rumensin CRC for disease reduction showed an economic benefit due to helping prevent diseases and increase milk production in a dairy herd. The higher the incidence of ketosis in a herd, the higher the value of using Rumensin CRC is. Reproductive performance and culling were not included as parameters in the model because a meta-analysis showed no impact of monensin on either parameter (17). There are no previous reports of economic analysis of using Rumensin CRC to help reduce disease and increase milk production. However, 1 study reported an increase of $0.39/day per cow in return over feed (milk income minus feed cost) when monensin was added to lactating cow rations (18).

Return on investment resulting from the sensitivity analysis specific to milk production is positive for all scenarios (ranging from 4:1 to 2:1). However, ROI will be lower if all of the increase in milk production was due to the reduction in incidence of ketosis. In the overall sensitivity analysis (Figure 1), the price of Rumensin CRC was the most sensitive input because the capsule is administered to all cows in a herd and there is a wide range of ketosis incidence (8% to 80%) among herds (16). The sensitivity of the proportion of cows with a BCS between 3.25 and 3.75 can be explained by the larger number of cows within this BCS range in a dairy herd than cows with a BCS $\geq 4$.

The model used to evaluate the economic benefits of using PG to treat ketosis diagnosed with different cow-side tests showed positive values when different scenarios were implemented. Diseases included in the model (DA and CK) were limited by the literature available that studied the effect of using PG to treat ketosis and the impact of this treatment on other diseases. McArt et al (11) found no difference in time to pregnancy between treated and control cows, hence reproductive performance was not included in the current model. The price of the Precision XTRA meter was not included in calculations because of its relatively low price ($40) that will be distributed over hundreds or thousands of cows.

Although the sensitivity of Ketostix is comparable to that of Keto-Test (79% and 82%, respectively), the low number of cows that are expected to provide a urine sample resulted in reduction of both the sensitivity and specificity of Ketostix, resulting in
the lowest ROI among the 3 cow-side tests evaluated. However, when a sensitivity analysis was performed, the percent of cows providing urine was among the sensitive inputs, indicating that if a urine sample was obtained from a high percentage of cows the ROI will be comparable to that of Precision XTRA and Keto-Test (Figure 4). The lower sensitivity of Ketostix meant that the lowest number of true positive cows would be diagnosed among the 3 cow-side tests and therefore losses from diseases and culling after using PG will be the least. However, these values were offset by the opportunity cost of cows diagnosed as false negatives and therefore will not benefit from the PG treatments due to the low test sensitivity resulting in the lowest ROI.

Return on investment for both Precision XTRA and Keto-Test were approximately the same. Although the opportunity cost of cows diagnosed as false negatives after using Precision XTRA was lower than that of Keto-Test (because of the higher sensitivity of Precision XTRA), this difference was not large enough to result in a higher ROI for Precision XTRA. In addition, comparable prices of test strips for Precision XTRA and Keto-Test ($3 and $2, respectively) (6) contributed to both tests having comparable results.

Sensitivity analysis showed that the incidence of ketosis was a common sensitive input among the 3 evaluated tests because of the wide range of incidences used in the current model (8% to 80%) to represent North American dairy herds (16). Cost of treatment was sensitive for the 3 evaluated tests; for both Keto-Test and Ketostix the reason was the higher number of false positives diagnosed by both tests compared to Precision XTRA, while for Precision XTRA the reason was the increase in the number of true positive cows that were treated due to the high test sensitivity. One should consider that the sensitivities and specificities of different cow-side tests evaluated in the current model were relative to a laboratory measurement of serum $\beta$-hydroxybutyrate $\geq 1400 \mu$mol/L (6) which means that they could vary at a different cutoff.

Hypothetical scenarios depicted in Figure 5 (no treatment) show that the ROI when herd incidence of ketosis is 40% and all cows are treated without being tested will be comparable to the ROI after testing with Ketostix and then treating. As the incidence of ketosis increases in a herd the ROI of treating without testing will increase. Such a result agrees with a recent study (19) in which authors found that the strategy of treating all cows without testing is the most cost-effective approach if the incidence of ketosis is $>50\%$. One can therefore conclude that herd incidence and diagnostic procedures should be considered before implementing any monitoring or prevention programs.

In conclusion, return on investment for Rumensin CRC was positive and its magnitude of impact depends primarily on the herd incidence of ketosis. The impact of propylene glycol depends on ketosis incidence, and on the method used to diagnose ketosis. However, there was no economic difference between treating cows orally with PG after diagnosis of ketosis using either Precision XTRA or Keto-Test. Using PG to treat all cows without testing for ketosis is comparable to testing with Ketostix and then treating if herd incidence of ketosis is 40%. Treating without testing should be practiced cautiously as there are no reports that studied the impact of PG on health when not needed. The choice of a diagnostic cow-side test should be based on the herd incidence of ketosis, farm settings that can facilitate the use of one test of over another, and the farmer’s goal (e.g., presence of headlocks will facilitate the use of Precision XTRA, whereas testing in the milking parlour allows the efficient use of Keto-Test).

References

ARTICLE


Comparison of intraoperative and postoperative pain during canine ovariohysterectomy and ovariectomy

Amanda Tallant, Barbara Ambros, Carol Freire, Sherisse Sakals

Abstract — This study compared physiologic parameters indicating nociception during surgery and pain scores after surgery among dogs undergoing ovariohysterectomy (OHE) and ovariectomy (OVE). Twenty healthy adult female dogs were randomly assigned to either the OHE or the OVE group. Physiologic data collected during surgery included heart rate, respiratory rate, temperature, blood pressure, hemoglobin oxygen saturation, end-tidal CO₂ and isoflurane, and vaporizer settings. Postoperative pain was measured using the short form Glasgow Composite Pain Scale, an interactive visual analog scale, and algometry. There were no clinically relevant differences in intraoperative nociception indices between groups. Duration of surgery for OVE was significantly shorter than for OHE (OVE 15.4 minutes, OHE 17.5 minutes, \( P = 0.04 \)). There was no significant difference between groups in the use of rescue analgesia after surgery, in the average interactive visual analog scale score over the 24-hour postoperative period (\( P = 0.12 \)), and in algometer readings (\( P = 0.34 \)).

Introduction

Ovariohysterectomy (OHE) and ovariectomy (OVE) are common procedures for sterilization of female dogs. In a retrospective study on the long-term effects of OHE and OVE in dogs, no differences were detected in complication rates between the 2 procedures (1). Similar incidences of vaginal discharge (2 of 69 in the ovariectomy group and 2 of 66 in the ovariohysterectomy group) and urinary incontinence (6 of the ovariectomy group and 9 of the ovariohysterectomy group) were noted between these 2 groups. The authors concluded that there was no indication for removing the uterus (1). A review of articles published between 1967 and 2004 revealed no significant differences between the 2 techniques in the incidence of long-term postoperative urogenital complications, including endometritis, pyometra, and urinary incontinence (2). The potential advantages of OVE noted were that it is less technically complicated, less time consuming, and associated with less morbidity due to a smaller incision and less intraoperative trauma (2). A 2011 study stated “Ovariectomy has replaced OHE as the preferred procedure for neutering healthy female dogs in many European countries” based on the potential advantages described above (3).

The purpose of our study was to investigate and compare intraoperative physiologic changes and postoperative pain scores in dogs undergoing OHE and OVE. We hypothesized...
that there would be a significant difference in intraoperative physiologic parameters indicating noiception (elevated heart rate and blood pressure) in dogs undergoing OHE compared to dogs undergoing OVE. We also hypothesized that there would not be a significant difference in postoperative pain scores or algometry between these 2 procedures.

**Materials and methods**

The study was approved by the institutional animal care committee. Twenty healthy adult female dogs were obtained from 2 local humane society shelters. Informed consent was obtained from the shelter veterinarians of each shelter. Exclusion criteria included signs of illness or cardiovascular abnormalities, evidence of estrus, and pregnancy as noted on physical examination. Body weight ranged from 3.3 to 30.1 kg. The dogs were individually housed in an isolated ward prior to surgery, during recovery, and during pain assessment. The dogs were acclimated to this ward for a minimum of 24 h before surgery. The dogs were fed a maintenance diet within 2 h of extubation and walked outside 4 times daily. After recovery from anesthesia and data collection, the dogs were returned to the humane societies for adoption.

Randomization software (http://www.graphpad.com/quickcalc/randomize1.cfm) was used to assign each dog to 1 of 2 treatment groups: OHE or OVE. Prior to surgery a full physical examination was performed. Body temperature, heart rate (HR), respiration rate (RR), capillary refill time, mucous membrane color and body weight for each dog were measured and recorded. Body condition scores and American Society of Anesthesiologists physical status classifications were assigned and recorded. Blood was collected from each dog for measurement of packed cell volume, total protein, blood urea nitrogen (Azostix Siemens Diagnostics; Siemens Canada, Mississauga, Ontario) and blood glucose levels (AlphaTrack2; Abbott, Ottawa, Ontario) prior to fasting.

**Anesthesia**

Each dog was administered carprofen (Rimadyl; Pfizer, Kirkland, Quebec), 4 mg/kg body weight (BW), SC, 30 min prior to induction of anesthesia. An IV catheter was placed in the cephalic vein and anesthesia was induced with propofol (Diprivan; AstraZeneca, Mississauga, Ontario), 6 mg/kg BW, IV. If insufficient relaxation for intubation was achieved with this dose, additional propofol was administered IV to effect. Anesthesia was maintained with isoflurane (Forane; Pharmaceutical Partners of Canada, Richmond Hill, Ontario) in 100% oxygen delivered via an endotracheal tube. Heart rate, RR, systolic blood pressure (SAP), mean blood pressure (MAP), diastolic blood pressure (DAP), hemoglobin oxygen saturation, end-tidal carbon dioxide (ETCO2), and end-tidal isoflurane (ETIso), were measured using a multi-parameter anesthetic monitoring device (Datech-Ohmeda; General Electric, Little Chalfont, UK), which was routinely calibrated. Isoflurane vaporizer setting, oxygen flow rate, palpebral reflex, eye position, jaw tone, and body temperature were recorded.

The isoflurane vaporizer setting was adjusted to provide a plane of anesthesia that maintained a relaxed jaw tone, a ventral eye position and absence of a palpebral reflex. Evaluation of anesthetic depth and adjustment of the vaporizer were performed by a single board certified anesthesiologist (BA) who was blinded to the surgical procedure being performed. Physiologic and instrument setting recordings were performed every 2 min from the time of induction until extubation.

**Surgery**

Ovariohysterectomy was performed through a ventral midline celiotomy, centered approximately in the cranial third of the distance between the umbilicus and pubis. Each ovary was removed together with the uterus to a level just cranial to the cervix. The suspensory ligament was torn using digital pressure during isolation and exteriorization of the ovary. Hemostasis of the ovarian and uterine vasculature, and sealing and division of the broad ligaments were achieved using a bipolar vessel sealing device (LigaSure5 mm blunt tip 20 mm sealer and divider; Covidien, Minneapolis, Minnesota, USA). The uterine body was sealed and divided using the vessel sealing device when the uterine body was ≤ 9 mm (4). When the uterine body exceeded 9 mm, as confirmed by blade handle measurements, a single circumferential ligature of 2-0 PDSII (Ethicon; Johnson & Johnson, Somerville, New Jersey, USA) was placed prior to transection of the uterus. The linea alba was closed in a simple continuous pattern using PDSII with suture sized appropriately for each dog. The subcutaneous tissue was closed using 3-0 Monocryl (Ethicon; Johnson & Johnson) in a simple continuous pattern, and the skin was closed with the same suture in an intradermal pattern.

Ovariection was performed through a ventral midline celiotomy centered over the umbilicus. The ovaries were removed by sealing and dividing the proper ligament of the ovary, suspensory ligament and the ovarian pedicle using the vessel sealing device. The suspensory ligament was not torn during OVE. Closure was identical to that described for OHE.

All surgeries were performed by a single board-certified surgeon (SS). The incision length was recorded for each dog. The duration of each phase of surgery and of the entire surgery was recorded.

Anesthesia and surgery were divided into phases. For a baseline measurement, and to achieve a constant plane of anesthesia before surgery, phase 0 began with induction and ended with initiation of the skin incision. Phase 1 began with initiation of the skin incision and ended when one of the ovaries was grasped. Phase 2 began with manipulation of the first ovary and ended at initiation of body wall closure. Phase 3 represented abdominal closure and suturing of subcutaneous tissue and skin.

**Pain assessment**

Each dog was assessed at 1, 2, 4, 6, 8, 12, 18, and 24 h after surgery by 1 blinded observer (AT). Temperature, HR, and RR for each dog was measured at each evaluation. A short form Glasgow Composite Pain Scale (GCPS) assessment was performed at each time point (5). The GCPS includes 30 descriptors in 6 behavioral categories. The descriptors are ranked numerically according to their associated pain severity. The observer assigns the appropriate descriptor in each category.
and totals the scores. Dogs with a score of 5/24 or greater were administered rescue pain medication in the form of buprenorphine (Vetregesic; Reckitt Benckiser Healthcare, Hull, UK), 15 μg/kg BW, SC (5). Following this assessment, an interactive visual analog scale (IVAS) 10 cm long was also used at each evaluation. Interaction involved removing the dog from the kennel, petting the dogs, offering treats, talking to the dogs and noting their responses to the observers. The right side of the line represented unbearable pain and the left represented no pain. A mark was made on the line to correspond to the observer’s perception of the pain felt by each dog at each evaluation. The distance of the mark from the left side of the line was measured and recorded.

An algometer (Topcat Metrology Pressure Rate Onset Device; Topcat Metrology, Little Downham, UK) was used to measure wound sensitivity. To test the mechanical wound threshold a rounded plastic tip was used (diameter of the rounded head = 8 mm) to apply steadily increasing pressure until the animal showed a response. Any sudden movement of the dog away from the device, attempting to stand, turning the head towards the device, vocalization, or attempts to bite were considered a response. Pressure was then instantly released and the applied force (Newton, N) was read from the display. The algometer provides guidance to the user in the form of red and green lights for the application of a constant rate of pressure increase. The algometer’s technical specification of force range of 0.5 to 20 N is accurate to +/- 1 N; all readings above 20 N were recorded as 20 N. Dogs were placed in left lateral recumbency and 3 algometer readings were obtained 1 cm cranial to the cranial edge of the incision on each dog prior to premedication and at each observation time point after surgery. The average of the values at each time point was used for statistical analysis.

**Statistical evaluation**

A prospective power analysis was performed based on a clinically significant difference of 15 mm for the IVAS, an alpha of 0.05, and a beta of 0.2. Significance for all tests was set at \( P < 0.05 \). A sample size of 20 animals was sufficient to determine significant difference between groups. Statistical software (STATA 12; StataCorp LP, College Station, Texas, USA) was used for analysis.

Average SAP, MAP, DAP, and HR in each phase and blood pressure and HR changes between phases of surgery were compared using a 2-sample \( t \)-test with equal variances between the 2 treatment groups. Following visual inspection the data were pooled over the 24-hour period for subsequent analysis.

End-tidal averages in each phase and changes between phases of surgery, total surgery duration and duration of each phase of surgery, and incision lengths were compared with a 2-sample \( t \)-test with equal variance between the 2 treatment groups.

The use of rescue pain medication based on short form GCPS score was compared with a Pearson’s Chi-squared test. Each patient’s average IVAS score over 24 h and peri-incisional algometer readings over 24 h were compared between the 2 treatment groups with a two-sample \( t \)-test with equal variance. Patients that received rescue pain medication continued to be assessed and included in the analysis.

**Results**

There were no significant differences in average values of SAP, MAP, DAP in each phase between procedures (Table 1). All blood pressure measurements increased from baseline measurements in phase 1 and again between phases 1 and 2, but declined between phases 2 and 3 (Table 1). The only statistically significant differences were in the changes of blood pressure between phases. There was a greater increase in MAP between phase 1 and 2 in the OHE group \((P = 0.02)\). The average increase in MAP in the OHE group was 25 mmHg +/- 14, while the average increase of MAP of the OVE group was 9 mmHg +/- 15. There was also a greater increase in the DAP between phase 1 and 2 in the OHE group \((P < 0.01)\). The average increase of DAP in the OHE group was 27 mmHg +/- 13, while the average increase of DAP in the OVE group was 6 mmHg +/- 14. The MAP and DAP changes between phases 2 and 3 were not significant \((P = 0.93 \) and \( P = 0.23 \) respectively).

There were no significant differences between groups in HR in phases 1 and 2 or HR changes between phases of surgery. The HR of the OVE group was greater than that of the OHE group during phase 0 and during phase 3 (Table 1).

The ETIiso for the OHE group was lower during phase 1 and phase 2 of surgery than for the OVE group. There was no difference during phase 3 or between the phases (Table 1).

The OHE procedure was of significantly greater duration than the OVE procedure \((P = 0.04)\). The average OHE procedure was 17.5 +/- 2.4 min and the average OVE procedure was 15.4 +/- 1.7 min. There were no significant differences between groups in duration of phase 0, phase 1 or phase 2; however, the duration of phase 3 was greater in the OHE group compared to the OVE group (Table 1).

The OHE skin incision lengths were significantly greater than the OVE incisions \((P = 0.02)\). The average skin incision length of the OHE was 6.4 +/- 0.7 cm, while the average skin incision length of the OVE was 5.3 +/- 1.1 cm.

There was no significant difference between groups in the use of rescue analgesia after surgery (1 in each group) as determined by GCPS results \((P = 0.37)\), in the average IVAS score over the 24-hour postoperative period \((P = 0.12)\) or in algometer readings \((P = 0.34)\).

There were no significant differences between groups in body weight \([\text{OHE mean } 19.25 \text{ kg SD } +/- 7.0, \text{ OVE mean } 17.53 \text{ kg SD } +/- 6.5 (P = 0.58)]\).

There were no complications in any of the dogs during surgery or before discharge at 24 h following the conclusion of the study.

**Discussion**

The 4 phases for the OHE and OVE procedures were established by Höglund et al (6) in a comparison of laparoscopic OVE and open OHE. Division of the procedures into phases allowed for identification of changes during portions of the procedures that were expected to be most relevant in revealing differences. It also allowed for steady state anesthesia to be reached in phase 0 prior to any surgical stimulation. The study showed that the differences between the 2 techniques could be
Table 1. Comparison of parameters (mean ± standard deviation) measured during the 4 phases of the surgery.

<table>
<thead>
<tr>
<th>Phase</th>
<th>HR (bpm)</th>
<th>SAP (mmHg)</th>
<th>MAP (mmHg)</th>
<th>DAP (mmHg)</th>
<th>ETIso (%)</th>
<th>Time (min)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Phase 0</td>
<td>127 ± 17</td>
<td>174 ± 17</td>
<td>103 ± 13</td>
<td>46 ± 10</td>
<td>1.35 ± 0.5</td>
<td>1.23 ± 0.3</td>
</tr>
<tr>
<td>Phase 1</td>
<td>128 ± 13</td>
<td>171 ± 12</td>
<td>102 ± 13</td>
<td>44 ± 10</td>
<td>1.9 ± 0.3</td>
<td>1.04 ± 0.4</td>
</tr>
<tr>
<td>Phase 2</td>
<td>122 ± 15</td>
<td>174 ± 17</td>
<td>102 ± 13</td>
<td>44 ± 10</td>
<td>2.3 ± 0.4</td>
<td>1.28 ± 0.4</td>
</tr>
<tr>
<td>Phase 3</td>
<td>123 ± 17</td>
<td>174 ± 17</td>
<td>103 ± 13</td>
<td>46 ± 10</td>
<td>1.9 ± 0.3</td>
<td>1.04 ± 0.4</td>
</tr>
</tbody>
</table>

- HR: heart rate; SAP: systolic pressure; MAP: mean arterial pressure; DAP: diastolic pressure; ETIso: end-tidal isoflurane.

- \( P\)-value was calculated using the Wilcoxon test.

- Differences between phases were considered significant at \( P < 0.05 \).

- Phase 0 was from induction to skin incision. Phase 1 was from skin incision to manipulation of the first ovary. Phase 2 was from manipulation of the first ovary to organ removal. Phase 3 was from organ removal to body wall closure.

- There were 10 dogs in each of the 2 groups. A 2-sample \( t\)-test was performed on each phase between the OVE and OHE groups and to compare changes between phases. Significant differences were indicated by \( P \leq 0.05 \).

- The increase in SAP between phases 1 and 2 in the OHE group was 22.8 mmHg and in the OVE group was 12 mmHg \( (P = 0.09) \). This approaches but does not reach statistical significance. Transient differences in blood pressure during the procedures in our study may not have been recognized with the 2-minute monitoring interval we used. Continuous monitoring may have allowed us to recognize transient blood pressure changes that occurred within a 2-minute period. Also, we used non-invasive blood pressure (NIBP) monitoring. While NIBP was used in both studies by Höglund et al \( (6,7) \), direct blood pressure monitoring via an arterial catheter may have been responsible for the greater increase in MAP and DAP in the OHE group. We suspect that the significantly greater increase in MAP and DAP in the OHE group between phases 1 and 2 was due to increased stimulation during handling of the suspensory ligament. For the OHE, the suspensory ligament was torn using digital pressure, whereas for the OVE, a vessel sealing device was used to divide the ligament. In the OVE procedure the incision is more cranially placed, centering the activity directly over the ovaries. This location requires less caudal retraction of the ovaries and usually does not require tearing of the suspensory ligaments to ligate the ovarian pedicle. We anticipated that the manual tearing of the suspensory ligament would be more stimulating than use of the vessel sealing device. Manual rupture of the ligament involves tearing the ligament from its cranial attachment sites using tension to the point of failure. When sealing and dividing the ligament with the vessel sealing device, there was little to no tension placed on the ligament. It is possible, however, that despite the lack of the tension on the ligament, division of the ligament with the vessel sealing device was more stimulating than we expected, thereby diminishing a difference between groups in the response to treatment of the ligament.

- Manipulation of the suspensory ligament and removal of the ovary has been recognized as the most stimulating portion of the spay and surgical trauma has been noted to result in blood pressure changes during OHE and OVE procedures \( (6) \). We expected that we would have observed an increase in SAP, as was noted between phases 1 and 2 in the study by Höglund et al \( (6) \). The increase in SAP between phases 1 and 2 was also observed by the same researchers in a follow-up study in which a pause of 15 min was introduced after the removal of each ovary in order to ensure a steady state of anesthesia before removal of the second ovary \( (7) \). While a statistically significant increase in MAP and DAP was noted between phases 1 and 2 in our study, there was no statistically significant increase in SAP.
revealed changes that our monitoring equipment did not detect. However, since changes in MAP and DAP were found despite intermittent monitoring, we are uncertain as to why SAP did not show a similar pattern.

The significantly greater increase in MAP and DAP in the OHE group between phases 1 and 2 may correspond to this group’s significantly lower average ETISO during phase 1 and phase 2. Higher ETISO is associated with vasodilation, which could account for the comparatively lower pressures of the OVE group. Differences in duration of the phases between groups could potentially contribute as well; however, the durations of each phase were not significantly different; therefore, the effects of phase duration was likely minimal. These are unexpected findings as OVE procedures require less abdominal organ manipulation; therefore, in theory, the OVE procedure should require less isoflurane to maintain an adequate plane of anesthesia.

There was a significantly higher average HR during phase 3 of the surgery in the OVE group. This difference of 14 beats/min may not be clinically relevant. Heart rate in itself cannot be correlated to intraoperative nociception. This elevation occurred at a time when differences between the procedures are unappreciable, as this phase represents incision closure, which was performed in identical fashion in both groups.

Incision lengths were statistically significantly shorter by 1.05 cm in the OVE group, and surgery duration was 2.1 min less for the OVE group. While these results were statistically significant, the clinical relevance is questionable. Achieving an incision length as short as possible was not an objective of our study.

Our second hypothesis was supported by the data as neither GCPS nor IVAS scores revealed any significant differences in post-operative pain between the groups. All dogs were awake and eating within 2 h of the procedures. Peeters et al (3) also found no significant difference in postoperative pain between OHE and OVE in dogs. We added algometry to further quantify differences after surgery but this did not identify a statistical difference between groups. This suggests that either the difference in pain is too subtle for us to detect with current pain measurement methods or that there truly are no differences in postoperative pain between the 2 procedures. The GCPS is a behavior-based assessment tool to evaluate acute pain in dogs (5). The GCPS is a standardized evaluation system that is intended to decrease variation among observers. Wagner et al (8) used GCPS as an assessment tool and showed pain-related behaviors were mitigated by the administration of analgesics. All dogs received a preoperative dose of carprofen; therefore, potential differences between the groups may have been diminished due to the analgesic. In a study evaluating carprofen and buprenorphine in premedication protocols, either one used independently provided adequate analgesia (9). Holton et al (10) found that while visual analog scales are commonly used in human medicine, they show observer variability when assessing dogs. These assessments have shown greater agreement when patients are in more severe pain (11). It is possible in our study that the pain experienced was sufficiently mild to lack a notable significant difference between groups.

Algometry was used to increase the objectivity of our postoperative pain scoring and to quantify superficial pain around the incision. In this study wound lengths were 1.05 cm different in average length. Pain threshold assessments of these wounds were unlikely to be significantly different. Although intra-abdominal pain assessment may have been a more accurate measure for our study, we are unaware of an effective method of quantitatively measuring pain originating from within the peritoneal cavity in dogs. It is possible that the use of the 8-mm tip diameter may have also obscured differences herein. An inconsistency in pain reactions and higher mechanical thresholds were noted with larger diameter probes in a recent study (12). Also, all dogs quickly became acclimated to the routine of assessments followed by positive reinforcement and were very compliant. A high degree of tolerance to both positioning and use of the algometer was noted in the dogs. This is in agreement with a recent study that found that effect of the individual dog is the predominant factor in mechanical threshold testing (12). We found immediate acceptance of application of the algometer. This may be due to the temperament of the dogs, which were obtained from a humane society, similar to another study in which client-owned pets quickly showed avoidance behaviors (13).

The change in MAP and DAP between phase 1 and phase 2 of OHE was significantly greater than for OVE, which may correspond to a greater level of nociception experienced during OHE or may be secondary to the higher levels of isoflurane in phases 1 and 2 in the OVE group. Follow-up studies will include continuous monitoring of physiologic parameters, especially during manipulation of the suspensory ligament and organ removal. There were no differences in postoperative measures of pain between groups. This may be due to an inability of our pain detection methods to ascertain subtle differences, or it may be that there is no difference in postoperative pain experienced between the two procedures. Although we did not find a dramatic difference in our indices of nociception experienced during these procedures, the frequency with which they are performed warrants further investigation of the pain induced.

Acknowledgment

The authors thank Dr. John Campbell for his direction in our statistical analysis.

References


Small Animal Soft Tissue Surgery, 2nd edition


This book contains 212 scenarios which are the basis for over 425 quiz-type questions. The front of every page has 2 scenarios, each case is followed by 2 to 4 questions that integrate diagnostic, anesthetic, surgical, and post-operative considerations. The answers, including thorough explanations, are on the back of the page. The front and back page format of this book is convenient, no holding your place while flipping to the back of the book. The photos used are of exceptional quality and add considerable depth and detail to the cases presented. The writing is clear, easy, and interesting to follow. The scenarios and solutions used are current, describing the latest treatment modalities and using up-to-date standards of care. This book is part of a series of 22 other question/answer review style books, and is available in a compact soft cover or hard copy, as well as various electronic formats including a Kindle and pdf format from the publisher, making it extremely portable.

This book has many strengths, and is perhaps a “must have” for the earnest intern or the surgical resident approaching his or her Board Exams. I would not, however, recommend this book to general practitioners, except perhaps to use as a diversion, similar to the CVJ’s Quiz Corner, during a slow point in the day. The description on the cover, “Self-Assessment Color Review,” sums this book up well.

Reviewed by Melissa Knowles, BSc, DVM, Associate Veterinarian — Northwest Veterinary Services, PO Box 328, Turtleford, Saskatchewan S0M 2Y0.
Article

Evolution of *in vitro* antimicrobial resistance in an equine hospital over 3 decades

Annie Malo, Caroline Cluzel, Olivia Labrecque, Guy Beauchamp, Jean-Pierre Lavoie, Mathilde Leclere

Abstract — This study identified antimicrobial resistance patterns of commonly isolated bacteria at the Equine Hospital of the Université de Montréal between 2007 and 2013, and compared the results with the resistance patterns observed in tests performed in previous decades in the same hospital. A total of 396 antimicrobial susceptibility tests were analyzed by the Kirby-Bauer method during the period 2007 to 2013 and compared to 233 and 255 tests completed in 1986 to 1988 and 1996 to 1998, respectively. The most common bacteria were *Streptococcus equi* subsp. *zooepidemicus* (*S.* *zooepidemicus*) and *Escherichia coli*. Except for resistance of coagulase-positive staphylococci to trimethoprim-sulfamethoxazole, there was no overall increase in resistance observed between 1986 to 1988 and 2007 to 2013 for antimicrobials reported for all 3 periods. However, between 1996 to 1998 and 2007 to 2013, there was an increase in *in vitro* resistance to enrofloxacin for *E. coli* and *Enterobacter* spp., and to ceftriaxone for *Enterobacter* spp. and coagulase-positive staphylococci. No increase in resistance was observed for *S. zooepidemicus* and no isolate was resistant to penicillin.


(Traduit par les auteurs)

Can Vet J 2016;57:747–751

Introduction

Antimicrobial administration early in the course of severe bacterial infections can increase the likelihood of survival. Selection of the appropriate antimicrobial is based on multiple factors including identification of pathogens, *in vitro* susceptibility, expected *in vivo* susceptibility, drug disposition, toxicity, ease of administration, and cost. The risk of increasing resistance among bacteria should also be taken into account during antimicrobial selection, especially when using those critically important to human health (1). These include third and fourth generation cephalosporins, aminoglycosides, fluoroquinolones, and macrolides, including antimicrobials highly relevant to the practice of equine medicine such as ceftriaxone, gentamicin, amikacin, enrofloxacin, and erythromycin. The development of resistance against these and other critically important antimicrobials is particularly worrisome and has been documented in human and equine populations (2–4). As recommended by the American College of Veterinary Internal Medicine (ACVIM), decisions on
Table 1. Resistance of frequently isolated Gram-negative bacteria from equine patients in 2007 to 2013, compared to previously reported resistance in 1986 to 1988 (6) and 1996 to 1998 (7): Pasteurellaceae and non-lactose fermenters

<table>
<thead>
<tr>
<th></th>
<th>Pasteurellaceae</th>
<th></th>
<th>Non-lactose fermenters</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Actinobacillus spp.</td>
<td>(including Actinobacillus suis)</td>
<td>Pseudomonas spp.</td>
</tr>
<tr>
<td>Amikacin</td>
<td>na</td>
<td>3a (36)</td>
<td>22b (36)</td>
</tr>
<tr>
<td>Ampicillin</td>
<td>17 (29)</td>
<td>17 (46)</td>
<td>6 (36)</td>
</tr>
<tr>
<td>Ceftriaxone</td>
<td>na</td>
<td>0 (47)</td>
<td>0 (36)</td>
</tr>
<tr>
<td>Chloramphenicol</td>
<td>25 (4)</td>
<td>0 (19)</td>
<td>0 (36)</td>
</tr>
<tr>
<td>Enrofloxacin</td>
<td>na</td>
<td>0 (47)</td>
<td>0 (36)</td>
</tr>
<tr>
<td>Erythromycin</td>
<td>13 (23)</td>
<td>33 (46)</td>
<td>31 (26)</td>
</tr>
<tr>
<td>Gentamicin</td>
<td>7 (29)</td>
<td>2 (47)</td>
<td>6 (33)</td>
</tr>
<tr>
<td>Penicillin</td>
<td>33c (30)</td>
<td>73b (26)</td>
<td>3b (34)</td>
</tr>
<tr>
<td>Tetracycline</td>
<td>10 (29)</td>
<td>6 (48)</td>
<td>na</td>
</tr>
<tr>
<td>TMS</td>
<td>0a (30)</td>
<td>17c (46)</td>
<td>8 (36)</td>
</tr>
</tbody>
</table>

spp. — species; % — percentage of isolates resistant; n — number of isolates; na — data not available; TMS — trimethoprim-sulfamethoxazole.

a,b,c For a given bacterium, percentages with the same superscript are significantly different between time periods (P < 0.05). d Intrinsic resistance — in vitro susceptibility cannot be used to predict treatment outcome (15).

Note — changes in guidelines for Pasteurella did not affect Actinobacillus spp.

how to treat bacterial infections should preferably be based on the antimicrobial susceptibility of isolated bacteria. When this is not possible, an empirical antimicrobial selection should be based on predictable susceptibility patterns and local resistance profiles (5). In order to provide guidance for these empirical choices, the goal of this study was to determine the resistance patterns of frequently isolated bacteria from the equine population of a referral hospital from 2007 to 2013. Its secondary goal was to identify trends in the variation of resistance by comparing data with previous studies performed in the same hospital over 2 previous decades (6,7).

Materials and methods

Selection of bacterial isolates

The Clinical Bacteriology Laboratory of the Faculty of Veterinary Medicine of the Université de Montréal computer system was searched to identify antimicrobial susceptibility tests performed on aerobic bacterial isolates from patients of the Equine Hospital of the Centre Hospitalier Universitaire Vétérinaire between March 1, 2007 and September 1, 2013. In order to provide guidance for these empirical choices, the goal of this study was to determine the resistance patterns of frequently isolated bacteria from the equine population of a referral hospital from 2007 to 2013. Its secondary goal was to identify trends in the variation of resistance by comparing data with previous studies performed in the same hospital over 2 previous decades (6,7).

Antimicrobial resistance testing

Following the Clinical and Laboratory Standards Institute (CLSI) guidelines (8), isolates were tested for antimicrobial resistance using the Kirby-Bauer disk diffusion method on Mueller-Hinton medium (Mueller-Hinton with 5% sheep blood for Streptococcus spp.). While the Kirby-Bauer method does not determine minimal inhibitory concentrations, qualitative results of bacterial resistance are obtained based on the inhibition zone diameter. Based on CLSI breakpoints, isolates were deemed susceptible, intermediate, or resistant. Veterinary-specific resistance breakpoints were used when available. For this study, and to be consistent with previous reports, intermediate susceptibility was considered resistant. Quality control antimicrobial resistance of E. coli ATCC 25922, Staphylococcus aureus ATCC 25923, and Streptococcus pneumoniae ATCC 49619 were performed monthly. Resistance was compared to the previously reported profiles by the same laboratory using the same technique (6,7).

Ceftriaxone and enrofloxacin were added after 1986 to 1988, and tetracycline stopped being included in standard Kirby-Bauer for Pasteurellaceae and non-lactose fermenters — species; % — percentage of isolates resistant; n — number of isolates; na — data not available; TMS — trimethoprim-sulfamethoxazole.

Similar criteria were used in 2 previous studies by our group, except for one bacterium-antimicrobial pair from 1986 to 1988 that was originally reported with less than 5 isolates (6).

Statistical analysis

Differences among proportions of resistant isolates across 3 time periods were compared with the exact Chi-square test using commercial software (SAS 9.4; SAS Institute, Cary, North Carolina, USA). Pair-wise comparisons between time periods
were only performed if there was an overall difference across time periods. The statistical significance level was set to 0.05.

**Results**

**Patients and sites of sampling**

There were 299 samples with bacterial growth on aerobic culture that had a Kirby-Bauer test performed during the period 2007 to 2013. Seventy-nine samples had multiple isolates, for a total of 396 Kirby-Bauer tests performed. Most (35%) of the samples originated from the respiratory system and included tracheal aspirates, nasopharyngeal swabs, and thoracocentesis. *Streptococcus zooepidemicus* was isolated from 37% of these samples. Other frequent sites included wounds and tissue swabs (13%), blood culture (11%), abscesses (7%), and joint fluid (6%). Patients (n = 272) from which these bacteria were isolated were between 0 and 29 years of age (median: 3 years old). Eighty-five (31%) of them were foals 8 mo old or less.

**Resistance over time**

The 396 resistance patterns were analyzed and compared to data from 1986 to 1988 and 1996 to 1998. Tables 1, 2, and 3 summarize the resistance of frequently isolated bacteria to commonly used antimicrobials during these 3 periods, and the significant differences between them. For antimicrobials with data available for all 3 periods, there was no overall increase in resistance between 1986 to 1988 and 2007 to 2013, except for resistance of coagulase-positive staphylococci to trimethoprim-sulfamethoxazole (P = 0.04). However, there was a significant increase in resistance of *E. coli* (P = 0.002) and *Enterobacter* spp. (P = 0.003) to enrofloxacin, and of *Enterobacter* spp. (P = 0.03) and coagulase-positive staphylococci (P = 0.02) to ceftiofur between the years 1996 to 1998 and 2007 to 2013. An increase in resistance of *Actinobacillus* spp. (P = 0.03) and *E. coli* (P = 0.02) to amikacin was observed between 1996 to 1998 and 2007 to 2013, but resistance from 2007 to 2013 did not differ from that in 1986 to 1988 for *E. coli* and could not be compared to data from 1986 to 1988 for *Actinobacillus* spp. The previously observed increase in resistance of coagulase-positive staphylococci to trimethoprim-sulfamethoxazole (TMS) was confirmed, while the increase observed for *Actinobacillus* was no longer significant (TMS). No increase in resistance was observed for *S. zooepidemicus* and no isolate was resistant to penicillin. Additional observations were that, among the 7 *E. coli* isolates resistant to amikacin in the 2007 to 2013 period, 5 were isolated between the end of 2012 and 2013, and 3 were also resistant to fluoroquinolones (enrofloxacin and marbofloxacin). Furthermore, 15% (4 of 26 isolates) of coagulase-positive staphylococci were resistant to cefoxitin, acephalosporin used to detect methicillin resistance among *S. aureus*. Among the 4 cefoxitin-resistant isolates, 3 were confirmed to be *S. aureus* and were isolated from a lymphangitis, an infected castration site and an infected biopsy wound.

**Discussion**

In this study, when comparing the results from the years 2007 to 2013 with the ones from 1986 to 1988, we did not observe an overall increase in the antimicrobial resistance of the most common bacteria isolated from our hospital, except for coagulase-positive staphylococci’s resistance to trimethoprim-sulfamethoxazole. However, not all antimicrobials had data for all 3 periods, and we observed a significant increase in resistance between the years 1996 to 1998 and 2007 to 2013 for 3 antimicrobials considered to be critically important to

---

**Table 2. Resistance of frequently isolated Gram-negative bacteria from equine patients in 2007 to 2013, compared to previously reported resistance in 1986 to 1988 (6) and 1996 to 1998 (7): Enterobacteriaceae**

<table>
<thead>
<tr>
<th></th>
<th>Enterobacteria spp.</th>
<th>Enterobacteriaceae</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>% (n)</td>
<td>% (n)</td>
</tr>
<tr>
<td>Amikacin</td>
<td>11 (9)</td>
<td>0 (0)</td>
</tr>
<tr>
<td>Ampicillin</td>
<td>63 (46)</td>
<td>34 (58)</td>
</tr>
<tr>
<td>Cefiotfur</td>
<td>na</td>
<td>32 (56)</td>
</tr>
<tr>
<td>Chloramphenicol</td>
<td>36 (42)</td>
<td>26 (34)</td>
</tr>
<tr>
<td>Enrofloxacin</td>
<td>na</td>
<td>0 (0)</td>
</tr>
<tr>
<td>Erythromycin</td>
<td>Intrinsic resistance</td>
<td>Intrinsic resistance</td>
</tr>
<tr>
<td>Gentamicin</td>
<td>13 (47)</td>
<td>19 (58)</td>
</tr>
<tr>
<td>Penicillin</td>
<td>Intrinsic resistance</td>
<td>Intrinsic resistance</td>
</tr>
<tr>
<td>Tetracycline</td>
<td>62 (48)</td>
<td>45 (58)</td>
</tr>
<tr>
<td>TMS</td>
<td>52 (48)</td>
<td>39 (57)</td>
</tr>
</tbody>
</table>

**Notes:**

- spp. — species; % — percentage of isolates resistant; n — number of isolates; na — data not available; TMS — trimethoprim-sulfamethoxazole.
- For a given bacterium, percentages with the same superscript are significantly different between time periods (P < 0.05).
- Intrinsic in vivo resistance, in vitro susceptibility cannot be used to predict treatment outcome (15).
- *P* = 0.05.
Table 3. Resistance of frequently isolated Gram-positive bacteria from equine patients in 2007 to 2013, compared to previously reported resistance in 1986 to 1988 (6) and 1996 to 1998 (7): *Streptococcus equi* subsp. *zooepidemicus* and coagulase-positive staphylococci

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>% (n)</td>
<td>% (n)</td>
<td>% (n)</td>
<td>% (n)</td>
<td>% (n)</td>
<td>% (n)</td>
</tr>
<tr>
<td><strong>Amikacin</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><em>S. zooepidemicus</em></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Low-level intrinsic</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>resistance*</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8 (12)</td>
<td>0 (6)</td>
<td>8 (37)</td>
<td>na</td>
<td>4 (24)</td>
<td>0 (42)</td>
<td></td>
</tr>
<tr>
<td><strong>Ampicillin</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><em>S. zooepidemicus</em></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Low-level intrinsic</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>resistance*</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>0 (5)</td>
<td>0 (5)</td>
<td>10 (10)</td>
<td>na</td>
<td>0 (19)</td>
<td>0 (42)</td>
<td></td>
</tr>
<tr>
<td><strong>Ceftiofur</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><em>S. zooepidemicus</em></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Low-level intrinsic</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>resistance*</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>na</td>
<td>2 (45)</td>
<td>2 (42)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Chloramphenicol</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><em>S. zooepidemicus</em></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Low-level intrinsic</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>resistance*</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>0 (18)</td>
<td>0 (12)</td>
<td>0 (86)</td>
<td>0 (23)</td>
<td>11 (46)</td>
<td>9 (34)</td>
<td></td>
</tr>
<tr>
<td><strong>Doxycycline</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><em>S. zooepidemicus</em></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Low-level intrinsic</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>resistance*</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>33 (9)</td>
<td>33 (9)</td>
<td>na</td>
<td>2 (45)</td>
<td>2 (42)</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Erythromycin</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><em>S. zooepidemicus</em></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Low-level intrinsic</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>resistance*</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>0 (7)</td>
<td>22b</td>
<td>0c</td>
<td>0 (23)</td>
<td>11 (46)</td>
<td>9 (34)</td>
<td></td>
</tr>
<tr>
<td><strong>Gentamicin</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><em>S. zooepidemicus</em></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Low-level intrinsic</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>resistance*</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4 (23)</td>
<td>15 (46)</td>
<td>19 (42)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Penicillin</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><em>S. zooepidemicus</em></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Low-level intrinsic</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>resistance*</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>53 (17)</td>
<td>44 (9)</td>
<td>86 (7)</td>
<td>0 (22)</td>
<td>28 (46)</td>
<td>na</td>
<td></td>
</tr>
<tr>
<td><strong>Tetracycline</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><em>S. zooepidemicus</em></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Low-level intrinsic</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>resistance*</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>18 (17)</td>
<td>25 (12)</td>
<td>35 (84)</td>
<td>0 (22)</td>
<td>28 (46)</td>
<td>na</td>
<td></td>
</tr>
<tr>
<td><strong>TMS</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><em>S. zooepidemicus</em></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Low-level resistance to</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>streptomycin</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>of aminoglycosides</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>0 (70)</td>
<td>33 (15)</td>
<td>17 (46)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

subsp. — subspecies; % — percentage of isolates resistant; n — number of isolates; na — data not available; TMS — trimethoprim-sulfamethoxazole.

*b,c* For a given bacteria, percentages with the same superscript are significantly different between time periods (*P* < 0.05).

*Low-level resistance of streptomycin to aminoglycosides* (17).

human health by the World Health Organization (WHO) (1). In addition to the increase in resistance to ceftiofur (*Enterobacter* spp.), enrofloxacin (*Enterobacter* spp. and *E. coli*), and amikacin (*E. coli*), there was a trend (*P = 0.05*) for an increase of *Enterobacter* spp.’s resistance to amikacin. A similar increase in resistance of *Enterobacteriaceae* isolated from equine patients to ceftiofur and other antimicrobials was also recently described by others (2,4), and at least 1 other study observed this change for enrofloxacin (9).

The pressure of selection due to the widespread use of antimicrobials in veterinary and human patients is an important cause of acquired bacterial resistance and could have played a role in the observed development of resistance to ceftiofur, enrofloxacin, and amikacin. The former (ceftiofur, enrofloxacin) became available in the late 1980s and 1990s, respectively, and have since become widely used by equine practitioners. Amikacin has been on the market for longer, but its use in the equine population (mainly in neonates) has increased in North America since the 1990s (2). However, since *Enterobacteriaceae* are not typically species-specific and numerous mobile genetic elements conferring resistance (plasmids, bacteriophages, transposons) can be transferred between bacteria and across species (10), an increase in resistance is not necessarily only a consequence of increased use of antimicrobials in the species of interest. Furthermore, even if resistance appears to be most common to the older antimicrobials such as tetracycline, streptomycin, penicillin, and sulfonamides (5), there are many exceptions and one cannot assume that increased resistance is always correlated with increased use.

This study also confirmed the continuing susceptibility of *S. zooepidemicus* to penicillin, also reported by others (11). The lack of resistance to penicillin and the few variations observed for other antimicrobials over time is notable because *S. zooepidemicus* is considered a mucosal commensal of the upper airways of horses and is therefore widely exposed to all antimicrobials used in the equine population. Previously observed increase in resistance between 1986 to 1988 and 1996–1998 for *Actinobacillus* (penicillin and TMS) was not observed again and there was even a decrease in the resistance to penicillin (7). It can be speculated that this is in part due to a decrease in the use of penicillin in our area in the past decade, but this is certainly not the case for TMS, since its ease of administration and observed rarity of side effects make it a widely used antimicrobial in our area. These fluctuations highlight the importance of long-term studies to evaluate trends over multiple decades.

Drugs designated as critically important antimicrobials by the WHO should be reserved for use after appropriate susceptibility testing or when no alternative is available (1). The ACVIM guidelines recommend that practitioners sort antimicrobials used in their practice into Primary, Secondary, and Tertiary categories, and to favor Primary Use drugs (such as penicillin, tetracycline, potentiated sulfonamides) over Secondary or Tertiary Use drugs when choosing an antimicrobial for first line treatment (5). A similar classification is recommended by the British Equine Veterinary Association Protect ME program (12). Some clinical implications can be drawn from the results of this study, particularly regarding respiratory infections. As previously reported (6), *S. zooepidemicus* was the most commonly isolated bacterium from respiratory samples. None of these isolates were resistant to penicillin, which confirms that this antimicrobial could be the Primary Use drug of choice for horses with non-life-threatening respiratory tract infections, unless culture and sensitivity testing suggests otherwise. It should be noted that, in addition to the relatively low frequency of *in vitro* activity of TMS against *S. zooepidemicus* (65% in 2007 to 2013), this antibiotic is unlikely to have appropriate *in vivo* activity against *S. zooepidemicus*, even in the face of apparent susceptibility *in vitro*, making it a poor choice of Primary Use drug for respiratory infections. Indeed, it was suggested that TMS efficacy decreases in purulent exudates due to low pH and high
concentrations of p-aminobenzoic acid (13,14). When treating non-respiratory infections, in the presence of life-threatening infections (respiratory or not), or in cases of poorly responding respiratory infections, it becomes even more important to base therapeutic decisions on culture and sensitivity testing, because the second most commonly isolated bacteria (Enterobacteriaceae) have unpredictable resistance patterns.

Resistance should be interpreted with caution when species and organ-specific breakpoints are not available. Such breakpoints are designed to predict the therapeutic outcome of a bacterial infection based on the expected antimicrobial concentrations that can be achieved in a patient, and ideally in a specific organ, depending on pharmacodynamics and recommended dosages (15). Only a limited number of breakpoints had been determined for equine pathogens at the time of the study and these include the following combinations: gentamicin for Enterobacteriaceae, Pseudomonas aeruginosa, Actinobacillus spp. (no organ specified), and ampicillin and cefotiofur for S. zooepidemicus (respiratory disease) (8). Because of this, while a therapeutic failure can most likely be predicted by the use of an antimicrobial in a patient infected by an organism deemed “resistant,” its “susceptibility” should be interpreted with caution in clinical settings. Another point to consider when interpreting the results of this study is that bacterial isolates obtained in referral centers might not represent infections treated in the field, but rather cases seen for a second opinion, which could have received prior antimicrobial treatment. Referral center cases could also include nosocomial infections, which could falsely increase resistance compared to community-acquired infections or first line cases. In fact, it has been shown that prior administration of antimicrobial drugs and sampling of hospitalized patients after their admission can influence susceptibility patterns (16). Unfortunately, it was not possible to extract from the available data the percentage of cases that had received prior antimicrobial treatment. Finally, tetracycline was removed from our routine susceptibility testing of equine bacterial isolates in the 2000s and data are therefore missing for 2007 to 2013.

In conclusion, the results of this study show little overall increase in resistance of common pathogens encountered in the equine species between the periods of 1986 to 1988 and 2007 to 2013 for antimicrobials with data available for all 3 periods. However, a significant and worrisome increase in resistance was observed for some bacteria to aminoglycosides, fluoroquinolones, and third generation cephalosporins between the periods 1996 to 1998 and 2007 to 2013. Since S. zooepidemicus is the most commonly isolated pathogen from the respiratory tract and it appears to be consistently susceptible to penicillin, this should be the drug of choice for non-life-threatening respiratory infections, unless culture and sensitivity testing suggests otherwise. Since Enterobacteriaceae, Pseudomonas spp., and coagulase-positive staphylococci have unpredictable susceptibility patterns in individual patients, routine culture and susceptibility testing should always be attempted for non-respiratory infections, or respiratory infections responding poorly to penicillin alone.

References
Presumed masitinib-induced nephrotic syndrome and azotemia in a dog
Lauren Devine, David J. Polzin

Abstract — Masitinib mesylate is a tyrosine-kinase inhibitor approved for the treatment of nonresectable or recurrent, Grade 2 or 3 mast cell tumors in dogs. This report describes nephrotic syndrome and acute kidney injury attributed to masitinib and illustrates the need for regular monitoring of serum creatinine concentration, urinalysis, and urine protein:creatinine ratio during its use.

Résumé — Présomption de syndrome néphrotique et d’azotémie induits par le masitinib chez un chien. Le mésylate de masitinib est un inhibiteur de la tyrosine-kinase homologué pour le traitement des mastocytes non résécables ou récurrents de grade 2 ou 3 chez les chiens. Ce rapport décrit le syndrome néphrotique et une blessure aigüe au rein attribués au masitinib et illustre le besoin d’une surveillance régulière de la concentration sèrique de créatinine, des analyses d’urine et du ratio protéine:créatinine urinaire durant son utilisation.

Masitinib mesylate (Kinavet, AB Science, Short Hill, New Jersey, USA) is a tyrosine-kinase inhibitor that has been approved for the treatment of nonresectable or recurrent, Grade 2 or Grade 3 mast cell tumors in dogs (1–10). The primary effect of masitinib is selective and potent inhibition of c-KIT-dependent cell proliferation. Masitinib plays a role in the inhibition of platelet-derived growth factor receptor (PDGFR)-dependent cell proliferation and Src family kinases such as LYN, a contributor to IgE-induced mast cell degranulation in vitro (2,5,7,11). Reported renal-related side effects of masitinib include proteinuria, nephrotic syndrome, and renal failure (1). To the authors’ knowledge, this is the first report describing a severe case of Masitinib-related nephrotic syndrome (NS) and acute kidney injury (AKI) with complete recovery of renal function based on biochemistry and urinalysis parameters.

Case description
A 3-year-old, 29.8 kg, intact female Weimaraner dog was presented to the University of Minnesota Veterinary Medical Center (VMC) for evaluation of acute onset of vomiting and abdominal distension of 1 wk duration. A mass had been noted on the left cheek 217 d prior to presentation. A Grade 1 mast cell tumor was diagnosed through incomplete surgical debulking with histopathology on day 292. Several weeks later (Day 277), treatment was initiated with masitinib at a dose of 4.4 mg/kg body weight (BW), PO, q12h.

A complete blood (cell) count (CBC) and serum chemistry performed by the referring veterinarian for an unrelated surgery prior to beginning the masitinib therapy (Day 233), revealed abnormalities that were consistent with mild dehydration (Table 1). A CBC and serum chemistry performed 1 mo (Day 230) after initiation of the medication revealed no significant abnormalities. The day before presentation (Day 21) to the VMC, the dog had been examined by her referring veterinarian for lethargy, inappetance, polydipsia, and abdominal distension. At that time, the serum chemistry results indicated panhypoproteinemia (Table 1) on an in-house chemistry analyzer and the referring veterinarian discontinued masitinib and recommended a high protein diet.

The following day (Day 0), the dog was presented to the University of Minnesota emergency service for vomiting and lethargy of 6 h duration. Physical examination revealed moderate submandibular edema and profound abdominal distension. A mass had been noted on the left cheek 217 d prior to presentation. A Grade 1 mast cell tumor was diagnosed through incomplete surgical debulking with histopathology on day −92. Several weeks later (Day −77), treatment was initiated with masitinib at a dose of 4.4 mg/kg body weight (BW), PO, q12h.

A complete blood (cell) count (CBC) and serum chemistry performed by the referring veterinarian for an unrelated surgery prior to beginning the masitinib therapy (Day −337), revealed abnormalities that were consistent with mild dehydration (Table 1). A CBC and serum chemistry performed 1 mo (Day −30) after initiation of the medication revealed no significant abnormalities. The day before presentation (Day −1) to the VMC, the dog had been examined by her referring veterinarian for lethargy, inappetance, polydipsia, and abdominal distension of 1 wk duration. At that time, the serum chemistry results indicated panhypoproteinemia (Table 1) on an in-house chemistry analyzer and the referring veterinarian discontinued masitinib and recommended a high protein diet.

The following day (Day 0), the dog was presented to the University of Minnesota emergency service for vomiting and lethargy of 6 h duration. Physical examination revealed moderate submandibular edema and profound abdominal distension. As a consequence, packed cell volume, total plasma protein, point-of-care chemistry analysis (Chem8 + iStat; Abaxis, Union City, California, USA), 4DX SNAP test (IDEXX, Westbrook, Maine, USA), abdominal radiographs, abdominal FAST scan (Focused Assessment with Sonography for Trauma Scan) and abdominocentesis were performed. The total plasma protein was low at 48 g/L; however, the limited chemistry panel was unremarkable. Serological tests for Dirofilaria immitis, Anaplasma phagocytophilum, Ehrlichia canis, and Borrelia burgdorferi were negative. Abdominal radiographs revealed poor serosal detail due
to abdominal effusion, and the FAST scan confirmed a moderate to severe abdominal effusion. Cytology of the abdominal fluid revealed a transudate with protein (<25 g/L), and a total nucleated cell count of 680 cells/μL. Systolic blood pressure was 120 mmHg. Upon admission into the Intensive Care Unit, a colloid osmotic pressure was determined to be decreased at 6.5 mmHg [reference interval (RI): 19.95 to 22.05 mmHg], and a metoclopramide (Reglan; Hospira, Lake Forrest, Illinois, USA) constant rate infusion (CRI) and a subcutaneous injection of Maropitant (Cerenia; Zoetis, Madison, New Jersey, USA) were administered for the vomiting prior to presentation.

On the third day, a moderate amount of a subcutaneous mass on the left cheek was noted in the same location as the previously incompletely excised mast cell tumor. The subcutaneous mass on the left cheek was consistent with recurrence of the previously diagnosed mast cell tumor. Maropitant was continued throughout the course of hospitalization.

The next morning (Day 1), physical examination revealed an approximately 2 cm diameter movable, soft, subcutaneous mass on the left cheek, a mild amount of dependent subcutaneous edema on the ventral thorax, and abdominal distension. The subcutaneous mass on the left cheek was consistent with recurrence of the previously diagnosed mast cell tumor. A CBC, serum chemistry, abdominal ultrasound, and thoracic radiographs were performed. A serum chemistry panel revealed hypoalbuminemia, hypocalcemia, and hypercholesterolemia (Table 1). The urine sample obtained on admission was not evaluated and reported until Day 3. This urinalysis revealed isohematuria, hematuria, proteinuria, pyuria, and bacteruria (Table 2). The urine protein:creatinine ratio (UPC) was significantly elevated at 36.3 (normally < 0.2). Abdominal ultrasound revealed marked abdominal effusion, edema of the gill bladder wall, and subcutaneous edema. Thoracic radiographs and a CBC were unremarkable. Colloid osmotic pressure on Day 2 remained low at 7.6 mmHg (RI: 19.95 to 22.05 mmHg). Treatment for Days 1 and 2 included Hetastarch (Hydroxyethyl starch; Teva Parenteral Medicines, Irvine, California, USA) and a proton pump inhibitor (Pantoprazole; Protonix; Pfizer, Madison, New Jersey, USA). Dexamethasone-SP (Dexamethasone Sodium Phosphate; Vedco, St. Joseph, Missouri, USA) and diphenhydramine (Benadryl; Parkedale Pharmaceuticals, Rochester, Michigan, USA) were administered once intravenously followed by oral diphenhydramine. Diphenhydramine and dexamethasone-SP were administered to minimize increased vascular permeability secondary to histamine from the mast cell tumor. Maropitant was continued throughout the course of hospitalization.

On the third day, a moderate amount of a subcutaneous edema of the vulva, perianal region, and hind limbs was present. Pyrexia of 40.6°C and a mild catheter site inflammation were discovered that afternoon. Purulent debris exuded from the catheter site during removal and the body temperature returned to normal (37.9°C) several hours after removal of the catheter and addition of antibiotics. Cytologic examination of the purulent debris revealed a marked septic neutrophilic inflammation with cocci bacteria. A serum chemistry, urine sodium, and Rocky Mountain spotted fever titer were revealed panhypoproteinemia, progressive hypocalcemia, and azotemia (Table 1). Urine sodium concentration determined on a urine sample obtained on Day 3 was elevated at 59 mmol/L (prerenal: < 20 mmol/L) possibly indicating active renal tubular dysfunction or a physiologic response post hetastarch therapy (14). The Rocky Mountain spotted fever titer was negative. Amoxicillin sublactam (Pfizer, New York, New York, USA), 22 mg/kg body weight (BW), q8h, and enrofloxacin (Bayer, Shawnee Mission, Kansas, USA), 10 mg/kg BW, q24h, were initiated and Prednisone (Prednisone; Teva Parenteral Medicines, Irvine, California, USA), 0.5 mg/kg BW, q24h was continued to prevent mast cell degranulation. Hetastarch was discontinued due to the progression of the subcutaneous edema and poor colloid osmotic pressure response suggesting possible overfill. Ondansetron (Zofran; Wockhart, Mumbai, India) and famotidine (Pepcid; Westward Pharmaceutical, Eatontown, New Jersey, USA) were administered for the vomiting prior to presentation.

The catheter site became severely inflamed and painful on Day 4. An ultrasound of the limb revealed 3 separate pockets of fluid; culture and sensitivity testing of the fluid grew Staphylococcus intermedius group resistant to ampicillin and penicillin, but susceptible to enrofloxacin. Three separate blood cultures revealed no bacterial growth after 5 d. A CBC revealed

<table>
<thead>
<tr>
<th>Table 1. Changes in biochemistry values over time</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Day</strong></td>
</tr>
<tr>
<td>---------</td>
</tr>
<tr>
<td>1</td>
</tr>
<tr>
<td>-337</td>
</tr>
<tr>
<td>-30*</td>
</tr>
<tr>
<td>-1b</td>
</tr>
<tr>
<td>1c</td>
</tr>
<tr>
<td>3</td>
</tr>
<tr>
<td>4d</td>
</tr>
<tr>
<td>5</td>
</tr>
<tr>
<td>6</td>
</tr>
<tr>
<td>9</td>
</tr>
<tr>
<td>16</td>
</tr>
<tr>
<td>30</td>
</tr>
<tr>
<td>44</td>
</tr>
<tr>
<td>196</td>
</tr>
</tbody>
</table>

Masitinib was initiated on day –77.
A CBC and serum chemistry were performed within 1 mo of initiation of therapy (day –30).
Masitinib was discontinued on day –1.
The subcutaneous mass on the left cheek was noted in the same location as the previously incompletely excised mast cell tumor.
The globulin value was not detectable on the chemistry analyzer.
The catheter site infection was observed.
CREA — creatine; BUN — blood urea nitrogen; TP — total protein; NA — not available.
an inflammatory leukogram and a mild nonregenerative anemia: leukocytosis 22,470/μL (RI: 3880 to 14,570/μL), neutrophilia 20,220/μL (RI: 2100 to 11,200/μL), with a regenerative left shift 220/μL (RI: 0 to 130/μL), lymphopenia 450/μL (RI: 780 to 3360/μL), and a monocytosis 1570/μL (RI: 0 to 1200/μL). A nonregenerative anemia was present with a hematocrit of 34% (37.5% to 60.3%), red blood cell concentration of 4.96 × 10⁶/μL (RI: 5.44 to 8.79 × 10⁶/μL), and a hemoglobin concentration of 118 g/L (RI: 133 to 207 g/L) were noted. The serum chemistry revealed progression of the renal dysfunction with progressive elevations in blood urea nitrogen (BUN), creatinine, and phosphate, worsened hypobicarbonemia, and static serum albumin concentration (Table 1). Urinalysis revealed a persistent proteinuria with occasional white blood cells, but no bacteria (Table 2). A urine culture was sterile. The prothrombin time (PTT) was slightly prolonged at 21.3 s (RI: 9.8 to 14.6 s). Venous blood gas (EC7 + iStat; Abaxis) revealed a metabolic acidosis with respiratory compensation: pH of 7.095 (RI: pH 7.3 to 7.47), hypobicarbonatemia 10 mmol/L (RI: 17.8 to 27.2 mmol/L), pCO₂ 32.5 mmHg (RI: 28.9 to 44.4 mmHg), and total CO₂ 11 mmol/L (18.6 to 28.4 mmol/L). Metabolic acidosis was treated with sodium bicarbonate ( Hospira). Massage and warm compresses were initiated to improve blood and lymphatic circulation to the affected limb. A fentanyl patch (Duragesic Patch; Noven Pharmaceutical, Miami, Florida, USA) was applied for the pain, and clinicare liquid diet (Clinicare; Abbott, Abbott Park, Illinois, USA) was administered through a nasoesophageal feeding tube.

Clinical improvement of the catheter site infection was noted on Day 5. A serum chemistry profile revealed further progression of the azotemia, and a relatively static hyperphosphatemia, hypoalbuminemia, and hypobicarbonatemia (Table 1). The point-of-care venous blood gas analysis revealed improvement in the metabolic acidosis with a pH 7.137, hypobicarbonatemia 10.2 mmol/L (RI: 17.8 to 27.2 mmol/L), and pCO₂ 37.1 mmHg (RI: 28.9 to 44.4 mmHg). Pantoprazole and Trimethoprimsulfamethoxazole (SMX-TMP; Amneal Pharmaceutical, Hauppauge, New York, USA) were added to the treatment protocol, and ampicillin sulfactam was discontinued based on the culture and sensitivity results of the catheter site infection.

On Day 6, the serum creatinine concentration continued to rise; however, the other blood values remained relatively stable (Table 1). The UPC ratio remained elevated (Table 2). The dog’s clinical signs appeared to be improving, and she was discharged from the hospital the same afternoon.

The dog was monitored closely on an outpatient basis and renal profiles were repeated on days 9, 16, 30, and 44. The UPC ratio values were repeated on days 16, 30, and 44 and a urinalysis was performed on day 16. Three days after discharge (Day 9), a renal profile revealed mild improvement in serum creatinine, urea nitrogen, phosphorus, and bicarbonate concentrations while serum albumin concentration remained static. Hypercholesterolemia worsened, most likely attributable to recent feeding (Table 1). One week later (Day 16), the azotemia had completely resolved and both hypoproteinemia, and hypoalbuminemia had improved. The UPC ratio was markedly improved but proteinuria persisted (Table 2). By day 30, the renal and electrolyte values had returned to pre-masitinib levels and the UPC ratio was normal (Table 1). These values were similar on days 44 and 196.

### Table 2. Urinalysis and urine protein:creatinine values over time

<table>
<thead>
<tr>
<th>Day</th>
<th>USG</th>
<th>pH</th>
<th>Occult</th>
<th>Protein</th>
<th>WBC</th>
<th>Bacteria</th>
<th>UPC</th>
</tr>
</thead>
<tbody>
<tr>
<td>0²</td>
<td>1.013</td>
<td>7.5</td>
<td>2+</td>
<td>3+</td>
<td>5 to 20/HPF</td>
<td>Many rods/HPF</td>
<td>36.3</td>
</tr>
<tr>
<td>4²</td>
<td>1.021</td>
<td>6.5</td>
<td>1+</td>
<td>3+</td>
<td>occasional</td>
<td>none</td>
<td>NA</td>
</tr>
<tr>
<td>6²</td>
<td>1.017</td>
<td>6.5</td>
<td>2+</td>
<td>3+</td>
<td>5 to 20/HPF</td>
<td>none</td>
<td>23.7</td>
</tr>
<tr>
<td>16²</td>
<td>1.013</td>
<td>6.5</td>
<td>1+</td>
<td>2+</td>
<td>occasional</td>
<td>none</td>
<td>8.3</td>
</tr>
<tr>
<td>30²</td>
<td>1.025</td>
<td>7.5</td>
<td>Trace</td>
<td>Negative</td>
<td>Negative</td>
<td>Negative</td>
<td>0.1</td>
</tr>
<tr>
<td>196²</td>
<td>1.025</td>
<td>7.5</td>
<td>Trace</td>
<td>Negative</td>
<td>Negative</td>
<td>Negative</td>
<td>0.1</td>
</tr>
</tbody>
</table>

² The day 0 sample was not reported until day 3.

USG — urine specific gravity; WBC — white blood cells; UPC — urine protein:creatinine ratio, which is normally < 0.2, urine samples were collected by cystocentesis on days 4 to 196; HPF — high-powered field; NA — not available.

### Discussion

The Weimaraner dog in this case report had laboratory and physical examination findings consistent with nephrotic syndrome (NS) and concurrent acute kidney injury (AKI) presumed secondary to masitinib administration. Masitinib mesylate is labeled for use in dogs for Grades 2 or 3 nonresectable mast cell tumors at a dose of 12 mg/kg BW per day (2,4). In this case, masitinib was used at a dose lower than recommended, and in an extralabel fashion in that the mast cell tumor was Grade 1. The noteworthy and not previously reported aspect of this case is the recovery of normal kidney function with no apparent long-term sequelae despite masitinib-associated severe nephrotic syndrome and concurrent IRIS AKI Grade II. This case demonstrates that dogs affected by severe masitinib-associated nephrotic syndrome with concurrent AKI can recover and return to normal levels of kidney function without long-term complications when treated by withdrawal of masitinib and supporting therapy.

Nephrotic syndrome is defined as the presence of hypoalbuminemia, proteinuria, extravascular fluid accumulation, and hypercholesterolemia. Nephrotic syndrome is seemingly uncommon in dogs, with the median number of dogs diagnosed with NS at tertiary institutions reported to be 0.5 every 12 mo (12). Hypoalbuminemia and proteinuria occur due to the loss of selective permeability of the glomerulus. The hypoalbuminemia may cause secondary hypercholesterolemia due to
hepatic biosynthesis upregulation, changes in plasma viscosity, or as a compensatory mechanism to low plasma oncotic pressure (12,13). Ascites occurs in approximately 75% of canine NS cases. Pitting edema and subcutaneous fluid, the most common finding in people with NS, is noted in 60% of dogs. The ascites fluid is characterized as a pure transudate with a nucleated cell count of less than 1500 cells/µL and a protein concentration < 25 g/L (12,13). It is possible that masitinib has an undescribed direct effect on peripheral blood vessels. Edema, primarily periorbital, was noted in 26% of humans during a masitinib trial for rheumatoid arthritis. In a sizable proportion of patients, the edema persisted and was thought to be secondary to PDGFR inhibition in the periorbital region (11). Periorbital edema has been described as a possible complication of masitinib in humans and it may be a contributing factor to the subcutaneous edema in the dog in the present case.

The progressive azotemia in this case is consistent with AKI, which may be attributable to the drug’s effect on the glomerulus, renal tubules, or both. Other causes of AKI such as pyelonephritis and hypoperfusion are less likely, given the continued progressive azotemia despite adequate volume support and broad spectrum antibiotics. In the safety and efficacy study published by Hahn et al (4), renal disorders were reported in 12 out of 161 dogs (7.5%) following treatment with masitinib, compared to 2 dogs (4.9%) in the placebo group. Renal dysfunction in this population of dogs was characterized as glomerulonephritis, renal failure, nephrotic syndrome, and/or proteinuria. Renal biopsy with electron microscopy was not performed in any of the dogs with noted renal disorders; therefore, the type of glomerular or tubular lesion was not definitively diagnosed in this study. All of the dogs affected with renal dysfunction had baseline BUN and creatinine values that were high/normal to mildly elevated (1,2). Three of the 12 dogs were euthanized and 6 dogs recovered without sequelae (1). In contrast with the findings in the safety and efficacy study, the dog in the current case had a normal creatinine prior to the development of AKI. A safety trial of masitinib mesylate in cats documented significant elevations in serum creatinine concentrations and a corresponding drop in serum albumin concentrations from baseline levels (15). Although changes in creatinine and serum albumin concentrations were noted from baseline, neither value appeared outside reference ranges in the population of study cats. Furthermore, 10% of the cats in this study experienced reversible proteinuria (15).

Renal complications associated with masitinib have been reported in the veterinary literature. Minimal change nephropathy secondary to masitinib administration was described in a giant schnauzer (7) and in a Labrador retriever (1). Clinical findings in the schnauzer included progressive panhypoproteinemia, and proteinuria without azotemia. The Labrador presented with vomiting, and abdominal pain, which progressed to severe subcutaneous edema and oliguric renal failure. Light microscopy on both dogs’ kidneys postmortem revealed podocyte enlargement, mild thickening or splitting of the basement membrane in the Bowman’s capsule, and slight swelling of the proximal tubular epithelium. Lesions observed by electron microscopy in both dogs confirmed podocyte effacement, swelling, and villous transformation. Patchy interstitial inflammation and multiple microthrombi were noted upon cross section of the Labrador’s kidney. While the Schnauzer’s nephrotic syndrome clinically resolved, the Labrador was ultimately euthanized due to increasing renal dysfunction (1,7).

Interpretation of the UPC ratio in this case is complicated by the bacteriuria and pyuria detected in the first urine sample. The urinary tract infection (UTI) is a possible cause for proteinuria. In our case, the method of the first urine collection was unclear and, while it was collected on day 1, it was not analyzed for 3 d. A meta-analysis of 80 human studies examining associations between proteinuria and asymptomatic UTI found that in only 10 studies did UTI have a significant effect on proteinuria (16). Although significantly elevated UPC ratio values have been reported in several dogs with experimentally induced cystitis (17), a prospective study of the effect of pyuria and bacteriuria in dogs revealed no correlation between the degree of pyuria and the magnitude of increase in UPC ratio. For 39 dogs with 6 to 20 white blood cells/high-powered field (HPF), similar to this dog, the UPC ratio ranged from 0 to 0.55 (median: 0.16). The UPC ratio values in 26 dogs with observed bacteriuria ranged from 0 to 1.4 (median: 0.2) (18). Similar to our case, the Labrador reported to have masitinib-associated minimal change nephropathy had 5 to 10 WBC/HPF, 4+ protein, 3+ blood, and a UPC ratio of 12 prior to euthanasia (1). Therefore, it is likely that the markedly elevated UPC ratio observed in the current case was not a consequence of bacterial UTI. It is possible that this dog’s AKI may be a consequence of pyelonephritis; however, pyelonephritis does not adequately explain the nephrotic syndrome in this dog. Further, the association between AKI and masitinib is well-established in the efficacy and safety study and previous case reports. In addition, there was no evidence of pyelonephritis in this dog.

The catheter site infection observed in this case is likely attributed to immunosuppression secondary to kidney dysfunction and/or administration of corticosteroid therapy to prevent mast cell degranulation. However, secondary infections have been well-documented in humans with NS. Humans have an up to 13-fold increase in risk for the development of bacterial infections and sepsis (19,20). However, this complication has yet to be clearly associated with NS in the veterinary literature.

Most dogs in the study by Hahn et al (4) and the dog in the minimal change nephropathy case report (7) recovered fully with no long-term sequelae. Despite the severity of the azotemia and NS, the dog in this case report recovered rapidly, and without relapse or long-term sequelae after discontinuation of the medication. Based on the number of dogs noted to have elevations in renal values and/or proteinuria in the study by Hahn et al (4), it seems prudent to recommend serial monitoring of serum chemistry, urinalysis, and UPC ratio for all dogs receiving masitinib mesylate. Significant elevations in renal values and/or proteinuria dictate discontinuation of the medication and subsequent monitoring of renal function. Serial UPC ratio may be an early marker for renal dysfunction in dogs treated with masitinib (6). When this dog was initially presented to the referring veterinarian, she had a serum creatinine above her previously observed values but not greater than the reference
range. Elevations in serum creatinine above baseline may warrant discontinuation of masitinib, or at the very least increased monitoring, even if the serum creatinine concentration remains within reference range. — Ed.

References
Hypoadrenocorticism mimicking protein-losing enteropathy in 4 dogs
Janne G. Lyngby, Rance K. Sellon

Abstract — Four dogs referred for suspected protein-losing enteropathy based on clinical signs, severe hypoalbuminemia, and hypcholesterolemia, and in 2 dogs, abdominal effusion or peripheral edema, were diagnosed with hypoadrenocorticism. Dogs with hypoadrenocorticism may have features of protein-losing enteropathy, including ascites or peripheral edema, which have not been described in dogs with hypoadrenocorticism.

Résumé — Hypoadrénocorticisme imitant l’entéropathie avec perte de protéines chez 4 chiens. Quatre chiens recommandés pour une entéropathie suspectée avec perte de protéines fondée sur les signes cliniques, accompagnée d’une hypoalbuminémie grave et de l’hypocholestérolémie et, chez 2 chiens, d’une effusion abdominale ou d’un œdème périphérique, ont reçu un diagnostic d’hypoadrénocorticisme. Les chiens atteints d’hypoadrénocorticisme peuvent présenter des signes d’entéropathie avec perte de protéines, y compris de l’ascite ou de l’œdème périphérique, qui n’ont pas été décrits chez les chiens atteints d’hypoadrénocorticisme.

Some clinicopathologic abnormalities of hypoadrenocorticism, such as hypoalbuminemia, hypoglycemia, and hypcholesterolemia (1) could be misinterpreted as liver disease or gastrointestinal disease from protein-losing enteropathy (PLE), potentially leading to inappropriate diagnostic and treatment interventions. To the authors’ knowledge, there are no published reports in the veterinary literature of hypoadrenocorticism resulting in hypoalbuminemia severe enough to cause abdominal effusion or edema. The purpose of this report is to describe 4 dogs with PLE-like features, including abdominal effusion and peripheral edema, that were attributed to hypoadrenocorticism.

Case descriptions
Case 1
A 5-year-old spayed female Labrador retriever (dog 1) weighing 35.1 kg was referred with a 6- to 8-week history of worsening lethargy, decreased appetite, chronic anemia, ascites, and panhypoproteinemia. There was no history of vomiting or diarrhea, but there were 3 episodes of regurgitation. The dog had developed melena at the time of presentation. The dog was up-to-date on vaccinations had not travelled outside the Pacific Northwest, and was not on any medications prior to referral.

On hematologic evaluation performed 4 d before referral, there was a mild hypochromic anemia. Mean corpuscular volume (MCV), reticulocyte count, and blood smear examination were not performed. There was no evidence of a stress leukogram. Serum biochemical abnormalities included hypoprolineemia, hypoalbuminemia, and hypoglobulinemia (Table 1). A post-prandial bile acid concentration was normal. No abnormalities were noted on urinalysis.

On examination at the referral hospital 4 days later, the dog was quiet, alert, and responsive. The dog was underweight with a body condition score (BCS) of 2/5. The rectal temperature was 38.7°C. There was mild to moderate generalized muscle atrophy. Abdominal effusion made abdominal palpation challenging. Heart and lung sounds were normal. Peripheral lymph nodes appeared normal. There was no information regarding rectal examination noted in the medical record. The remainder of the physical examination was normal.

Abdominal ultrasound showed marked ascites and mild enlargement of medial iliac (1.5 cm) and mesenteric lymph nodes (1.4 cm). No abnormalities were noted in the stomach, or small or large intestine. The adrenal glands were not visualized. Results of peritoneal fluid analysis were consistent with a pure transudate (protein: 15 g/L, nucleated cell count/μL: 1430 with 46% non-degenerate neutrophils, 38% small lymphocytes, 12% macrophages, and 4% eosinophils) attributed to hypoalbuminemia.

Serum biochemical abnormalities included hypcholesterolemia, hypoalbuminemia, hypoglobulinemia, and hypocalcemia (Table 1); ionized calcium was not determined. The diagnosis of hypoadrenocorticism was confirmed on adrenocorticotropic hormone (ACTH) stimulation test (Table 1).

The dog was treated with prednisone (PredniSONE Tablets USP; Boehringer Ingelheim Roxane Laboratories, Columbus, Ohio).
Ohio, USA), 0.28 mg/kg body weight (BW), PO, q24h and discharged to follow-up with the regular veterinarian. Two weeks after discharge there was improvement in the laboratory abnormalities and all had resolved 2 mo after discharge. The ascites, regurgitation, and melena had reportedly resolved and the dog had a good appetite and energy level. The patient was continued on the same dose of prednisone.

**Case 2**

A 5-year-old castrated male great Dane (dog 2) weighing 52.4 kg was referred for endoscopic examination and biopsy of the gastrointestinal tract for hypoproteinemina presumed secondary to gastrointestinal disease. Three days prior to presentation to the referral hospital the dog was seen for acute gastric dilatation at an emergency clinic, at which time laboratory abnormalities included hypoalbuminemia, hypoglycemia, hypocholesterolemia, and anemia. Clinical signs resolved after orogastric tube decompression. The dog had been losing weight over the last 6 mo, despite a good appetite. There was no history of vomiting or diarrhea. The dog was up to date on vaccinations and had not travelled outside the Pacific Northwest.

Two days before referral the dog had mild to moderate anemia; a reticulocyte count was not performed. There was no evidence of a stress leukogram. Abnormalities on a limited serum chemistry panel included hypoproteinemina, severe hypoalbuminemia, hypoglycemia, and no measureable cholesterol on repeated tests (Table 1). The only abnormality on urinalysis was mild hyperbilirubinuria. On abdominal ultrasound the liver, gastrointestinal tract, spleen, kidneys, bladder, and pancreas were unremarkable. The adrenal glands were small with the right and left measuring 5 mm and 4.1 mm, respectively.

At the referral hospital the dog was quiet, alert, responsive, and underweight with a BCS of 1.5/5. There was severe generalized muscle atrophy. Mucous membranes were pale pink with a capillary refill time of 2 s. Heart and lung sounds were apparently normal. No abnormalities were noted on abdominal palpation. Peripheral lymph nodes were normal. No abnormalities were noted on rectal examination.

Abnormal results of a complete blood (cell) count (CBC) included a microcytic, non-regenerative anemia [reticulocyte count 0.025 × 10⁶/µL, reference interval (RI): > 0.1 × 10⁶/µL for regeneration]. There was still no evidence of a stress leukogram and abnormalities of the biochemical profile persisted. The diagnosis of hypoadrenocorticism was confirmed on ACTH stimulation test (Table 1).

The dog was treated with prednisone, 0.29 mg/kg BW, PO, q24h, and discharged to follow-up with the regular veterinarian. All laboratory abnormalities had resolved at examination 4 wk after discharge, and the dog had gained weight. At this time the prednisone dose was decreased to 0.19 mg/kg, BW PO, q24h, and the dog was reported to do well on this dose.

**Case 3**

A 10-year-old spayed female husky (dog 3) weighing 37.6 kg was referred for an 8- to 12-week history of colitis. Initially, colitis was treated with an unspecified dose of metronidazole resulting in weakness that resolved after discontinuation of metronidazole. One week before presentation to the referral hospital the dog developed hematochezia. At the time of presentation the dog also had hematemesis. The dog was up-to-date on vaccinations. Travel history was not noted in the medical record.

On examination the dog was quiet, alert, and responsive. Heart and lung sounds were normal. There were no abnormalities noted during abdominal palpation. Mucous membranes were pale pink with a capillary refill time of 3 s. Peripheral lymph nodes appeared normal. The dog had pitting edema of the peripheral limbs, ventral abdomen, and thorax. There was no information regarding rectal examination recorded in the medical record.

On a CBC there was no evidence of a stress leukogram, but there was moderate neutropenia. Abnormal serum chemistry panel results (Table 1) included hypocholesterolemia,
hypoproteinemia, hypoalbuminemia, hypoglycemia, and hypercalcemia attributed to hypoalbuminemia; ionized calcium was not determined. The diagnosis of hypoadrenocorticism was confirmed on ACTH stimulation test (Table 1). The CBC was repeated the following day and the neutrophil count had normalized.

An abdominal ultrasound showed fluid-filled and hypomotile small and large bowels and a scant amount of free peritoneal fluid. The remaining abdomen was normal; however, there was no specific mention of the adrenal glands in the ultrasound report. The thoracic radiographs were unremarkable except for evidence of hypovolemia.

The patient was administered prednisolone sodium succinate (Zoetis, Kalamazoo, Michigan, USA), 0.5 mg/kg BW, IV, q12h, for 1 d until she regained her appetite. With resumption of food consumption the dog was discharged to follow-up with the regular veterinarian with prednisone, at 0.53 mg/kg BW, PO, q24h for 1 wk and then decreased to 0.13 mg/kg BW, PO, q24h. Four weeks after discharge all previously documented clinical and biochemical abnormalities had normalized.

**Case 4**

A 5-year-old neutered male Labrador retriever (dog 4) weighing 28 kg was evaluated for a 2-day history of lethargy, vomiting, diarrhea, and hematochezia. Previous history included an avulsion of the right front dew claw 2 wk earlier, and an episode of vomiting and diarrhea 8 mo prior.

On examination, the dog was quiet, alert, and responsive, but shortly became obtunded and laterally recumbent. The dog had a BCS of 3/5. Mucous membranes were pink and capillary refill time was < 1 s. The rectal temperature was 36.8°C. Heart rate was 156 beats/min and respiratory rate was 16 breaths/min. Femoral pulses were hypokinetic but synchronous. There were normal breath sounds and no arrhythmia, but there was a left-sided grade I/VI systolic murmur loudest over the left apex. The dog seemed uncomfortable with abdominal palpation, but there were no other abnormalities. Peripheral lymph nodes appeared normal. Hematochezia was noted on rectal examination. The remainder of the physical examination was normal.

Abdominal radiographs were taken at the time of presentation to the referral hospital. There was good serosal detail, but the small and large bowels were fluid-filled with no evidence of obstruction. There was no stress leukogram on a CBC. Abnormal results of a serum chemistry panel (Table 1) included hypocholesterolemia, hypoproteinemia with both hypoalbuminemia and hypoglobulinemia, lymphopenia, hypocalcemia, hypomagnesemia, and hypocobalaminemia (1–2). The diagnostic approach to a dog suspected of having PLE commonly involves exclusion of other causes of hypoalbuminemia including protein-losing nephropathy, liver failure, and third space losses, but hypoadrenocorticism is not routinely mentioned as a differential diagnosis (2–3). The 4 cases described here highlight the importance of considering hypoadrenocorticism as a differential diagnosis for a PLE-like presentation in dogs with hypoalbuminemia and/or hypocholesterolemia, even when such dogs exhibit clinical consequences of enteric protein loss, such as peripheral edema or ascites.

The pathophysiologic mechanism driving hypoalbuminemia in hypoadrenocorticism is unknown. Loss of albumin into the GI tract or decreased intake/assimilation of proteins, is the main suspected cause (4). The human literature suggests that glucocorticoids enhance barrier function of epithelial cells due to suspect epithelial-specific properties, but more research is needed in this area (5).

Two of the 4 dogs had fluid accumulation (abdominal effusion, dog 2; peripheral edema, dog 3) attributed to hypoalbuminemia. It is well-known that hypoadrenocorticism can mimic gastrointestinal disease; however, to our knowledge there is no literature describing ascites or peripheral edema secondary to hypoadrenocorticism-induced hypoalbuminemia (4,6). Effusions and edema are, however, relatively common in dogs with PLE, potentially increasing the likelihood that a clinician erroneously suspects PLE as the cause of the clinical features in dogs affected by hypoadrenocorticism.

Hypocholesterolemia is common in dogs with what has been historically referred to as atypical, or glucocorticoid-deficient, hypoadrenocorticism. A recent paper (7) found that dogs with “atypical” hypoadrenocorticism had mineralocorticoid deficiencies despite having normal electrolyte concentrations, but for the sake of this discussion, we will retain the atypical hypoadrenocorticism designation. In one study, 13/17 (76.5%) dogs with atypical hypoadrenocorticism had hypocholesterolemia.

**Discussion**

All 4 dogs in this report were referred for evaluation of what was believed to be primary gastrointestinal (GI) disease; all were diagnosed with hypoadrenocorticism. Although the presence of a primary enteropathy was not definitively excluded in any of these dogs, resolution of both clinical signs and laboratory abnormalities of hypoproteinemia, hypoalbuminemia, and hypocholesterolemia following therapy with physiologic replacement doses of prednisone supports the likelihood that all of the clinical features of these dogs were a consequence of untreated hypoadrenocorticism and not a concurrent enteropathy.

The dogs in this report were suspected of having PLE, a spectrum of GI diseases characterized by loss of serum proteins into the GI tract. Dogs with PLE are often seen for chronic or relapsing diarrhea and/or vomiting, and commonly exhibit weight loss. They may have ascites, pleural effusion, or peripheral edema, usually as a consequence of hypoalbuminemia and low oncotic pressure (2). Common laboratory findings include hypoalbuminemia, hypoglycemia, and potentially hypoglobulinemia, lymphopenia, hypocalcemia, hypomagnesemia, and hypocobalaminemia (1–2). The diagnostic approach to a dog suspected of having PLE commonly involves exclusion of other causes of hypoalbuminemia including protein-losing nephropathy, liver failure, and third space losses, but hypoadrenocorticism is not routinely mentioned as a differential diagnosis (2–3). The 4 cases described here highlight the importance of considering hypoadrenocorticism as a differential diagnosis for a PLE-like presentation in dogs with hypoalbuminemia and/or hypocholesterolemia, even when such dogs exhibit clinical consequences of enteric protein loss, such as peripheral edema or ascites.

The pathophysiologic mechanism driving hypoalbuminemia in hypoadrenocorticism is unknown. Loss of albumin into the GI tract or decreased intake/assimilation of proteins, is the main suspected cause (4). The human literature suggests that glucocorticoids enhance barrier function of epithelial cells due to suspect epithelial-specific properties, but more research is needed in this area (5).

Two of the 4 dogs had fluid accumulation (abdominal effusion, dog 2; peripheral edema, dog 3) attributed to hypoalbuminemia. It is well-known that hypoadrenocorticism can mimic gastrointestinal disease; however, to our knowledge there is no literature describing ascites or peripheral edema secondary to hypoadrenocorticism-induced hypoalbuminemia (4,6). Effusions and edema are, however, relatively common in dogs with PLE, potentially increasing the likelihood that a clinician erroneously suspects PLE as the cause of the clinical features in dogs affected by hypoadrenocorticism.

Hypocholesterolemia is common in dogs with what has been historically referred to as atypical, or glucocorticoid-deficient, hypoadrenocorticism. A recent paper (7) found that dogs with “atypical” hypoadrenocorticism had mineralocorticoid deficiencies despite having normal electrolyte concentrations, but for the sake of this discussion, we will retain the atypical hypoadrenocorticism designation. In one study, 13/17 (76.5%) dogs with atypical hypoadrenocorticism had hypocholesterolemia.
In a study by Thompson et al (8), dogs with glucocorticoid-deficient hypoadrenocorticism had significantly lower albumin and cholesterol concentrations than dogs with typical hypoadrenocorticism. The diagnostic challenge posed by atypical hypoadrenocorticism, and often the more prolonged course of disease before diagnosis, could contribute to the increased frequency of hypercholesterolemia in affected dogs (8,9). All the dogs of our report had hypercholesterolemia, and in dog 2, the frequency of hypocholesterolemia in affected dogs (8,9). All the dogs of our report had hypercholesterolemia, and in dog 2, the hypoadrenocorticism was severe. The mechanism for hypercholesterolemia in hypoadrenocorticism is not known. It has been suggested that glucocorticoids play a role in fat absorption from the GI tract; decreased mobilization or increased utilization of fatty acids secondary to high ACTH concentrations has also been proposed (1,6,9).

Dogs with hypoadrenocorticism often have no stress leukogram because of cortisol deficiency. In the study by Thompson et al (8), all dogs had normal lymphocyte, monocyte, and eosinophil counts, and Scott-Moncrief (9) reported that 97% of dogs with hypoadrenocorticism lacked a stress leukogram. Since hyperkalemia and/or hyponatremia often prompt suspicion of hypoadrenocorticism and subsequent testing for the disease, recognition that a patient lacks a stress leukogram becomes critical to generating suspicion of atypical hypoadrenocorticism even when none of the classic electrolyte abnormalities are present (8–9). None of the dogs in this report had a stress leukogram.

In a retrospective study, pre- and post-ACTH serum cortisol concentrations were below 27.6 nmol/L in 37/42 of dogs with hypoadrenocorticism, whereas the remaining 5/42 had pre- and post-ACTH serum cortisol levels between 27.6 and 55.2 nmol/L (8). Thus, a resting cortisol can be a useful and relatively inexpensive tool in ruling out hypoadrenocorticism. It could be argued that an ill patient without a stress leukogram should have a basal cortisol concentration measured before more invasive and expensive diagnostics are performed. If the basal cortisol is less than 55.2 nmol/L the sensitivity and specificity for detecting hypoadrenocorticism are 100% and 63% to 78%, respectively, and obtaining post-ACTH cortisol concentration is recommended to confirm the diagnosis (10–11).

Three dogs in this report had small or non-detectable adrenal glands during abdominal ultrasonography. It has previously been described that dogs with hypoadrenocorticism had significantly thinner adrenal glands than those of healthy dogs, but dogs with atypical hypoadrenocorticism were not well-represented in these reports (12,13). All patients in the paper by Wenger et al (13) had unspecified electrolyte abnormalities, and Hoerauf and Reusch (12) did not describe laboratory results/abnormalities for their patients. Adrenal ultrasonography may be of value in dogs with clinical signs otherwise suggestive of PLE as small adrenal glands could enhance the suspicion of hypoadrenocorticism.

In conclusion, the challenge of diagnosing atypical hypoadrenocorticism resides in generating clinical suspicion. The absence of a stress leukogram in dogs with hypoalbuminemia and/or hypocholesterolemia, even with ascites or peripheral edema, should warrant a resting cortisol, and ACTH stimulation testing if indicated, before pursuing causes of primary GI disease.

References
Case Report   Rapport de cas

Total laryngectomy for management of chronic aspiration pneumonia in a myopathic dog

Karen M. Vernau, Stanley L. Marks, Maggie A. Kuhn, William T.N. Culp, Tammy J. Owens, G. Diane Shelton, Tausif Siddiqui, Rachel Pollard, Peter C. Belafsky

Abstract — A 5-month-old female pit bull terrier dog evaluated for ataxia, progressive regurgitation, and recurrent aspiration pneumonia had markedly elevated creatine kinase activity, non-inflammatory generalized myopathy, and severe esophageal dysmotility. A narrow-field total laryngectomy was performed. The dog is doing well 30 months after surgery, and no longer has episodes of aspiration pneumonia, despite intermittent regurgitation. This case represents the first application of total laryngectomy for the prevention of chronic recurrent aspiration pneumonia in the dog.

Résumé — Laryngectomie totale pour la gestion d’une pneumonie par aspiration chronique chez un chien myopathique. Une chienne Pit Bull Terrier âgée de 5 mois évaluée pour de l’ataxie, de la régurgitation progressive et une pneumonie par aspiration récurrente présentait une activité de la créatine kinase particulièrement élevée, une myopathie généralisée non inflammatoire et un trouble de motilité de l’œsophage grave. Une laryngectomie totale à champ étroit a été réalisée. La chienne se porte bien 30 mois après la chirurgie et n’a plus d’épisodes de pneumonie par aspiration, malgré une régurgitation intermittente. Ce cas représente la première application d’une laryngectomie totale pour la prévention d’une pneumonie par aspiration chronique récurrente chez un chien.

Since Theodor Billroth performed the first human laryngectomy for laryngeal carcinoma in 1873, the procedure has been modified and improved many times (1–6). Total laryngectomy has been used to prevent chronic aspiration in 4 human patients (7); however, application of the procedure for treatment of chronic aspiration in humans was limited due to complete loss of phonation and naso-laryngeal breathing, hyposmia, and atrophy of nasal mucosa (7,8). Various medical and surgical alternatives to laryngectomy have been used for chronic aspiration in humans, including dietary and behavioral modification, oral care and sitting posture, levodopa to improve swallow and cough reflex, tracheostomy with gas bag, laryngeal diversion, tracheoesophageal diversion, laryngeal diversion with a speech fistula, dynamic laryngotracheal closure, and a paced glottis closure (9–13). Conservative measures are generally preferred for concerns of voice preservation in humans. However, when medical management fails, total laryngectomy is the gold standard treatment of chronic and life-threatening aspiration pneumonia in humans (7). Experimental laryngectomy was first performed in the dog in the early 19th century (6,14), and was exclusively used for the surgical management of laryngeal cancer in dogs (15–17). To the best of our knowledge, a total laryngectomy has not been performed for the treatment and prevention of chronic recurrent aspiration pneumonia in the dog.

This report documents the successful management via total laryngectomy of a 5-month-old female pit bull terrier with progressive regurgitation and recurrent aspiration pneumonia secondary to a severe non-inflammatory congenital myopathy.
Case description

A 5-month-old female pit bull terrier dog was referred to the William R. Pritchard Veterinary Medical Teaching Hospital (VMTH), University of California, Davis, for evaluation of an abnormal gait. The dog was rescued 1 mo previously, and the previous medical history was unknown. At presentation, the dog weighed 16 kg with a body condition score (BCS) of 4/9. The pelvic limbs were held in an adducted position, and the pelvic limb musculature was palpably firm, with limited range of motion and apparent pain on gentle manipulation of the coxofemoral (CF) joints. The thoracic limbs had a wide-based stance with elbow abduction, but normal range of motion in all joints. On neurological examination, abnormalities were restricted to a short-strided gait in all 4 limbs, reduced flexor reflexes and delayed proprioception in the pelvic limbs. Bilateral CF luxation was noted on pelvic radiographs. A serum chemistry profile revealed hyperphosphatemia [2.2 mmol/L, reference range (RR): 0.84 to 1.68 mmol/L], hypercalcemia (3 mmol/L, RR: 2.4 to 2.8 mmol/L), and marked elevation of creatine kinase (CK) activity (74 272 IU/L, RR: 55 to 257 IU/L) with elevated alanine aminotransferase (ALT) (295 IU/L, RR: 21 to 72 IU/L) and aspartate aminotransferase (AST) (1339 IU/L, RR: 20 to 49 IU/L). The alkaline phosphatase (ALP) activity was mildly increased (97 IU/L, RR: 14 to 91 IU/L). The elevated CK and AST were consistent with a myopathy, and the elevated ALP activity and increased phosphorus were associated with osteoblastic activity during growth. A complete blood (cell) count (CBC) and urinalysis were unremarkable. Infectious disease titers for *Neospora* (direct fluorescent antibody) and *Toxoplasma* (latex agglutination test) were negative.

The dog was placed under general anesthesia for an electrodiagnostic evaluation by electromyography (EMG) and biopsies were collected from the cranial tibial, vastus lateralis, triceps, and adductor muscles. In addition, the dog underwent a bilateral femoral head ostectomy (FHO) and tenotomies of the pectineus muscle to improve the CF pain and ability to ambulate. The pectineus muscle was also biopsied during the FHO. The EMG was abnormal and characterized by diffuse complex repetitive discharges in the distal and proximal thoracic and pelvic limb, epaxial, head, and tongue muscles. All muscle biopsies revealed a non-inflammatory generalized myopathy with dystrophic features, most severe in the adductor (Figure 1) and pectineus muscles.

Following adoption, the dog was noted to have progressive dysphagia and regurgitation. Thoracic radiographs revealed a fluid-filled caudal thoracic esophagus and a videofluoroscopic...
swallow study revealed evidence of severe esophageal dysmotility in the cranial esophagus characterized by retention of large volumes of liquid barium and retrograde motility of the bolus into the pharynx (Figure 2A–C). In addition, the dog had multiple episodes of gastroesophageal reflux and a sliding (Type I) hiatal hernia (Figure 2D). Persistent regurgitation was managed with famotidine (Famotidine; Major Pharmaceuticals, Livonia, Michigan, USA), 1 mg/kg body weight (BW), PO, q24h, sucralfate (Carafate; Nostrum Laboratories, Kansas City, Missouri, USA), 1 g PO, q8h, and omeprazole (Omeprazole delayed release tablets; Dexcel Pharma Technologies, Yokneam, Israel), 1 mg/kg BW, PO, q24h. Feedings were changed to a commercial complete and balanced puppy food fed in small volumes 3 times daily. Although the dog was fed in a dog sitting position, regurgitation persisted. The dog underwent corrective surgery for the hiatal hernia characterized by a left-sided gastropexy, esophagopexy, and esophageal hiatal plication 2 mo later. The dog’s diaphragm was found to be markedly thickened secondary to the severe myopathy and the diaphragmatic defect was reduced. Two biopsies were obtained from the left crura of the diaphragm and the muscle was found to be severely affected with a dystrophic process similar to that observed in the other muscles (Figure 1). The frequency of regurgitation decreased for approximately 3 mo; however, clinical signs progressed shortly thereafter and the dog developed aspiration pneumonia that was treated with ampicillin/sulbactam (Unasyn; Pfizer), 50 mg/kg BW, IV, q8h and enrofloxacin (Baytril; Bayer Healthcare, Shawnee Mission, Kansas, USA), 10 mg/kg BW by PEG tube q24h, with nebulization and coughing necessary to manage the pneumonia. The dog’s quality of life was poor with frequent episodes of regurgitation, nasal reflux of ingesta, and difficulty sleeping due to partial airway obstruction. The dog lost 3 kg body weight and had a BCS of 2/9. Regurgitation persisted despite administration of cisapride (Cisapride, compounded product; Road Runner Pharmacy, Phoenix, Arizona, USA), 0.5 mg/kg BW, PO, q12h. A customized calorie-dense complete and balanced home-prepared

Figure 2. A, B, C – Videofluoroscopic swallow study with liquid barium documenting evidence of aspiration characterized by barium coating the trachea and severe esophageal dysmotility with retrograde movement of the bolus in the proximal esophagus prior to movement of the bolus in an aborad direction. D – Videofluoroscopic swallow study with barium-soaked kibble documenting displacement of the cardia cranially to the diaphragmatic crus (sliding hiatal hernia) with gastroesophageal reflux.
diet of liquid consistency was formulated for the dog. Despite the administration of prokinetics and the liquid diet via the low profile gastrostomy device (LPGD), the dog continued to regurgitate and had 3 episodes of airway obstruction with loss of consciousness, requiring emergent intervention to re-establish airway patency. In light of the frequent episodes of regurgitation and subsequent aspiration with airway obstruction, a narrow-field laryngectomy was elected when the dog was 14 mo of age.

A narrow-field total laryngectomy was performed under general anesthesia by 2 otolaryngologists and a board-certified veterinary surgeon. The dog was placed in dorsal recumbency, the fur was clipped, and the skin was prepared with aseptic technique. A cushion was placed under the neck to elevate the cervical region into the surgical field. A 5-cm horizontal curvilinear incision was made 2 cm below the level of the cricoid cartilage. The sternohyoideus and sternothyroideus muscles were bluntly separated on the ventral midline and retracted to expose the larynx. Blunt and sharp dissection was utilized to expose the cricoid and thyroid cartilage of the larynx as well as the cranial aspect of the trachea (1st and 2nd tracheal rings). The entire circumference of the cranial trachea was dissected free from all surrounding tissues. The pharyngeal constrictor muscles (hyopharyngeus, thyropharyngeus, and cricopharyngeus) were separated from their attachments on the larynx as were the sternothyroideus and thyrohyoideus muscles. The cuff of the endotracheal tube was deflated, and the endotracheal tube was pulled cranially, to allow for a tracheal incision. A size #15 blade was utilized to enter the trachea between the 2nd and 3rd tracheal rings. This incision was continued around the entire circumference of the trachea; a sterile endotracheal tube was introduced into the open end of the trachea, and the cuff was inflated to allow for a tight seal. Cranially, the larynx was freed from its attachments to the hyoid apparatus (disarticulated bilaterally) as well as the attachments to the tongue and hyoid bone, which were preserved. The larynx and cranial trachea were then removed. The pharyngeal mucosa was closed with 3-0 polydioxanone (PDS Suture; Ethicon, Somerville, New Jersey, USA) in a simple continuous pattern, followed by closure of the paired thyropharyngeal and cricopharyngeal muscles with 3-0 polydioxanone (Ethicon) in a simple continuous pattern. The cranial trachea was then brought into apposition with the skin to form a permanent tracheostomy. The severed end of the trachea was rotated to allow the entire circumference to be sutured to the skin edges forming an airtight seal. The trachea was sutured to the skin with 3-0 silk (Perma-Hand Silk Suture; Ethicon) because of its braided and non-absorbable features and optimal knot security qualities. Two closed-suction drains (Jackson-Pratt drain; Cardinal Health, Dublin, Ohio, USA) were placed in the surgical wound and the rest of the cervical incision was closed with staples. A light compression dressing was placed around the neck. The dog recovered uneventfully from anesthesia in the intensive care unit (ICU) and was discharged from the unit the following morning.

The dog was unable to swallow immediately following surgery secondary to the pharyngeal and esophageal myopathy, but otherwise did well in the post-operative period. The stoma was cleaned with sterile saline after nebulization with sterile water for 10 min 3 times daily for 10 d and a size #8 tracheostoma vent (Bivona; Smiths Medical ASD, Gary, Indiana, USA) was applied 14 d after surgery and held in place with a Posey foam tracheal tie (Posey Company, Arcadia, California, USA). The drains were removed on postoperative day 3 and the staples were removed on postoperative day 7. The dog is doing well 30 mo after surgery with a weight of 25 kg and a BCS of 8/9. There have been no episodes of aspiration pneumonia, even though the dog continues to regurgitate. The dog is managed with glycopyrrolate (Par Pharmaceutical, Woodcliff Lake, New Jersey, USA), 1 mg q8h to reduce saliva production, acid suppressants (famotidine, omeprazole), and gastrointestinal protectants (sucralfate) administered via PEG tube for the chronic gastroesophageal reflux and esophagitis, and lactated Ringer’s solution (500 mL SQ, q12h) to maintain hydration status. The dog has frequent episodes of regurgitation and nasal reflux of saliva and refluxed food due to her pharyngeal and esophageal myopathy. She wears the tracheostoma vent continuously to maintain a patent tracheal stoma. In addition, the dog is heat intolerant secondary to the inability to thermoregulate by panting; however, quality of life is considered excellent by the owners and clinicians. Neurological status has minimally progressed since initial presentation with increased muscle rigidity in the thoracic limbs.
Discussion

Aspiration pneumonia is a common clinical problem in dogs with neurological disease, particularly neuromuscular disorders such as myasthenia gravis, polymyopathies, and polyneuropathies affecting the swallowing reflex (18–20). In 1 report, aspiration pneumonia was most frequently noted in dogs with esophageal disease, vomiting, and neurological disorders (21). In that study, 22 of 88 dogs died or were euthanized, and 3 of the 22 dogs (14%) were euthanized because of continual or refractory aspiration pneumonia (21). Most dogs with myasthenia gravis have esophageal weakness and dysfunction, in addition to generalized weakness. In 1 study, 12 of 25 dogs (48%) with myasthenia gravis died or were euthanized shortly after admission to the hospital due to aspiration pneumonia (18). Given the high incidence of spontaneous remission of myasthenia gravis in dogs (22), a laryngectomy procedure should be reserved for those animals with the most intractable pneumonia and an irreversible primary disease that is refractory to medical therapy, regardless of cause. Currently, there is no established surgical treatment for prevention of chronic or recurrent aspiration pneumonia in dogs.

In humans, it has been suggested that surgery is indicated for those cases with chronic aspiration and severe associated medical problems, whereby a total laryngectomy is the only justifiable surgical intervention which can improve patient quality of life (7). We utilized this approach to prevent recurrent aspiration pneumonia in a dog and prevented chronic aspiration, markedly improved quality of life, and obviated the need for euthanasia. Documented complications of laryngectomy in dogs include collapse of the laryngeal stoma, tracheoesophageal fistula formation, pharyngeal dehiscence, megaesophagus, hypocalemia secondary to iatrogenic hypoparathyroidism, pneumonia, and death (15–17). Two of these reports describe significant post-laryngectomy morbidity in dogs while another report demonstrated no significant complications during 18 mo of follow-up (15–17). Other complications related to permanent tracheostomy include skin fold occlusion of a tracheal stoma, hyposmia and olfactory mucosal changes, loss of thermoregulation through panting, and increased CNS temperature (23–25). Postoperative activity of such dogs should be limited, as upper respiratory ventilation is required for normal thermoregulation and restriction of outdoor activities in warm weather should be considered in some cases as well (17). These dogs are also unable to swim due to the risk of drowning.

Although this dog was cured of recurrent aspiration pneumonia, it remains unable to swallow because of the progressive myopathy. The dog has also developed hyposmia as reported by the owners because the dog can no longer smell the family cat entering the family room, and the dog used to chase the cat out of the room as soon as she was aware of its presence. The myopathy in this case is congenital and no specific treatments or cures are available, thus the necessity for the laryngectomy to prevent aspiration pneumonia. She is maintained on intermittent tube feedings administered through a PEG tube and subcutaneous fluids, and maintains an excellent quality of life according to her owners and clinicians. It is plausible that dogs with less severe dysphagia may be able to eat and drink orally after laryngectomy, without the previous risk of aspiration. By removing the larynx and separating the respiratory and digestive tracts, the risk of aspiration pneumonia is eliminated.

Chronic regurgitation and recurrent life-threatening aspiration pneumonia are challenging conditions to treat and result in death or euthanasia in many dogs, particularly in those with esophageal and neuromuscular disorders. Currently there is no established surgical management available for this disorder and many dogs are euthanized. This case report suggests that a narrow field laryngectomy can be safely and effectively performed for management of chronic aspiration in the dog, and should be considered as a viable alternative treatment for dogs with profound oropharyngeal dysphagia, chronic regurgitation, and aspiration pneumonia.

The ethical considerations and importance of comprehensive client communications surrounding the surgical management of a dog with a progressive myopathy cannot be overemphasized. The dog in this report did not have an obviously clinically progressive myopathy other than the involvement of the pharynx and esophagus. Prior to the laryngectomy procedure, the dog suffered 3 episodes of airway obstruction secondary to aspiration of regurgitated material with consequent loss of consciousness. Without the laryngectomy procedure, the dog would have undergone elective euthanasia as it was deemed inhumane for her to continue to aspire and suffer respiratory obstruction. The internists and surgeons met with the owners on several occasions to discuss the ramifications of the laryngectomy procedure as well as potential complications. The owners were given ample opportunity to discuss the options with their family members and elected to move forward with the procedure recognizing that euthanasia would be indicated if the dog’s quality of life was not dramatically improved. The dog has continued to thrive and its quality of life is deemed to be excellent by the owners and clinicians.

Acknowledgments

The authors thank John Doval for assistance with the images and Robin Fisher and Paula Howell for their technical support.

References


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

Specialized insurance programs and risk management services for CVMA members

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

CVMA INSURANCE PROGRAM

1-866-860-2862 • cvmaininsurance.com
Case Report  

Rapport de cas

Citrobacter freundii induced endocarditis in a yearling colt

Eleonora E.A. Guidi, Aurélie Thomas, Jean-Luc Cadoré, Agnès Benamou Smith

Abstract — Endocarditis is a rare pathology in horses and the clinical signs can be misleading. We describe the clinical, echocardiographic, and pathological features of Citrobacter freundii induced bacterial endocarditis in a horse. This bacterium has never been reported before as an agent of vegetative endocarditis in the horse.

Résumé — Endocardite induite par Citrobacter freundii chez un poulain âgé d’un an. L’endocardite est une pathologie rare chez les chevaux et les signes cliniques peuvent être trompeurs. Nous décrivons les caractéristiques cliniques, échographiques et pathologiques d’une endocardite bactérienne induite par Citrobacter freundii chez un cheval. Cette bactérie n’a jamais été signalée auparavant comme un agent d’endocardite végétante chez un cheval.

Bacterial endocarditis is a rare disease in horses, compared to other species, and is associated with a high mortality rate (1). Infection of the endothelial layer of the heart results in vegetation and valve regurgitation. Most commonly the mitral valve is affected, followed by aortic, tricuspid, and pulmonary valves (1). Persistent regurgitation in the left side can lead to heart failure even if infection has been treated. Actinobacillus spp. and Streptococcus spp. are the microorganisms most commonly cultured, but a wide range of other bacterial and fungal pathogens have been implicated (2).

This report describes the clinical, echocardiographic, and pathological findings in a yearling with a Citrobacter freundii induced endocarditis.

Case description

A 10-month-old French saddlebred colt was presented at the Veterinary Teaching Hospital of the University of Lyon, with a 2-week history of weakness, hyperthermia, and intermittent-shifting lameness (right hind limb, right front limb). Hematology showed a marked neutrophilia and a mild anemia. Prior to referral the horse had been treated with trimethoprim sulphonamide (Avemix; Vétoquinol, Magny, Vernois, France), 30 mg/kg body weight (BW), PO, q24h for 8 d and vedaprofene (Quadrisol; Intervet, Ivoyville, France), 1 mg/kg BW, PO, q12h for 6 d without any improvement. Serological tests for Streptococcus equi, Borrelia spp., and Anaplasma phagocytophilum were all negative.

Clinical findings

The colt was in moderately poor body condition [weight 308 kg, body condition score 3/9 (3)] and lethargic. A warm, painful, soft edematous swelling was present at the dorsal surface of the left carpus and the horse had a 4/5 grade lameness. He had pale mucous membranes, normal capillary refill time, and no fever. Cardiac auscultation revealed a markedly elevated and irregular heart rate with 72 beats/min [reference range (RR): 28 to 40 beats/min], and a harsh pansystolic heart murmur, loudest over the mitral valve area, graded as 4/5 on the left side of the chest and 3/5 on the right side. Respiratory rate was increased (36 breaths/min, RR: 8 to 14 breaths/min). Auscultation with a rebreathing bag revealed some crackles in the cranio-ventral areas of both lungs but did not induce cough or nasal discharge.

Other examinations

Hematology indicated a moderate anemia (red blood cells 6.46 × 10¹²/L, RR: 6 to 9 × 10¹²/L; hemoglobin 71 g/L, RR: 110 to 190 g/L; hematocrit 22.8%, RR: 32% to 50%), leukocytosis at 18.9 × 10⁹/L (RR: 7 to 10 × 10⁹/L) with a marked neutrophilia (84%). Total serum protein concentration was 69 g/L (RR: 65 to 83 g/L) with severe hypoalbuminemia (11 g/L, RR: 25 to 39 g/L) and hyperglobulinemia (58 g/L, RR: 20 to 44 g/L; albumin/globulin ratio 0.19, RR: 0.9 to 1.6). A base-apex (4) electrocardiogram revealed a sinus tachycardia and occasional atrial premature complexes (Figure 1). Cardiac troponin I concentration in serum was moderately increased at 0.31 ng/mL (RR: 0 to 0.2 ng/mL). Blood culture wasn’t performed since the colt was already under antibiotic treatment.

An echocardiographic examination was performed without sedation using an Aloka alpha 10 sonographic unit (Hitachi Medical Systems Europe Holding AG, CH-6300 Zurich, Switzerland).

Département Hippique, VetAgro-Sup, Campus vétérinaire de Lyon, 1, avenue Bourgelat — 69280 Marcy l’étoile — France (Thomas, Cadoré, Smith); Dipartimento di Scienze Veterinarie, Università degli Studi di Torino, Largo Braccini 2-5-10095 Grugliasco — Italia (Guidi).

Address all correspondence to Dr. Eleonora Guidi; e-mail: eleonora.guidi@gmail.com

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-acvm.org) for additional copies or permission to use this material elsewhere.
A prominent change in the anatomic shape of the mitral valve was evident on B-mode and M-mode echocardiography (Figure 2). Severe nodular thickening of the valve, with at least 2 echogenic masses on the leaflets was present and pathognomonic for mitral valve endocarditis. The nodules ranged from 2 to 3 cm in diameter. Considerable left atrial and ventricular dilation was also present (left ventricle internal diameter in diastole = 9.25 ± 1.05 cm, left atrium internal diameter in systole = 10.85 ± 0.45 cm, normal for reference range in adult horses so increased for a yearling), with a large and rounded left ventricular apex (Figure 2). The chambers of the right heart were barely visible from the left and right sides (Figures 2, 3), because of compression by the enlarged left heart. Left cardiac chamber dilatation, in addition to an increased fractional shortening (Figure 3), indicated left heart volume overloading. Color flow Doppler echocardiography was also performed and revealed severe holosystolic mitral valve regurgitation due to a loss of leaflets coaptation (Figure 4). No other valvular regurgitation was detected.

Thoracic X-rays were obtained because of the abnormalities noted during thoracic auscultation. Both interstitial and alveolar patterns were present caudally to the heart, indicating pulmonary cardiogenic edema and pulmonary hypertension. The pulmonary hypertension was also supported by the enlarged pulmonary artery diameter at 3.9 cm (almost equating the size of the aorta at 4.1 cm) seen on echocardiography. Cardiomegaly was also noted on radiographs, with a marked enlargement and a rounded appearance of the cardiac silhouette.

**Diagnosis and outcome**

The clinical, laboratory, and ultrasonographic findings were consistent with a diagnosis of bacterial endocarditis of the mitral valve. The foal was treated with broad-spectrum antibiotics: procaine penicillin (Depocilline; Intervet), 25 000 IU/kg BW, IM, q12h, and gentamicin (G4; Virbac Group, Carros, France), 6.6 mg/kg BW, IV, q24h and provided intensive care (IV fluid therapy, nasal oxygen and diuretics).

The animal was euthanized 3 d later because of worsening of heart failure signs (severe respiratory distress, foamy nasal discharge, increased jugular pulse, and ventricular extra systoles) (Figure 5) and a necropsy was performed.

**Postmortem findings**

At necropsy the mitral valve had large nodular masses (Figure 6) that were aseptically biopsied for histology and bacteriological culture. One of the chordae tendinae was ruptured explaining...
the acute worsening of heart failure. The lungs showed signs of secondary pulmonary edema and the kidneys had an infarcted area (probably resulting from septic emboli) and signs of glomerulonephritis. Bacterial culture lead to a pure and heavy growth of *Citrobacter freundii* and histology of the mitral valve confirmed an active endocarditis.

**Discussion**

Endocarditis following *C. freundii* infection has never been reported before in a horse and is also an uncommon finding in humans in whom infectious endocarditis is more frequently encountered than in equids. *Citrobacter freundii* is an aerobic, Gram-negative bacillus that belongs to the family Enterobacteriaceae. Its habitats include the environment, food, and animal and human intestinal tracts (5).

In humans *C. freundii* represents up to 29% of all opportunistic hospital infections (6) and is typically found in neonates, debilitated aged (≥ 65 y) or immunocompromised patients (7). *Citrobacter* species is responsible for a wide variety of nosocomial infections such as urinary tract and hematological infections, intra-abdominal sepsis, brain abscesses, pneumonia in adults (8,9) and neonatal infections, such as meningitis, neonatal sepsis, joint infection, or bacteremia (10–12). There is only 1 report of *C. freundii* endocarditis in a human: the patient also had chronic and advanced liver disease that contributed to the fatal infection and the bacterium was resistant to most first line antimicrobials as commonly reported for *Citrobacter* spp. (13).

In horses, *Citrobacter* spp. has been found occasionally as an agent of neonatal septicemia (14), endometritis (15), ulcerative keratitis (16), and arthritis (17). *Citrobacter freundii* has been reported to be resistant to several broad-spectrum antibiotics (18) and may act as a reservoir of antimicrobial resistance genes in soils (19).

In the present case, the diagnosis of endocarditis was based on echocardiographic findings of oscillating intracardiac heterogeneous masses on the mitral valves. Echocardiography is a non-invasive technique that usually provides sufficient evidence to substantiate the diagnosis of bacterial endocarditis. When interpreted in combination with relevant clinical signs and concurrent volume overload, echocardiographic examination of valve regurgitation or ruptured chordae tendinae is helpful in establishing the prognosis for the animal (20). According to a study by Porter et al (21) clinical signs such as hyperthermia, synovial distension, and lameness associated with blood parameters revealing hyperglobulinemia, hypoalbuminemia, hyperfibrinogenemia, and leukocytosis significantly increase the probability of diagnosing vegetative endocarditis. In human medicine, the criteria used to diagnose an endocarditis are divided into major criteria (oscillating intracardiac masses, abscesses, persistently positive blood culture) and minor criteria (fever, predisposing heart conditions, emboli, infarcts, petechiae, glomerulonephritis, rheumatoid factor, microbiologic evidence). Thus, evidence of 2 major criteria or 1 major with 2 minor criteria leads to a definitive diagnosis of infectious endocarditis (22). In the case described herein 3 of these minor signs were present: glomerulonephritis and an infarcted area on the kidneys as evidenced in the necropsy as well as a shifting lameness due to synovitis because of immune-complex deposition. Systematic use of those parameters in veterinary medicine could improve the sensitivity of the diagnostic procedure.

This report describes the clinical and echocardiographic signs presented by a colt presenting with endocarditis caused by *C. freundii*. This bacterium has never been reported before as a causative agent of endocarditis in the horse, and although ubiquitous in the environment, it is not a common pathologic finding. Infection by *Citrobacter* spp. should therefore be considered as a possible differential diagnosis in young, old, or immunocompromised animals particularly those not responding to first line antimicrobial treatment.

**References**

Environmental allergens pose an invisible but constant nuisance to many dogs. Pollens, molds, and house dust mites can be found almost anywhere, and in any season. It is estimated that more than 50% of allergy cases in dogs are caused by environmental and flea allergies, which can leave dogs with itchy skin that they just can't seem to stop scratching. Scratching damages the skin, allowing allergens to penetrate, potentially leading to infections and creating a vicious cycle.

Hill’s® Prescription Diet® Derm Defense™ pet food for dogs with Histaguard complex is the first and only nutrition formulated to reduce signs of environmental allergies by helping disrupt the internal allergy response and create a barrier against future episodes. Histaguard complex, a proprietary blend of antioxidants, egg, and phytoneutrients containing quercitin, helps continuously normalize the immune response to allergens. In addition, Omega 3 fatty acids and antioxidants such as vitamin E help reduce inflammation and support skin rejuvenation to aid healing, while Omega 6 fatty acids help restore the skin barrier.

“Derm Defense is uniquely formulated to help block environmental allergens, ideally before they trigger a reaction,” said Dr. Ellen Lowery, Director of U.S. Professional and Veterinary Affairs at Hill’s Pet Nutrition. “The Histaguard Complex helps decrease the release of histamine and inflammatory cytokines that cause itching. The ability to help interrupt this reaction using nutrition is revolutionary, but that is only one component of Derm Defense.”

“Derm Defense drives healthy skin from within,” said Dr. Lowery. “We’ve seen remarkable transformations in pets that had been suffering from environmental allergies.” With the addition of Derm Defense, the Hill’s Prescription Diet portfolio includes nutrition to help address almost any dermatologic condition or dietary sensitivity.

Contact: Hill’s Pet Nutrition Canada Inc., Two Morneau Shepell Centre, 6th Floor, 895 Don Mills Road, Toronto, ON M3C 1W3; phone: (800) 668-4626; fax: (800) 268-0821; website: www.hillspetca
Case Report  Rapport de cas

Equine motor neuron disease in 2 horses from Saskatchewan

Michelle L. Husulak, Katharina L. Lohmann, Kamal Gabadage, Chris Wojnarowicz, Fernando J. Marqués

Abstract — Two horses from Saskatchewan were presented with signs of sweating, muscle fasciculations, weight loss, and generalized weakness. The horses were diagnosed with equine motor neuron disease (EMND), by histological assessment of a spinal accessory nerve or sacrocaudalis dorsalis medialis muscle biopsy. This is the first report of EMND in western Canada.

Résumé — Maladie équine des motoneurones chez 2 chevaux de la Saskatchewan. Deux chevaux de la Saskatchewan ont été présentés avec des signes de sudation, de fibrillations musculaires, de perte de poids et de faiblesses généralisée. On a diagnostiqué la maladie équine des motoneurones (MEMN) chez les chevaux en effectuant une évaluation histologique d’un nerf accessoire de la colonne vertébrale ou une biopsie du muscle sacrocaudalis dorsalis medialis. Il s’agit du premier rapport de MEMN dans l’Ouest canadien.

Equine motor neuron disease (EMND) is an acquired neurodegenerative disorder, which sporadically affects horses that have limited access to pasture for long periods of time (1). It was first described in 1990 by Cummings et al (2), who compared the clinical signs and the neuronal degenerative changes to sporadic amyotrophic lateral sclerosis (ALS) in humans. Common clinical signs in horses with EMND include weight loss, muscle wasting, muscle trembling (fasciculations), prolonged recumbency, shifting weight while standing, a short-strided gait, and a base-narrow stance (3,4). Other findings may include elevated tail head carriage, low head and neck carriage, profuse sweating, a ravenous appetite, and a brown pigment retinopathy due to ceroid-lipofuscin accumulation within the retinal pigment epithelium (3,5,6). Affected horses may have mildly to moderately elevated muscle enzymes (creatine kinase and aspartate aminotransferase) and deficiency in serum or plasma concentration of α-tocopherol (1,3), an isoform of vitamin E.

One of the main roles of vitamin E in the body is prevention of oxidant injury to cell membranes by scavenging of free radicals (7). Deficient plasma α-tocopherol concentrations have been linked with neurologic disease in several species (7). Experimental models in which animals have been fed vitamin E-deficient diets have resulted in degenerative lesions in the central and peripheral nervous systems. In Rhesus monkeys (8) and rats (9) these lesions have been found primarily in sensory neurons. Experimental models with adult horses fed vitamin E-deficient diets have resulted in degenerative changes to motor neurons, typical of EMND (10,11). In naturally occurring cases, affected horses have degenerative changes in their somatic motor neurons and axonal degeneration of the ventral horns of the spinal cord, ventral roots, and peripheral nerves (2). These lead to neurogenic muscle atrophy, which is grossly present in severely affected cases. Muscles containing high numbers of type I fibers, such as the sacrocaudalis dorsalis medialis muscle, have high oxidative requirements and therefore undergo the most damage due to oxidative stress (12), leaving them appearing pale, soft, and with a yellow-red discoloration (13).

Equine motor neuron disease was first reported in Canada in Nova Scotia (14) and Prince Edward Island (15) in 1994. Since then, additional cases have been reported in Ontario (1) but to the authors’ knowledge there are no previously published reports from western Canada. This report describes 2 cases of EMND in horses that resided in different parts of Saskatchewan and had no history of travel outside of the province. Veterinarians practicing in western Canada need to be aware of EMND and be familiar with the clinical signs in order to proceed with the appropriate diagnostic tests and treatment for these cases.

Case descriptions

Case 1
A 3-year-old Quarter Horse stallion (Figure 1) was referred to the Western College of Veterinary Medicine, Veterinary Medical Department of Large Animal Clinical Sciences, Western College of Veterinary Medicine, University of Saskatchewan (Husulak, Lohmann, Gabadage, Marqués), Prairie Diagnostic Services (Wojnarowicz), 52 Campus Drive, Saskatoon, Saskatchewan S7N 5B4.

Address all correspondence to Dr. Michelle L. Husulak; e-mail: michelle.husulak@usask.ca

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.
Center (VMC) with a 7-day history of lethargy, muscle fasciculations, profuse sweating, and prolonged frequent periods of recumbency. His owners estimated that the stallion had lost 100 kg in the previous 2 wk, despite a normal appetite. He had been housed in a paddock with no access to pasture for most of his life. His diet consisted of mixed alfalfa-grass hay, with oats and corn provided as supplements. The horse was up-to-date on vaccinations and did not have any previous history of disease prior to the onset of clinical signs. He was the only affected horse in a herd of 40 horses.

On presentation to the VMC, the stallion was quiet and responsive, and exhibited generalized muscle atrophy. He had continuous muscle fasciculations, especially of the triceps and quadriceps muscles. He was tachycardic (heart rate: 60 beats/min), hyperthermic (rectal temperature: 38.7°C), had decreased borborygmi on abdominal auscultation, and was sweating profusely throughout the examination. Thoracic auscultation revealed no abnormalities. His head and neck carriage was low with muscle wasting of the cervical musculature and his tail head was elevated. The horse stood with a base-narrow stance and shifted his weight continuously on both forelimbs and hind limbs. At a walk, his gait appeared labored and weak, but no ataxia or proprioceptive deficits were noted. His digital pulses were within normal limits. Based on the history and physical examination findings the initial differential diagnoses included colic, laminitis, exertional rhabdomyolysis, hyperkalemic periodic paralysis (HYPP), and EMND.

Evaluation for colic included nasogastric intubation, which yielded no reflux, and a rectal examination that revealed no abnormalities. An abaxial sesamoid nerve block was performed on all 4 limbs in order to help rule out foot pain causing extreme discomfort. The nerve blocks did not dramatically improve the horse’s stance or gait, ruling out laminitis.

Blood work included a venous blood gas analysis and complete blood (cell) count (CBC), which revealed no abnormalities. An abaxial sesamoid nerve block was performed on all 4 limbs in order to help rule out foot pain causing extreme discomfort. The nerve blocks did not dramatically improve the horse’s stance or gait, ruling out laminitis.

Blood work included a venous blood gas analysis and complete blood (cell) count (CBC), which revealed no abnormalities. The serum biochemistry profile revealed a mild elevation in creatine kinase [450 U/L, reference range (RR): 88 to 439 U/L] and aspartate aminotransferase activity (477 U/L, RR: 6 to 347 U/L), which was attributed to prolonged recumbency and made exertional rhabdomyolysis a less likely diagnosis. Serum magnesium concentration was low at 12 μg/mL [RR: 18 to 35 μg/mL (16)]. Examination by a board-certified ophthalmologist revealed an incipient posterior capsular cataract of the right eye. The fundi of both eyes were normal and no pigment retinopathy was noted. Hair samples from the stallion’s mane were collected to test for HYPP. Results indicated that the stallion was homozygous normal (NN), and therefore negative for the sodium channel α-subunit gene mutation responsible for HYPP (17). Serum selenium concentration was normal at 0.227 μg/mL, while α-tocopherol concentration was deficient at 0.41 μg/mL [normal > 2 μg/mL (18)]. A nerve biopsy was obtained from the left distal branch of the spinal accessory nerve (19) while the horse was restrained with xylazine hydrochloride (Rompun; Bayer Animal Health, Mississauga, Ontario), 0.5 mg/kg body weight (BW), IV, and butorphanol (Torbugesic; Zoetis, Kirkland, Quebec), 0.01 mg/kg BW, IV to induce standing sedation and the site was infiltrated with 2% lidocaine hydrochloride (Zoetis) as local anesthesia. The sample was then fixed in formalin and stained with hematoxylin and eosin (H & E) for histological evaluation. Histopathological analysis revealed significant Wallerian degeneration and a few bundles of unmyelinated nerves, which were interpreted as Büngner’s bands [cords of proliferating Schwann cells (2)]. These findings supported a diagnosis of EMND.

The stallion was treated by his owners with dl-α-tocopherol capsules (10 000 IU/day, PO, brand unknown) (18) for 3 mo and housed on pasture during the summer. Repeat evaluation of the stallion’s serum α-tocopherol levels would have been ideal following 3 to 6 mo of treatment, but was not possible in this...
case. A follow-up conversation with the owner 1 y later indicated that the stallion’s gait and stance had improved, and the muscle fasciculations and profuse sweating had subsided.

Case 2

A 17-year-old Thoroughbred gelding was referred to the VMC for evaluation and treatment of suspected colic. The horse had a history of weight loss and behavioral changes over the last 2 mo. The owners reported that he had recently become the subordinate horse in the herd; while he was formerly dominant over the other horses. He was up-to-date on vaccinations and had no previous medical problems. The gelding had a good appetite and was fed a diet of grass hay, occasionally supplemented with pelleted complete feed following exercise. He was housed in a dirt paddock with no pasture access.

The horse presented with generalized muscle fasciculations, profuse sweating, and stood with a hunched back and base-narrow stance. His head carriage was low and his tail head carriage was elevated. He was tachycardic (heart rate: 60 beats/min), tachypneic (respiratory rate: 32 breaths/min), and had increased borborygmi on abdominal auscultation. Tacky mucous membranes and a slightly elevated packed cell volume (45%) were consistent with dehydration; however, the concentration of total solids (75 g/L) was normal. The referring veterinarian had performed a CBC and serum biochemistry, which revealed a mild elevation of aspartate aminotransferase activity at 366 U/L (RR: 175 to 340 U/L) as the only abnormality. A nasogastric tube was passed and no gastric reflux was obtained. Rectal examination revealed no abnormalities. An abdominocentesis yielded peritoneal fluid that was normal based on cytological analysis.

Following the initial examination, the horse was treated with flunixin meglumine (Flunixin injection; Zoetis), 1.1 mg/kg BW, IV, once for pain control and intravenous fluids (Lactated Ringer’s Solution; Baxter, Mississauga, Ontario), 90 mL/kg BW per day to replace fluid deficits and to provide maintenance fluid needs. The horse was monitored overnight for signs of colic.

Once he was placed in a stall and allowed to lie down, his tachycardia resolved and the profuse sweating stopped. The muscle fasciculations were present only when the horse was standing. As no further colic signs were observed, the primary differential diagnosis was EMND. Other differentials included laminitis, exertional rhabdomyolysis, and pheochromocytoma, but all were considered less likely than EMND based on monitoring of physical examination findings and the serum biochemistry results from the referring veterinarian.

Examination by a board-certified ophthalmologist revealed incipient posterior cataracts bilaterally and normal fundi with no apparent pigment retinopathy. A serum vitamin and mineral panel revealed deficient levels of both serum magnesium at 10.10 μg/mL [RR: 18 to 35 μg/mL (16)] and α-tocopherol at 0.86 μg/mL [normal > 2 μg/mL (18)]. A muscle biopsy for histopathological evaluation was obtained from the left
sacrocaudalis dorsalis medialis (SCDM) muscle (19) under standing sedation with xylazine hydrochloride (Bayer Animal Health), 0.5 mg/kg BW, IV, and butorphanol (Zoetis), 0.01 mg/kg BW, IV, and local anesthesia with 2% lidocaine hydrochloride (Zoetis). The SCDM muscle contained muscle fibers with moderate size variation, anguloid atrophy, angular atrophy, centrally displaced nuclei, and sarcoplasmic masses, which is consistent with neurogenic atrophy that occurs in EMND cases (20). Electromyography (EMG) was performed under general anesthesia (21). Spontaneous fibrillation potentials consistent with muscle fiber denervation were detected in several muscles on the left side of the horse including the extensor carpi radialis (Figure 2), gluteal, quadriceps, triceps, and neck muscles. Complete examination of the right side was not undertaken due to the positioning of the horse in right lateral recumbency.

Given the results of the muscle biopsy examination and EMG, an antemortem diagnosis of EMND was established. The horse was given a guarded to poor prognosis for return to his previous level of function and the owners elected euthanasia. On postmortem examination, there were no gross abnormalities. Histologic examination revealed minimal degenerative lesions in the extensor carpi radialis muscle (Figure 3). Abundant lesions of Wallerian degeneration in both spinal accessory nerves (Figure 4) and degenerative lesions of ventral motor neurons in both cervical (Figure 5) and lumbar intumescences of the spinal cord confirmed the diagnosis of EMND (13).

**Discussion**

The 2 cases of EMND presented with similar clinical signs of muscle fasciculations and sweating, history of recent weight loss and no access to pasture (3). Interestingly, fundic examination in both horses showed no evidence of a pigment retinopathy, which has been reported commonly in cases of EMND (5). The breeds of the horses in this report are not unusual as Quarter Horses are reportedly the most commonly affected breed and Thoroughbreds are overrepresented amongst reported EMND cases (1,3). Equine motor neuron disease has been diagnosed in adult horses as young as 3 y old (3), but the risk of developing cases (1,3). Equine motor neuron disease has been diagnosed in both horses showed no evidence of a pigment retinopathy, which has been reported commonly in cases of EMND (5). The breeds of the horses in this report are not unusual as Quarter Horses are reportedly the most commonly affected breed and Thoroughbreds are overrepresented amongst reported EMND cases (1,3). Equine motor neuron disease has been diagnosed in adult horses as young as 3 y old (3), but the risk of developing the disease peaks at 16 y (1,22). Experimental models have demonstrated that the disease can be reproduced after 18 (11) to 21 mo (10) of feeding a diet completely deficient in vitamin E. In order for this disease to occur in a 3-year-old horse, as in Case 1, his diet would likely have had very low or no vitamin E for most of his life.

Several differential diagnoses were considered during initial examination of the horses described here. Colic, laminitis, and exertional rhabdomyolysis were considered in both cases, as they are common differential diagnoses in horses presenting with tachycardia, profuse sweating, and occasionally, muscle fasciculations (23). Equine hyperkalemic periodic paralysis (HYPP) was included as a differential diagnosis in Case 1 as it mainly occurs in Quarter Horses and one of the most common clinical signs is muscle fasciculations (24). Pheochromocytoma is a catecholamine secreting adrenal medullary tumor, which results in clinical signs such as prolonged tachycardia, tachypnea, profuse sweating, muscle tremors, and anxiety (25). This was considered in Case 2 until the tachycardia and sweating resolved when the horse was able to lie down. Botulism and equine grass sickness are other differential diagnoses that could also have been considered for these cases. Equine grass sickness is a polyneuropathy, which results in clinical signs similar to EMND, as well as dysphagia and ptosis. Grass sickness has only been reported once in North America to date (26), and in contrast to horses with EMND, horses with grass sickness are commonly kept on pasture (27). Botulism should also be considered in cases of muscle weakness; however, the lack of dysphagia in the presented cases put it lower on the differential list (28). The low magnesium in both cases was considered to be an incidental finding and not the primary cause of the clinical signs. Primary hypomagnesemia is rare in horses (29) and causes mineralization of several body tissues (30). Low serum magnesium has been associated with severe illness and endotoxemia in hospitalized horses (31), which was not present in either of these cases.

Different diagnostic techniques were used to confirm a diagnosis of EMND in the 2 cases reported here. Histopathology of the spinal accessory nerve was the first reliable antemortem diagnostic test for definitive diagnosis of EMND (32). When interpreted by an experienced pathologist, this test has a specificity of 94% and a sensitivity of 92% (32). In Case 1, the spinal accessory nerve biopsy was obtained by an experienced board-certified equine surgeon, with the horse restrained under standing sedation and local anesthetic infiltration at the surgical site. This procedure is technically challenging and in some cases may require general anesthesia (32). In Case 2, antemortem diagnosis of EMND was made by evaluation of frozen and formalin-fixed SCDM muscle biopsy specimens. Frozen specimens are thought to yield higher test sensitivity than formalin-fixed samples (20). The SCDM muscle biopsy procedure is technically easier than the spinal accessory nerve biopsy (19) and therefore is preferred by many clinicians. The SCDM muscle is used for diagnosis because it is easily accessible and it contains a high percentage of type 1 muscle fibers, causing it to be more severely affected by denervation atrophy than other muscles (19). Denervation atrophy of the SCDM muscles ultimately leads to fibrotic contracture and elevation of the tail head. The sensitivity and specificity of the SCDM muscle biopsy for diagnosing EMND is approximately 90% (19).

The neurodegeneration that occurs in EMND is associated with a deficiency in plasma α-tocopherol levels (3). Alpha-tocopherol is a potent anti-oxidant and has several important roles in the body including immune function, gene transcription, and neuromuscular function (18). When a deficiency of vitamin E manifests itself as EMND, neurodegeneration occurs in the areas of the body that have high oxidative requirements, such as the motor neurons supplying the type 1 muscle fibers (12,13). A neuronal loss of approximately 30% is required before clinical signs will manifest as EMND (33). It has been hypothesized that both neuronal loss and dysfunctional motor neurons may be present in the diseased state (6). The affected horses that recover may be those with a higher proportion of neuronal dysfunction, rather than neuronal loss, and the dysfunctional motor neurons may be capable of recovery (6). In cases in which the horse is able to continue to eat and remain mobile, treatment may be beneficial.
Treatment usually involves supportive care, which may include administration of corticosteroids in acute cases, and increasing dietary vitamin E through supplementation and the addition of fresh green forage in the diet (4, 12). The recommended dose for supplementation is 5000 to 7000 IU of vitamin E/horse per day, with the highest safe level being 10 000 IU of vitamin E/horse per day (18), which was the dose used in Case 1. This dose is expected to increase the serum α-tocopherol concentration to normal levels within 2 to 4 wk of initiation (4). It is important to consider the type of vitamin E in the supplement, as vitamin E in its natural form (RRR-α-tocopherol) is up to twice as bioavailable as the synthetic formulations (all-α-tocopherol and dl-α-tocopherol) (18). Clinical improvement is noticeable in 40% of cases within 6 wk of treatment and of these, some will appear normal within 3 mo (4). However, it should be considered that improvement of clinical signs at rest can be deceiving and owners should be warned that the horse may deteriorate if it is put back into work, potentially leading to injury of both the horse and the rider (4). In 20% of EMND cases clinical signs progress to prolonged recumbency and debilitation, which often leads to euthanasia (4). The stallion in Case 1 was expected to be a breeding animal and due to the severity of his clinical condition, the highest safe dose was used in an attempt to promote his recovery. In Case 2 the horse was to be used for riding, and due to the unpredictability of his recovery, he was euthanized.

Equine motor neuron disease occurs sporadically and the etiology has not been fully determined. It is still unknown why some horses are affected and others are not when they are on the same farm and fed the same diet. One study evaluated vitamin E levels in clinically normal horses kept on the same property and fed the same diet. One study evaluated vitamin E concentrations in clinically normal horses kept on the same property and fed the same diet. This study showed that clinically normal horses had low vitamin E concentrations, but the EMND-affected horses from these farms had significantly lower plasma vitamin E concentrations than the clinically normal controls (3). Genetic factors have been considered and based on the genetic mutation responsible for human familial ALS, the coding sequence of the equine copper/zinc superoxide dismutase (SOD1) gene was evaluated in a group of affected horses, but no similar mutations were detected (34). A heritable component of EMND has not been completely ruled out, however, and it could be argued that the stallion in Case 1 should not be used as a breeding animal.

Veterinarians in western Canada need to be aware of EMND as horse husbandry during long winters typically involves feeding stored hay, which contains less vitamin E than fresh forage (35), and therefore may predispose those horses to dietary vitamin E deficiency. By familiarizing themselves with the clinical signs of EMND, veterinarians can proceed with appropriate diagnostics and treatment.

Acknowledgments

The authors thank the equine surgeons who assisted with the cases and performed the biopsies, including Drs. David Wilson, Joe Bracamonte, Holly Sparks, and Keri Thomas. Drs. Bianca Bauer and Lynne Sandmeyer were the consulting ophthalmologists. Dr. Gillian Muir performed the electromyography assessment. Dr. Sara Higgins and members of the WCVM class of 2013 were instrumental in the management of the horse in Case 2 during his hospitalization.

References


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 April 2016 issue of CJVR that might be of interest to practitioners include:

**Farm-level prevalence and risk factors for detection of hepatitis E virus, porcine enteric calicivirus, and rotavirus in Canadian finisher pigs** on page 95

**Breed- and age-related differences in canine mammary tumors** on page 146

**The effects of intravenous alfaxalone with and without premedication on intraocular pressure in healthy dogs** on page 156

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 CJVR is also available on the member-only section of the CVMA website.


Publiée par l’ACMV, cette revue trimestrielle évaluée par les pairs est la seule publication nationale de recherche vétérinaire au Canada.

Les articles suivants du numéro d’avril 2016 de la RCRV pourraient intéresser les praticiens:

**Farm-level prevalence and risk factors for detection of hepatitis E virus, porcine enteric calicivirus, and rotavirus in Canadian finisher pigs** à la page 95

**Breed- and age-related differences in canine mammary tumors** à la page 146

**The effects of intravenous alfaxalone with and without premedication on intraocular pressure in healthy dogs** à la page 156

La RCRV, avec La *Revue vétérinaire canadienne* qui est publiée mensuellement, est aussi archivée sur PubMed Central (www.pubmedcentral.com) six mois après la publication. Un pdf interactif de La RVC est aussi disponible dans la section réservée aux membres du site Web de l’ACMV.
JULY 13-16, 2017
SAVE THE DATE
CHARLOTTETOWN • PEI

CVMA CONVENTION welcomes everyone “from away”
Diagnostic performance of an indirect enzyme-linked immunosorbent assay (ELISA) to detect bovine leukemia virus antibodies in bulk-tank milk samples

Omid Nekouei, Jean Durocher, Greg Keefe

Abstract — This study assessed the diagnostic performance of a commercial ELISA for detecting bovine leukemia virus antibodies in bulk-tank milk samples from eastern Canada. Sensitivity and specificity of the test were estimated at 97.2% and 100%, respectively. The test was recommended as a cost-efficient tool for large-scale screening programs.

Résumé — Performance diagnostique d’un test ELISA indirect pour détecter les anticorps contre le virus de la leucémie bovine dans des échantillons prélevés dans les réservoirs à lait. Cette étude a évalué la performance diagnostique d’un test ELISA commercial pour détecter les anticorps contre le virus de la leucémie bovine dans des échantillons prélevés dans des réservoirs à lait provenant de l’Est du Canada. La sensibilité et la spécificité du test ont été estimées à 97,2 % et à 100 %, respectivement. Le test a été recommandé comme un outil rentable pour les programmes de dépistage à grande échelle.

Can Vet J 2016;57:778–780
Edward Island, Charlottetown to be tested for BLV antibodies. All Quebec samples were submitted to the Valacta central laboratory (Sainte-Anne-de-Bellevue, Quebec) for BLV testing. All samples were preserved with BROTAB (Sierra Court, California, USA) and tested within a maximum of 7 d from the original sampling dates using a commercial indirect ELISA (Svanovir BLV gp51-Ab, Svanova, Uppsala, Sweden). The test results were reported as percent positivity (PP) values:

\[ PP = \left( \frac{OD_{\text{corrected sample}}}{OD_{\text{corrected positive control}}} \right) \times 100 \]

Where: OD = optical density.

The statistical analyses were conducted in Stata 13.1 (StataCorp, College Station, Texas, USA).

To determine the apparent within-herd prevalence of BLV-antibodies (AP), number of positive cows (PP > 45) was divided by the number of lactating (tested) cows for every herd. True within-herd prevalence of BLV infection (TP) was then estimated for each of the selected herds using the following formula (12):

\[ TP = \frac{(AP + Sp - 1)}{(Se + Sp - 1)} \]

Where: AP is the apparent prevalence of BLV infection within the study herds; sensitivity (Se) and specificity (Sp) of the individual ELISA test at the applied threshold of 45 were 95.5% and 98.4%, respectively (13). The true within-herd prevalence was regarded as the reference standard for evaluating the diagnostic performance of the pooled-level application of the BTM ELISA. If the true within herd prevalence was zero (i.e., all cows were negative), the herd was considered as uninfected; and if it was above zero (i.e., at least 1 positive cow was present), the herd was considered as infected with BLV. A two-graph receiver operating characteristic (TG-ROC) analysis was carried out to determine the optimal cut-point on BTM ELISA values using the defined dichotomized reference standard.

Based on the true within-herd prevalence of BLV, 81.2% (108/133) of the study herds were found to be infected (i.e., true positive herds). Of 8358 cows tested (90% Holstein), 2661 (31.8%) were positive to BLV milk-antibodies in the true positive herds. Of 8358 cows tested (90% Holstein), (108/133) of the study herds were found to be infected (i.e., at least 1 positive cow was present), the herd was considered as uninfected; and if it was above zero (i.e., at least 1 positive cow was present), the herd was considered as infected with BLV. A two-graph receiver operating characteristic (TG-ROC) analysis was carried out to determine the optimal cut-point on BTM ELISA values using the defined dichotomized reference standard.

Based on the true within-herd prevalence of BLV, 81.2% (108/133) of the study herds were found to be infected (i.e., true positive herds). Of 8358 cows tested (90% Holstein), 2661 (31.8%) were positive to BLV milk-antibodies in the individual cow tests. Descriptive statistics for the study herds, by province, are presented in Table 1. The mean of BLV true within-herd prevalence for the 108 infected herds was 0.39 (SD = 0.27). Figure 1 displays the distribution of BLV true within-herd prevalence for the study herds.

From the TG-ROC analysis, maximum accuracy for BTM ELISA titers was achieved at 2.1 and 7.2 (percent positivity), respectively. Hence, the midpoint of 5 was considered as our practical cut-point value. At this cut-point, sensitivity and specificity of the BTM ELISA were estimated at 97.2% [95% confidence interval (CI): 92.1% to 99.4%] and 100% (95% CI: 86.3% to 100%), respectively.

According to our established reference standard, 3 truly infected herds were negative by the BTM ELISA (defined as false negative herds). Each of those 3 herds harbored only 1 infected cow: 1 herd from NS (including 53 lactating cows), and 2 herds from QC (including 37 and 47 lactating cows). In stringent eradication programs, repeated sampling from bulk-tank over appropriate time intervals has been recommended in order to compensate for the imperfect sensitivity of the BTM tests, and to capture as many positive animals in a herd as possible (12).

Addition or elimination of some cows can be influential on the BTM titers, such as those at advanced stages of BLV infection (e.g., cows with persistent lymphocytosis), because they often produce high levels of virus and circulating antibodies (14). However, it is generally believed that the prevalence of BLV in herds from endemic areas (e.g., North America) remains fairly steady over time (15); this characteristic supports the credibility of the current testing strategies (BTM ELISA) used in detecting BLV infection.

We were not able to apply more sophisticated statistical analyses to our data in order to include some potentially important herd-level factors such as lactating herd size (representing the potential dilution effect of BTM) because there were only 3 false positives among the total 133 herds.

Table 1. Descriptive summary for 133 study dairy herds that had all their lactating cows tested for bovine leukemia virus milk antibodies, from eastern provinces of Canada

<table>
<thead>
<tr>
<th>Province</th>
<th>Tested herds</th>
<th>Lactating herd size</th>
<th>Tested cows</th>
<th>Positive cows</th>
<th>Proportion (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>New Brunswick</td>
<td>30</td>
<td>23</td>
<td>287</td>
<td>2232</td>
<td>37.8</td>
</tr>
<tr>
<td>Nova Scotia</td>
<td>30</td>
<td>30</td>
<td>214</td>
<td>2281</td>
<td>46.0</td>
</tr>
<tr>
<td>Prince Edward Island</td>
<td>30</td>
<td>28</td>
<td>126</td>
<td>1598</td>
<td>55.5</td>
</tr>
<tr>
<td>Quebec</td>
<td>43</td>
<td>14</td>
<td>145</td>
<td>2247</td>
<td>35.6</td>
</tr>
<tr>
<td>All 4 provinces</td>
<td>133</td>
<td>14</td>
<td>287</td>
<td>8358</td>
<td>32.1</td>
</tr>
</tbody>
</table>

\( ^a \) Positive in individual milk ELISA test (percent positivity > 45).

\( ^b \) Number of positive cows/number of tested cows.
diagnoses by the BTM test. However, this issue should not lead to any substantial bias since the selected herds were fairly representative of the herds in eastern Canada with regards to the main characteristics, including herd size. For instance, the average lactating herd size in our study was 62.8, which was very close to the average of lactating herd size in all 4 study provinces (approximately 60).

Applying a cut-point of 5 as the criterion for a negative herd test, when using the ELISA for BTM samples, generated reasonably valid results. Farmers whose farms are free from BLV and would desire to maintain their negative status or those who wish to monitor their decreasing trend of BLV prevalence on their farms (due to taking control measures) could efficiently adopt ongoing monitoring using the BTM ELISA test over appropriate time-intervals. Application of the BTM ELISA in other regions (particularly with large herds) should be validated before use in future surveillance programs.

Acknowledgments

The authors gratefully acknowledge the contribution of all parties to this project, including study farmers, personnel at the MQM laboratory (Charlottetown, PE), Natasha Robinson, Shereen Hassan and other Valacta personnel (Sainte-Anne-de-Bellevue, QC). This study was funded by the MQM laboratory, Valacta, Dairy Farmers of Prince Edward Island, New Brunswick, and Nova Scotia, the New Brunswick Department of Agriculture, and Agriculture and Agri-Food Canada through the Agricultural Adaptation programs in Prince Edward Island and Nova Scotia.

References


Submit Your Article Online

Both The Canadian Veterinary Journal and the Canadian Journal of Veterinary Research are accepting manuscripts through the online submission system, ScholarOne, by way of the CVMA website (www.canadianveterinarians.net). Go to publications, choose the specific journal you want, then choose submit manuscript. This will take you directly to the ScholarOne site where you can log on. The Instructions for Authors are provided on the same website. Please follow these instructions carefully before submitting your manuscript. Please call 613-236-1162, ext. 117 or 1-800-567-2862, ext. 117 with any questions if you are having difficulty.

Soumettez votre article en ligne

Student Paper Communication étudiante

Congenital nutritional myodegeneration in a neonatal foal

Jessie MacQuarrie

Abstract — A 2-day-old Quarter Horse colt was presented to the Atlantic Veterinary College for recumbency and diarrhea. Dietary history of the dam, serum biochemistry findings, and whole blood selenium levels were consistent with nutritional myodegeneration. The patient was treated successfully with fluid therapy and broad-spectrum antimicrobials. Recovery was uneventful, and the patient was discharged with a favorable prognosis.

Résumé — Myodégénérescence nutritionnelle congénitale chez un poulain néonatal. Un poulain Quarter Horse âgé de deux jours a été présenté à l’Atlantic Veterinary College pour un décubitus et de la diarrhée. L’anamnèse nutritionnelle de la mère, les résultats de la biochimie sérique et les taux de sélénium dans le sang total étaient conformes à la myodégénérescence nutritionnelle. Le patient a été traité avec succès à l’aide d’une fluidothérapie et d’antimicrobiens à large spectre. Le rétablissement a été sans incident et le patient a reçu son congé avec un pronostic favorable.

At the time of presentation to AVC, the foal was recumbent, unable to rise, and had a dull mentation. The patient had a body weight of 67 kg and rectal temperature of 37.0°C. Heart rate was 108 beats/min, and pulse quality was poor. Distal extremities were cold to the touch. Oral mucous membranes were dark pink and tacky, with a capillary refill time of 2 s, suggestive of dehydration and poor perfusion. Respiratory rate was 25 breaths/min, accompanied by increased respiratory effort and normal lung sounds. Ecchymoses were noted on the inner surface of both pinnae, but were not present on any other mucosal surfaces. A weak suckle reflex was present, and abdominal auscultation revealed decreased intestinal borborygmi in all 4 quadrants. No heat or swelling was detected in the umbilicus or joints. The patient was assumed to be full-term, as no signs of prematurity were noted on physical examination.

Problems identified from the clinical history and physical examination were recumbency with an inability to rise, dull mentation, diarrhea, dehydration, and a shock-like state. Differential diagnoses initially considered included failure of passive transfer, neonatal septicemia, hypoxic ischemic encephalopathy, and uroabdomen or uroperitoneum.

Initial diagnostic evaluation included a complete blood (cell) count (CBC), serum biochemical profile, arterial blood gas, blood culture, serum lactate, and gluteraldehyde coagulation test. The CBC revealed mild leukocytosis [white blood cells, 17.6 \times 10^9/L; reference interval (RI): 5.5 to 12.5 \times 10^9/L] characterized by moderate mature neutrophilia, consistent with inflammation or stress.

Abnormalities on the serum biochemistry included highly elevated creatine kinase (CK, 38 4073 U/L; RI: 0 to 500 U/L) and aspartate aminotransferase (AST, 9478 U/L; RI: 197 to 429 U/L), suggestive of acute muscle cell injury. Moderate azotemia (urea 11.6 mmol/L; RI: 3.5 to 7.0 mmol/L and creatinine 317 \mu mol/L; RI: 78 to 143 \mu mol/L) could be attributed...
to a pre-renal cause such as decreased renal perfusion, a renal cause such as acute renal injury, or to a post-renal cause such as uroabdomen. Severe hyperkalemia (potassium 9.1 mmol/L; RI: 3.0 to 5.0 mmol/L) was attributed to decreased renal excretion potentially caused by uroabdomen, urinary obstruction, or acute renal failure. Shifting of potassium from intracellular fluid to extracellular fluid as a result of muscle cell leakage was another possible cause for hyperkalemia. Severe hyponatremia (sodium 112 mmol/L; RI: 135 to 148 mmol/L) and severe hypochloremia (chloride 71 mmol/L; RI: 98 to 110 mmol/L) were attributed to increased loss (such as renal loss or third space sequestration) or shifting from intracellular to extracellular fluid due to myopathy or uroabdomen. Mild hyperphosphatemia (phosphorus 2.39 mmol/L; RI: 1.0 to 1.8 mmol/L) was attributed to decreased renal excretion or leakage from injured myocytes. Hypocalcemia (calcium 1.91 mmol/L; RI: 2.8 to 3.44 mmol/L) and hypoalbuminemia (albumin 21 g/L; RI: 25 to 36 g/L) were attributed to increased renal loss or normal variation in a neonatal patient. Mildly elevated alkaline phosphatase (ALP) was consistent with normal variation in a neonatal patient.

Hyperlactatemia (3.77 mmol/L; RI: 0.55 to 1.11 mmol/L) was suggestive of tissue hypoxia. Arterial blood gas results revealed a mild respiratory acidosis. The gluteraldehyde coagulation test showed a serum IgG concentration greater than 8 g/L, suggesting adequate colostral transfer of maternal antibodies. The foal had a negative sepsis score of 9, based on the University of Florida scoring system. A sample of blood was collected and submitted for bacterial culture.

The clinical presentation, biochemical abnormalities, and clinical signs were consistent with acute muscle cell injury. Some findings were also suggestive of decreased renal excretion. Other differential diagnoses included nutritional myodegeneration, uroabdomen or uropertitoneum, renal or post-renal azotemia, and myoglobinuric renal insufficiency. Transabdominal ultrasonography and urinary catheter placement were performed to determine the likelihood of uroabdomen and post-renal azotemia.

Transabdominal ultrasonography (IU22 Ultrasound Sytem; Philips Healthcare, Andover, Massachusetts, USA) using a 5 to 8 MHz curvilinear transducer determined that the bladder contained a significant amount of urine and was severely distended. Hyperechoic foci were visible within the bladder. The bladder wall appeared intact, and no free abdominal or retroperitoneal fluid was noted. A cystic lesion was noted within the cortex of the right kidney as an incidental finding. These ultrasonographic findings ruled out uropertitoneum.

Since no urination had been observed, a urinary catheter was passed to determine if an obstruction was present and to collect a sample of urine for urinalysis. The catheter passed easily, making a diagnosis of post-renal obstruction unlikely. A sample of turbid, dark yellow urine was collected following catheter placement and submitted for urinalysis. Proteinuria and large numbers of hyaline casts were noted, suggestive of myoglobinuria. The absence of red blood cells on urinalysis provided additional support for myoglobinuria, which was confirmed using the Differential Solubility Test. Large numbers of granular casts were present, indicative of renal tubular degeneration. These findings led to a tentative diagnosis of myoglobinuric nephropathy, potentially associated with congenital nutritional myodegeneration. Concurrent sepsis could not be ruled out at this time. Blood was collected from both the mare and foal to assess serum and whole blood selenium levels. A stall side EKG detected no abnormalities of heart rate or rhythm.

Initial medical therapy focused primarily on correcting electrolyte abnormalities and dehydration. Following diagnostic testing and placement of a jugular catheter, a continuous rate infusion of IV fluids (0.9% NaCl with 5% dextrose solution) was initiated at a rate of 200 mL/h. Antimicrobial therapy was also instituted; Ceftriaxone (Zoetis Canada, Kirkland, Quebec), 5 mg/kg body weight (BW), IV, q12h and Penicillin G Sodium (Pharmaceutical Partners of Canada, Richmond Hill, Ontario), 22 000 IU/kg BW, IV, q6h, were administered for 7 d. A nasogastric feeding tube was placed to provide enteral nutrition. Urine output was monitored for a 24-hour period.

The patient made attempts to stand within 12 h of hospitalization, and his suckle reflex gradually returned. The foal was standing, nursing from the mare, and urinating within 24 h. Over the first 5 d, repeated blood samples were submitted approximately every 24 h for serum biochemistry to monitor the efficacy of fluid therapy. Biochemical derangements progressively returned to normal reference ranges. As these imbalances stabilized, fluid therapy was modified accordingly, and the patient was weaned off IV fluids completely after 5 d of hospitalization. The foal was nursing, ambulating, and urinating independently at the time of discharge. Blood culture results were negative, with no growth of organisms.

Seven days after admission, the patient was discharged on a 5-day course of Trimethoprim sulfa tablets (Apo Sulfadim-DS; Apotex, Toronto, Ontario), 25 mg/kg BW, PO, q12h. The mare was given an IM injection of selenium and vitamin E prior to discharge to treat a suspected deficiency. The owners were advised to subject the foal to 2 wk of stall confinement followed by 6 to 8 wk of turnout in a small paddock, and to provide both the mare and foal with a concentrate ration suitably supplemented with selenium, as well as a trace mineral block supplemented with selenium. Continued monitoring of the foal’s serum selenium status by the referring veterinarian was also recommended. To prevent future cases of congenital nutritional myodegeneration, adequate selenium supplementation for all broodmares on the farm during gestation and after parturition was recommended.

Results of whole blood and serum selenium levels received following discharge confirmed that both the mare and foal were selenium deficient. The foal had a serum selenium concentration of 0.05 ppm, while the mare’s serum selenium concentration was 0.031 ppm (RI: 0.14 to 0.25 ppm). This confirmed the tentative diagnosis of congenital nutritional myodegeneration leading to myoglobinuric nephropathy in the foal.

Three months after discharge the foal was doing well and growing at a normal rate. A serum sample collected by the referring veterinarian 60 d after discharge yielded a serum selenium concentration of 0.14 ppm, indicating that proper nutrition was helping to restore selenium levels in the patient.
Nutritional myodegeneration is a disease of rapidly growing neonatal foals due to a congenital deficiency of selenium and vitamin E. The disease is more common in geographic areas where soil is known to be selenium deficient, such as Atlantic Canada (1). Both vitamin E and selenium act as antioxidants in circulation; deficiency leads to the presence of circulating free radicals, which damage muscle cell membranes and disrupt the barrier between intracellular and extracellular compartments (2,3).

Affected foals exhibit weakness, recumbency, and difficulty rising with the subacute form of the disease affecting skeletal muscles. Myoglobinuria due to skeletal muscle destruction, and secondary pneumonia due to respiratory muscle weakness are common sequelae of the disease (4). Pathogen inhalation during recumbency can also contribute to pneumonia (5). White streaking of skeletal muscles due to calcium deposition is a commonly reported postmortem finding, giving rise to the common name of “White Muscle Disease” (6). Although the subacute form of the disease affecting skeletal muscle is more common, a peracute form affecting cardiac muscle can also occur. Foals affected with the cardiac form of nutritional myodegeneration typically have a rapid irregular heartbeat, although many are found dead. In cases in which the diaphragm and intercostal muscles are concurrently affected, cardiomyopathy can result (4). Treatment involves strict rest, significant supportive care, and supplementation of vitamin E and selenium by IM injection. Despite aggressive therapy, disease prognosis is generally guarded to grave (4).

Biochemical disturbances seen in the patient on initial diagnostic evaluation included hyperkalemia, hyponatremia, hypochloremia, hyperphosphatemia, hypocalcemia, and azotemia. Taking into account the patient’s age at presentation, inability to rise, and suspected anuria, the electrolyte profile was suggestive of uroabdomen or uroperitoneum (7). These electrolyte abnormalities may also occur, however, as a result of severe muscle damage (8). Nutritional myodegeneration was high on the differential diagnosis list, given the nutritional history of the mare and the fact that the mare and foal were from an area known to be selenium deficient.

Skeletal muscle is the largest intracellular fluid compartment in the body and thus a major reservoir for potassium (5,6). Severe muscle cell injury, as seen with nutritional myodegeneration, leads to disruption of the barrier between intracellular and extracellular fluid compartments and altered electrolyte composition of serum. Potassium and phosphorus move from damaged muscle cells into the bloodstream. Sodium, chloride, and calcium follow a concentration gradient from serum to damaged muscles, leading to the electrolyte abnormalities described in the patient.

Evaluating serum CK and AST, and performing abdominal ultrasound are the most reliable methods of differentiating uroabdomen from nutritional myodegeneration (6). Markedly elevated levels of serum CK and AST have been associated with selenium deficiency and resulting oxidative stress to skeletal muscle (6). The absence of free fluid on abdominal ultrasound, the lack of bacterial growth on blood culture, and the inability to identify a post-renal obstruction made nutritional myodegeneration the likely cause of the foal’s acute recumbency. Confirming the presence of myoglobinuria provided further support for nutritional myodegeneration (8).

Initial fluid therapy consisted of 0.9% NaCl with 5% dextrose solution, based on initial biochemical derangements. The 0.9% NaCl was selected to correct hyponatremia, and 5% dextrose solution was added to correct hyperkalemia by driving potassium back into cells (6). Broad-spectrum antimicrobial therapy was instituted to treat a potential underlying sepsis, and as prophylaxis against a possible secondary pneumonia (5,6). Cefotiofur and penicillin G sodium were chosen to provide broad-spectrum coverage against Gram-positive and Gram-negative bacteria (9). Gentamicin, although efficacious against Gram-negative bacteria, was contraindicated in this patient due to the patient’s compromised renal function and the risk of nephrotoxicity associated with aminoglycosides (9).

The low serum selenium concentrations confirmed the tentative diagnosis that poor broodmare nutrition led to inadequate placental and colostral transfer of selenium to the foal. A recent study comparing dietary treatments in multiparous broodmares found higher levels of colostral selenium in mares supplemented with selenium from organic sources (10). Concentration of selenium in red blood cells in foals, an indicator of placental transfer, was also higher when dams were supplemented with selenium from an organic source (10). Colostal transfer of selenium had a short-term effect, whereas selenium obtained transplacentally resulted in elevated red blood cell concentrations for up to 1 mo after foaling. These studies suggest that selenium supplementation during gestation is imperative for establishing adequate selenium levels in the fetus and newborn foal.

The clinical presentation of the foal combined with the dietary history of the mare led to a diagnosis of congenital nutritional myodegeneration. This case report emphasizes the importance of proper broodmare nutrition in selenium-deficient areas as a means of preventing nutritional myodegeneration in neonatal foals.

Acknowledgments
I thank Drs. Maureen Wichel and Emily John, the senior clinician and resident on the case, for their guidance and support. I also acknowledge my rotation mates (Jessica Eisnor, Bethany Holliday, Maria Kearney, Jamie Linthorne) and 2 visiting veterinary students from Kasetsart University in Bangkok, Thailand (Nance Duangkamol and Ana Prommarit) for their assistance with patient care.

References
Despite its importance, nutrition is routinely given only a cursory mention during veterinary appointments. Veterinarians may brush over the conversation, not wishing to seem like pushy salespersons, and believing that their clients perceive veterinary diets as too expensive.

The reality, however, is that veterinary exclusive diets are highly competitive in price when compared to premium pet food store diets, and in some cases can result in the pet owner saving hundreds of dollars per year.

For the average pet owner, it can be exceedingly difficult to accurately compare the cost of a diet as variable bag sizes and caloric densities can confuse the assessment. The key figure that needs to be determined is the consumption cost, or the cost of feeding per day. Calculating this will allow for an “apples to apples” analysis of prices among diets.

When the consumption costs are calculated, veterinary exclusive diets are found to be in close competition. Tables 1 and 2 outline the consumption cost of a number of veterinary exclusive diets, as well as premium pet food store diets. The veterinary exclusive diets (highlighted in blue) all have a daily cost to feed that is either lower than, or close to these common premium foods sold in pet stores. Indeed, some of the most popular premium diets are significantly more expensive in pet stores on a cost per day basis.

Chris Doherty, DVM/D.M.V.
To make this as relevant as possible for clients, after making a dietary recommendation during the examination, provide the consumption cost of the pet’s current diet compared to the veterinary exclusive diet that has been proposed. This will assist in removing any hesitation based on cost, so the discussion can focus on other relevant benefits.

Determining the cost per day of feeding a diet is relatively straightforward, requiring only a few key pieces of information:
- Divide the price of the bag of food by the weight of the bag to determine the price per kilogram;
- Consult the feeding guide to determine how many grams to feed the individual animal per day (based on weight, age, etc.), and divide by 1000 to convert to kilograms;
- Multiply the kilograms fed per day by the price per kilogram, resulting in cost to feed per day.

To really drive the point home for pet owners, the savings per year can also be illustrated. As an example, take the Purina Veterinary Dental Health and BLUE Wilderness diets from Table 1. Feeding the veterinary exclusive diet to a 25 lb dog would result in an annual savings of over $375.

With this competitive pricing, veterinary hospitals are in an excellent position to discuss the foods they recommend based on nutritional and safety merits alone.

Consider assigning the role of nutritional expert to one staff person in the clinic. Provide them access to proper training, and de consommation quotidien qui est inférieur ou est très près de celui des diètes de qualité supérieure les plus populaires vendues dans les animaleries. En effet, le coût quotidien de certaines des diètes de qualité supérieure les plus populaires est beaucoup plus dispendieux dans les animaleries.

Afin d’assurer la plus grande pertinence possible pour les clients, après la communication d’une recommandation alimentaire durant l’examen, fournissez le coût de la consommation de la diète actuelle de l’animal par rapport à celui des aliments vétérinaires exclusifs qui ont été proposés. Cette comparaison vous aidera à dissiper les doutes à propos du coût et la discussion pourra ensuite porter sur les autres bienfaits pertinents.

Il est relativement facile de déterminer le coût quotidien d’une diète et vous avez besoin uniquement de quelques données :
- Divisez le prix du sac d’aliments par le poids du sac pour déterminer le prix par kilogramme;
- Consultez le guide de nutrition afin de déterminer combien de grammes l’animal individuel doit consommer par jour (selon le poids, l’âge, etc.) et divisez par 1000 pour convertir en kilogrammes;

Table 1/Tableau 1. Name, size of bag, amount fed, and cost per day of canine maintenance and dental diets/Nom, taille du sac, quantité consommée et coût par jour des diètes canines de maintien du poids et de soins dentaires

<table>
<thead>
<tr>
<th>Diet name</th>
<th>Size of bag (kg)</th>
<th>Grammes d’aliments/jour (chien de 11 kg) (g)</th>
<th>Cost/day (g)</th>
<th>Cost/ (11 kg dog) (g)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Royal Canin Medium Adult</td>
<td>2.7</td>
<td>177</td>
<td>$1.50</td>
<td>$1.60</td>
</tr>
<tr>
<td>Royal Canin — Adult Moyen</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hill’s Science Diet Adult — Light Original</td>
<td>2.3</td>
<td>200</td>
<td>$1.56</td>
<td>$1.66</td>
</tr>
<tr>
<td>Hill’s Science Diet Adult — Légère Originale</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Purina Veterinary Dental Health</td>
<td>2.7</td>
<td>184</td>
<td>$1.60</td>
<td>$1.75</td>
</tr>
<tr>
<td>Purina Vétérinaire — Formule dentaire</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Royal Canin Dental</td>
<td>3.5</td>
<td>170</td>
<td>$1.66</td>
<td>$1.88</td>
</tr>
<tr>
<td>Royal Canin — Formule dentaire</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>New Fresh Grain Free — Adult</td>
<td>2.7</td>
<td>163</td>
<td>$1.75</td>
<td>$2.08</td>
</tr>
<tr>
<td>New Fresh Sans Grains — Adult</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Orijen Canine Adult</td>
<td>2.3</td>
<td>160</td>
<td>$1.90</td>
<td>$2.15</td>
</tr>
<tr>
<td>Orijen Canine — Adult</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Acana Grasslands — Grain Free</td>
<td>2.3</td>
<td>175</td>
<td>$2.08</td>
<td>$2.35</td>
</tr>
<tr>
<td>Acana Grasslands — Sans Grains</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hill’s T/D</td>
<td>2.2</td>
<td>197</td>
<td>$2.15</td>
<td>$2.43</td>
</tr>
<tr>
<td>BLUE Wilderness Chicken</td>
<td>2.0</td>
<td>199</td>
<td>$2.63</td>
<td>$2.88</td>
</tr>
<tr>
<td>BLUE Wilderness — Poulet</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 2/Tableau 2. Name, size of bag, amount fed, and cost per day of feline maintenance and dental diets/Nom, taille du sac, quantité consommée et coût par jour des diètes félines de maintien du poids et de soins dentaires

<table>
<thead>
<tr>
<th>Diet name</th>
<th>Size of bag (kg)</th>
<th>Grammes/jour (chat de 4,5 kg) (g)</th>
<th>Cost/day</th>
<th>Cost/ (4,5 kg cat) (g)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hill’s Science Diet Optimal Care Original</td>
<td>3.2</td>
<td>62</td>
<td>$0.70</td>
<td>$0.80</td>
</tr>
<tr>
<td>Royal Canin Adult</td>
<td>4.5</td>
<td>60</td>
<td>$0.75</td>
<td>$0.85</td>
</tr>
<tr>
<td>Royal Canin — Adult</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Acana Wild Prairie</td>
<td>2.3</td>
<td>68</td>
<td>$0.75</td>
<td>$0.85</td>
</tr>
<tr>
<td>Purina Essential Care Adult</td>
<td>3.6</td>
<td>78</td>
<td>$0.85</td>
<td>$1.00</td>
</tr>
<tr>
<td>Purina Essential Care — Adult</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>BLUE Wilderness Chicken</td>
<td>2.3</td>
<td>60</td>
<td>$0.87</td>
<td>$1.00</td>
</tr>
<tr>
<td>BLUE Wilderness — Poulet</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hill’s Healthy Advantage Adult</td>
<td>1.4</td>
<td>62</td>
<td>$0.88</td>
<td>$1.00</td>
</tr>
<tr>
<td>Hill’s Healthy Advantage — Adult</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Royal Canin Dental</td>
<td>3.5</td>
<td>60</td>
<td>$0.92</td>
<td>$1.09</td>
</tr>
<tr>
<td>Royal Canin — Soins dentaires</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Orijen Cat and Kitten</td>
<td>2.3</td>
<td>68</td>
<td>$0.97</td>
<td>$1.10</td>
</tr>
<tr>
<td>Orijen — Chat et chaton</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Royal Canin Feline Indoor Cat</td>
<td>3.2</td>
<td>77</td>
<td>$1.00</td>
<td>$1.20</td>
</tr>
<tr>
<td>Royal Canin — Formule Chats d’intérieur</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Performatrin Indoor Formula</td>
<td>2.7</td>
<td>102</td>
<td>$1.01</td>
<td>$1.20</td>
</tr>
<tr>
<td>Performatrin — Formule d’intérieur</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hill’s T/D</td>
<td>3.9</td>
<td>72</td>
<td>$1.09</td>
<td>$1.20</td>
</tr>
<tr>
<td>Purina Veterinary Dental Health</td>
<td>2.7</td>
<td>82</td>
<td>$1.10</td>
<td>$1.30</td>
</tr>
<tr>
<td>Purina Vétérinaire — Soins dentaires</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
have them educate the rest of the practice on current trends and knowledge on pet foods. Make a point of asking your clients what they are feeding and how it is working for them. Help them better understand the ingredient list. Discussing the topic of nutrition during appointments or offering a nutritional consultation with your resident “expert,” making a dietary recommendation, and comparing the consumption cost of the current and recommended diets will position veterinary clinics as experts in nutritional advice.

Through these strategies, you can provide your clients with higher quality pet food, promote pet health, and grow your sales of pet food.

**Notes:** Grams fed per day are based on the manufacturer’s recommended feeding guide for a dog weighing 11 kg, and a cat weighing 4.5 kg. The actual amount required to be fed per day may vary for an individual animal, affecting consumption cost. The costs of veterinary exclusive diets were determined by taking the cost from veterinary suppliers for an individual diet and applying a markup of 1.43 (the national average determined through the Practice Owners Economic Survey).
1. A) This is a typical presentation for a mast cell tumor. Fibrosarcomas and hemangiosarcomas can occur in the skin, but are spindle cell tumors and not round cell tumors. Mammary gland tumors typically occur within the mammary chain and only rarely have the appearance of round cells. Lymphoma is a round cell tumor but the granules and variation in size of the mass over time make a mast cell tumor a more likely diagnosis.

2. A) Bladder neoplasia is considerably more likely in the older dog. Urge incontinence is possible with UTI; however, UTI in the young rarely occurs as a separate entity but rather occurs in addition to a congenital anomaly. PSMI is very uncommon in very young dogs. Urge incontinence is possible with urolithiasis, and stone formation in the young is possible secondary to a UTI or to a metabolic problem. However, this is still less common than incontinence resulting from congenital anomaly, the most common of which is ectopic ureter.

3. C) Spines on the base of a cat’s penis are responsive to androgenic stimulation; thus, their presence in a cat devoid of any scrotal testes is an indication that androgenic stimulation continues to occur and may be due to retained intra-abdominal testicles.

4. D) Because of the elevated hormone levels in these horses, the contralateral ovary can take a prolonged period of time to resume normal activity.

5. E) Nasal swabs will pick up bacteria that are normally found in the upper respiratory tract. Serology is difficult to interpret, especially in the face of vaccine titers and previous pathogen exposure. Necropsy of calves with chronic pneumonia often reveals secondary and tertiary pathogens, and not the inciting pathogens.

E) Les écouvillons nasaux prélèvent les bactéries qui sont normalement présentes dans le tractus respiratoire supérieur. La sérologie est difficile à interpréter, spécialement en présence de titres vaccinaux et d’exposition à des agents pathogènes antérieurs. La nécropsie de veaux souffrant de pneumonie chronique révèle souvent des agents pathogènes secondaires ou tertiaires et non les agents pathogènes causaux.
A 6-year-old, neutered male miniature poodle dog was referred to the ophthalmology service at the Western College of Veterinary Medicine (WCVM) for evaluation of acute blindness. The neuro-ophthalmologic examination revealed absent menace responses bilaterally with normal pupillary light, palpebral, and oculocephalic reflexes. Schirmer tear test (Schirmer Tear Test Strips; Alcon Canada, Mississauga, Ontario) values were 21 and 19 mm/min in the right and left eyes, respectively. The intraocular pressures were estimated with a rebound tonometer (Tonvet; Tiolat, Helsinki, Finland) and were 11 and 13 mmHg in the right and left eyes, respectively. Fluorescein staining (Fluoret; Bausch & Lomb Canada, Markham, Ontario) was negative bilaterally. The pupils were dilated with 0.5% tropicamide (Mydriacyl; Alcon Canada, Mississauga, Ontario) and biomicroscopic examination (Osram 64222; Carl Zeiss Canada, Don Mills, Ontario) and indirect ophthalmoscopic (Heine Omega 200; Heine Instruments Canada, Kitchener, Ontario) examinations were completed bilaterally. Biomicroscopic examination was within normal limits, bilaterally, and fundic photographs are provided for your assessment (Figure 1).

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

Discussion
The ophthalmic diagnosis was bilateral complete rhegmatogenous retinal detachments with vitreal degeneration. In the clinical photographs (Figure 1) the retina is hanging ventrally in the vitreous over the optic nerve head due to a giant dorsal peripheral retinal tear at the ora ciliaris retinae. The grey membrane is the neurosensory retina hanging from and obscuring direct visualization of the optic nerve head. A physical examination, complete blood (cell) count (CBC), serum biochemical profile, urinalysis, and blood pressure measurements were performed and no abnormalities were noted. Routine chest radiographs were also performed and were unremarkable. Bilateral vitrectomy with retinal reattachment surgery was recommended but declined by the owner. Annual examinations to monitor for inflammation secondary to the retinal detachments were recommended and 6 mo following initial presentation the dog re-presented to the WCVM for blepharospasm and hyphema in the left eye. Due to the presence of discomfort and chronic...
uveitis in the face of blindness, evisceration and placement of an intrascleral prosthesis was performed on the left eye with continued annual examinations for the right eye.

Retinal detachments occur as the neurosensory retina separates from the underlying retinal pigment epithelium (RPE). They can develop in one of 3 ways: i) exudative, in which effusions, exudations, or solid accumulations of cells push off the neurosensory retina; ii) rhegmatogenous retinal detachments, in which a tear or hole in the retina causes disinsertion allowing liquefied vitreous to accumulate under the tear; and iii) traction detachments, in which proliferation of pre-retinal (i.e., vitreal) membranes pulls the neurosensory retina away from its underlying RPE (1). Causes of retinal detachment are variable and include infectious disease (including bacterial, rickettsial, and mycotic infections), systemic hypertension, trauma, and congenital ocular disease (1). Rhegmatogenous retinal detachments are most common in the shih tzu, whippet, and Italian greyhound breeds in which a primary vitreal degeneration and liquefaction predisposes to peripheral retinal tears and sudden, total detachment. The diagnosis of rhegmatogenous retinal detachment is confirmed by ophthalmoscopic examination unless opacification of the anterior segment (cornea, anterior chamber, lens) precludes fundic examination. In such cases ultrasonographic examination can often confirm the diagnosis. Ophthalmic examination by a veterinary ophthalmologist is often helpful in confirming the diagnosis. Further diagnostic testing in cases of retinal detachment should include a systemic work-up consisting of a physical examination, CBC, serum biochemical profile, blood pressure, urinalysis, and chest radiographs to rule out any systemic disease resulting in the retinal detachment. In this particular case all diagnostics were within normal limits. Vitreal degeneration and liquefaction resulting in vitreal traction bands and a retinal tear were the suspected cause of retinal detachments.

Complete rhegmatogenous retinal detachment results in blindness in the affected eye(s). Once the retina is detached there is rapid degradation of the photoreceptors when they are detached from the RPE. The recommended treatment in cases with rhegmatogenous retinal detachments is vitrectomy with retinal reattachment surgery. In such cases, reattachment surgery is the patient’s only chance to restore vision. The duration of the retinal detachment is important in predicting any anticipated return of vision but in animals, the timeline of events is often unknown. This case presented with a history of acute bilateral blindness; however, it is important to note that in many cases of bilateral rhegmatogenous retinal detachments the detachments do not happen simultaneously in both eyes. Astute owners may notice acute unilateral vision loss in their pet; however, most cases presenting with acute bilateral retinal detachments have one retina that has been detached long-term and it is only when the retina detaches in the fellow eye that the owner is aware of a visual disturbance (2). It has been demonstrated that if the retina is reattached within 4 wk, there is a reasonable chance of return of some functional vision (3). Obviously, the sooner the repair, the better the odds of good vision.

Without surgical correction, chronic retinal detachments release vascular endothelial growth factors, which induce vascular membranes that predominate on the anterior and posterior iris surfaces and extend into the vitreous. These membranes are fragile, and often leak serum and blood, resulting in chronic uveitis and secondary glaucoma (4). In cases of chronic retinal detachment there is a 90% chance that a dog will develop secondary complications such as chronic uveitis and secondary glaucoma within the animal’s lifetime (4). In this particular case, the dog developed hyphema and pain from chronic uveitis necessitating an evisceration and intrascleral prosthesis in the left eye 6 mo after initial presentation. Owners with dogs suffering from retinal detachment who are unable to arrange for surgical correction should be made aware of the risk of secondary complications necessitating enucleation or evisceration. Annual complete ophthalmic examinations including Schirmer Tear Tests, intraocular pressures, and fluorescein staining are recommended in patients affected with chronic retinal detachment.

**References**

CLASSIFIEDS  
Petites annonces

Business Directory

PRACTICE ONE CONSULTING
Practice Valuations  ♦  Practice Purchase
Practice Sale  ♦  Practice Management

Dr. Frank Richardson, DVM, MBA
Veterinary Management Consultant

P.O. Box 176
Western Shore, Nova Scotia
B0J 3M0

Phone: (902) 531-2617
E-mail: frank.richardson@vm@gmail.com
Fax: (902) 531-2618

VetAdvise.com
TERRY A. JACKSON
CHARTERED PROFESSIONAL ACCOUNTANT

All About Veterinarians
Consulting, Coaching, Valuations, Negotiations, Purchase / Sale

TERRY JACKSON, C.P.A. - C.G.A.
Phone: 604.939.2323
tjackson@jandacga.com

Gallant Custom Laboratories Inc.
Your Canadian Leader for Autogenous Biologics

1425 Bishop St. N. Units 16-13
Cambridge, ON N1R 6J9
Phone: (519) 620-2488
Fax: (519) 620-2489
Toll Free: 1-888-838-5223
E-mail: Jackie@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

Horseback Expeditions
Into British Columbia's Northern Working Wilderness
Now Booking, Expeditions & Base Camps
(June–September)
Veterinary recommended by jleonn@hotmail.com
(519) 326-3171
Experience with horses is useful, but not necessary; Fitness however is mandatory....
www.go2mk.ca...wsawchuk@pris.ca
(http://vimeo.com/user17242253/muskwa-kechika)

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
Kerrville  (813) 298-8320
Email: ahlinfo@uoguelph.ca
Website: www.ah.uoguelph.ca

CHIRON
COMPOUNDING PHARMACY INC.
100% Canadian Owned and Operated

PROFESSIONAL PRECISE PROMPT
Speak to a Veterinary Compounding Pharmacist today!
Call Rita, Scott, Beley, or Linda
info@chironcompounding.com
Tel: 1-888-546-6699

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
Business Directory

DOUGLAS C. JACK – Counsel

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

Tel.: 416.367.6389 | TF: 800.563.2595
Fax: 416.361.2448 | dcjack@blg.com
Scotia Plaza, 40 King St W
Toronto, ON, Canada M5H 3Y4

Borden Ladner Gervais LLP
Calgary | Montreal | Ottawa
Toronto | Vancouver
www.blg.com

Reaching Canada’s Veterinarians
Get your message into

The Canadian Veterinary Journal
For more information contact:
Laima Laffitte
Advertising Manager
Tel.: (613) 673-2659
Fax: (613) 673-2462
e-mail: llaffitte@cvma-acmv.org
STOP THE ITCH. RIGHT HERE, RIGHT NOW.

Introducing Apoquel™, the groundbreaking first-line treatment for canine allergic dermatitis from Zoetis®.

Go to www.ExcellenceInDermatology.ca for more information on CAD.
Treating otitis externa just got easier.

Breakthrough product, innovative dosing

• Two easy doses, one week apart
• Smart gel formulation stays in the ear
• Same dose for any dog, regardless of its size and weight
• Single-dose tube with soft, flexible tip is gentle on a dog’s ears
• Easy application leads to better compliance

Ask your Elanco sales representative about Osurnia™ today.