Hypertrophic osteopathy secondary to metastatic ovarian adenocarcinoma in a mare

Ureteral obstruction secondary to disseminated penicilliosis in a German shepherd dog

Magnetic resonance imaging and immunohistochemistry of primary vertebral hemangiosarcoma in a dog and implications for diagnosis and therapy

Paradoxical vestibular syndrome in a dog from western Newfoundland infected with French heartworm (*Angiostrongylus vasorum*)

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Survey of Ontario veterinarians’ knowledge and attitudes on pain in dogs and cats in 2012

Influence of parity of birth and suckled sows on piglet nasal mucosal colonization with *Haemophilus parasuis*

Reduction of serum 25-hydroxyvitamin D concentrations with intravenous lipid emulsion in a dog

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Marijuana for pets?
De la marijuana pour les animaux de compagnie?

T he plant Cannabis sativa (marijuana) has been used by humans for both medicinal and recreational purposes for thousands of years — a PubMed search for “marijuana” yielded over 24,000 references. Most of these studies addressed the psychoactive features of and the adverse effects of marijuana on humans, including detrimental effects on the developing brain, impairment related to driving, and addiction. Although there are more than 480 unique compounds in cannabis, the 2 major cannabinoids are delta-9-tetrahydrocannabinol (THC), the primary psychoactive component, and cannabidiol (CBD), the primary nonpsychoactive component (1). Cannabinoids act on various pathways in cells through cannabinoid receptors (CBs) on these cells. There are at least 2 types of receptors: CB1 is present mainly in parts of the central nervous system that affect cognition, appetite, motor activity, emotions, memory but is also found in peripheral tissues including testes, ovaries, prostate, salivary glands; CB2 is found primarily in cells of the immune system. Endogenous cannabinoids use these receptors as part of a signaling system that regulate function of these cells, and have been implicated in several neurological disorders.

In humans, cannabinoids have been shown to have the potential to be valuable therapeutic drugs. They may be of value in treatment of cancer, nausea and vomiting, pain, epilepsy, inappetence, and inflammatory bowel disease (1,2). Cannabinoids are used in several countries in the palliative therapy of patients with cancer because it inhibits some side-effects due to chemotherapy and radiotherapy. In particular they are used to inhibit vomiting and nausea, combat pain, and stimulate the appetite. They are also used for treatment of epilepsy that is refractory to conventional treatments. There are studies in vitro and in animal models that indicate that cannabinoids also possess anti-tumor activity (2); however, concerns have been expressed that cannabinoids may exert an adverse effect on cancers because of their ability to suppress anti-tumor immunity. A number of synthetic analogs of cannabinoids found in marijuana have yielded over 24,000 references. Most of these studies addressed the psychoactive features of and the adverse effects of marijuana on humans, including detrimental effects on the developing brain, impairment related to driving, and addiction. Although there are more than 480 unique compounds in cannabis, the 2 major cannabinoids are delta-9-tetrahydrocannabinol (THC), the primary psychoactive component, and cannabidiol (CBD), the primary nonpsychoactive component (1). Cannabinoids act on various pathways in cells through cannabinoid receptors (CBs) on these cells. There are at least 2 types of receptors: CB1 is present mainly in parts of the central nervous system that affect cognition, appetite, motor activity, emotions, memory but is also found in peripheral tissues including testes, ovaries, prostate, salivary glands; CB2 is found primarily in cells of the immune system. Endogenous cannabinoids use these receptors as part of a signaling system that regulate function of these cells, and have been implicated in several neurological disorders.

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been developed in an effort to obtain potent anti-inflammatory activity while avoiding the psychotropic activity of marijuana. These products offer biochemical uniformity, a reliable delivery system, and relief of symptoms. However, some argue that herbal synergy among components of the plant may be important.

In animals, there is much less information on the effects of cannabinoids. Researchers have concentrated on the toxic effects on dogs, in particular. There are less than 60 papers in PubMed on marijuana in dogs and they are almost all on toxic effects — due to accidental ingestion, experimental administration to study toxicity, or ingestion of synthetic cannabinoids. The information on toxicity is likely to gain increasing importance as legal access to marijuana comes into effect in Canada and spreads across the United States. In Colorado, a State with legalized marijuana for medical use, the frequency of marijuana toxicosis in dogs at 2 veterinary hospitals increased 4-fold over a 5-year period (2005 to 2010) (3). The authors found a positive correlation between the increased number of cases of marijuana toxicosis in dogs and the increased number of medical marijuana licenses issued. Dogs are reported to have a higher number of cannabinoid receptors in the brain compared with humans and it has been suggested that they may be more susceptible to the toxic effects than are humans (1). In the Colorado study 2 dogs that consumed baked goods that included butter with concentrated medical grade THC died.

In human medicine it is likely that we will see a massive increase in research on potential therapeutic effects of cannabis and its derivatives (4). There will be more research on growing marijuana with various concentrations of the major cannabinoid components and with more consistent supply of cannabis. More research will also take place in the laboratory and in clinical trials in humans. There are differences in the CB2 receptors and in the metabolism of cannabinoids in dogs compared with humans and veterinary medical researchers should ensure that they become involved in parallel research on the potential value of marijuana for treatment of animal diseases. Marijuana cookies may well find a place in the veterinarian's arsenal for treatment of epilepsy and the side-effects of cancer.

References

Renvois
2. PYSZNIAK, M., M. TABARKIEWICZ et J.J. ŁUSZCZKI. « Endocannabinoid system as a regulator of tumor cell malignancy —
Dear practice owner:

THANK YOU!

As 2016 comes to a close, I wanted to thank all the veterinarians we have met and had the personal pleasure of speaking with at the various conferences this year. We are very appreciative of the many owners who candidly share their thoughts about appraising and selling their practices.

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Best wishes,

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1. A 1-year-old neutered male Doberman pinscher presents for recurrent hair loss and mild pruritus. Examination reveals patchy alopecia, predominantly affecting the trunk, with occasional papules and pustules. Multiple deep skin scrapings are negative for Demodex mites. Which of the following is the most likely underlying cause for this recurrent problem?
   A. Hypoadrenocorticism
   B. Hyperestrogenism
   C. Hyperadrenocorticism
   D. Hypothyroidism
   E. Hyperthyroidism

2. In horses, globe retraction and prolapse of the third eyelid are associated with which of the following?
   A. Tetanus
   B. Botulism
   C. Colic
   D. Rabies

3. Which of the following options describes the appropriate management of lame cows on a dairy farm (components are listed in the order in which they will be performed)?
   A. Vital signs, limb palpation, hoof examination, nerve blocks
   B. Limb palpation, hoof examination, nerve blocks, radiographs
   C. Hoof examination, nerve blocks, radiographs
   D. Vital signs, hoof examination, radiographs
   E. Limb palpation, hoof examination, radiographs

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Quiz Corner
Test éclair

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1. Un jeune mâle Doberman pinscher castré, âgé de 1 an, présente une perte de poils récurrente et un léger prurit. L’examen révèle de l’alopécie en clairière affectant de façon prédominante le tronc, avec à l’occasion des papules et des pustules. Plusieurs raclages cutanés en profondeur ne décelent aucun *Demodex*. Laquelle des causes sous- jacentes suivantes est la plus probable pour ce problème récurrent?
   A. hypoadrénocorticisme;
   B. hyperœstrogénisme;
   C. hyperadrénocorticisme;
   D. hypothyroïdisme;
   E. hyperthyroïdisme.

2. Chez le cheval, la rétraction du globe oculaire et le prolapsus de la troisième paupière sont associés à quel problème suivant?
   A. tétanos;
   B. botulisme;
   C. colique;
   D. rage.

3. Lesquelles des options suivantes décrivent la prise en charge la plus appropriée pour des vaches qui boitent sur une ferme laitière (les actions sont énumérées dans l’ordre dans lequel elles devraient être faites)?
   A. signes vitaux, palpation des membres, examen des onglons, blocages nerveux;
   B. palpation des membres, examen des onglons, blocages nerveux, radiographies;
   C. examen des onglons, blocages nerveux, radiographies;
   D. signes vitaux, examen des onglons, radiographies;
   E. palpation des membres, examen des onglons, radiographies.
4. A 12-year-old cat has weight loss, dehydration, depression, vomiting, severe hyperglycemia, glycosuria, and ketonuria. Which of the following statements is correct?
A. This cat probably has diabetes mellitus, and therapy with glargine insulin should be initiated.
B. This cat probably has diabetes mellitus complicated by diabetic ketoacidosis; therapy with short-acting regular insulin should be initiated.
C. This cat probably has chronic renal disease, and therapy with insulin is not indicated.
D. This cat probably has diabetes mellitus; oral hypoglycemic agent therapy and a change in diet are indicated.
E. This cat does not have diabetes mellitus; these results are due to stress.

5. An 8-year-old neutered male Doberman pinscher is seen with complaints of weakness and inappetence for a week. The owners report vomiting 2 to 4 times a day. The dog has been treated with carprofen over the past year for pain associated with orthopedic problems. On physical examination the dog is found to be 6% dehydrated and underweight. Laboratory test findings include moderate normocytic normochromic anemia; mild leukocytosis; increased serum ALP, ALT, and aspartate transaminase (AST) activities; isosthenuria; and trace bilirubinuria. Which of the following statements is correct?
A. The presence of bilirubinuria with increased liver enzymes activities indicates the presence of hepatic failure.
B. The presence of bilirubinuria with anemia indicates hemolytic anemia.
C. The increased liver enzyme activities indicate parenchymal liver injury.
D. The presence of isosthenuria in the face of dehydration indicates renal insufficiency.

4. Un chat âgé de 12 ans présente une perte de poids, de la déshydratation, de l’abattement, des vomissements, de l’hyperglycémie, de la glycosurie et de l’acétonémie sévères. Lequel des énoncés suivants est correct?
A. Ce chat souffre probablement de diabète sucré et un traitement à l’insuline glargine devrait être commencé.
B. Ce chat souffre probablement de diabète sucré compliqué de cétacidose diabétique; un traitement à l’insuline ordinaire devrait être commencé.
C. Ce chat souffre probablement de maladie rénale chronique et un traitement à l’insuline n’est pas indiqué.
D. Ce chat souffre probablement de diabète sucré; un traitement avec un agent hypoglycémiant et un changement de diète sont indiqués.
E. Ce chat ne souffre pas de diabète sucré; ces problèmes sont causés par le stress.

5. Un mâle Doberman pinscher castré, âgé de 8 ans, manifeste de la faiblesse et de l’inappétence depuis 1 semaine. Les propriétaires rapportent des vomissements 2 à 4 fois par jour. Le chien est traité au carprofène depuis 1 an à cause de douleur associée à des problèmes orthopédiques. À l’examen physique, le chien est déshydraté de 6 % et démontre un poids insuffisant. Les résultats des tests de laboratoire indiquent de l’anémie monochrome monocyttaire modérée, une leucocytose légère, une augmentation de l’activité sérique de la phosphatase alcaline, de l’alanine aminotransférase et de l’aspartate aminotransférase; une isosthénurie et une trace de bilirubinurie sont aussi notées. Lequel des énoncés suivants est correct?
A. La présence de bilirubinurie avec une augmentation de l’activité enzymatique du foie indique la présence d’insuffisance hépatique.
B. La présence de bilirubinurie avec de l’anémie indique une anémie hémolitique.
C. L’augmentation de l’activité enzymatique du foie indique une lésion du parenchyme hépatique.
D. La présence d’isosthénurie avec de la déshydratation indique de l’insuffisance rénale.

(See p. 1256 for answers./Voir les réponses à la page 1256.)
Ethical question of the month — December 2016

A “swine” client calls to report that a recent hire turned out to be an animal activist who placed disturbing videos on the Internet of another employee mishandling both sows and piglets. Major retailers immediately notified their suppliers that they would not accept pork from this farm. Your swine client reports that the employee in the video had behavioral problems that led to his dismissal shortly after he was hired. The client explained to the media that the employee was terminated and that the video does not reflect the farm’s stockmanship practices. Nevertheless retailers want to distance themselves from this disturbing video and are refusing to purchase his pork. As a result your client now has over-stocking problems as he waits for regulatory bodies to investigate. The client is calling to request that you euthanize healthy market hogs so he will not be accused of overcrowding his pigs. He wants the euthanasia done by a professional to ensure he is not in some way accused of further animal welfare infractions. You are concerned that euthanizing these healthy hogs will simply increase public displeasure but you cannot find a packer willing to accept the pigs. How should you respond?

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.

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Ethical question of the month — September 2016

A dairy client calls for help with a number of heifers suffering from chronic respiratory disease. When you arrive in the late afternoon there are 6 heifers crowded into a small, damp hospital pen in a poorly ventilated corner of the barn. Two are down, emaciated, and mouth-breathing, 2 have labored breathing and are pyrexic, and 2 are eating and have normal temperatures. The owner has to leave twice during your examination of the heifers to address other concerns on the farm. You treat the 2 pyrexic individuals, insist that the 2 mouth-breathing animals be humanely euthanized, and recommend that the better pair be housed in an outdoor loafing shed to improve their environment and to decrease crowding in the hospital pen. You insist that the hospital pen be scraped out and fresh bedding supplied, windows opened for ventilation, and treatment of the 2 remaining heifers continued for 3 more days. The owner is appreciative but anxious to leave to attend to another matter on the farm. You are seriously concerned that your recommendations will not be acted upon that day, if at all. Have you fulfilled your duty of care and professional obligation to protect animal welfare at this point?

Question de déontologie du mois — Septembre 2016

Un client qui est producteur laitier vous appelle pour demander de l’aide avec plusieurs génisses souffrant d’une maladie respiratoire chronique. Lorsque vous arrivez à la ferme en fin d’après-midi, il y a six génisses à l’étroit dans un petit enclos d’infirmerie humide situé dans un secteur mal ventilé de la grange. Deux vaches sont couchées, émaciées et respirent par la gueule, deux ont une respiration difficile et sont atteintes de pyrexie et deux mangent et ont une température normale. Le propriétaire doit quitter deux fois durant votre examen des génisses pour répondre à d’autres situations à la ferme. Vous traitez les deux vaches atteintes de pyrexie, insistez que les deux génisses respirant par la gueule soient euthanasiées de manière non cruelle et vous recommandez que la paire en santé soit logée dans un abri à stabulation libre à l’extérieur afin d’améliorer leur environnement et de réduire le nombre d’animaux dans l’enclos d’infirmerie. Vous insistez que le sol de l’enclos d’infirmerie soit gratté et qu’une literie fraîche soit fournie, que les fenêtres soient ouvertes pour offrir de la ventilation et que le traitement de deux autres vaches soit maintenu pendant trois autres journées. Le propriétaire est reconnaissant mais il semble désireux de quitter pour s’occuper d’une autre situation à la ferme. Vous vous inquiétez sérieusement du fait que vos recommandations ne seront pas mises en œuvre ce jour-là, ni ultérieurement. Avez-vous rempli votre devoir de diligence et votre obligation professionnelle de protéger le bien-être animal à ce moment?

An ethicist’s commentary on a dairy farm with sick heifers

Anyone with a modicum of life experience is aware that being a professional — at least an effective professional — involves far more than learning a series of algorithms and applying them by rote, though most professional training programs, be they medicine, veterinary medicine, law, or university teaching cannot teach the subtle nuances involved with dealing with particular cases. For example I, as a college professor, often teach the same syllabus on multiple occasions. But given the enormous variation among students from semester to semester, let alone from year-to-year or decade to decade, a truly effective teacher will alter the form and content of teaching to fit the students at a given time.

I ran across this phenomenon in a truly dramatic way pertaining to psychiatry. I was in a conversation with a psychiatrist who specialized in dealing with mental disorders on a Native American reserve in the US southwest. He told me of being called to treat an old woman who was patently schizophrenic, but also well-established as a shaman. She greeted him with contempt, dismissing his authority and powers as far inferior to hers. Resourcefully, he slipped a harmless powder into her drink, which when consumed turned her urine bright orange. He then dramatically informed her that his powers were so great, he could make her burn from inside. She was suitably cowed, and meekly accepted his authority.

I have written extensively of medical professionals’ Aesculapean authority and how it can be deployed to the benefit of those who are treated. This case represents a paradigmatic example of where such authority should be deployed. The client is clearly concerned about the animals; else he would not have called upon you for help. You have diagnosed the problem and recommended treatment. Does your duty end there?

Emphatically not! In fact, this is where the real work starts. The owner is obviously well-intentioned, but also overworked and stressed. You therefore must deploy your authority for the benefit of the animals and, for the financial well-being of the dairy. You must forcefully point out that the situation that is occurring is likely to continue to occur as long as the management continues to be desultory and perfunctory. You must point out that not only is this issue one of animal welfare, and unnecessary suffering for the animals, but also animal health, food safety, sustainability, and indeed, the health of the owners and workers. You should also forcefully insist that the owner not spread himself so thin as to lead to breaches in animal welfare and proper dairy management. Indeed, you should also point out that the situation as it stands is very likely to lead to unacceptable levels of somatic cells in the milk, and a deterioration in the dairy’s reputation.

Were I the veterinarian, I would press my Aesculapean authority relentlessly. For example, although you have no legal backing, you can insist that your recommendations be followed that very day, and that failing that, morbidity is extremely likely...
to increase. I would also offer my help in creating a management plan that would benefit the owner, the animals, and the efficiency of the dairy. You can point out that whatever you charge for your advice will be quickly recovered by increased productivity, profitability, and better health for the animals.

There is nothing in the conditions described that suggests that the owner will not respond to reasonable advice. You can also point out that the presence of unhealthy animals on his dairy harms your reputation as a practitioner, as well as his reputation as a dairyman.

Proceeding in this manner creates a clear win-win situation, something well within your purview as a veterinarian. In this way, you enhance the well-being of the animals you are sworn to serve, as well as that of the client.

*Bernard E. Rollin, PhD*
The Canadian Veterinary Medical Association (CVMA) celebrated a successful Animal Health Week in October. With over 220 clinics and animal hospitals participating, thousands of animal families from coast to coast were introduced to this year’s theme of “Animal Health + Human Health + Planet Health = One Health.”

Thank you to all veterinarians, veterinary teams, and students who helped us to celebrate. We hope you were able to engage with clients and help disseminate information about One Health that will help keep families, pets, and the planet healthy well into the future.

Animal Health + Human Health + Planet Health = One Health

Animal Health Week 2016 Wrap-Up

The Centre for Public Health and Zoonoses (CPHAZ), Ontario Veterinary College, celebrating Animal Health Week with some hands-on learning.

Le Centre for Public Health and Zoonoses (CPHAZ) de l’Ontario Veterinary College a célébré la Semaine de la vie animale en organisant des activités d’apprentissage interactif.

Nothing like a little Tim Hortons to start off your day. Staff at Warman Animal Hospital, in Warman, Saskatchewan, enjoy the $50 Tim Hortons gift certificate they received as the winners of the Animal Health Week Online Order prize.

Rien n’égale une boisson de Tim Hortons pour commencer la journée du bon pied. Les employés de la clinique Warman Animal Hospital ont profité de leur carte-cadeau de 50 $ chez Tim Hortons qu’ils ont reçue à titre de gagnants du prix de la commande en ligne de la Semaine de la vie animale.

The Torbay Road Animal Hospital celebrated with a full week of festivities ranging from a microchip clinic to bake sales and lunchtime cake and coffee with proceeds supporting local animal rescues!

La clinique Torbay Road Animal Hospital a célébré lors d’une semaine remplie de festivités durant laquelle elle a organisé une clinique sur les micropuces et a aussi tenu une vente de pâtisseries et servi du gâteau et du café le midi afin de recueillir des fonds pour des groupes locaux de secours des animaux!

The Forest Grove Veterinary Clinic staff enjoying the fruits of the Animal Health Week Early Bird Prize, a $100 Subway gift certificate. Our materials supplier, Creo Marketing, also provided the clinic with complimentary Under Armour bags, complete with the CVMA logo.

Les employés de la Forest Grove Veterinary Clinic ont savouré leur prix pour la commande hâtive de la Semaine de la vie animale, une carte-cadeau de 100 $ chez Subway. Notre fournisseur d’articles promotionnels, Creo Marketing, leur a aussi offert gratuitement des sacs Under Armour arborant le logo de l’ACMV.
We are thrilled with the success of this year’s Animal Health Week. Check out clinic celebrations by looking up #celebrateAHW and #OneHealth on Facebook and Twitter.

Mark your calendar for the 2017 Animal Health Week campaign, which will take place from October 1 to October 7 next year.

We could not have achieved this success without the support of our generous sponsors. We would like to graciously thank our 2016 Animal Health Week sponsors: Principal Sponsor, Petsecure Pet Health Insurance, and Program Sponsors, iFinance Petcard and Merial.

Please visit the website (www.canadianveterinarians.net) to learn more about the Canadian Veterinary Medical Association and Animal Health Week.

Council Welcomes New Representative of CVMA Members from Alberta

The Canadian Veterinary Medical Association (CVMA) is delighted to welcome Dr. Louis Kwantes as the new representative of CVMA members from Alberta. He replaces Dr. Troy Bourque who took on the role of CVMA president at the annual Convention in July.

Dr. Kwantes hails from Sherwood Park, Alberta, where he has lived for the past 22 years. His educational background includes high school in Japan, college in the United States, veterinary school in Canada (Ontario Veterinary College in 1987), and a MSc in Tropical Veterinary Medicine in the United Kingdom (University of Edinburgh). His professional background includes mixed animal practice in Ontario, shorter this year of «Santé animale + Santé humaine + Santé de la planète = Une Seule Santé».

Merci aux vétérinaires, aux équipes vétérinaires et aux étudiants qui ont contribué aux célébrations. Nous espérons que vous avez pu interagir avec vos clients afin de diffuser de l’information à propos d’Une Seule Santé qui contribuera à protéger la santé des familles, des animaux de compagnie et de la planète dans l’avenir.

Nous sommes ravis du succès de la Semaine de la vie animale de cette année. Renseignez-vous sur les célébrations des cliniques en consultant les mots-clics #celebronslaSVA et #UneSeuleSante sur Facebook et Twitter. Vous pouvez voir la liste des participants ici.

Inscrivez à votre calendrier la date de la campagne 2017 de la Semaine de la vie animale qui se déroulera du 1er au 7 octobre l’an prochain.

Nous n’aurions pas pu connaître un tel succès sans le soutien de nos généreux commanditaires. Nous aimerions gracieusement remercier les commanditaires de la Semaine de la vie animale 2016 : le commanditaire principal, Petsecure assurance maladie pour animaux, et les commanditaires de programme, iFinance Petcard et Merial.

Veuillez visiter le site Web (www.veterinairesaucanada.net) pour en apprendre davantage à propos de l’Association canadienne des médecins vétérinaires et de la Semaine de la vie animale.

Le Conseil accueille un nouveau représentant des membres de l’ACMV en Alberta

L’Association canadienne des médecins vétérinaires (ACMV) est ravie d’accueillir le Dr Louis Kwantes à titre de nouveau représentant des membres de l’ACMV en Alberta. Il remplace le Dr Troy Bourque qui a assumé les fonctions de président de l’ACMV lors du congrès annuel en juillet.

Le Dr Kwantes est domicilié à Sherwood Park, en Alberta, où il habite depuis 22 ans. Pendant ses études, le Dr Kwantes a fréquenté l’école secondaire au Japon, l’université aux États-Unis et la faculté de médecine vétérinaire au Canada (Ontario Veterinary College en 1987) et il a obtenu une maîtrise en médecine vétérinaire tropicale au Royaume-Uni (Université d’Édimbourg). Ses antécédents professionnels incluent notamment la pratique mixte
en Ontario, des affectations vétérinaires outremer plus ou moins longues en Haïti, en Ouzbékistan et au Moyen-Orient (surtout dans le Sultanat d’Oman, en tant que vétérinaire principal pour le Centre for Overseas Research and Development de l’Université de Durham).

Il est actuellement vétérinaire directeur du Park Veterinary Centre de National Veterinary Associates à Sherwood Park (une clinique vétérinaire pour animaux de compagnie qu’il a fondée en 1997 avec son associé). Par ailleurs, il a été membre spécialiste de l’Edmonton Veterinary Emergency Clinic ainsi qu’ancien président du groupe des vétérinaires pour petits animaux de la région d’Edmonton et de l’ABVMA et il a occupé divers postes auprès de l’ABVMA pendant dix années.

En 1987, il a reçu le prix du ACMV pour l’érudition et le leadership et il obtenu le prix des communications de l’ACMV en 2006. C’est un promoteur passionné de la médecine vétérinaire et il a été un collaborateur régulier dans les médias imprimés, à la radio et à la télévision.

Les enfants de Louis et de Janet, sa jeune, aimante et patiente épouse depuis 26 ans, ont quitté le nid familial et seul un jeune chat reste maintenant à la maison. Leur fille aînée fait une maîtrise en musique à Boston et leurs deux autres enfants fréquentent l’Université de l’Alberta.

Le D’ Kwantes est honoré d’avoir été nommé en tant que représentant des membres de l’ACMV en Alberta et il se réjouit à la perspective de représenter ses collègues dans ce nouveau rôle.

Dr./Dr Jaspinder Komal

Dr./Dr Louis Kwantes

L’ACMV accueille le D’ Jaspinder Komal à titre de membre d’office du Comité sur les enjeux nationaux

L’Association canadienne des médecins vétérinaires (ACMV) souhaite une chaleureuse bienvenue au D’ Jaspinder Komal à titre de membre d’office du Comité sur les enjeux nationaux.

Le D’ Komal est directeur exécutif de la Direction de la santé des animaux, au sein de la Direction générale des politiques et des programmes de l’Agence canadienne d’inspections des aliments (ACIA), et vétérinaire en chef adjoint du Canada.

En 1994, le D’ Komal est entré au service de l’ACIA à titre de vétérinaire-inspecteur et de surveillant de laboratoire dans les provinces du Nouveau-Brunswick et de l’Île-du-Prince-Édouard. En 2000, le D’ Komal et sa famille ont déménagé à Ottawa où il a ensuite occupé divers postes à responsabilités croissantes au sein de l’ACIA et d’autres ministères tels Agriculture et Agroalimentaire Canada (AAC) et Santé Canada. Plus récemment, il a occupé le poste de directeur général de la Direction des stratégies intégrées de la Direction des sciences et de la technologie ainsi que celui de directeur général de la Direction des opérations et de la gestion des urgences à la Direction générale des services à l’industrie et aux marchés, ces deux postes étant au sein de AAC.

CVMA Welcomes Dr. Jaspinder Komal to Ex-Officio Position on the National Issues Committee

The Canadian Veterinary Medical Association (CVMA) warmly welcomes Dr. Jaspinder Komal to the ex-officio position on the National Issues Committee.

Dr. Komal is the executive director of the Animal Health Directorate, within the Canadian Food Inspection Agency’s (CFIA) Policy and Programs Branch, and the Deputy Chief Veterinary Officer for Canada (DCVO).

In 1994, Dr. Komal joined the CFIA as a veterinary inspector, as well as a laboratory supervisor in the provinces of New Brunswick and Prince Edward Island. In 2000, Dr. Komal and his family moved to Ottawa where he held various positions of increasing responsibility within the CFIA and other departments such as Agriculture and Agri-Food Canada (AAFC) and Health Canada. Most recently, he worked as the director general of the Strategic Directions Directorate of the Science and Technology Branch and as the
Business Strategies to Increase Your Client Base

Self-employed professionals need a steady flow of clients to achieve continuous success. The challenge is to continually attract qualified leads, especially during busy times, so your pipeline stays full.

Here are 3 possible strategies that will help increase revenue and stabilize cash flow:

1. Create a marketing system
   - There are many ways you can market your business. The key is consistency. Set time aside each week to network, make new contacts and follow-up with clients you haven't seen in a while.
   - You need to always be motivated to keep up your marketing strategies, even when your business is busy. So it's important to design a system that works with, rather than against, your personal strengths. Here are some other ideas for attracting and keeping up with clients:
     - Keep your web presence up-to-date with engaging, optimized blog posts.
     - Maintain a social media presence, weighing in on hot topics.
     - Check in with clients on a regular basis to see whether they need your help or just to say thank you.
     - Socialize — invite a new contact for coffee.

2. Develop your sales funnel
   - Your marketing system will fit into a bigger sales strategy: your sales funnel. The purpose of a funnel is to capture prospects, then move them through a step by step process toward a sale, filtering out unqualified leads as you go. The steps for setting up a sales funnel are the same for any business, and so is the goal — to close as quickly as possible.

Stratégies d'affaires pour élargir votre clientèle

Les travailleurs professionnels autonomes ont besoin d'un afflux constant de clients pour continuer de prospérer. Le défi consiste à cultiver de bonnes sources de clients, particulièrement durant les périodes achalandées, afin que votre pipeline demeure toujours plein.

Voici trois stratégies possibles qui aideront à accroître vos revenus et à stabiliser l'encaisse :

1. Créez un système de marketing
   - Vous pouvez faire connaître votre entreprise de nombreuses façons, mais il est important d'assurer l'uniformité des messages. Chaque semaine, réservez du temps pour réseauter, établir de nouveaux contacts et effectuer un suivi auprès des clients que vous n'avez pas rencontrés depuis un certain temps.

   Vous devrez toujours être motivé afin de maintenir vos stratégies de marketing, même lorsque votre entreprise traverse une période achalandée. Il est donc important de concevoir un système qui fait appel à vos forces personnelles. Voici quelques idées pour attirer et conserver des clients :
   - Conservez une présence à jour sur le Web en publiant des blogs intéressants et ciblés.
   - Conservez une présence dans les médias sociaux, en donnant votre opinion sur les sujets de l'heure.
   - Contactez régulièrement vos clients pour voir s'ils ont besoin de votre aide ou simplement pour les remercier.
   - Rencontrez des gens et invitez de nouvelles relations à prendre le café.

2. Créez votre entonnoir de ventes
   - Votre système de marketing s'inséra dans votre stratégie de vente globale : votre entonnoir de ventes. Le but d'un entonnoir consiste à attirer des clients éventuels et à les acheminer...
ensuite dans un processus étape par étape jusqu'à la vente, en filtrant les personnes non intéressées. Les étapes de la création d'un entonnoir de ventes sont les mêmes pour toutes les entreprises et le but est semblable : de conclure une vente le plus rapidement possible.

En tant que professionnel, tentez de concentrer vos efforts de marketing sur votre réseau de contacts. En intégrant des «clients potentiels» dans votre entonnoir, vous passerez moins de temps à développer des relations de confiance avec vos clients potentiels. N'hésitez pas à demander des recommandations. Le marketing de bouche à oreille représente la meilleure publicité et, de surcroît, elle est gratuite!

3. Effectuez un suivi de votre succès
Il est essentiel de posséder un mécanisme permettant d'effectuer un suivi de vos efforts de marketing, sinon vous ne saurez pas ce qui fonctionne et ce qui ne fonctionne. Lorsque vous pourrez facilement effectuer un suivi de votre système, vous pourrez raffiner vos processus de vente afin qu'ils puissent être plus efficaces. Votre système de gestion des relations à la clientèle devrait être simple et vous devriez seulement l'utiliser pour garder le contact avec les pistes prometteuses. Vous gaspillerez du temps précieux en incluant tout le monde dans votre système de gestion de la clientèle, du temps que vous pourriez consacrer à une piste prometteuse.

Il faut du temps pour mettre sur pied une clientèle solide et il ne faut pas se décourager. Souvent, lorsqu'il s'agit de recruter un client, la décision ne s'appuiera pas sur les titres de compétence ou sur la façon dont vous avez fourni un service. Ce sont les personnalités qui deviendront le facteur déterminant. Les clients qui restent avec vous dans votre entonnoir de ventes sont habituellement ceux avec qui vous voudrez établir une relation à long terme parce que vous éprouverez une compatibilité mutuelle.

Cet article est fourni par la Banque Scotia, le fournisseur de services bancaires privilégié de l'ACMV, co-sponsor du Programme de gestion commerciale et commanditaire de niveau Or.
Save Money on Your Vacation Through CVMA's Hotel Discount Program

Travelling over Christmas? Save money on your hotel, anywhere in the world, by booking through the CVMA’s exclusive, member-only hotel discount program.

The CVMA's hotel discount program gives online access to a worldwide inventory of hotels at unbeatable rates. Whether you are travelling for business or pleasure, you can save as much as 50% and take advantage of below-market rates averaging between 5 to 20% better than other popular online hotel booking services. Reservations made through our system are guaranteed to be the lowest available. If you can find the same booking available at a lower rate within 24 hours of your reservation, a service agent will either refund the difference or cancel the reservation without penalty (with few exceptions). The majority of bookings are “pay on arrival,” which means that you only pay when checking out of the hotel. In some instances, you may want to opt for an attractive “pre-paid” rate.

You can search for your hotel and book completely online. Plus, our partner and service provider offers exceptional customer service and support. Through a dedicated toll-free phone number, call center agents are available to answer questions, help guide you through your online bookings, process reservations directly, and administer changes or cancellations, if needed.

Take advantage of this discount program by visiting the CVMA website (www.canadianveterinarians.net), then under Value of Membership — Member Benefits and Services, click on Hotel Discounts. As an exclusive CVMA members-only benefit, you will be required to log-in using your CVMA log-in credentials. If you do not know or forgot your password, you can request it from the CVMA at (admin@cvma-acmv.org) or 800-567-2862.

Happy travels!

Économisez sur vos vacances grâce au Programme de rabais hôteliers de l'ACMV

Vous prévoyez un voyage à Noël? Vous pouvez obtenir des rabais sur les tarifs hôteliers, n'importe où dans le monde en réservant par l'entremise du programme de rabais hôteliers offert exclusivement aux membres de l'ACMV.

Le programme de rabais hôteliers de l'ACMV vous permet d'accéder en ligne à un inventaire d'hôtels partout dans le monde offerts à des tarifs imbattables. Qu'il s'agisse d'un voyage d'affaires ou d'agrément, vous pouvez économiser jusqu'à 50 % et profiter de tarifs inférieurs aux prix du marché qui représentent une économie de 5 à 20 % par rapport aux services populaires de réservation d'hôtels en ligne. Nous garantissons que les tarifs des réservations effectuées par l'entremise de notre système sont les plus bas. Si vous trouvez la même réservation offerte à un tarif inférieur dans un délai de 24 heures après votre réservation, un agent de service vous remboursera la différence ou annulera la réservation sans pénalité (sous réserve de certaines exceptions). Pour la majorité des réservations, le paiement s'effectuera à la destination, c'est-à-dire que vous paierez seulement lorsque vous quitterez l'hôtel. Dans certains cas, vous voudrez peut-être choisir un tarif «prépayé» attrayant.

Vous pouvez chercher votre hotel et faire la réservation entièrement en ligne. De plus, notre partenaire et fournisseur de services offre un service à la clientèle et un soutien exceptionnels. Par l'entremise d'un numéro sans frais, des agents sont disponibles pour répondre à vos questions, vous guider lors du processus de réservation en ligne, prendre des réservations directement et, au besoin, administrer les changements ou les annulations.

Profitez de ce programme de rabais en visitant le site Web de l'ACMV (www.veterinairesaucanada.net), sous l'onglet Valeur de l'adhésion — Avantages et services aux membres, et en cliquant sur Rabais hôteliers. Il s'agit d’un avantage offert exclusivement aux membres de l’ACMV et vous devrez utiliser vos identifiants de connexion de l'ACMV. Si vous ne connaissez pas votre mot de passe ou si vous l’avez oublié, vous pouvez le demander auprès de l’ACMV à (admin@cvma-acmv.org) ou au 800-567-2862.

Bon voyage!

Get away for the weekend
The CVMA has Mentors Waiting to Help Early Career DVMs
Des mentors de l’ACMV sont prêts à aider les vétérinaires en début de carrière

Vet erinary graduates face difficult challenges while starting their new career. Gaining hands-on experience, performing surgeries, diagnosing correctly and providing proper patient treatment are just some of these challenges. Coupled with that is the lack of experience and confidence interacting and communicating with clients and colleagues.

To help recent graduates settle into professional life and overcome these challenges, CVMA created the CVMA Mentoring Program, which connects CVMA members who want to provide support to final year DVM students, recently graduated members and veterinarians in their early career.

Mentoring is an invaluable personal and career development opportunity and a powerful confidence building tool for mentees. Also, professional nurturing can be a very satisfying and rewarding experience for mentors who are helping others progress in their career through the sharing of knowledge and expertise.

The CVMA has mentors waiting for you. To learn more about the CVMA Mentoring Program and to find out how to register as a mentor or a mentee, please visit the CVMA Mentoring Program section under the Practice & Economics tab in the CVMA website (www.canadianveterinarians.net). Only CVMA members can participate in this program.

The Canadian Animal Health Surveillance System
A shared national vision leading to effective, responsive, integrated animal health surveillance in Canada

I n its 2011 report, “Surveillance in a Time of Transition in Farmed Animal Health,” the National Farmed Animal Welfare Council (NFAWC) identified a need to address major weaknesses in the present animal health surveillance system in Canada. Surveillance refers to the systematic ongoing collection, collation, and analysis of information related to animal health, and the timely dissemination of information so that action can be taken.

Le Système canadien de surveillance de la santé animale
Une vision nationale commune pour une surveillance zoosanitaire efficace, reactive et integree au Canada

D ans son rapport de 2011, «La surveillance de la santé des animaux d'élevage dans une période de transition», le Conseil national sur la santé et le bien-être des animaux d'élevage (CNSBEAE) a identifié le besoin d’aborder les faiblesses majeures présentes dans le système de surveillance de la santé animale au Canada. La surveillance fait référence à la collecte, à la compilation et à l’analyse systématiques et permanentes de données sur la
Weaknesses were identified in organization and decision-making, as well as in information and data sharing. The Canadian Animal Health Surveillance System (CAHSS) has been created to address these issues.

The CAHSS is an all-inclusive voluntary network of networks. All those that wish to join and contribute to the shared purpose and follow the guiding principles are welcome. Members include federal and provincial governments; industry (producers, practitioners, and organizations), and others working in animal health (farmed and wild) and public health. CAHSS work is disease-focused, including reportable, notifiable, production limiting, zoonotic and emerging diseases, however, other serious issues that may affect both animal and human health are within the organization’s scope.

Groups within the network function independently and are connected by stable linkages that enable discussion of current activities and the identification of gaps in the current surveillance systems. A major focus for the CAHSS is to determine what can be accomplished collectively, that the individual groups cannot do alone.

Several working groups have been initiated within the CAHSS. The communications group has developed a website where network members can have both a public face, and an area for the sharing of private working group materials. This site will function as a central location for information sharing, and to help identify contacts for each part of the network. Another group has been established to identify the key attributes of a surveillance data system. Since many surveillance activities are underway across Canada, the power of the data can be increased to everyone’s benefit if the data collected becomes more standardized. The first network groups for the swine and poultry sectors have been created, and each has begun to identify their common goals and needs within the network.

New groups are encouraged to join and/or self-organize. These groups can be temporary or permanent dependent upon the sector needs. The networks will function most effectively through the creation of relationships, when people are able to connect easily with others in a manner that results in trust between the partners.

Please visit the website (www.cahss.ca) for further information on the CAHSS and progress on its development.

(by Dr. Andrea Osborn, Dr. Cheryl James, Dr. Grant Maxie, Dr. Chris Byra, and Dr. Betty Althouse)
CVMA Green Veterinary Practice: Waste Management

The Canadian Veterinary Medical Association’s (CVMA) Green Veterinary Practice initiative is a web-based resource that offers many tips on how to make your veterinary practice more environmentally friendly. Consider these tips for waste management:

• Install waste receptacles that have separate compartments for non-recyclable garbage, recyclables and compost. It is essential that all mercury containing products and light bulbs (CFLs, for example) are disposed of properly. Most often hardware stores or local waste collection agencies have specific collections in place to deal with mercury containing materials. If you are unsure whether materials in your clinic contain mercury, please consult the following website for more information (www.epa.gov/mercury/mgmt_options.html).

• Consider auditing your clinic’s plastic medical supply waste to determine what can be recycled in your municipality. Often this is determined by the plastic identification code (PIC) that appears on the packaging. Example:

- Consult your municipality to confirm what PIC plastics can be recycled. Keep in mind some biomedical waste cannot be recycled and must be disposed of using appropriate biomedical waste disposal services.

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

Pratique vétérinaire écoresponsable de l’ACMV : Gestion des déchets

L’initiative d’une Pratique vétérinaire écoresponsable de l’Association canadienne des médecins vétérinaires (ACMV) est une ressource Web qui offre de nombreux conseils pour une pratique vétérinaire plus respectueuse de l’environnement. Considérez les conseils suivants pour la gestion des déchets :

• Installez des poubelles qui sont dotées de compartiments séparés pour les déchets non recyclables, les déchets recyclables et le compost. Il est essentiel que tous les produits et les ampoules contenant du mercure (les lampes fluocompactes, par exemple) soient mis au rebut de manière appropriée. La plupart des quincailleries ou des agences de collecte des déchets locales offrent des collectes spéciales pour les matériaux contenant du mercure. En cas d’incertitude relativement à la présence de mercure dans les matériaux de votre clinique, veuillez consulter le site Web suivant pour de plus amples détails : http://www.epa.gov/mercury/mgmt_options.html.

• Envisagez la réalisation d’une vérification des déchets des fournitures médicales de plastique de votre clinique afin de déterminer ce qui peut être recyclé par votre municipalité. Souvent, ces options sont déterminées par le code d’identification plastique (CIP) qui figure sur l’emballage. Par exemple :

- Consultez votre municipalité pour confirmer les plastiques CIP qui peuvent être recyclés. N’oubliez pas que certains déchets biomédicaux ne peuvent pas être recyclés et doivent être éliminés en utilisant des services d’élimination des déchets biomédicaux.

Visitez la section Pratique et finances du site Web de l’ACMV (www.veterinairesaucanada.net) afin d’accéder à l’initiative d’une Pratique vétérinaire écoresponsable.

Have you been checking your e-mail inbox?

The Canadian Veterinary Medical Association (CVMA) communicates time-sensitive and relevant information and news to its members by e-mail based on the addresses we have on record in our database. If you are not receiving e-mail communication from us, it may be that we do not have a valid e-mail address for you.

Review/update your contact information and stay connected!

Also, ensure that you add us (notify@cvma-acmv.org) to your safe sender’s list so that our messages do not get blocked.

Online

Log on at www.canadianveterinarians.net and view your contact information. You can make changes directly online.

Contact CVMA

By e-mail at admin@cvma-acmv.org or by telephone at 1.800.567.2862. We will confirm the e-mail address we currently have for you and make any necessary changes.


Around the Provinces

Saskatchewan Veterinary Medical Association (SVMA)

Greetings from the beautiful province of Saskatchewan! Things at the SVMA office have been busy this year with the implementing of the new process for registered veterinary technician (RVT) registration. We are working toward our role of improved oversight of our VTs. The Saskatchewan Association of Veterinary Technologists and the SVMA are jointly working on the organization’s respective bylaws to ensure alignment. Dr. Judy Currie continues her role as a very capable registrar. We have also added an additional staff member to assist with the ever-increasing work load. Dr. Betty Althouse continues as our provincial veterinarian, and has done an excellent job for the profession.

The global issue of antimicrobial resistance (AMR) will not soon disappear and it is prudent that we as veterinarians do our part contributing to discussions with government and industry stakeholders, do our best to follow the updated Dispensing Manual for Veterinarians, and keep up with continuing education (CE) in this area. Now that the SVMA has made one hour of continuing education on AMR mandatory, we have created an excellent one-hour educational video on this subject that is available to all our members on our website, followed by a short quiz to get CE.

Another by-law change is that up to 5 hours of acceptable CE can now be non-scientific. At meetings with other VMAs, it was found that in all provinces, most complaints that ended up going through the discipline process had resulted either from inadequate communication between the veterinarian and the client or from errors in medical recordkeeping. So allowing our members to get credit for some training in these problem areas makes sense.

The continually declining number of bovine spongiform encephalopathy (BSE) submissions has been an ongoing concern of the SVMA Council. By chronically failing to meet our submission requirements, the future of the entire Canadian beef industry and its export markets is very much at risk. The SVMA conducted a member survey on various aspects of BSE sampling to determine the root cause of our declining submission numbers. The survey results indicate that the biggest factors for declining submission numbers are that veterinarians are not being adequately compensated for mileage or their time to collect samples. Council is currently lobbying the Canadian Food Inspection Agency for more compensation for both the veterinarians and producers and to have mileage paid.

Le tour des provinces

Saskatchewan Veterinary Medical Association (SVMA)


La question mondiale de l’antibiorésistance ne disparaîtra pas de sitôt et il est prudent que nous, à titre de médecins vétérinaires, fassions notre part pour contribuer aux discussions avec les gouvernements et les intervenants de l’industrie, que nous fassions de notre mieux pour respecter la version révisée du Dispensing Manual for Veterinarians et que nous tenions notre formation continue à jour dans ce domaine. Maintenant que la SVMA a déterminé qu’il était obligatoire de suivre une heure de formation continue sur l’antibiorésistance, nous avons créé une excellente vidéo éducative d’une heure sur ce sujet qui est offerte à tous nos membres sur notre site Web et est suivie d’un court test pour obtenir les crédits de formation continue.

Les règlements ont aussi été modifiés afin de stipuler que jusqu’à cinq heures de formation continue peuvent maintenant être de nature non scientifique. Lors des réunions avec d’autres AMV, on a constaté que, dans toutes les provinces, la plupart des plaintes déposées par le biais du processus disciplinaire découlaient soit d’une communication inadéquate entre le vétérinaire et le client ou d’erreurs dans la tenue des dossiers médicaux. Il était donc logique de permettre à nos membres d’obtenir des crédits pour une formation obtenue dans ces domaines problématiques.

Le nombre continuellement en déclin des soumissions d’encéphalopathie spongiforme bovine (ESB) a représenté l’une des préoccupations du Conseil de la SVMA. En raison du non-respect chronique des exigences de soumission, l’avenir de l’ensemble de l’industrie canadienne du boeuf et de son marché d’exportation est mis en péril. La SVMA a réalisé un sondage auprès des membres sur divers aspects de l’échantillonnage de l’ESB afin de déterminer la cause profonde de la chute du nombre de nos soumissions. Les résultats du sondage indiquent que le facteur le plus important en lien avec la chute du nombre de soumissions est sa rémunération insuffisante des vétérinaires pour le kilométrage ou le temps requis pour prélever les échantillons. Le Conseil exerce actuellement des pressions auprès de l’Agence canadienne d’inspection des aliments pour augmenter la rémunération des vétérinaires et des producteurs ainsi qu’ajouter le paiement d’une indemnité pour le kilométrage.

À titre de profession auto-réglementée, nous pouvons être rassurés que les normes de pratique ne seront pas supprimées de
As a self-regulated profession, we can rest assured that practice standards are not going away any time soon. They play an important role in the protection of the public and also in the protection of our profession’s reputation in the eyes of the public. SVMA council initiated a member’s survey to give members the opportunity to voice their opinions after they have gone through the inspection process. We will see what conclusions are reached. This will determine if any adjustments to the process are warranted.

Wellness issues in our profession have become a much more open topic. The SVMA is trying to address these issues by offering confidential personal counselling services to members who require such assistance. We are also getting in more keynote speakers who openly discuss issues such as compassion fatigue, burnout, suicide, veterinary happiness and thriving during times of change and cross cultural communication. These are issues that affect all veterinary health care professionals.

Mentorship is an important part of veterinary practice. Whether in the form of student guidance, transition to practice, or colleague support, mentorship plays a key role. In partnership with the Saskatchewan Ministry of Agriculture, the SVMA is pleased to once again offer the summer mentorship program to Saskatchewan veterinary students. This annual summer placement initiative provides wage subsidy for student employment in large and mixed animal practices in Saskatchewan. The SVMA is also continuing its involvement with the WCVM Mentorship Review Committee in its efforts to identify opportunities to apply and strengthen mentorship initiatives. By teaching veterinary students how to be mentored as well as helping practicing veterinarians become better mentors, our hope is that this will result in better experiences for both parties when a new grad joins a practice!

(by Dr. Debbie Hupka-Butz, President, Saskatchewan Veterinary Medical Association)

Around the Provinces is a regular news feature in The Canadian Veterinary Journal designed to inform Canadian veterinarians about the work of provincial veterinary associations across Canada. We invite the provincial presidents of these associations to report on the activities and issues being addressed by their respective organizations. We thank Dr. Debbie Hupka-Butz for her article in this issue. CVJ eds.

Le tour des provinces est une chronique régulièrement publiée dans La Revue vétérinaire canadienne afin d’informer les vétérinaires du Canada sur le travail des associations vétérinaires provinciales. Nous invitons les présidents de ces associations à nous faire part des activités et des enjeux de leurs organismes respectifs. Nous tenons à remercier Dʳ Debbie Hupka-Butz pour son article. Les rédacteurs de la RVC.
Obituary

Brian Derbyshire

John Brian Derbyshire passed away in Burlington, Ontario, on July 16 after a brief illness. Brian was awarded his veterinary degree in 1955 and his PhD in 1960, both from The Royal Veterinary College, University of London. He worked at the Agricultural Research Council Institute for Research on Animal Diseases in Compton, England, and carried out investigations on immunity in staphylococcal mastitis as well as on porcine adenoviruses and enteroviruses. He quickly rose to the position of Principal Scientific Officer at Compton. When he came to the OVC in 1971, he continued to work on a range of animal viruses and he soon achieved acclaim for his contributions to the field of animal virology. Brian always acknowledged the important role graduate students played in his research program and he and his wife Ishbel developed close and caring relationships with them.

Brian's achievements were recognized nationally and internationally. He served as President of the Conference of Research Workers in Animal Diseases (CRWAD) in 1980. In 1998, CRWAD dedicated its annual meeting to Brian, in recognition of his having been one of the pillars of the animal diseases research community. The World Health Organization tapped into his expertise and he was invited to be a member of the board of the WHO/FAO program on Comparative Virology. The Natural Sciences and Engineering Research Council also recognized his accomplishments and called on him to serve on grant selection committees — there his profound knowledge and sound judgment served the scientific community well. He was editor of the Canadian Journal of Veterinary Research, scientific editor of the Journal Research in Veterinary Science, and a member of the editorial boards of Veterinary Microbiology and Veterinary Bulletin.

Brian was a brilliant academic with a gift for clear, deep thinking and an exceptional ability to communicate. His ability to formulate probing questions on a wide range of topics and to provide a humorous context in which to ask the question are legendary and will not soon be forgotten by the large number of graduate students, staff, and faculty who had the privilege of learning from these questions.

Brian was an exceptional teacher in both veterinary virology and veterinary history. Veterinary students marveled that a course in history could be made exciting. Brian took the time to get to know the DVM students; he cared deeply about them — and they loved him. He was a winner of both the OVC’s Norden Award for teaching Excellence in 1976 and the University of Guelph Faculty Association Distinguished Professorial Teaching award in 1993.

Brian was also an outstanding administrator and leader at the University of Guelph. He chaired the Department of Veterinary Microbiology and Immunology for a 5-year term, he was acting dean of Graduate Studies for the university, and he served on the Board of Governors. He was fair, wise, and decisive; he was fearless, outspoken, principled, and ardently supported what he felt was right.

Brian retired in 1995 but continued to be very active in the life of the college and as a researcher and publisher in the field of animal viruses.

Nécrologie

Brian Derbyshire

John Brian Derbyshire est décédé le 16 juillet à Burlington, en Ontario, après une courte maladie. Brian a obtenu son diplôme de médecine vétérinaire en 1955 et son Ph.D. en 1960, tous deux au Royal Veterinary College de l’Université de Londres. Il a travaillé à l’Agricultural Research Council Institute for Research on Animal Diseases à Compton, en Angleterre, et a effectué de la recherche sur l’immunité pour les mammifères à staphylocoques ainsi que sur les adénovirus et enterovirus porcins. Il a rapidement été promu au poste de chercheur scientifique principal à Compton. Lorsqu’il est arrivé à l’OVC en 1971, il a continué de travailler à un vaste éventail de virus animaux et il a bientôt été acclamé pour ses contributions au domaine de la virologie animale. Brian a toujours reconnu le rôle important des étudiants des cycles supérieurs dans son programme de recherche et lui et sa femme Ishbel ont développé des relations étroites et profondes avec eux.

Les réalisations de Brian ont été reconnues à l’échelle nationale et internationale. Il a été président de la Conference of Research Workers in Animal Diseases (CRWAD) en 1980. En 1998, la CRWAD a dédié sa réunion annuelle à Brian afin de reconnaître qu’il avait été l’un des piliers de la collectivité de la recherche sur les maladies animales. L’Organisation mondiale de la santé a eu recours à son expertise et il a été invité à titre de membre du conseil du programme l’OMS-FAO en virologie comparée. De plus, le Conseil de recherches en sciences naturelles et en génie a reconnu ses réalisations et lui a demandé de siéger à des comités de sélection des subventions — où ses vastes connaissances et son jugement sûr ont bien servi la collectivité scientifique. Par ailleurs, il a été rédacteur en chef de la Revue canadienne de recherche vétérinaire, rédacteur scientifique la revue Research in Veterinary Science et membre des comités éditoriaux de Veterinary Microbiology et de Veterinary Bulletin.

Brian était un universitaire brillant qui possédait le don d’une pensée claire et perspicace ainsi qu’une aptitude exceptionnelle pour la communication. Ses capacités de formulation des questions d’approfondissement sur un vaste éventail de sujets ainsi que de présentation d’un contexte humoristique où poser ces questions sont légendaires et elles ne seront pas oubliées de si tôt par le grand nombre d’étudiants des cycles supérieurs, d’employés et de professeurs qui ont eu le privilège d’apprendre de ces questions.


Brian était aussi un administrateur et un leader exceptionnel à l’Université de Guelph. Il a été directeur du Département de microbiologie et d’immunologie vétérinaire pendant un mandat de cinq ans, il a été doyen des Études supérieures par intérim de l’université et il a siégé au Conseil des gouverneurs. Il était juste, sage et décisif. C’était aussi un homme de principes qui était téméraire et parlait franc tout en luttant pour ce qui, selon lui, était juste.
Brian a pris sa retraite en 1995 mais il a continué d’être très actif dans la vie de l’OVC et en tant que chercheur et éditeur sur l’histoire de la médecine vétérinaire. En 2012, dans le cadre des célébrations du 150e anniversaire de l’OVC, Brian a organisé avec succès un programme d’une journée sur l’histoire de la médecine vétérinaire, qui était commandité conjointement par l’OVC et l’American Veterinary Medical History Society. Brian a aussi rédigé plusieurs articles impressionnants sur l’histoire de la médecine vétérinaire canadienne.

Brian était admiré non seulement pour son intellect mais aussi pour l’exemple qu’il a donné tout au long de sa vie. Les collègues et les amis se souviennent d’un homme qui était doux, attentionné et compatissant. Un homme qui aimait sa pipe, était dévoué à Manchester United, marchait pour le plaisir et avait beaucoup d’esprit. Un homme qui vivait une vie bien équilibrée. La virologie représentait le cœur de son travail, mais le centre de son univers était sa famille. Brian est survécu par sa femme de 61 ans, Ishbel, sa fille Jane (Joe), son fils John (Carol), et sa petite-fille Heather ainsi que de la famille au Royaume-Uni.
Hypertrophic osteopathy (HO, Marie’s Disease, hypertrophic pulmonary osteoarthropathy) is a syndrome characterized by symmetrical palisading to solid proliferation of periosteal bone and connective tissue. This typically occurs along the diaphyses and metaphyses of long bones, although there have been reports of mandibular and maxillary involvement (1). In the horse, HO is a rare condition occurring most often secondary to space-occupying lesions in the thorax (1,2), but extrathoracic disease such as ovarian neoplasia (3,4), pituitary adenoma (5), and gastric squamous cell carcinoma (6) have been reported to cause HO.

Although the pathogenesis of HO is unclear, the initial process appears to involve increased blood flow to the distal limbs leading to proliferation of connective tissue (7). The neural theory suggests that afferent impulses from the lungs travel via the vagus nerve to the brainstem resulting in reflex vasodilation in the limbs (2). Other proposed mechanisms include increased estrogen levels (8), increased growth hormone (9), and most recently a role for vascular endothelial growth factor (VEGF) and platelet derived growth factor (PDGF) (10,11).

Granulosa theca cell (GTC) tumors are the most common ovarian neoplasm found in the mare, but other tumors such as teratoma, melanoma, epithelioma, cystadenoma, adenocarcinoma, dysgerminoma, hemangioma, and hemoblastoma have also been identified (12–15). Ovarian adenocarcinomas are rare in horses but have been reported in dogs, cats, and cattle (12,16). Metastasis of most ovarian tumors is rare, but when it occurs, tumors of non-stromal origin are more likely to have distant metastases via hematogenous and/or lymphatic spread (12,17). There has been 1 report of papillary adenocarcinoma of the ovary with metastases to the sublumbar, tracheobronchial lymph nodes, and mediastinum in the mare (18). Although there are several reports of ovarian disease leading to HO in the mare (2,3,19), there is only 1 in which ovarian carcinoma with local metastasis is described (4).

Treatment of HO is typically aimed at removing the underlying cause, but this may not always be possible. In previously reported cases of HO in the horse, medical treatment of inflammatory and infectious conditions resulted in complete resolution of clinical and radiographic signs (1,2,19,20).

Although ovarian disease has been associated with HO in horses, to the authors’ knowledge, there are no reports of distant metastases from a rare ovarian tumor leading to severe HO in the horse.

Case description

A 315-kg, 10-year-old Andalusian mare was presented to the Virginia-Maryland Regional College of Veterinary Medicine (VMRCVM) for evaluation of a 6-month history of weight loss, increasing periods of recumbency, and swelling of the distal aspect of all 4 limbs.

On admission, the mare was quiet, alert, and responsive with a body condition score (BCS) of 2/9. Rectal temperature was 39.3°C, heart rate was 72 beats/min, and respiratory rate was 24 breaths/min. A grade 1/5 systolic heart murmur was ausculted over the left heart base. The mare was reluctant to stand for prolonged periods. Bilaterally symmetrical, hard nonpainful swellings were palpated around the metacarpophalangeal joints,
metatarsophalangeal joints, tarsometatarsal joints, and both distal radiuses. Joint effusion was present in the tibiotarsal and radiocarpal joints.

Clinically significant hematologic abnormalities included normocytic, hypochromic anemia (red blood cell count (RBC) 5.6 × 10⁶ cells/μL, reference range (RR): 6.8 to 12.9 × 10⁶ cells/μL; hemoglobin (HGB) 81 g/L, RR: 110 to 190 g/L; and mean corpuscular hemoglobin (MCH) 14.3 pg, RR: 14.5 to 19.0 pg), and leukocytosis (14.3 × 10³ cells/μL, RR: 5.4 to 14.3 × 10³ cells/μL) characterized by a neutrophilia (12.4 × 10³ cells/μL, RR: 2.4 to 6.4 × 10³ cells/μL), lymphopenia (1.2 × 10³ cells/μL, RR: 2.1 to 5.9 × 10³ cells/μL) and monocytosis (0.5 × 10³ cells/μL, RR: 0 to 0.4 × 10³ cells/μL) Hyperfibrinogenemia (20.6 μmol/L, RR: 2.9 to 11.8 μmol/L) was also noted. Serum biochemical evaluation revealed hypoproteinemia (21 g/L, RR: 32 to 40 g/L) and hyperglobulinemia (52 g/L, RR: 23 to 41 g/L).

Standing lateral, dorsopalmar, and dorsolateral-palmaromedial oblique radiographic views of the left tarsus and right carpus revealed severe intracapsular and extracapsular soft tissue swelling. Severe palisading to solid, well-mineralized periosteal reaction was present circumferentially along the distal tibial metaphysis and epiphysis of the left hind limb as well as the distal radius and proximal metacarpals 2, 3, and 4. Patchy periosteal reaction was also evident circumferentially on the tarsal and carpal bones as well as metatarsals 2, 3, and 4. Articular surfaces of the tarsus, radiocarpal, middle, and carpometacarpal joints were not involved and appeared radiographically normal.

Standing dorsopalmar and lateral radiographs of the left metatarsophalangeal joint revealed severe periosteal to solid periosteal new bone formation along the dorsal, medial, and lateral surfaces of the left, third metatarsal and proximal phalanx (Figure 1). Mild periosteal reaction was also present along the dorsal aspect of the second phalanx, the plantar surfaces of the proximal sesamoid bones, and the distal aspects of the third and fourth metatarsals.

Radiographs of the thorax revealed normal cardiovascular and pulmonary structures with a convex soft tissue opacity in the cranial aspect of the mediastinum superimposed over the ventral aspect of the trachea. Ultrasonography of the thorax revealed a mild amount of hypoechoic pleural fluid bilaterally and a moderate amount of pericardial fluid. Mild pleural roughening was noted along the cranioventral aspects of the lungs bilaterally. The mediastinal mass was not observed on ultrasound evaluation.

Ultrasonography of the abdomen revealed a moderate amount of hypoechoic fluid within the peritoneal cavity with normal-appearing gastrointestinal viscera “floating” in the fluid. Examination of the kidneys revealed multiple hypoechoic circular areas within the renal cortex bilaterally and a loss of corticomedullary distinction. Renal pelvies were mildly dilated bilaterally.

Due to the mare’s reluctance to stand, no further diagnostics were performed. A presumptive diagnosis of HO was made based on clinical signs and radiographs. Although thoracic or abdominal neoplasia was suspected to be the cause of the HO in this case, other differential diagnoses included granulomatous disease or abscessation in the thorax or abdomen. Although there are reports of regression of HO after treatment of underlying disease (1,21,22), due to the severity of clinical signs, radiographic changes and unfavorable prognosis, the mare was euthanized.

At necropsy, multiple abnormalities were noted. There was a mildly increased amount of translucent serous fluid in the thoracic cavity, pericardial space, and peritoneal cavity. A spherical mass displacing all normal ovarian tissue was present in the location of the left ovary. It was 24.0 cm in diameter, and weighed 5.0 kg. On cut surface, the mass was mottled red and yellow, with variably-sized blood-filled cavities and multifocal regions of mineralization. The right ovary was small, with no observable follicular activity. A 14 cm × 10 cm × 5 cm, irregularly lobulated, firm mass was adhered to the first rib on the right side; a fibrous adhesion extended from the mass to the diaphragm and right cranial lung lobe. On cut surface, this irregular mass was yellow-tan in color. A separate irregular mass was adhered to the ventral surface of the caudal lumbar vertebral bodies, proximal to the root of the mesentery. This mass was 47 cm × 14 cm × 6.0 cm, nodular, and mottled yellow and white on cut section. The inguinal and mesenteric lymph nodes were enlarged and edematous. There were notable abnormal bony proliferations on the long bones as well as bilaterally on the frontal bones of the skull.

Representative sections of the masses and grossly abnormal tissues were fixed in 10% neutral buffered formalin and processed routinely for histopathology. The mass associated with the left ovary was effaced by dense, fibrous connective tissue surrounding a moderately cellular neoplasm composed of epithelial...
cells. The epithelial cells were arranged in dysplastic tubules, islands, and cords separated by abundant dense, fibrous connective tissue with large regions of hemorrhage and hematoidin, hemosiderin, and melanin-laden macrophages. Surrounding the neoplastic tubules was a pronounced desmoplastic response with large regions of myxomatous matrix. Neoplastic cells had indistinct borders, moderate amounts of bright eosinophilic cytoplasm, and centrally located round-oval vesicular, basophilic nuclei (Figure 2). Neoplastic cells exhibited moderate anisocytosis and anisokaryosis with a mitotic index of 1 to 2 mitotic figures per 40× magnified field. Metaplastic cartilage and bone (mineralized osteoid) were present within the mass. The thoracic and sublumbar masses were composed of dense fibrous connective tissue surrounding neoplastic cords, islands and tubules similar to those described in the ovarian mass. The mesenteric and inguinal lymph nodes were infiltrated by large islands, cords and tubules of neoplastic epithelial cells similar to those seen extending from the ovary. There was an abundant amount of pale basophilic myxomatous matrix with occasional small, central areas of mineralization present within the neoplastic tubules. Most of the neoplastic cells stained positively for cytokeratin AE1/AE3 and negatively with inhibin and vimentin (Figure 3). This staining pattern is characteristic of adenocarcinoma and distinguishes this tumor from more common ovarian tumors such as granulosa theca cell tumors.

On the basis of gross, histological, and immunohistochemical evaluation, the neoplasm was identified as a poorly differentiated adenocarcinoma of ovarian origin, with metastases to thoracic and abdominal lymph nodes.

Discussion
This report documents a case of metastatic ovarian adenocarcinoma resulting in secondary HO in a mare. Malignant adenocarcinoma of ovarian origin is extremely rare (12). Diagnosis of the malignancy was based on the presence of gross lesions, characteristic histopathological findings and characteristic staining patterns. Hematologic abnormalities were consistent with inflammation or secondary to an underlying disease process.

Although the pathophysiology of hypertrophic osteopathy remains unclear, a primary lesion in the abdomen or thorax of animals is typically the underlying cause. Lesions related to HO in dogs most commonly affect the metacarpi and metatarsi followed by the distal and proximal long bones (21); this is a similar finding in horses (2). In dogs, HO is typically found as a paraneoplastic syndrome secondary to intrathoracic disease, and most commonly, primary or secondary neoplasia (21,23).

In humans, primary lung cancer, squamous cell carcinoma, adenocarcinoma, and large cell neoplasia have been associated with secondary HO (24,25) with up to 5% of adults with lung cancer demonstrating signs of HO (26). In the horse, most cases are secondary to intrathoracic disease including pleuritis, pulmonary abscesses, granulomatous disease, or equine multinodular pulmonary fibrosis, but there are also many case reports of extra-thoracic disease alone leading to HO (1,2,4,19,27,28).

There are multiple theories to explain the development of the characteristic periosteal lesions seen with HO. The neural theory is supported by successful reports of HO regression following vagotomy (7,23,22,29). Holling et al (25) showed that local anesthesia of the vagus in dogs with HO can result in decreased blood flow to the limbs. This theory was also elucidated by Flavell (29) when thoracic vagotomy was used to treat a man with HO secondary to a lung tumor and then again in 1962, when distal cervical vagotomy was used to eliminate HO in a man with bronchial carcinoma (22). Vagal fibers located in peripheral lung tissue synapse in the medullary cavity of long bones, where the release of a neuropeptide may act directly.
on the periosteum or its blood supply (24,30). Intra-thoracic disease may result in the formation of afferent impulses that result in vasodilation via parasympathetic stimulation (19,24).

More recently, cytokine expression has been implicated in the initial hyperemia leading to periosteal proliferation. Platelet-derived growth factor (PDGF) and vascular endothelial growth factor (VEGF) were elevated in cases of HO as a result of the lack of inactivation of megakaryocytes in the pulmonary circulation as well as in response to local tissue hypoxia (10,11). Platelet aggregation in the digital vasculature leads to the release of PDGF, which can then act locally to increase angiogenesis and stimulate VEGF release (10,11). These studies also showed that VEGF acts not only as a potent angiogenic stimulus, but also to induce new bone formation (10). More recent studies have shown an increase in VEGF and PDGF in humans with bronchogenic carcinoma and fibrosing alveolitis and secondary HO concurrent with local tissue hypoxia and thus have been implicated in the pathogenesis (11).

Although granulosa theca cell tumors are the most common equine ovarian neoplasm (13,14), ovarian adenocarcinomas have been diagnosed in horses, dogs, cats, and cattle. Metastatic ovarian tumors are rare in horses, but have been reported (4,12,31). Local intraperitoneal metastasis is more common with distant metastases to the liver, lung, and pleura present in only 8% of human patients (17,18,32). In the previously described report of mild HO secondary to ovarian carcinoma, there was no evidence of metastasis at the time of initial presentation; however, almost 8 mo later, the mare had local metastases within the abdominal cavity (4). Despite the relative frequency of granulosa cell tumors in horses, the percentage of horses that develop HO secondary to a granulosa theca cell tumor appears to be quite low (13,14,33). Therefore it is uncertain in this case whether the presence of intra-thoracic metastases or the presence of an ovarian mass led to the development of HO. Due to the presence of an intra-thoracic lesion, it is possible that neural involvement played an important role in the development of clinical signs; however, local tissue hypoxia and resultant elevations in cytokine levels could have played a role. The pathogenesis of HO remains unclear in the mare in this report.

Various tumors, including carcinomas, in humans and animals have been described to secrete a parathyroid hormone-related peptide (PTHrP) which acts similar to parathyroid hormone (PTH) to activate osteoclasts (34,35). Elevations in PTH or PTHrP are associated with hypercalcemia and increased serum alkaline phosphatase (ALP) activity thus alerting to the potential presence of a tumor. Some authors have noted that some cases of HO are associated with elevations in serum ALP activity likely due to increased osteoclast activity (5,20). In 1 case report describing hypertrophic osteopathy in a mare with ovarian adenocarcinoma, PTH was normal (4). In the present report, both plasma calcium and ALP levels were normal and therefore further testing was not performed.

In summary, there are few reports of metastatic ovarian neoplasia resulting in hypertrophic osteopathy (HO) in horses. Ovarian tumors are one of the more common extra-thoracic diseases to result in secondary HO in horses, and it is important to recognize the metastatic potential of some ovarian tumors. Histopathologic and biochemical analyses of tumors should be used to determine malignancy in ovarian tumors, and HO should be considered as a sequela to any malignant ovarian tumor.

Acknowledgment

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References

Ureteral obstruction secondary to disseminated penicilliosis in a German shepherd dog

Michelle M. Acierno, Christopher P. Ober, Brad A. Goupil, Erik J. Olson

Abstract — Abdominal ultrasonographic evaluation of a 2-year-old male German shepherd dog evaluated for weight loss demonstrated a right ureteral mass with ipsilateral hydronephrosis, hypoechoic splenic nodules, and hypoechoic and rounded lymph nodes. A fungal mat extending from the renal pelvis into the ureter secondary to disseminated *Penicillium* was confirmed at necropsy.

Résumé — Obstruction urétérale secondaire à une infection disséminée à *Penicillium* chez un chien Berger allemand. L'évaluation abdominale par échographie d'un chien Berger allemand mâle âgé de 2 ans qui était évalué pour une perte de poids a révélé une masse urétrale droite avec de l'hydronephrose ipsilatérale, des nodules spléniques hypoéchogènes et des ganglions lymphatiques arrondis et hypéchochogènes. Une masse fongique s'étendant du pelvis rénal jusqu'à l'urètre secondaire à une infection disséminée à *Penicillium* a été confirmée à la nécropsie.

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Case description

A 2-year-old intact male German shepherd dog was presented to the University of Minnesota Veterinary Medical Center for evaluation of anorexia, weight loss, and lethargy. The patient had lost 4.5 kg in a 2-month period and became acutely lethargic and anorexic during the previous week. Physical examination revealed a body condition score of 2/9 with diffuse, minimal loss of muscle mass. No other physical abnormalities were detected.

Multiple radiographs had been taken and a minimum database was on record with the referring veterinarian. Pelvic radiographs obtained 3 and 2 months earlier were within normal limits. Thoracic radiographs obtained a month earlier revealed vertebral endplate lysis at T6-7, suggestive of discospondylitis. The cardiovascular, pulmonary, mediastinal, and pleural structures were within normal limits radiographically. Blood analysis performed 2 d earlier showed a mild lymphocytosis [4.54 × 10^9 cells/L; RR: 0.69 to 4.50 × 10^9 cells/L], monocytosis (1.13 × 10^9 cells/L; RR: 0 to 0.84 × 10^9 cells/L), eosinophilia (1.46 × 10^9 cells/L; RR: 0 to 1.2 × 10^9 cells/L), hyperglobulinemia (43 g/L; RR 16 to 36 g/L), and azotemia [blood urea nitrogen (BUN) 16.78 mmol/L; RR: 2.14 to 11.07 mmol/L, creatinine 150.28 µmol/L; RR: 44.20 to 141.44 µmol/L]. Urine dipstick revealed trace protein and 1+ occult blood. Urine sediment evaluation showed mild hematuria (4 to 10 red blood cells/HPF; RR: 0 to 3/HPF), calcium oxalate dihydrate crystals (21 to 50/HPF), and spermatozoa. Urine specific gravity was 1.028.

Initial diagnostics consisted of serial routine bloodwork, urine specific gravity, gastrointestinal panel, and adrenal function testing. A complete blood (cell) count (CBC) showed persistent lymphocytosis (3.39 × 10^9 cells/L; RR: 0.78 to 3.36 × 10^9 cells/L), monocytosis (1.22 × 10^9 cells/L; RR: 0 to 1.2 × 10^9 cells/L), and eosinophilia (1.49 × 10^9 cells/L; RR: 0 to 1.2 × 10^9 cells/L). Serum chemistry revealed moderately progressive azotemia (BUN 16.42 mmol/L; RR: 3.21 to 11.07 mmol/L, creatinine 229.84 µmol/L; RR: 53.04 to 141.44 µmol/L), hypercalcemia (3.43 mmol/L; RR: 2.33 to 2.88 mmol/L), hyperproteinemia (70 g/L; RR: 50 to 69 g/L), hyperglobulinemia (43 g/L; RR 16 to 36 g/L), and elevated alanine aminotransferase (111 U/L; RR: 22 to 92 U/L). Fasting cobalamin, folate, and trypsin-like immunoreactivity were within normal limits.

An abdominal ultrasonographic examination was performed by a board-certified veterinary radiologist using an 8 MHz transducer (GE Logiq 9; GE Medical Systems, Milwaukee, Wisconsin, USA) 12 d after initial presentation when a cause for the clinical signs remained elusive. The right renal pelvis...
was severely dilated and only a thin rim of normal parenchyma remained in the right kidney. The proximal right ureter was severely distended to a diameter of 1.4 cm. An irregular, ovoid mass measuring 1.8 cm × 0.8 cm × 0.8 cm was present midway along the length of the right ureter (Figure 1). It could not be determined if the mass originated from the ureteral wall or if it was intraluminal material adherent to the ureteral wall. No blood flow signal was detected in the lesion using Color Doppler ultrasound. Distal to the mass, the right ureter tapered to normal and could not be visualized from the level of the mass to the urinary bladder. The left renal cortex was moderately hyperechoic, but the left kidney was otherwise normal.

The spleen was diffusely mildly enlarged. The parenchyma appeared coarse with multiple ill-defined hypoechogenic patches and several variably sized hypoechogenic nodules. Both medial iliac, multiple mesenteric, and multiple gastric lymph nodes were moderately enlarged, hypoechogenic, and rounded.

The imaging findings were consistent with either a multicentric neoplasia or a systemic infectious process. Differentials for the ureteral mass included neoplasia (such as transitional cell carcinoma), pyogranulomatous disease, or less likely an adherent blood clot. The splenic and lymph node changes were also suggestive of multicentric neoplasia or systemic infection. There was no blood flow signal detected in the lesion using Color Doppler ultrasound. Distal to the mass, the right ureter tapered to normal and could not be visualized from the level of the mass to the urinary bladder. The left renal cortex was moderately hyperechoic, but the left kidney was otherwise normal.

Macroscopically, the left kidney was normal, while the right kidney had a severely dilated pelvis with only a 1- to 3-cm rim of normal renal parenchyma remaining (Figure 2). The right renal pelvis contained irregularly shaped, friable, orange and green material that was variably adherent to the pelvic wall. A large plug of this material extended from the renal pelvis into the proximal portion of the markedly dilated right ureter.

The dilated portion of the right ureter measured up to 2 cm in diameter, and at a location approximately 6 cm distal to the renal pelvis, tapered down to a normal diameter (0.2 to 0.4 cm). Attached to the adventitial surface of the dilated portion of the right ureter, but not extending into the ureteral lumen, was a firm, tan and white mass measuring 2.5 cm × 2 cm × 2 cm.

The spleen contained numerous multifocal, firm, beige nodules, measuring up to 0.5 cm in diameter scattered throughout the parenchyma and affecting approximately 15% of the splenic surface area. Both perihilar and numerous perigastric and peripancreatic lymph nodes were markedly enlarged. These lymph nodes were mottled white to tan and contained multifocal, firm, round nodules measuring 0.1 to 1.5 cm in diameter.

Microscopically, the nodules in the spleen and lymph nodes consisted of multifocal to coalescing, well-demarcated, variably encapsulated, round to oval granulomas, composed of a central region of eosinophilic cellular and karyorrhectic debris (necrosis), surrounded by a band of vacuolated macrophages, few neutrophils, lymphocytes, and multinucleated giant cells, and moderate numbers of plasma cells. The granulomas were surrounded by variably dense fibrous connective tissue capsules. Similar granulomas were scattered throughout the lungs, liver, right kidney, thyroid gland, femoral diaphyseal bone marrow, and thoracic vertebrae. Rarely, the centers of the granulomas contained 2- to 4-μm diameter, rectangular, negative staining fungal hyphae. The granulomas contained numerous argyrophilic (by Grocott’s methenamine silver) and Periodic acid-Schiff positive, dichotomously branching, 2- to 4-μm diameter, septate

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**Figure 1.** A — Longitudinal ultrasonographic image of the proximal right ureter demonstrating severe dilation. A portion of the right kidney has severe pelvic dilation. B — Longitudinal ultrasonographic image of the right ureter roughly midway between the kidney and bladder. Within the lumen of the ureter an amorphous, echogenic mass is present with associated dilation of the ureter proximally, indicating obstructive disease.
fungal hyphae with thin, parallel walls, and occasional bulbous dilations. The material observed within the right renal pelvis and right ureter consisted of large numbers of fungal hyphae as well (Figure 3).

Samples from the spleen and periureteral mass were submitted for fungal culture. There was no significant growth from the spleen, but the right periureteral sample grew *Penicillium* species. Based on the histological findings and fungal culture, the diagnosis was disseminated penicilliosis. The severe right-sided hydronephrosis was the result of obstruction by a fungal mat.

**Discussion**

*Penicillium* is a saprophytic fungus that is ubiquitous in the environment, found in the soil, seeds, grain, and decaying vegetation. Traditionally, along with *Aspergillus*, *Penicillium* is thought of as an opportunistic pathogen (*P. marneffei* being the exception) (1,2). Therefore, clinical cases in humans and animals typically involve immunosuppressed patients. Human patients who have been treated with steroids or chemotherapeutics, or have immunosuppressive diseases (such as AIDS), are at an increased risk for fungal disease, and the incidence of fungal disease has increased in parallel with the rise of immunocompromised humans (1,3). In animals, immunosuppression can arise from treatment with steroids or chemotherapeutics, persistent neutropenia, diabetes mellitus, chronic infections, and deficiency in cell-mediated immunity (4). Studies in murine models suggest that cell-mediated immunity is important in limiting and preventing clinical fungal disease in healthy individuals (4–8).

Opportunistic fungal disease, whether from aspergillosis or penicilliosis, occurs in a wide variety of anatomic sites, but certain disease profiles are recognized more often in the dog and cat. Due to the fact that fungal spores are easily aerosolized, respiratory disease is common. While pulmonary disease is seen more often in humans, animals tend to present with localized upper airway disease instead, presumably due to the anatomic differences in their nasal cavity (4,9). These sino-nasal and sino-orbital infections are more commonly due to aspergillosis than penicilliosis, and while they can cause extensive local disease, they have not been reported to subsequently spread to other locations. Pulmonary disease without dissemination due to aspergillosis and penicilliosis has been reported in dogs, but is rare (10–14).

A less common presentation of opportunistic fungal infection involves disseminated disease. Disseminated aspergillosis is more common than penicilliosis in dogs, and reports of disseminated penicilliosis are few (15–24). However, it should be noted that differentiation of the 2 fungi requires culture, as they cannot be distinguished on the basis of gross or histologic appearance alone, and some cases of penicilliosis may be missed due to presumptive diagnosis of aspergillosis without culture confirmation (2,4). The pathogenesis of disseminated disease involves aspiration of the fungal spores into the lungs, followed by hematogenous spread. Alternatively, entry via the gastrointestinal tract and subsequent spread to the lymph nodes and then the bloodstream is possible (1). Given that the pathogen spreads hematogenously, common sites of infection are those that also have a high incidence of embolic disease. These include the intervertebral discs, uveal tracts, and renal glomeruli (4).

Disseminated fungal disease is reported in cats, it is more commonly seen in dogs, and specifically the German shepherd dog (4,15–24,26,28). German shepherd dogs are thought to be predisposed to opportunistic infections where cell-mediated immunity is needed to prevent disease, namely rickettsial and fungal disease, and have been shown to have low IgA levels relative to other breeds (4,29–31). While the underlying immune status of the patient in this case is...
unknown, it is important to consider the possibility of diminished immunocompetence in any case of opportunistic fungal infection.

The imaging characteristics of disseminated aspergillosis and penicilliosis have not been extensively described outside of case reports and limited retrospective studies. Radiographs are most often obtained of the spine and thorax, and less commonly the long bones. The most commonly described radiographic changes are productive and destructive bone lesions indicative of discospondylitis and osteomyelitis (15–17,20,24,27). Less frequently described abnormalities include thoracic lymphadenopathy, pleural effusion, pulmonary infiltrates, and cranial mediastinal mass (20).

Abdominal ultrasonographic changes in canine disseminated aspergillosis were reported in 1 retrospective study (20). The most commonly affected organ was the kidney, with evidence of pyelactasia, mottled architecture, reduced corticomedullary distinction, and pelvic and proximal ureteral dilation with echogenic debris. Other abnormalities included hypoechoic splenic nodules, lymphadenopathy, and diffuse hepatic hypoechogeticity (20). Only 1 case study of disseminated penicilliosis in a dog briefly mentioned the abdominal ultrasonographic findings, which involved iliac and abdominal lymphadenomegaly (25).

As mentioned, disseminated penicilliosis is known to affect the kidneys; however, involvement of the ureters in dogs has not been reported. There has been 1 reported case of *Paecilomyces* pyelonephritis in the absence of disseminated systemic disease (32). In that case, sonographic examination showed bilateral pyelactasia, proximal left hydroureter, echogenic debris in the left renal pelvis, and an avascular, echogenic mass within the right renal pelvis. At surgery, bilateral *Paecilomyces* bezoars were present within the renal pelvices, but did not extend into the ureters. In contrast, in the current case, ureteral obstruction was secondary to a fungal mat which extended from the renal pelvis into the proximal ureter. Interestingly, during ultrasonographic examination, there only appeared to be a solitary, intraluminal mass in the proximal ureter that did not involve the renal pelvis. Given the delay between imaging and postmortem examination, it is feasible that the fungal mat either progressed or the proximal portion was too thin to resolve from the ureteral wall ultrasonographically. It is unclear why the fungal mat would have specifically grown mid-ureter, but given that dogs with disseminated disease often shed fungal hyphae into their urine, there is ample opportunity for them to establish in the urinary tract. Interestingly, urine sediment examination did not reveal fungal hyphae despite sonographic evidence that the organism was being shed into the urine. The authors speculate that this may have been due to the early timing of this test relative to clinical disease progression. As the patient’s azotemia had progressed at the time of referral, a repeat examination may have proven diagnostic and allowed more appropriately targeted second-line diagnostics.

In conclusion, this is the first report, to the authors’ knowledge, of ureteral obstruction with a fungal mat secondary to disseminated penicilliosis. In cases with azotemia and the finding of a dilated renal pelvis and proximal ureter with echogenic debris, disseminated fungal infection should be considered. A urine sediment evaluation will help to easily prioritize this on the differential list when fungal hyphae are present. Given the overlapping clinical signs and imaging characteristics of many fungal diseases, penicilliosis should be included an differential despite its rarity.

**Acknowledgments**

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**References**


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Case Report  
Rapport de cas

Magnetic resonance imaging and immunohistochemistry of primary vertebral hemangiosarcoma in a dog and implications for diagnosis and therapy

Claudia Pérez-Martínez, Marta Regueiro-Purriños, Beatriz Fernández-Martínez, José R. Altónaga, José M. Gonzalo-Orden, María J. García-Iglesias

Abstract — A vertebral mass in a dog with an acute onset paraparesis was identified by magnetic resonance imaging. A poorly differentiated hemangiosarcoma was diagnosed by histopathology and immunohistochemistry. Endothelial nitric oxide synthase could be a new differential marker for poorly differentiated hemangiosarcoma in dogs. Immunohistochemical detection of p53 phosphorylated at Serine392, p53, CD117, and CD44 suggest targets for design of therapeutic strategies.

Résumé — Imagerie par résonance magnétique et immunistochimie d’un hémangiosarcome vertébral primaire chez un chien et répercussions pour le diagnostic et le traitement. Une masse vertébrale chez un chien atteint d’une manière soudaine d’une paraparésie a été identifiée à l’aide d’imagerie par résonance magnétique. Un hémangiosarcome mal différencié a été diagnostiqué par histopathologie et immunohistochimie. La synthase à l’oxyde nitrique endothélial pourrait être un nouveau marqueur différentiel pour l’hémangiosarcome mal différencié chez les chiens. La détection immunohistochimique de p53 phosphorylé à la sérine392, p53, CD117 et CD44 suggère des cibles pour la conception de stratégies thérapeutiques.

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Hemangiosarcoma (HSA) is a highly malignant tumor of endothelial cells that can arise in any site with blood vessels. The most common primary sites for this tumor in dogs are the spleen, skin, and subcutaneous tissue and right atrium; primary bone HSAs are uncommon (1). Clinical signs of HSA involving bone include lameness and pain on manipulation of the affected anatomic region; however, they are not pathognomonic for neoplastic disease. Magnetic resonance imaging (MRI) accurately identifies the location and extent of a mass, but the MRI changes for a neoplasm may be similar to MRI findings due to non-neoplastic soft tissue masses (2). Thus, the final diagnosis is based on histological and immunohistological (IHC) studies. However, there is limited information on cellular and molecular features of non-visceral HSA (3).

The aims of this study were to emphasize the importance of considering cancer as a differential diagnosis of lesions detected by MRI in dogs with paraplegia, and to evaluate the expression of IHC markers in a poorly differentiated HSA as suitable tools for its accurate diagnosis and for the identification of molecules which may be used as therapeutic targets of non-visceral HSA in future investigations.

Case description

A 4-year-old male American Staffordshire terrier was evaluated for an acute onset, progressive pelvic limb weakness of 8 days duration. Neurological examination showed marked ambulatory paraparesis, proprioceptive deficits in both hind limbs and normal segmental spinal reflexes. The cutaneous trunci reflex was absent caudal to the first lumbar vertebra. Superficial pain perception was diminished. Based upon neurologic examination, a T3-L3 myelopathy was suspected. Differential diagnoses included disk herniation, vascular lesions, fibrocartilaginous embolism, neoplasms, and inflammatory/infectious diseases. No significant abnormalities were identified in the complete blood (cell) count (CBC), serum biochemistry, urinalysis, two-view thoracic radiograph, and electrocardiogram. Magnetic resonance imaging (MRI) was performed with a high field 3.0T magnet (Signa HDx; GE Healthcare, Madrid, Spain). Technical sequences included: T1-weighted pulse sequences in sagittal and axial planes; T2-weighted pulse sequences [Fast Relaxation Fast Spin Echo sequence (FRFSE); and Gradient Echo sequence (GRE)] and T1 [Spin Echo sequence (SE) post-contrast]. Images in sagittal and axial planes were obtained after intravenous administration of paramagnetic contrast medium.
A mass was identified in the vertebral arch and spinous process of L2. It invaded the vertebral canal and the L2-L3 disc space, causing dorsolateral compression of the spinal cord. The lesion (4 cm × 2 cm × 4 cm) was hyperintense compared to normal spinal cord and epidural fat on T2-weighted images in FRFSE and T2 GRE images (Figure 1). It was mildly hyperintense on T1-weighted images, and enhanced strongly and homogeneously after the administration of contrast. The MRI findings did not allow a definitive diagnosis to be made because, although they were mainly consistent with neoplasia, other etiologies such as epidural hematoma and inflammatory/infectious tumor-like lesions, or osteomyelitis should also be considered.

The animal was euthanized due to its poor quality of life. On necropsy, a 2 cm × 3 cm, ill-defined, hemorrhagic mass was initially identified within the iliopsoas muscle on the right side of the spine. Gross examination of the spine showed an abnormally large L2 vertebra with destruction of normal bone due to the presence of a soft tissue mass which also intruded into the spinal canal, strictly epidural, causing spinal cord compression. The lungs contained disseminated, dark red nodules, 1 to 2 mm in diameter. No gross abnormalities were identified in skin overlying the mass or other organs.

Samples were fixed in 10% neutral buffered formalin, embedded in paraffin, sectioned (4 μm) and stained with hematoxylin and eosin (H&E) and Masson’s trichrome stains. Selected sections were immunohistochemically labelled by the avidin-biotin-peroxidase complex (ABC-P) method and double immunofluorescence. Details of the primary antibodies used in this study, including dilutions, are summarized in Table 1.

Microscopically, the highly cellular lesion was composed of cords and solid sheets of pleomorphic cells, which infiltrated myofibers and vertebral bone, resulting in degeneration and necrosis. Neoplastic cells showed ill-defined limits with a single nucleus that ranged from spindle-shaped to reniform and chromatin from finely stippled to coarse smudged. Nuclear size often differed two-fold or more among tumor cells with presence of 1 prominent nucleolus in the larger ones. The mitotic index was high (4 mitoses per high-power field) and atypical mitotic figures were seen frequently. A few areas of the tumor showed small splits, which were lined by a single layer of plump undifferentiated pleomorphic cells resembling irregular vascular spaces. Masson’s trichrome stain revealed the presence of little intercellular collagen in any location in the tumor mass. Multifocal to coalescing foci of hemorrhage and necrosis corresponded to the grossly hemorrhagic appearance of the neoplasm. The pulmonary nodules and 1 small focus (< 1 mm) in the spleen showed similar characteristics to those of the main mass. No lesions were observed in the nerves within the iliopsoas muscle.

Pleomorphic tumor cells were negative for keratin, but positive for vimentin (Table 1) which supported a diagnosis of sarcoma. Almost all the pleomorphic cells exhibited strong expression of CD31 and focal weak labelling for vWF, suggesting a diagnosis of HSA (4). There was no detectable expression of antigens characteristic of glial cells (GFAP), striated muscle (α-sarcomeric actin, desmin), smooth muscle (α-smooth muscle actin, desmin), histiocytes (lysozyme), and T-lymphocytes (CD3); this was important in ruling out the diagnoses of glioma and other sarcomas (Table 1). However, numerous vimentin- and SMA-positive spindle-shaped to oval cells, which were difficult to differentiate morphologically in H&E sections, were arranged in clusters or around the groups of CD31-positive cells (Figure 2). Lack of desmin expression (Table 1) may be useful in differentiating SMA-positive myofibroblasts from pericytes, weakly positive for desmin, and from smooth muscle cells, strongly positive for desmin (5). Endothelial nitric oxide synthase, p53, p53 phosphorylated at Serine392 and CD117 were expressed in pleomorphic tumor cells and CD44 was expressed in myofibroblasts (Table 1).

Based on overall differentiation and nuclear variation (6) as well as cellular immunostaining, the tumor was categorized as a poorly differentiated hemangiosarcoma with an important supportive component of myofibroblasts. Taking into account the fact that lung and spleen lesions were smaller and composed of CD31-positive pleomorphic cells with few myofibroblasts, the location in the spine was considered the neoproliferative site of origin with muscle invasion and intrusion into the vertebral canal. Foci in lungs and spleen were considered to be early lesions from the spreading of the tumor.

Discussion

This case report is focused on the description of IHC features of primary vertebral HSA, which is relatively uncommon in dogs (1), but must be included in the differential diagnosis for compressive myelopathies (2) because the prognosis and treatment of this clinical manifestation depend on its correct diagnosis. Thus, it is important to obtain information that allows the early detection of this aggressive neoplasm and the identification of potential therapeutic targets (3). The present results support that the IHC detection of CD31 antigen has a greater value than the vWF antigen in the diagnosis of poorly differentiated HSAs, as
has been previously reported (4). Although CD31 specificity is excellent (4), there are reports of CD31 positivity in human carcinomas and monocytes, which highlights the importance of using a panel of antibodies to aid in avoiding a misdiagnosis (7,8). Furthermore, the lower expression of vWF suggested an origin from endothelial progenitor cells, in which vWF expression occurs later than CD31 expression (9). The origin of this neoplasm from primitive, poorly differentiated cells is also supported by the immunodetection of c-kit proto-oncogene product (CD117), tyrosine kinase growth factor receptor for stem cell factor, as has been described in an in vitro study on canine HSA (10). As such, canine HSA may be expected to respond to tyrosine kinase inhibitors (TKI) and this approach may allow the future development of novel therapies for treatment of HSA in dogs (6,11). However, recent in vivo results report that the use of TKI does not improve either disease-free interval or overall survival in dogs with stage I and II splenic HSA (12). These results highlight the need for larger and deeper evaluation of in vivo HSAs.

Expression of eNOS in the pleomorphic cells, an enzyme that catalyzes the production of nitric oxide in endothelial cells, suggests that eNOS was a more sensitive marker than vWF in the diagnosis of poorly differentiated HSA, and it also supported an origin from endothelial progenitor cells (13), as did the lack of SMA expression.

The high proliferation index (> 20% tumor cells staining with Ki67) and the negative caspase-3 immunolabelling suggested that the nuclear p53 protein, which is detected in more than 90% of pleomorphic cells, was of a mutant type instead of wild type p53 which induces cell-cycle arrest in G1 or apoptosis. Unlike other reports (14), the present results seem to suggest that inactivation of the p53 pathway might play a role in the pathogenesis of poorly differentiated HSA with invasiveness in dogs, a relationship that has been also described in cows (15). The present study examined the phosphorylation status of Ser392, which seems to regulate the oncogenic function of this study.

Table 1. Immunohistochemical characterization of a vertebral poorly differentiated hemangiosarcoma in a dog

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* Scoring grades for IHC staining: + + + , > 70%; + , 70% to 31%; + , 30% to 10%; and –, < 10% labelled cells.
† BD Biosciences, San Jose, California, USA.
‡ Thermo Fisher, Rockford, Illinois, USA.
§ Dako, Glostrup, Denmark.
¶ Sigma Aldrich, St. Louis, Missouri, USA.
∥ Biolegend, San Diego, California, USA.
× Santa Cruz Biotech, Heidelberg, Germany.
¢ Cell Signaling, Danvers, Massachusetts, USA.

CK — cytokeratin; CD — cluster of differentiation; vWF — von Willebrand factor; eNOS — endothelial nitric oxide synthase; SMA — α-smooth muscle actin; GFAP — glial fibrillary acidic protein; pp53 Ser392 — p53 phosphorylated at Serine392.

Figure 2. Immunostaining of hemangiosarcoma in the spine of a dog. Clusters of CD31-positive cells are surrounded by numerous SMA-positive myofibroblasts. Double immunofluorescence for CD31 (green, fluorescein isothiocyanate, and SMA (red, rhodamine)) with nuclear DAPI counterstain.
mutant p53 (16). The finding of numerous pleomorphic cells exhibiting p53 phosphorylated at Ser392 could indicate that tumors showing this IHC expression pattern may be more sensitive to the cytotoxic effect of radiotherapy and chemotherapy than those expressing the unphosphorylated form of mutant p53 which is more potent in protecting tumor cells (16). Thus, presence of mutant p53 phosphorylated at Ser392 could possibly be used to predict the responsiveness to therapy in this type of canine neoplasm, but further research with a larger number of dogs with HSA should be carried out to test this hypothesis.

The use of SMA enabled the identification of numerous myofibroblasts as a previously unrecognized stromal supporting element, an active participant in the progression of the tumor (5). Moreover, the expression of CD44 in the myofibroblasts seems to support critical functions of these stromal cells in the tumor growth which could be blocked as previously described (17); so a potential antitumor substance targeted on this stromal population in poorly differentiated HSAs might provide a basis for therapy.

In summary, the novelty of the current study is the assessment of eNOS for routine diagnosis and of p53 phosphorylated at Ser392 for therapy purposes in poorly differentiated HSAs in dogs. Although these results are based on the study of a single case and they should be researched in a large number of dogs, the possibility that eNOS could be used as a new differential marker with greater sensitivity than vWF for the diagnosis of poorly differentiated HSA in dogs should be explored. Furthermore, the positive expression of p53 phosphorylated at Ser392, p53, and CD117 in tumor cells as well as CD44 in myofibroblasts suggests that these proteins might be suitable targets for the development of novel therapeutic approaches to this aggressive disease. Further investigation is required to confirm the significance of these findings.

References
Case Report  Rapport de cas

Paradoxical vestibular syndrome in a dog from western Newfoundland infected with French heartworm (*Angiostrongylus vasorum*)

Hye-Yeon Jang, Joane M. Parent, Chris Hagen, Emily Colwell, Paul M. Rist, Nicole Murphy, Shelley Burton, Gary Conboy

**Abstract** — A dog from western Newfoundland was presented with paradoxical vestibular syndrome. First-stage larvae of *Angiostrongylus vasorum* were detected on fecal examination. Treatment with milbemycin oxime resulted in resolution of signs. This is the first report of the spread of this parasite to western Newfoundland and of paradoxical vestibular syndrome in a dog infected with *A. vasorum*.


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*A. vasorum* is a nematode of domestic and wild canids found in various regions of the world (1). In Canada, an endemic focus of *A. vasorum* occurs in eastern Newfoundland with infection reported in domestic dogs (*Canis lupus familiaris*), red foxes (*Vulpes vulpes*), and coyotes (*Canis latrans*) (2–6). Common clinical presentations in dogs infected with *A. vasorum* include cardiorespiratory disease and hemorrhagic diathesis, although neurologic abnormalities as a consequence of central nervous system (CNS) hemorrhage have also been reported. This is the first report of a dog from western Newfoundland that was presented with paradoxical vestibular syndrome (PVS), and diagnosed with *A. vasorum* infection.

**Case description**

A 3-year-old, 10-kg intact male Border collie mixed breed dog from Codroy, a town on the western coast of Newfoundland, was referred to the Atlantic Veterinary College (AVC) Veterinary Teaching Hospital at the University of Prince Edward Island. The dog had an 8-week history of weight loss totaling 1.3 kg, weakness, vertical nystagmus, head tilt, and circling.

The patient was presented to the referring veterinarian with a 4-day history of weakness and hypermetric gait 5 wk prior to evaluation at the AVC. The owner also suspected that the patient had 1 episode of producing vomitus containing large worms. Results of a complete blood (cell) count (CBC) and serum biochemical panel at this time were unremarkable. Clindamycin, 20 mg/kg body weight (BW), PO, q12h for 21 days was initiated by the referring veterinarian as granulomatous meningoencephalitis or a protozoal infection such as toxoplasmosis or neosporosis was suspected. The dog was unresponsive to clindamycin and returned 1 wk later to the referring veterinarian. He was then treated with prednisone, 1.3 mg/kg BW, PO, q12h and tramadol, 4.3 mg/kg BW, PO, q12h in addition to the antibiotics for a suspected inflammatory central nervous system (CNS) disease. After 4 wk of medical management with no resolution of clinical signs, the dog was referred to the AVC.

On referral examination, the dog was quiet, alert, and responsive but with a dull mentation. He was assigned a body condition score (BCS) of 2/9 and was observed to pace, circle to the right, and rapidly grow tired.

A complete neurologic examination was performed by an American College of Veterinary Internal Medicine board-certified neurologist. Neuroanatomic localization was made to the left cerebellum or left cerebellar peduncle despite right-sided clinical signs (Table 1). A space occupying lesion was suspected with a mass effect extending over the midline causing right facial nerve involvement. The neurologic deficits were also consistent...
with diffuse cerebellar lesions and multifocal lesions involving the right vestibular nuclei complex and right facial nucleus.

On the day of presentation (Day 0), diagnostic tests included a CBC, serum biochemical panel, urinalysis, thoracic radiography, abdominal ultrasonography, and magnetic resonance imaging (MRI) of the brain under general anesthesia.

The CBC revealed leukogram abnormalities indicating severe chronic inflammation. A mild normocytic, normochromic regenerative anemia (hematocrit 32 L/L, reference interval: 40 to 56 L/L) was found, likely due to chronic inflammation or gastrointestinal bleeding secondary to corticosteroid treatment. Mild (1+) schistocytosis was observed and considered either a microangiopathic effect associated with inflammation or due to mild disseminated intravascular coagulation (DIC). Abnormalities of the serum biochemical panel indicated hepatic changes associated with stress, excitement, or corticosteroid treatment. Urinalysis findings on a free catch sample included a specific gravity of 1.025, trace blood reaction, and unremarkable sediment. A marked proteinuria was found and considered to be due to renal proteinuria with the possibility of a slight contribution from hemoglobinuria.

Thoracic radiography revealed a moderate, diffuse, unstructured interstitial to bronchial lung pattern (Figure 1A) indicative of allergic airway disease or an infectious, inflammatory or neoplastic process. There was a mild to moderate enlargement of the region where the pulmonary trunk normally lies on the ventrodorsal view (Figure 1B). Abdominal ultrasonography revealed a moderately enlarged and hyperechoic liver which was considered potentially due to a corticosteroid hepatopathy. The brain MRI did not reveal any lesions or masses.

On Day 1, bronchoscopy and bronchoalveolar lavage (BAL) were performed. Bronchoscopy revealed a patchy distribution of focal hemorrhagic lesions in both lungs. Fluid from the BAL was submitted for bacterial culture and cytologic examination. Culture was negative and cytologic examination revealed macrophagic and neutrophilic inflammation. Pigment consistent with hemosiderin was seen within macrophages, indicating previous hemorrhage. Cerebrospinal fluid (CSF) was collected and had no cytologic abnormalities. A fecal sample was evaluated by zinc sulfate (ZnSO₄) centrifugal flotation, direct smear, and Baermann examination. First-stage larvae (L1) of Angiostrongylus vasorum (Figure 2) were detected by all 3 methods. The larvae were 350 to 390 μm in length and had a kinked tail with a dorsal spine. An estimated 65 020 L1 were recovered by Baermann examination. First-stage larvae (L1) of A. vasorum were 350 to 390 μm in length and had a kinked tail with a dor-

| Table 1. Findings on complete neurologic examination |
|-----------------------|--------------------------|
| Neurological examination |                           |
| Mental status | Quiet but appropriate, hyperesthesia to movements|
| Gait and posture | Ambulatory, no ataxia observed |
| Postural reactions | Decreased hopping in LF, RH, absent hopping in LH |
| Spinal reflexes | Present and adequate in all limbs |
| Cranial nerves | Positional ventral strabismus; R > L |
| Nociception | Adequate, hyper-reactive to forelimb stimulation |
| Neck/Back pain | Unable to lift head past neutral carriage, reactive to palpation in caudal thoracic region |

L — left; R — right; P — pelvic limb; F — thoracic limb.

Treatment for A. vasorum was instituted on Day 2. This included prophylactic administration of diphenhydramine (Nadryl 25; Laboratoire Riva, Blainville, Quebec), 2 mg/kg BW, SQ, once prior to the initial dose of milbemycin oxime (Sentinel; Novartis, Mississauga, Ontario), 0.5 mg/kg BW, PO, q7d for 4 treatments, due to concern for a possible reaction to released antigens from dying parasites. No signs of post-treatment reactions were observed. On Day 3, the dosage of dexamethasone was decreased to 0.075 mg/kg BW, IV, q24h.

On Day 4, the dog was bright, alert, and responsive and there was an appreciable improvement in neurologic signs. Another CBC and serum biochemical panel were performed on this day. The CBC revealed findings supportive of ongoing inflammation with possible contributory stress/corticosteroid or excitement effects. Serum biochemical changes seen on Day 0 were improved. The patient was discharged with the medication regimen of gabapentin (10 mg/kg BW, PO, q8h for 2 wk, dexamethasone, 0.075 mg/kg BW, PO, q24h for 1 wk then tapered, and milbemycin oxime, 0.5 mg/kg BW, PO, q7d) for 4 treatments.

Two months following discharge, the patient had completed 4 treatments of milbemycin oxime and the corticosteroid therapy had been tapered down and then discontinued. Neurologic signs had completely resolved and steady weight gain was occurring. Recommended post-treatment fecal examinations were not performed.

Discussion

This is the first report of A. vasorum infection in a dog outside of the recognized endemic focus in eastern Newfoundland. This report also documents the first case of paradoxical vestibular
syndrome (PVS) in a dog with *A. vasorum* infection. The strong therapeutic response to milbemycin oxime treatment suggests the PVS was a secondary pathologic process to the *A. vasorum* infection. However, given the lack of abnormalities found on MRI and CSF cytology, it cannot be ruled out that the PVS was a concurrent and separate disease process.

The life cycle of *A. vasorum* requires a definitive and intermediate host. Definitive hosts include members of the Canidae family such as the red fox, coyote, wolf, and domestic dog (1,5–9). Intermediate hosts include a wide range of gastropods (over 20 species) and an amphibian (frog) that have been naturally or experimentally infected (10–14). Definitive hosts become infected after ingesting a gastropod or frog containing infective third-stage larvae (L3) of *A. vasorum*. The L3 penetrate the wall of the gastrointestinal tract of the canid, migrate to abdominal lymph nodes, and travel to the pulmonary artery and right ventricle of the heart where they molt twice and mature to adults. Adult nematodes mate and produce eggs, which become embedded in lung capillaries. Here, they develop and L1 hatch into the alveolar spaces before being coughed up and swallowed. The life cycle continues when L1 are passed in the feces and penetrate or are ingested by an intermediate host (1,15).

As eggs, larvae, and adults inhabit various organ systems in the definitive host, this parasite has the potential to cause a diversity of pathologic lesions and diseases. The 2 most common clinical signs of *A. vasorum* infection are cardiopulmonary disease and hemorrhagic diathesis. Coughing, exercise intolerance, and dyspnea as well as pulmonary radiographic changes are consequences of verminous pneumonia as a result of developing and migrating larvae and adult nematodes. The cause for bleeding tendencies is unknown, although speculated to be due to a low-grade, chronic disseminated intravascular coagulopathy (DIC) (16,17). Dogs infected with *A. vasorum* have presented with hemoabdomen (18), hemothorax (19), conjunctival hemorrhage (20), and CNS hemorrhage (20–25). In these cases, dogs presented with an overt hemorrhage event and had abnormal coagulation profiles. The patient in this case did not exhibit cardiorespiratory signs and abnormal lung sounds were not detected on auscultation, despite evidence of microscopic (hemosiderin on BAL cytology) and macroscopic (bronchoscopic findings) hemorrhage. The pathogenesis of bleeding tendencies in dogs infected with *A. vasorum* is suspected to be due to a consumptive coagulopathy in response to parasite antigens (26).
One report showed that 35% of dogs diagnosed with *A. vasorum* had hemorrhagic diathesis and 52% of dogs had prolonged prothrombin time (PT) and/or activated partial thromboplastin time (aPTT) or were thrombocytopenic on CBC (27). While there was no evidence of thrombocytopenia in this patient, the possibility of a coagulation abnormality cannot be ruled out. Hemorrhage could have lead to the neurologic signs as well as radiographic and bronchoscopy findings on examination.

Neurologic abnormalities, as the predominant clinical sign of *A. vasorum*, occur in a small proportion of cases and have been documented in Denmark, Germany, Italy, and the United Kingdom (20–25). In these cases, acute neurologic signs were seen ranging from ataxia and cranial nerve deficits as a result of hemorrhage in the intra-cranial (24) and intra-cerebral (20–23, 25) spaces. Additionally, aberrant migrations of larvae in CSF (28) and nematode eggs in neural parenchyma (5) have been found on postmortem examinations.

Paradoxical vestibular syndrome (PVS) is a unique collection of neurologic signs in which the head tilt and loss of balance are contralateral to the side of the central lesion, which typically involves the cerebellar peduncle. With central vestibular disease, the head tilt and loss of balance are ipsilateral to the central lesion. The paradox of central vestibular disease (PVS) lies in that the clinical signs are towards the side with the least vestibular system activity. The most common causes for PVS in dogs have been reported to be infarcts, inflammation, and neoplasia (29). It is possible that the PVS in this case was an isolated concurrent problem in the presence of *A. vasorum* infection, although the cause for this patient’s neurologic deficits remains unknown, particularly due to the unremarkable findings on MRI and CSF cytology. It is also unknown whether the resolution of neurologic signs was due to the anti-inflammatory dose of corticosteroids that was started at AVC, or whether it was truly a secondary process associated with *A. vasorum* infection. To our knowledge, PVS secondary to *A. vasorum* infection has not been reported previously. However, more significantly, this present case is one of the few reports of neurologic manifestation of *A. vasorum* infection in a dog which was successfully treated with antiparasitic drugs (24,28).

The first report of *A. vasorum* in North America was documented in 2 red foxes on the Avalon peninsula of Newfoundland as part of a helminth necropsy survey of terrestrial mammals in 1973 (30). Subsequently, *A. vasorum* has been reported in the red fox, coyote, and domestic dog populations in Newfoundland (2–6). Molecular analysis and comparison of European and Canadian *A. vasorum* in red foxes and dogs revealed no significant differences (31), supporting the hypothesis that this parasite most likely became established in Newfoundland via importation of infected intermediate and/or definitive hosts. Results of the same study also showed no genetic differences between *A. vasorum* in dogs and red foxes, indicating that transmission occurs between these 2 groups of canids. A necropsy survey of dogs from humane societies in the St. John’s region of Newfoundland found *A. vasorum* infection in 10.7% (6/56) of the animals (2). A fecal examination survey using the Baermann technique documented the presence of *A. vasorum* L1 in 24% (16/67) of dogs from Newfoundland with clinical signs of cardiorespiratory disease (4). Prevalence may have been higher as infected dogs may be clinically normal or have non-cardiorespiratory signs such as the dog in this report. A survey of *A. vasorum* infection in the red fox population throughout Newfoundland found an overall prevalence of 56% (6). The dog in the case described here had no record of travelling out of western Newfoundland, thereby indicating the likely spread of the parasite from the endemic area of eastern Newfoundland through intermediate or definitive hosts.

The potential spread of *A. vasorum* to other parts of North America is a major concern due to the ease and frequency of travel and the historical tendency of this parasite for geographic spread. Computer modeling suggests suitable climatic conditions to sustain the establishment of *A. vasorum* occur throughout the eastern half and along the western coastal regions of North America (32). Whether the recent report of *A. vasorum* infection in a red fox in West Virginia represents a new introduction event or a long standing endemic focus is unknown (33). Geographic spread is a particular concern for the Maritime provinces which share similar climatic and ecological conditions (large red fox population, abundant terrestrial gastropods) as occur in eastern Newfoundland (34). *Crenosoma vulpis*, the fox lungworm, has the same life cycle requirements as *A. vasorum*. The high prevalence of *C. vulpis* infection in Maritime canids indicates that *A. vasorum* will likely thrive as well if introduced into this region (32). Further research is required to assess the current epidemiology of *A. vasorum* infection in dog populations to gain a greater understanding of its prevalence and distribution and to prevent the spread of disease.

References

Answers to Quiz Corner
Les réponses du test éclair

1. D) The Doberman pinscher is a breed associated with a younger age of onset due to the immune-mediated mechanism of the disease. The other answers are not correct: C, hyperadreno-corticism, is typically diagnosed in older dogs; B, this dog is neutered; E, this is not a common endocrinopathy in the dog, nor a cause for recurrent pyoderma in the dog.

D) Le Doberman pinscher est une race dont le jeune âge est associé à la flambée due au mécanisme à médiation immunitaire de la maladie. Les autres réponses ne sont pas correctes : C, l’hyperadrénocorticisme est diagnostiqué de façon caractéristique chez les vieux chiens; B, ce chien est castré; E, ce n’est pas une endocrinopathie commune chez le chien, ni une cause de pyodermite.

2. A) Clinical signs of tetanus infection in horses include initial stiffness of gait, reluctance to lower the head to the ground or to eat, rigid extension of the tail and neck, anxious facial expression, erect ears, nostril flaring, dysphagia, dyspnea, and globe retraction and prolapse of the third eyelid.

A) Les signes cliniques du tétanos chez le cheval comprennent une raideur de la démarche, une répugnance à baisser la tête vers le sol ou à manger, une extension rigide de la queue et de la tête, une expression faciale anxieuse, des oreilles dressées, une dilatation des narines, de la dysphagie, de la dyspnée, une rétraction du globe oculaire et un prolapsus de la troisième paupière.

3. E) Nerve blocks are not performed in cattle to diagnose lameness. Measurement of vital signs in lameness cases is not useful for diagnosis. Limb palpation should occur prior to hoof examination in case the latter exacerbates an upper limb problem. Radiographs are useful in joint and bone assessment below and including the elbow and knee, but not commonly required or employed because of cost and lack of treatment options for the associated conditions. Additionally, prognosis can often be established without radiographs.

E) On ne fait pas de blocage nerveux chez les bovins pour le diagnostic des boiteries. La prise des signes cliniques dans les cas de boiterie n’est pas utile pour le diagnostic. La palpation des membres doit se faire avant l’examen des ongles au cas où ce dernier exacerbe un problème dans le segment proximal du membre. Les radiographies sont utiles dans l’évaluation des articulations et des os distalement et incluent le coude et le grasset, mais ne sont pas communément nécessaires ou utilisées à cause du prix et du manque de traitement pour les affections connexes. De plus, le pronostic peut souvent être établi sans la prise de radiographies.

4. B) This cat most likely has diabetes mellitus, and the presence of ketonuria suggests diabetic ketoacidosis. Short-acting insulin therapy should be initiated and continued until ketonuria resolves. Glycosuria and ketonuria are not typically associated with chronic renal disease.

B) Ce chat souffre plus probablement de diabète sucré et la présence de cétonurie suggère une cétoacidose diabétique. Un traitement à l’insuline ordinaire devrait être instauré et poursuivi jusqu’à ce que la cétonurie disparaîsse. La glycosurie et la cétonurie ne sont pas typiquement associées à la maladie rénale chronique.

5. C) Parenchymal liver injury is most consistent with these findings. Trace bilirubinuria may be found in the urine of normal dogs (especially males). In most cases, hemolytic anemia is regenerative. Extrarenal abnormalities (such as decreased urea production) may impair the urine concentration ability of the kidneys.

C) Une lésion au parenchyme hépatique est plus compatible avec ces signes. Une trace de bilirubinurie peut être trouvée dans l’urine des chiens sains (surtout les mâles). Dans la plupart des cas, l’anémie hémolytique est régénérative. Les anomalies extrarénales (telle une diminution de la production d’urée) peuvent altérer la capacité de la concentration de l’urine des reins.
Clinical indications, complications, and long-term outcome of esophageal surgeries in 27 horses

Judith B. Koenig, Andressa Silveira, Nicola C. Cribb, Perrine Piat, Sheila Laverty, Ulrike S. Sorge

Abstract — The main objective of this retrospective study was to describe clinical findings, management, and short- and long-term outcome in 27 horses that underwent various surgical techniques for esophageal disease. Surgical techniques (sometimes concurrently) performed were: esophagostomy (n = 14), esophagotomy with primary closure (n = 6), esophagomyotomy (n = 3), and esophagoplasty (n = 2). Esophageal perforation in 5 horses was treated by ventral drainage; 3 horses had the esophageal defect sutured (n = 3). Feeding tubes were placed in 15 horses. Postoperative complications occurred in 52% (14/27) with a median of 3 complications/horse (range: 1 to 7). Significantly more complications occurred in horses with a perforated esophagus. Eighteen horses (18/27; 67%) were discharged. Most horses (8/9; 89%) with a lesion located in the proximal esophagus were discharged. Horses with a higher number of postoperative complications, particularly postoperative infection, were more likely to be euthanized. One year after surgery, 41% of the horses were alive and free of complications.

Résumé — Indications cliniques, complications et résultat à long terme de chirurgies œsophagiennes chez 27 chevaux. L’objectif principal de cette étude rétrospective a été de décrire les résultats cliniques, la gestion et les résultats à court et à long terme chez 27 chevaux qui ont subi diverses techniques de chirurgie pour le traitement de la maladie œsophagienne. Les techniques chirurgicales réalisées (parfois de manière concomitante) étaient : l’œsophagostomie (n = 14), l’œsophagotomie avec fermeture primaire (n = 6), l’œsophagomyotomie (n = 3) et l’œsophagoplastie (n = 2). La perforation œsophagienne chez 5 chevaux a été traitée par drainage ventral; 3 chevaux ont subi une suture du défaut œsophagien (n = 3). Des sondes d’alimentation ont été placées chez 15 chevaux. Les complications postopératoires se sont produites chez 52 % des chevaux (14/27) avec une médiane de 3 complications/cheval (fourchette : 1 à 7). Un nombre significativement supérieur de complications se sont produits chez les chevaux ayant une perforation de l’œsophage. Dix-huit chevaux (18/27; 67 %) ont reçu leur congé. La plupart des chevaux (8/9; 89 %) ayant une lésion situé dans l’œsophage proximal ont reçu leur congé. Il était plus probable que les chevaux avec un nombre supérieur de complications postopératoires, particulièrement une infection postopératoire, soient euthanasiés. Un an après la chirurgie, 41 % des chevaux étaient vivants et libres de complications.

(Traduit par Isabelle Vallières)

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Introduction

There is limited information on the long-term outcome of esophageal surgery in horses. Only 1 retrospective study reported on the 6-month outcome of surgical management of esophageal disorders in 17 horses (1).

Esophageal surgery is uncommon, but surgical correction is necessary for esophageal obstructions unresponsive to medical treatment, for the retrieval of specific foreign bodies, or to address functional or anatomic disorders (e.g., stricture, diverticula, perforation, laceration) (2,3). Postoperative complications are common and include aspiration pneumonia, pleuritis, and postoperative surgical site infection, all of which influence survival after esophageal surgery (1). Repeated surgical intervention is often required to correct the underlying problem (4).

The objectives of this study, therefore, were to i) report clinical findings and management associated with esophageal disease in horses and identify factors such as postoperative complications that influenced outcome; and ii) evaluate short
and long-term (≥ 1 y) outcome in 27 horses that underwent various surgical procedures for esophageal disease.

Materials and methods
Medical records (1994–2012) of 2 equine hospitals were reviewed for horses that had had esophageal surgery. Horses were included if esophageal surgery was performed or an esophageal perforation was diagnosed that required surgical debridement and establishment of drainage. Horses were excluded if they were euthanized under general anesthesia.

Data retrieved from the records included signalment, presenting complaint, history of previous esophageal disease or neck trauma, concurrent neurologic or respiratory signs, duration of clinical signs prior to surgical intervention, diagnostic methods, clinical diagnosis, lesion location (proximal, middle, or distal third of cervical esophagus), type of esophageal surgery, use of a feeding tube (enteral feeding tube or indwelling nasogastric tube), complications, and duration of hospitalization. Surgical site infection was defined as the presence of a purulent discharge from the incision site and either pain or swelling, or both, around the wound edges. Dehiscence was defined as the spontaneous rupture of the incision. Neck cellulitis was defined as the spread of subcutaneous infection from an esophageal incision or perforation along the neck of the horse. Short-term outcome was defined as the time to discharge from the hospital. Long-term follow-up (≥ 1 y) was obtained by telephone survey of owners or trainers.

The data were analyzed using a statistical program (SAS version 9.3; SAS Institute, Cary, North Carolina, USA) and the level of statistical significance was set at α = 0.05. For the purpose of this study, count data were considered continuous. The distribution of continuous data was assessed visually (histogram, QQ-Plot) and generally deemed not normally distributed. Continuous data, therefore, were summarized as median and range. Categorical data were summarized with frequency statistics. When continuous variables were compared between groups, the non-parametric Kruskal-Wallis and Mann-Whitney U-tests were used where appropriate. Associations between categorical variables were analyzed with Fisher’s exact test and the association between 2 dichotomous variables was expressed as odds ratio (OR). Statistical significance was set at P ≤ 0.05.

Results
Twenty-seven horses aged 2 mo to 19 y (median age: 3.0 y; interquartile range: 1.0 to 6.0 y) had esophageal surgery. Two additional horses were anesthetized for esophageal surgery but were excluded from the study because they were euthanized during surgery as the damage to the esophagus was severe and the prognosis was poor.

The study population included 18 females, 6 intact and 2 castrated males, and 1 horse without recorded gender. There were 8 Thoroughbreds, 6 Quarter Horses, 4 Standardbreds, 4 Warmbloods, 2 Belgians, 1 Arabian, 1 pony, and 1 whose breed was not recorded.

Duration of clinical signs prior to hospital admission was less than 24 h (n = 11), over 24 h (n = 11) or unknown (n = 5). Presenting complaints were either primarily esophageal obstruction [n = 19; initial obstruction (n = 11), recurrent obstruction (n = 8)] or a history, or clinical signs (or both), of neck trauma (n = 8).

Clinical diagnosis at the referral centers included: primary esophageal impaction (n = 11; food only in 10, and food impacted around a piece of metal in 1 horse), stricture (n = 5), esophageal perforation (n = 5; in 1 horse the underlying cause was a stricture leading to rupture), dysphagia caused by neurologic disease affecting multiple cranial nerves (n = 4) and pulsion diverticula (n = 2).

The esophageal lesion was located in the proximal esophagus (n = 9), middle esophagus (n = 10), and caudal esophagus at the level of the thoracic inlet (n = 4). In 4 horses no specific site of esophageal lesion was identified and in 2 horses megaesophagus was present throughout the cervical esophagus.

 Concurrent clinical findings in the 27 horses included signs associated with aspiration pneumonia (n = 8), dysphagia (n = 4), impaired cranial nerve function (n = 6; due to primary neurologic disease in 4, due to trauma in 2), guttural pouch problems (longus capitis rupture due to trauma in 3 and tympany due to neurologic disease in 2) (n = 5), and laryngeal hemiplegia (secondary to trauma in 3 or neurologic disease in 2) (n = 5).

Esophageal lesions

Primary esophageal obstruction (n = 11). Obstruction was caused by feed in 8 horses (beet pulp in 6) and by esophageal stenosis in 2 horses, which had perforated by admission (n = 1) or was caused by a piece of metal (n = 1). The 10 horses with an intact esophagus were sedated for hydropulsion, which was unsuccessful in relieving the obstruction. Subsequently, obstruction was relieved by esophagotomy with primary closure (n = 5), esophagostomy and use of a feeding tube (n = 5) (in the horse with stenosis and rupture, the esophagostomy was performed through the stenosis, the feeding tube placed through the incision, and ventral drainage was established); by esophagomyotomy and massage of the food impaction distally in the horse with an uncomplicated stenosis. One horse had severe ulceration at the esophagotomy site, so an esphagostomy with placement of a feeding tube was performed aborally (Table 1).

Recurrent esophageal obstruction (n = 8). Five of 8 horses had feed obstruction on admission. Esophageal obstruction was caused by stricture (n = 4), pulsion diverticulum (n = 2), severe mucosal ulceration (n = 1), and undetermined (n = 1). Hydropulsion with the horses standing and sedated, was unsuccessful in relieving the obstruction. Subsequently, 3 had esophagotomy and placement of a feeding tube at the site of obstruction (2 strictures and 1 impaction), 2 had esophagomyotomy, and 1 had esophagotomy with primary suture performed. The horses with the pulsion diverticulae were treated by esophagoplasty.

Traumatic esophageal perforation (n = 4). Four horses had severe neck swelling and esophageal perforation. In 3 horses, the perforation was debrided and sutured; and in 1 of these, a feeding tube was placed further aborally. In the other horse, ventral drainage was established and a feeding tube was placed through the rupture.
Table 1. Summary data for 27 horses that had esophageal surgery

<table>
<thead>
<tr>
<th>Category</th>
<th>Diagnosis</th>
<th>Surgery</th>
<th>Feeding tube</th>
<th>Number of post-operative complications</th>
<th>Short-term outcome</th>
<th>Long-term outcome</th>
</tr>
</thead>
<tbody>
<tr>
<td>Obstruction ((n = 11))</td>
<td>Impaction</td>
<td>Esophagotomy</td>
<td>No</td>
<td>0</td>
<td>Discharged</td>
<td>Alive</td>
</tr>
<tr>
<td>Impaction</td>
<td>Esophagotomy</td>
<td>No</td>
<td>4</td>
<td>Euthanized</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Impaction</td>
<td>Esophagotomy</td>
<td>No</td>
<td>1</td>
<td>Discharged</td>
<td>Alive</td>
<td></td>
</tr>
<tr>
<td>Impaction</td>
<td>Esophagotomy</td>
<td>No</td>
<td>0</td>
<td>Euthanized</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Impaction</td>
<td>Esophagotomy</td>
<td>Yes</td>
<td>0</td>
<td>Discharged</td>
<td>Alive</td>
<td></td>
</tr>
<tr>
<td>Impaction</td>
<td>Esophagotomy</td>
<td>Yes</td>
<td>2</td>
<td>Euthanized</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Impaction</td>
<td>Esophagotomy</td>
<td>Yes</td>
<td>0</td>
<td>Discharged</td>
<td>Alive</td>
<td></td>
</tr>
<tr>
<td>Foreign body (metal)</td>
<td>Esophagostomy</td>
<td>Yes</td>
<td>2</td>
<td>Discharged</td>
<td>Home</td>
<td>Alive</td>
</tr>
<tr>
<td>Impaction</td>
<td>Esophagostomy</td>
<td>Yes</td>
<td>0</td>
<td>Discharged</td>
<td>Lost to follow-up</td>
<td></td>
</tr>
<tr>
<td>Recurrent impaction</td>
<td>Esophagostomy</td>
<td>No</td>
<td>2</td>
<td>Discharged</td>
<td>Alive</td>
<td></td>
</tr>
<tr>
<td>Recurrent impaction</td>
<td>Esophagostomy</td>
<td>Yes</td>
<td>4</td>
<td>Discharged</td>
<td>Euthanized-stricture, recurrent choke</td>
<td></td>
</tr>
<tr>
<td>Rupture/perforation ((n = 5))</td>
<td>Perforation</td>
<td>Suture of rupture</td>
<td>No</td>
<td>5</td>
<td>Euthanized</td>
<td></td>
</tr>
<tr>
<td>Perforation</td>
<td>Suture of rupture</td>
<td>Yes</td>
<td>4</td>
<td>Discharged</td>
<td>Lost to follow-up</td>
<td></td>
</tr>
<tr>
<td>Perforation</td>
<td>Ventral drainage</td>
<td>Esophagostomy</td>
<td>No</td>
<td>7</td>
<td>Discharged</td>
<td>Alive with modified diet-diverticulum</td>
</tr>
<tr>
<td>Perforation</td>
<td>Suture of rupture</td>
<td>Yes</td>
<td>5</td>
<td>Euthanized</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Stricture/rupture</td>
<td>Esophagostomy</td>
<td>Yes</td>
<td>6</td>
<td>Euthanized</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Stricture ((n = 5))</td>
<td>Esophagostomy</td>
<td>Yes</td>
<td>0</td>
<td>Discharged</td>
<td>Alive</td>
<td></td>
</tr>
<tr>
<td>Stricture</td>
<td>Esophagostomy</td>
<td>Yes</td>
<td>0</td>
<td>Discharged</td>
<td>Alive</td>
<td></td>
</tr>
<tr>
<td>Stricture</td>
<td>Esophagostomy</td>
<td>No</td>
<td>1</td>
<td>Discharged</td>
<td>Euthanized-stricture</td>
<td></td>
</tr>
<tr>
<td>Stricture</td>
<td>Esophagostomy</td>
<td>No</td>
<td>0</td>
<td>Discharged</td>
<td>Euthanized-stricture</td>
<td></td>
</tr>
<tr>
<td>Stricture</td>
<td>Esophagostomy</td>
<td>No</td>
<td>3</td>
<td>Discharged</td>
<td>Euthanized-stricture, diverticulum, recurrent choke</td>
<td></td>
</tr>
<tr>
<td>Dysphagia ((n = 4))</td>
<td>Neurological disease</td>
<td>Esophagostomy</td>
<td>Yes</td>
<td>0</td>
<td>Discharged</td>
<td>Alive with modified diet-megaesophagus</td>
</tr>
<tr>
<td>Neurological disease</td>
<td>Esophagostomy</td>
<td>Yes</td>
<td>0</td>
<td>Euthanized</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Neurological disease</td>
<td>Esophagostomy</td>
<td>Yes</td>
<td>2</td>
<td>Euthanized</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Neurological disease</td>
<td>Esophagostomy</td>
<td>Yes</td>
<td>0</td>
<td>Euthanized</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Diverticulum ((n = 2))</td>
<td>Pulsion diverticulum</td>
<td>Esophagoplasty</td>
<td>No</td>
<td>0</td>
<td>Discharged</td>
<td>Alive</td>
</tr>
<tr>
<td>Pulsion diverticulum</td>
<td>Esophagoplasty</td>
<td>No</td>
<td>0</td>
<td>Discharged</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Dysphagia \((n = 4)\).** Primary neurologic disease (equine protozoal disease \(n = 1\), botulism \(n = 1\), and undetermined cause \(n = 2\)) was the underlying cause of dysphagia in 4 horses in which an esophagostomy with placement of a feeding tube was performed.

**Surgical management techniques**

Surgical management techniques were in accordance with those described by Stick (3). There were 14 esophagostomies with placement of a feeding tube (Figure 1). Briefly, as previously described (3), a nasogastric tube was placed under standing sedation in 6 horses. The tube was then palpated below the left jugular vein and an incision made through the skin and carried through all the layers of the esophagus. A feeding tube was placed into the stomach. The other 8 horses were anesthetized, positioned in right lateral recumbency and a nasogastric tube placed as far as possible. A ventrolateral approach was carried out as previously described (3) and the esophagus incised sharply in 5 horses caudal to the impaction, and in 3 horses through the stricture. Foreign material (impaction, foreign body) was removed, necrotic tissue debrided if needed, and a feeding tube placed through the incision into the stomach of the horse.

Esophagotomies with primary closure were performed in 6 horses under general anesthesia as previously described (3). Lavage to disrupt the obstruction was attempted prior to esophagostomy in 4 of these horses, but was unsuccessful.

Three esophagomyotomies and 2 esophagoplasties were performed in accordance with techniques described by Stick (3). In
these 5 horses with perforation, ventral drainage was established and the ruptured esophagus was sutured in 3 horses. In 1 horse with a perforation, the feeding tube was placed through the perforated site.

**Use of a feeding tube**

Overall, 15 horses (56%) had a feeding tube placed for a median duration of 12 d (range: 3 to 28 d). An enteral feeding tube was used \((n = 5)\), or an indwelling nasogastric tube \((n = 5)\), or the type of tube used was not described \((n = 5)\). Leakage around the stoma occurred in 5 horses. Although not statistically significant, there was a trend for horses with a feeding tube to be hospitalized longer than those without a feeding tube \((P = 0.06)\).

**Complications**

Fourteen (52%) horses had postoperative complications with a median of 3 complications per horse (range: 1 to 7 complications). Horses with a perforated esophagus had significantly more complications than those without \((P < 0.001)\). Fistula formation was 22 times more likely in horses that had a perforation sutured \([P = 0.04; 95\% \text{ confidence interval (CI)}: 1.3 \text{ to } 362.3]\) compared to the other horses studied. Table 2 summarizes the frequency of post-operative complications.

Although statistically not significant, horses that had esophageal lavage under general anesthesia before surgery tended to be 10.5 times more likely to have postoperative dehiscence than horses that were not lavaged \((P = 0.09; 95\% \text{ CI}: 0.9 \text{ to } 120.3)\).

**Short-term outcome (discharge from the hospital)**

Nine horses were euthanized and 18 (67%) horses were discharged from the hospital (Table 1). Reason for euthanasia (poor prognosis or financial constraints or both) was not consistently recorded, but euthanasia occurred on average (median) after 6 d (range: 1 to 29 d). Horses that were discharged left the hospital on average (median) after 19 d (range: 2 to 60 d).

The presenting complaint had a significant effect on outcome. Almost half of the horses (47%) admitted with an initial esophageal obstruction requiring surgery were euthanized \((P = 0.01)\), whereas all horses admitted with recurrent esophageal obstruction survived \((P = 0.01)\). Horses with esophageal obstruction that had guttural pouch involvement \((P < 0.01)\) or laryngeal hemiplegia \((P < 0.05)\) identified on admission had significantly reduced chances of survival. The duration that clinical signs were observed prior to hospital admission (i.e., under 24 h or longer) was not associated with survival of the horses in this study \((P = 0.18)\).

Most horses (89%) with a lesion located in the proximal region of the esophagus were discharged from the hospital \((P = 0.05)\). The likelihood of euthanasia increased with an

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**Figure 1.** Esophagostomy procedures performed in 14 horses.
Horses presenting with a stricture were more likely to be diagnosed with esophageal fistula 
and perforation were the second most common reason for a surgical intervention. A high 
percentage of horses with esophageal perforation had aspiration pneumonia (1,6) which reported that aspiration pneumonia was the leading complication associated with death in horses after treatment for esophageal obstructions and was frequently observed in cases undergoing medical treatment alone (6) or both medical and surgical treatment (1). It is unknown what percentage of horses with esophageal obstruction have aspiration pneumonia directly due to the primary problem and not secondary to medical therapy. A longer duration of illness prior to referral was associated with the occurrence of aspiration pneumonia (7), suggesting that it arises due to the primary problem. Hydropulsion is employed to treat equine esophageal obstruction medically in the majority of clinical reports and it is also speculated that this approach could be responsible, in part, for the aspiration pneumonia (1,6,7). In the current population, most horses were referred within 24 h of first appearance of clinical signs with obstruction due to pulsion diverticulae, however, had an excellent long-term outcome, similar to other studies (1).

The 2 most common complications following the esophageal interventions were surgical site infections (SSIs) and aspiration pneumonia. The SSI rate was, however, lower (37%) than in a previous study (53%) (1). Surgical site infection increased the odds of euthanasia by 11 times. In some cases, significant tissue contamination had already occurred either through translocation of bacteria through compromised tissues or through an unidentified perforation.

It was not surprising that horses with a perforated esophagus had more complications than those without. In a recent case series of esophageal perforation (n = 4), a multitude of complications were also reported including: esophageal obstruction, thrombophlebitis, laryngeal hemiplegia, diarrhea, aspiration pneumonia, diverticulum formation, azotemia, weight loss, and laminitis (2). Primary repair of the esophageal perforation site is currently recommended in human surgery, even if the diagnosis is delayed more than 24 h (5). Exceptions to this recommendation include a perforation that cannot be accessed but can be drained, a perforation too large to be re-approximated, or when the patient is clinically unstable for anesthesia (5). It has also been suggested that equine esophageal ruptures should be sutured within 12 h of occurrence (3). Fistula formation was more likely following suture of a perforated esophagus in the study herein (3 of 5 perforations were sutured and 2 fistulas were observed). The effective sample size is unfortunately too small to draw definite conclusions on whether suturing a perforation is beneficial or whether the timing of suturing was associated with subsequent complications.

A trend (P = 0.09) was also noted for postoperative dehiscence in all horses with esophagotomy. An additional unexpected finding was that horses that underwent hydropulsion under general anesthesia, prior to esophagotomy, had 11 times the odds for postoperative dehiscence compared with other horses. We speculate that these horses might have had very firm ingesta impacting the esophagus, which could have led to necrosis of the esophageal wall with bacterial migration facilitated by the hydropressure of compromised tissues.

Aspiration pneumonia was the second most common complication in the present study but was not associated with euthanasia. This finding was in contrast to previous studies (1,6) which reported that aspiration pneumonia was the leading complication associated with death in horses after treatment for esophageal obstructions and was frequently observed in cases undergoing medical treatment alone (6) or both medical and surgical treatment (1). It is unknown what percentage of horses with esophageal obstruction have aspiration pneumonia directly due to the primary problem and not secondary to medical therapy. A longer duration of illness prior to referral was associated with the occurrence of aspiration pneumonia (7), suggesting that it arises due to the primary problem. Hydropulsion is employed to treat equine esophageal obstruction medically in the majority of clinical reports and it is also speculated that this approach could be responsible, in part, for the aspiration pneumonia (1,6,7). In the current population, most horses were referred within 24 h of first appearance of clinical signs with obstruction due to pulsion diverticulae, however, had an excellent long-term outcome, similar to other studies (1).

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and < 2/3 of these horses received hydropulsion therapy as many of our cases had a diagnosis for which hydropulsion was contraindicated (rupture, stricture, etc.), which may explain the low rate of aspiration pneumonia in this study.

Combined, these findings suggest that horses with esophageal obstruction should be examined and radiographed to detect aspiration pneumonia early after admission and that the owner should be informed of the most common complications and risks prior to embarking on treatment.

A variety of medical and surgical approaches are reported here, reflecting the multi-institutional nature of the study, multiple clinicians involved in management, and the variety of presenting problems. Consequently, it is impossible to provide clear evidence-based recommendations from study of a relatively rare condition such as this. Nevertheless, some common treatment approaches can be addressed to help guide clinicians in the management of these challenging cases.

Unfortunately, the medical records were often unclear as to whether the esophageal incisions were made directly over the obstruction or aborally to it. Based on the observations of this study, we postulate that it may be better to perform an esophagostomy aborally to the impacted food in a zone of healthy tissue for removal of the impaction and subsequent placement of a feeding tube.

Most horses with a lesion located in the proximal esophagus were discharged from the hospital. Interestingly, humans with perforations of the cervical esophagus have a much lower mortality than those with perforations in other parts of the esophagus and this is thought to be related to the anatomic tissue planes in the neck that limit the spread of contamination and infection (5). It could also be argued that the ventral surgical approach, which is commonly used to access the proximal esophagus (3,8), may be less prone to complications. Two ventral techniques were employed (3,8). The first involved suturing of the esophagus, placement of a drain adjacent to the esophagus, and subsequent closure of the muscles, subcutaneous tissues, and skin. The drain is then left in place for at least 48 h to detect leakage from the esophageal incision. With the second technique all tissue planes, including the esophageal wall, are left open to allow drainage and healing by second intention. Although the latter technique takes longer to heal, fewer postoperative complications have been reported with it (8). Regardless of the technique used, it is speculated that the ventral approach to the proximal esophagus facilitates drainage and that leakage would be detected earlier.

Esophagomyotomy has been used successfully to treat type 1 mural strictures (9). In our study, the lesion restricted after the procedure in all 3 horses that underwent an esophagomyotomy, similar to other reports (1). In 3 cases with strictures, an esophagostomy through the stricture with placement of a feeding tube through the stricture or “stage 1” (10) was performed. The theory behind this approach is that once the feeding tube is removed, the fistula heals and a traction diverticulum is formed that rarely causes a clinical problem (10,11). However, 1 horse was euthanized because of aspiration pneumonia, another lost to follow-up; the final horse did not have long-term complications. In the case described by Craig and Todhunter (10), the authors felt that there was still a cicatrix left from the stricture so they fenestrated the mucosal cicatrix circumferentially in 5 mm intervals through the fistula created by the feeding tube. This step was not performed in our 3 cases.

The principal limitation of our study is that the included horses presented with a variety of esophageal diagnoses and problems that required different surgical treatment strategies. Consequently, the effective sample size and statistical power of the study are limited.

Our observations provide insights into the management and complications encountered with equine esophageal obstructions nonresponsive to medical therapy and with esophageal perforations. Horse owners should be advised of the high complication rates including aspiration pneumonia, SSIs and restructure, and the low long-term survival. All horses should undergo a radiographic examination to identify the presence of aspiration pneumonia on admission. Caution should be exercised with hydropulsion therapy because of potential esophageal tissue compromise and potential risk of dissemination of infection. An aboral esophagotomy in healthy tissue is an acceptable approach for removal of an esophageal obstruction. A stage 1 repair may be the best approach for esophageal stricture. Esophageal ruptures should be sutured where possible and a drain left in place to detect leakage.

References

Incidence of post-anesthetic colic in non-fasted adult equine patients

Patricia A. Bailey, Brent A. Hague, Michael Davis, Michael D. Major, Chad J. Zubrod, Jeff E. Brakenhoff

**Abstract** — The purpose of this study was to determine the incidence of post-anesthetic colic in non-fasted adult horses undergoing isoflurane inhalant anesthesia for an elective, non-abdominal procedure at a single referral center. Medical records were searched from May 1, 2012 to May 31, 2014. Inclusion criteria included non-fasted patients ≥ 2 years of age that were anesthetized for an elective, non-abdominal procedure. The incidence of post-anesthetic colic for this study population was 2.5%. None of the risk factors examined (season, age, gender, breed, surgeon, procedure, recumbency, butorphanol administration, additional surgical complications, and the length of anesthesia) were associated with an increased risk of post-anesthetic colic. Providing food may maintain normal gastrointestinal motility and may decrease the risk of post-anesthetic colic.

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**Introduction**

General anesthesia in horses has been associated with severe complications such as death, fractured limbs, and colic. Post-anesthetic colic increases the morbidity, mortality, and expense associated with general anesthesia. Post-anesthetic colic rate has been reported from 2.8% to 10.5% in horses after an elective procedure and has been reported as high as 12% in horses undergoing elective and emergency procedures (1–6). Potential risk factors have been previously examined and many have been considered questionable, such as isoflurane use and the length of anesthesia (1,4,5).

Fasting equine patients prior to general anesthesia is common in some practices in an attempt to decrease the risk of post-anesthetic colic. Anesthetic protocols recommend fasting from 6 to 12 h before induction of anesthesia (1–6). Most patients in previously published post-anesthetic colic studies were fasted before anesthesia (1–6). To the authors’ knowledge, the incidence of post-anesthetic colic in a large population of equine patients allowed access to food prior to anesthesia has not been investigated.

The objective of this study was to determine the incidence of post-anesthetic colic in non-fasted adult horses undergoing isoflurane inhalant anesthesia for elective, non-abdominal procedures at a single, multi-surgeon referral center. We hypothesized that the incidence of post-anesthetic colic would be lower in a population of non-fasted horses compared to previously published incidence reports in fasted horses.

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**Materials and methods**

**Study design**

Medical records at the referral center were searched for all horses that had undergone inhalant anesthesia including magnetic resonance imaging (MRI), from May 1, 2012 to May 31, 2014.
A total of 1965 inhalant anesthetic procedures were performed during the 2-year period selected. Inclusion criteria consisted of patients ≥ 2 y of age, an elective-based procedure only, non-abdominal in nature, and the patients could not have been fasted before induction of general anesthesia. The patients had to be monitored in the hospital for a minimum of 24 h following isoflurane anesthesia. Patients were either in the hospital or returned for treatment of colic signs. Cases were excluded if the patient’s age was unknown or if the horse was admitted to the hospital as an emergency. If horses had more than 1 general anesthetic procedure, each anesthetic event was included separately if the procedures were not performed within a 24-hour period. If a patient received 2 general anesthetics within a 24-hour period it was considered 1 procedure. This resulted in 1200 cases available for inclusion in the study.

Data collection
Data obtained from the medical records included date of the procedure, signalment (age, gender, and breed), procedure performed, recumbency, duration of hospitalization, if perioperative/intraoperative butorphanol was administered, the presence of any complications (gastrointestinal or otherwise), duration of anesthesia, and the surgeon performing the procedure. For cases showing signs of colic after surgery additional information collected included time to the first colic clinical signs, time to colic resolution, treatment type (medical, surgical, or other), treatment specifics, etiology if identified, and estimate of the additional cost due to colic treatment.

Horse management
The patients were presented the day before or the day of general anesthesia. Hospitalized patients received a standard diet of Bermuda grass hay and all-stock pelleted grain twice daily along with access to free choice water. Clients were instructed not to withhold feed, hay, or water from patients prior to anesthesia. Hospitalized patients received a minimum of once daily physical examination and visual examinations a minimum of 3 times daily.

Anesthesia
Anesthetic protocols are standardized within the surgical center. Horses undergoing elective procedures typically receive xylazine (Anased; Lloyd, Shenandoah, Iowa, USA), 0.7 mg/kg body weight (BW), IV, phenylbutazone (ButaJect; Henry Schein, Dublin, Ohio, USA), 4.4 mg/kg BW, IV, gentamicin (Gentafuse; Henry Schein), 6.7 mg/kg BW, IV, and procaine penicillin G (Pen-Aqueous; Aspen Veterinary Resources, Liberty, Missouri, USA), 20,000 IU/kg BW, IM, before surgery. Magnetic resonance imaging pre-anesthetic protocol differs as no pre-anesthetic non-steroidal anti-inflammatories or antimicrobials are administered. Induction is accomplished using diazepam (Hospira, Lake Forest, Illinois, USA), 0.11 mg/kg BW, IV, and ketamine (Ketaject; Phoenix, St. Joseph, Missouri, USA), 2.2 mg/kg BW, IV. Following induction, horses are maintained on isoflurane (Isothesia; Henry Schein) vaporized in 100% oxygen. Lactated Ringer’s solution (Hospira) is administered IV. Patients receive dobutamine (Hospira) and calcium gluconate (Aspen Veterinary Resources, Liberty, Missouri, USA) infusion as needed to maintain mean arterial blood pressure above 60 mmHg. Butorphanol (Dorolex; Merck Animal Health, Summit, New Jersey, USA), 0.05 to 0.1 mg/kg BW, IV, is administered when necessary for painful procedures. Anesthetic time is recorded from the initiation of inhalation anesthesia to the end of inhalation anesthesia. Anesthetic monitoring includes direct arterial blood pressure via arterial catheter and electrocardiogram (Escort Prism; Medical Data Eletronics, Arleta, California, USA).

Case definition
A horse with colic was defined as one that required treatment for gastrointestinal discomfort. Clinical signs that indicated abdominal discomfort included pawing, rolling, inappetence, anorexia, lying down, or flank watching. If gastrointestinal discomfort was identified, a full physical examination was performed and the patient was treated as per the discretion of the attending surgeon.

Statistical analysis
A Chi-square (or Fisher Exact) test was used to identify possible risk factors associated with the likelihood of colic occurring following general anesthesia. Risk factors examined included season, age, gender, breed, surgeon, procedure, recumbency, butorphanol, additional surgical complications (including incisional dehiscence, post-operative myositis, colitis, and septic arthritis), and the duration of anesthesia. Age of the horse was categorized as young adult, mature adult, or geriatric. Duration of anesthesia was divided into long (≥ 60 min) or short (< 60 min). These classifications were based on Little et al (5).

Results
The incidence rate for post-anesthetic colic was 2.5% (30/1200). None of the risk factors examined (season, age, gender, breed, surgeon, procedure, recumbency, butorphanol administration, additional surgical complications, and the duration of anesthesia) were associated with a significantly increased risk of post-anesthetic colic (P = 0.21 to 1.0).

The season of the year had no influence on the number of colic cases versus non-colic cases seen in our study population. The age range of anesthetic patients that did not experience post-anesthesia colic was 2 to 23 y with a median age of 4 y. The age range of colic cases was also 2 to 23 y with a median age of 3.5 y. The non-colic cases included 606 geldings, 426 mares, and 117 stallions. Colic cases included 13 geldings, 14 mares, and 3 stallions. The most common breed affected by post-anesthetic colic was the Quarter Horse, followed by Thoroughbreds, which was consistent with the general population seen at the referral center. Butorphanol was administered to a total of 221 patients, 5 of which developed post-anesthetic colic.

The procedures performed under general anesthesia in the post-anesthetic colic cases included arthroscopy, conjunctival flap, third metacarpal bone fracture repair, MRI, plantar fasciectomy and neurectomy, superior check ligament desmotomy, cryptorchid castration, partial arthrodesis, and wound repair. The general surgery caseload encompassed wide varieties of
anesthetic procedures with the most common procedures being orthopedic, upper respiratory, and MRI. Most anesthetic patients were in dorsal recumbency for the procedure. Average duration of anesthesia for non-colic surgical patients was 73.1 min and for post-anesthetic colic cases was 76.3 min; the range for all anesthetic procedures was 20 to 190 min.

Time until first observation of clinical signs of colic ranged from the same day of the anesthetic procedure to 6 d after surgery; any patients that experienced colic beyond 6 d after surgery were excluded as the anesthetic event was presumed to be unlikely to be the cause. The majority of patients (83.3%) exhibited colic signs within the first 48 h after surgery. An etiology was not identified in most colic cases (19 of 30 cases) but the most common etiology identified was large colon impaction (5 of 30 cases). Medical therapy alone was used to treat 28 of the 30 colic cases. Nasogastric intubation with administration of a mild laxative (Laxade Powder; Aspen Veterinary Resources, Liberty, Missouri, USA) and/or electrolyte powder (Entrolyte H.E; Pfizer, New York, New York, USA) was performed in 93.3% of the cases. For the other 2 colic cases that required additional therapy, one had a nephrosplenic entrapment correction procedure (rolling) performed and the other required an exploratory laparotomy. Rolling for nephrosplenic entrapment correction was successful after 1 attempt. The patient that required surgical intervention was diagnosed with a severe large colon impaction which was treated with a pelvic flexure enterotomy. This patient was euthanized 11 d following exploratory laparotomy due to post-operative complications related to the exploratory laparotomy, and not general anesthesia.

Discussion

In this study the incidence of post-anesthetic colic in adult, non-fasted horses undergoing an elective, non-abdominal procedure with general anesthesia was 2.5%, which is lower than in published reports (1–6). In these published reports, most of the patients were fasted for a minimum of 6 to 12 h before induction of anesthesia (1–6). Horses herein were allowed a normal diet and feeding regimen in the pre-anesthetic period, which is markedly different than the previously published studies examining post-anesthetic colic in equine patients.

Jago et al (6) investigated perianesthetic complications in an equine referral hospital and the most common complication was post-anesthetic colic. The population in that study (6) was similar to the current population as both had a large number of cases, a single referral hospital was involved, and similar anesthetic protocols were used. The major differences between the populations were fasting protocols, antimicrobials selected, surgical facility, and geographical location. Horses were fasted overnight before anesthesia was induced in the study published by Jago et al (6), as in the other previously published studies. Out of 1067 horses, 111 displayed signs of gastrointestinal pain with an incidence rate of 10.5%. The study by Jago et al (6) demonstrates that there is significant need to formulate recommendations to decrease post-anesthetic colic risk, as it is the most common post-operative complication encountered by the equine patient, accounting for 65% of the complications experienced in their study population.

Due to the retrospective nature of our study, there was no in-house control population of fasted patients available, due to hospital protocols, to directly compare non-fasted versus fasted patients under the same management protocols. The ideal situation to further investigate the role of fasting on post-anesthetic colic would be to perform a prospective randomized blinded control trial. As general anesthesia in the equine patient can be associated with a significant risk of morbidity and mortality, all steps should be taken to decrease the risk to the patient.

Another limitation of this study was consideration and investigation into other potential variables not examined. The potential risk factors examined were selected based on previous study findings as these had historical importance (1–6). One variable not specifically investigated was duration of pre-operative hospitalization on the risk of post-anesthetic colic. This was not included as most horses were presented less than 24 h before surgery, which did not allow for an accurate comparison. Other potential risk factors not examined included the possible effect of certain antimicrobials administered or possible abnormalities on pre-anesthetic blood analysis. The standardized anesthetic protocol at this referral hospital involved the same broad-spectrum antimicrobial medication and pre-anesthetic blood analysis was not routinely performed.

Horses included in the current study were within the practice area and surgeons had regular communications with the referring veterinarians. All surgical complications were referred to the hospital for assessment and treatment including post-operative colic, ensuring a reliable incidence rate was determined. Anesthetic events were included separately if they occurred at least 24 h apart. Thirty-nine patients had 2 separate anesthetic procedures performed within 7 d. If the incidence rate was adjusted to only include anesthetic events separately if they occurred at least 7 days apart, the incidence is 30 out of 1161 cases or 2.58%, which remains markedly lower than that of previous studies.

It is important to understand the basis for the initial fasting recommendations before creating new recommendations. Reasons for fasting an equine anesthetic patient include reducing the risk of post-anesthetic colic, aspiration pneumonia, and hypoventilation (1–10). Regurgitation under general anesthesia rarely occurs in normal horses (7). In human, feline, and canine patients, fasting before general anesthesia was thought to reduce the risk of regurgitation and/or aspiration pneumonia (8,9). However, food deprivation has been linked to an increase in the volume and acidity of stomach contents, thus increasing the risk of regurgitation, aspiration pneumonia, and esophageal stricture in dogs (8). If regurgitation does occur in the equine patient it usually is associated with an indwelling nasogastric tube and manipulation of the stomach during colic surgery, not with procedures such as arthroscopy (7). However it is important to note that none of the patients in this study experienced complications associated with aspiration pneumonia or had evidence of regurgitation under or following general anesthesia.

Another reason many anesthetic protocols include a mandatory fast in equine patients is to decrease the size of the large colon, thus decreasing the pressure placed on the diaphragm to decrease the risk of hypventilation. In ruminants, fasting
does not appear to be effective in reducing the risk of hypoventilation despite recommendations for a much longer fast (10). Considering that a 48-hour fast in ruminants does not decrease the size of the rumen enough to prevent hypoventilation, then the 6- to 12-hour fast in equine patients may also be ineffective in preventing hypoventilation (10). The direct effect of allowing access to feed on the ability to properly ventilate the patient during inhalant anesthetic procedures was not examined in this study, since arterial blood gas analysis was not performed at the surgical facility.

This study demonstrated a low risk of post-anesthetic colic in a large population of horses when food was not withheld. It may be important to understand the potential reason that fasting the equine anesthetic patient may increase the risk of post-anesthetic colic. Fasting in the equine patient may cause abnormal physiologic events to occur, leading to an increased risk of post-anesthetic colic. During a prolonged fast, myoelectric activity is decreased in the equine colon leading to a decrease in contractile activity (12). This decreased contractility may lead to an increase in transit time, allowing for impaction and gas build-up within the intestinal lumen leading to colic.

In addition to decreasing myoelectricity and contractile activity, fasting the equine patient also leads to a decrease in water intake. Horses restrict their food intake when water is restricted and conversely restrict water intake when food is restricted (14). A documented risk factor for colic is decreased water intake in normal, healthy horses (14,15). For anesthesia patients, maintaining access to food will likely ensure water intake is maintained, decreasing the risk of colic.

The risk of post-anesthetic colic in this population was low; however, possible causes for post-anesthetic colic in the fasted horse should be investigated in hopes of creating additional recommendations for patient management. The potential causes for post-anesthetic colic in non-fasted horses include change in management and stress associated with transportation and hospitalization. Williams et al (16) demonstrated that water intake and fecal water content showed an abrupt, significant change immediately following a change in management in horses that were moved from a pasture to a stabled environment (16). Stabled horses had a dramatic increase in water intake but produced less fecal water. This proves equine patients experience physiological effects when undergoing stressful events, such as being hospitalized (16). Patient husbandry was not recorded in the current study so the possible link between post-anesthetic colic and the management change from pasture to hospital could not be investigated.

This study suggests that non-fasted adult equine anesthetic patients have a decreased risk of post-anesthetic colic. Allowing equine patients access to free choice food and water before anesthesia may maintain normal myoelectricity and contractile intestinal activity. Fasting the equine anesthetic patient may predispose them to post-anesthetic colic. Additional studies are required to further investigate this topic, but this paper suggests the need to re-evaluate some of the current pre-anesthetic recommendations.

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References
The effect of time until surgical intervention on survival in dogs with secondary septic peritonitis

Maxwell Bush, Margaret A. Carno, Lindsay St. Germaine, Daniel E. Hoffmann

Abstract — This retrospective study examined the effect of time to intervention on outcome in cases of dogs with secondary septic peritonitis, and also searched for other potential prognostic factors. The medical records of 55 dogs were reviewed. No association was found between outcome and the time from hospital admission to surgical source control. However, several other factors were found to influence survival, including: age, needing vasopressors, lactate, pre-operative packed cell volume, serum alkaline phosphatase, serum total bilirubin, and post-operative serum albumin. These values were then used to create accurate pre- and post-operative survival prediction models.

Résumé — Effet du délai jusqu'à l'intervention chirurgicale sur la survie des chiens atteints de péritonite septique secondaire. Cette étude rétrospective a examiné l'effet du délai jusqu'à l'intervention sur le résultat dans les cas de chiens atteints de péritonite septique secondaire et a aussi cherché d'autres facteurs de pronostic potentiel. Les dossiers médicaux de 55 chiens ont été examinés. Aucune association n'a été trouvée entre le résultat et le délai entre l'admission à l'hôpital et le contrôle chirurgical de la source. Cependant, on a constaté que plusieurs autres facteurs influençaient la survie : l'âge, le besoin de vasopresseurs, le lactate, la valeur d'hématocrite avant l'opération, la phosphatase alcaline sérique, la bilirubine totale sérique et l'albumine sérique post-opératoire. Ces valeurs ont ensuite été utilisées pour créer des modèles de prédiction de la survie exacts avant et après l'opération.

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Introduction

Secondary septic peritonitis is the most common form of peritonitis encountered in companion animals and results from bacterial contamination of the abdomen, from internal fluid leakage, or external penetration (1). Leakage from the gastrointestinal (GI) tract is the most common cause of septic peritonitis in dogs and cats, but other sources include the biliary or urogenital system (2). Treatment of secondary sepsis is focused on hemodynamic stabilization of the patient, antibiotic administration, and surgical source control and decontamination (2,3).

Septic peritonitis is a surgical emergency and the condition is associated with a guarded to poor prognosis, with most studies reporting survival rates of approximately 50%, but ranging from 36.4% to 85% (3,4). As these patients require intensive treatment, experience high complications rates, and have prolonged hospitalization, it is important to be able to appropriately guide owners’ expectations regarding outcome, length of stay, and possible complications.

Underscoring the difficulty in predicting outcome in these cases, several studies have shown no difference between survivors and non-survivors with regard to signalment, pre-operative clinicopathologic variables, or location of contamination (3,5,6). Others have examined the effects of various treatments on outcome including early enteral nutrition, open versus closed abdominal drainage, early antibiotic administration, and the use of canine albumin transfusion; however, no clear survival advantage has been demonstrated (3,7–9).

While human hospitals have recently documented a clearer correlation between early diagnosis and treatment of sepsis, the relationship between time and outcome in veterinary patients with septic peritonitis is less clear. To the authors’ knowledge, there is only one previous veterinary study that investigated time until intervention (source control) and its impact on mortality (10).

The primary goal of our study was to determine if there is an association between time from admission to surgical intervention (TTI) and survival in patients with septic peritonitis. Our hypothesis was that patients which had a shorter TTI would have higher survival rates. A secondary goal of the study was to identify potential prognostic indicators of survival in patients with septic peritonitis.
Table 1. Sources of abdominal contamination

<table>
<thead>
<tr>
<th>Source of contamination</th>
<th>Survivors</th>
<th>Non-survivors</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stomach</td>
<td>8</td>
<td>5</td>
</tr>
<tr>
<td>Duodenum</td>
<td>9</td>
<td>5</td>
</tr>
<tr>
<td>Jejunum/ileum</td>
<td>8</td>
<td>7</td>
</tr>
<tr>
<td>Colon</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Biliary/ liver</td>
<td>1</td>
<td>3</td>
</tr>
<tr>
<td>Urogenital (Uterus/prostate/bladder)</td>
<td>6</td>
<td>1</td>
</tr>
</tbody>
</table>

Materials and methods

The medical records of all dogs diagnosed with septic peritonitis that underwent surgical intervention at Veterinary Specialists & Emergency Services (VSES) between May 2007 and April 2015 were reviewed. Cases were included based upon reported intraoperative findings (gross leakage of viscus contents or ruptured abscess.) Cytology (presence of bacteria in abdominal effusion) and culture were used to further support the diagnosis if exploratory surgery was suggestive but not definitive of secondary septic peritonitis.

Surgery was performed by a board-certified surgeon, a surgical resident supervised by a board-certified surgeon, or a surgical resident alone. All dogs were treated with the objective of source control (drainage and debridement of the infectious nidus as well as restoration of optimal function to that area), and administration of broad-spectrum antimicrobials. Post-operative abdominal drainage was performed in some cases.

Data collected included age, breed, gender, body weight, duration of hospitalization prior to surgery, duration of clinical signs prior to surgery, history of recent abdominal surgery or other invasive procedures, recent administration of steroids or nonsteroidal anti-inflammatory drugs (NSAIDs), source of contamination, nature of the abdominal effusion, bacterial culture and sensitivity (if available), type of surgery performed, level of surgeon’s experience, length of surgery, placement of a feeding tube, placement of an abdominal drain, whether or not patients were treated for hypotension pre-, intra-, or post-surgery, pre-operative coagulation status (normal versus prolonged), administration of a transfusion, whether or not the patient was evaluated by their primary veterinarian prior to admission, as well as pre-operative lactate, alanine aminotransferase (ALT), blood urea nitrogen (BUN), creatinine, albumin, hematocrit, total protein, potassium, white blood cell (WBC), and post-operative albumin.

When available, hemograms were noted for the presence of hands or toxic change to the neutrophils. If a patient had surgery for septic peritonitis more than once at this hospital, only the first encounter was defined as the event. For patients that survived surgery, data for post-operative packed cell volume (PCV), total solids (TS), and lowest recorded post-operative serum albumin level were collected.

Final outcome was categorized as survived, died/arrested, or euthanized intra- or post-surgery. Euthanasia was performed during surgery if the owners did not wish to proceed after surgical exploration, based on perceived poor quality of life or increased financial estimate. For our study we classified patients as survivors or non-survivors, grouping patients euthanized in surgery with patients which were euthanized or died after surgery to assess final outcome. We combined cases of dogs that were euthanized after surgery with those that arrested after surgery, because these patients were usually euthanized due to perceived imminent death, in an effort to palliate pain and suffering.

Statistical analysis

To compare survivors to non-survivors, Fisher’s exact test (2 × 2 tables) or Chi-square test was used for categorical variables. A 1-way analysis of variance (ANOVA) was used to compare continuous variables. Categorical data are presented as frequencies and percentages, and continuous data are presented as means ± standard deviation (SD). Odds ratios were calculated when applicable.

After identifying variables with significant differences between groups, a logistic regression was used to create a predictive model of survival using selected variables. All analyses were performed using commercially available statistical software (IBM SPSS Statistics 20; IBM, Armonk, New York). Statistical significance was set at $P < 0.05$.

Results

Fifty-five cases met the inclusion criteria. In 44 cases diagnosis was made on the basis of surgical exploration, 8 cases were confirmed based on bacteria in the effusion and 3 were confirmed with abdominal fluid culture. There were 5 intact females, 5 intact males, 19 spayed females, and 26 neutered males. The ages of dogs ranged from 2 mo to 15 y, with the mean age of all dogs being 7.2 ± 4.25 y. The mean age of dogs that survived was 5.8 ± 3.9 y compared to the mean age of dogs that did not survive, which was 9.3 ± 3.7 y ($P = 0.013$). The overall survival in our population was 33/55 (60%). Six dogs died during surgery or after surgery. Nine dogs were euthanized during surgery, and 7 dogs were euthanized after surgery.

There was no association between location of leakage, or type of surgery and outcome (Table 1). The gastrointestinal (GI) tract was the most common source of leakage, which was caused by a perforating foreign body ($n = 15$), perforation of an ulcer (after NSAID or steroid use) ($n = 9$), dehiscence of a previous surgery site ($n = 8$), perforation of a neoplasm ($n = 5$), mesenteric torsion (with necrosis and leakage) ($n = 1$), gastric dilatation and volvulus (GDV) (from gastric necrosis) ($n = 1$), iatrogenic (bowel laceration from trocarization) ($n = 1$), gunshot wound ($n = 1$), and perforations of unknown cause ($n = 5$). The type of surgery performed did not have a significant association with outcome (Table 2).
Table 3. Patient and laboratory values

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Survivors n</th>
<th>Non-survivors n</th>
<th>n</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lactate* (mmol/L)</td>
<td>50</td>
<td>30</td>
<td>30</td>
<td>0.001</td>
</tr>
<tr>
<td>Post-operative albumin (g/L)</td>
<td>38</td>
<td>27</td>
<td>27</td>
<td>0.061</td>
</tr>
<tr>
<td>Age* (years)</td>
<td>55</td>
<td>33</td>
<td>33</td>
<td>0.002</td>
</tr>
<tr>
<td>Hospitalization (days)</td>
<td>45</td>
<td>33</td>
<td>33</td>
<td>0.006</td>
</tr>
<tr>
<td>Time from admission to surgery (h)</td>
<td>55</td>
<td>33</td>
<td>33</td>
<td>0.264</td>
</tr>
<tr>
<td>Length of surgery (h)</td>
<td>55</td>
<td>33</td>
<td>33</td>
<td>0.055</td>
</tr>
<tr>
<td>Duration of symptoms (d)</td>
<td>55</td>
<td>33</td>
<td>33</td>
<td>0.873</td>
</tr>
<tr>
<td>ALT (U/L)</td>
<td>55</td>
<td>33</td>
<td>33</td>
<td>0.191</td>
</tr>
<tr>
<td>BUN (mmol/L)</td>
<td>54</td>
<td>32</td>
<td>32</td>
<td>0.06</td>
</tr>
<tr>
<td>Creatinine (μmol/L)</td>
<td>53</td>
<td>32</td>
<td>32</td>
<td>0.254</td>
</tr>
<tr>
<td>Pre-operative albumin (g/L)</td>
<td>53</td>
<td>32</td>
<td>32</td>
<td>0.179</td>
</tr>
<tr>
<td>Pre-operative PCV* (%)</td>
<td>53</td>
<td>32</td>
<td>32</td>
<td>0.026</td>
</tr>
<tr>
<td>Pre-operative total protein (g/L)</td>
<td>53</td>
<td>33</td>
<td>33</td>
<td>0.75</td>
</tr>
<tr>
<td>K (mmol/L)</td>
<td>53</td>
<td>31</td>
<td>31</td>
<td>0.751</td>
</tr>
<tr>
<td>WBC × 1000 (×/mm³)</td>
<td>55</td>
<td>33</td>
<td>33</td>
<td>0.128</td>
</tr>
</tbody>
</table>

* Indicates variable with significant difference between survivors and non-survivors. ALT — alanine aminotransferase; BUN — blood urea nitrogen; K — potassium; WBC — white blood cells.

The time from admission to surgery was analyzed on a linear basis and also categorically by classifying patients in 6- or 12-hour groups. The 6-hour time blocks represented a reasonable and recommended time period for any medical therapy or preoperative stabilization to take place, and reflected the urgency with which the case was approached. For either method of analysis there was no correlation between time from admission to surgery and outcome.

The length of surgery ranged from 10 min to 5.5 h. The average length of surgery was 2.53 ± 1.03 h when performed by a resident alone, 1.63 (± 0.64) h when performed by a diplomate, and 1.89 ± 1.16 hours when performed by a resident supervised by a diplomate.

We also examined the length of surgery with animals which were euthanized in surgery removed from the data set. The mean length of surgery was 2.36 ± 1.05 h. Surgery was longer when residents were alone in the operating room (2.86 ± 0.88 h) than when either a diplomate alone (1.63 ± 0.64 h) or a diplomate and a resident (2.12 ± 1.14 h) were present during the procedure (P = 0.007). We did not find this when all cases were analyzed. Overall length of surgery though, was not statistically different when those dogs which had been euthanized during surgery were removed from the data set.

Results for univariate analysis of pre- and post-operative laboratory and patient variables are listed in Table 3. The relationship between albumin level (pre- and post-operative) was examined and as a continuous variable was not significantly associated with survival. When we designated a cutoff point of 10 g/L to constitute severe hypoalbuminemia, post-operative severe hypoalbuminemia was significantly associated with non-survival [χ² = 7.18; P = 0.01 (OR: 7.33)].

Mean pre-operative serum lactate levels in survivors were significantly lower (2.11 ± 1.10 mmol/L) than those of patients that died or were euthanized (4.71 ± 4.02 mmol/L; P < 0.05). Using a cutoff of 3 mmol/L was a strong predictor of survival (OR: 0.103, P = 0.001, χ² = 2.01).

Pre-operative bilirubin and serum alkaline phosphatase (ALP) levels were significantly higher in those dogs which died versus those which survived (P = 0.04 and P = 0.001, respectively) and higher in those which died a natural death than those which were euthanized (P = 0.05 and P = 0.006, respectively) but not significantly different between those which survived and those which were euthanized (P = NS) (Table 4).

Twenty-nine of 55 (53%) patients suffered from hypotension (SYS < 90 mmHg, MAP < 60 mmHg) during hospitalization (pre-, intra-, or post-surgery). Of these patients, 13 (45%) received a vasopressor agent either pre-, intra-, or post-surgery. Fourteen patients had hypotension that occurred pre- or post-surgery (i.e., not while under anesthesia). When excluding those patients in whom hypotension only occurred during surgery, 6 patients with hypotension received a vasopressor.

The presence of hypotension during hospitalization or surgery was not associated with survival (P = NS). This remained the case when patients in whom hypotension only occurred during surgery were excluded. Patients which were hypotensive and received a vasopressor had a significantly higher rate of death or euthanasia (P = 0.023 (OR: 5.02)); however, this difference was not significant when examining only the cases in which vasopressor use occurred outside of anesthesia.

The use of vasopressors was also significantly (P = 0.010) correlated with pre-operative lactate level. Patients which received vasopressors had mean pre-operative lactate levels of 4.84 ± 4.22 mmol/L, compared to 2.53 ± 2.06 mmol/L in patients which did not receive vasopressors. When examining only cases in which vasopressor use occurred outside of anesthesia, the lactate of those which received vasopressors and those which

### Table 4. Differences in liver values between patients which survived, died, or were euthanized

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Survived</th>
<th>Died</th>
<th>Euthanized</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pre-operative total serum bilirubin (μmol/L)</td>
<td>7.87 ± 13.00</td>
<td>32.16 ± 56.44</td>
<td>7.01 ± 10.26</td>
</tr>
<tr>
<td>Pre-operative serum ALP (U/L)</td>
<td>262.12 ± 355.2</td>
<td>1440.17 ± 1991.9</td>
<td>348.13 ± 333.39</td>
</tr>
</tbody>
</table>

ALP — alkaline phosphatase.
did not were 6.58 ± 4.56 mmol/L and 2.89 ± 2.57 mmol/L, respectively ($P = 0.007$).

Two models were created based on findings from the univariate analysis: 1 for predicting survival before surgery and 1 for post-operative survival. Both models accurately predicted outcome > 80% of the time, based upon our data. The model variables for pre-operative survival included age, PCV, pre-operative total bilirubin, serum ALP, and serum lactate level. A test of the full model was statistically significant indicating that the chosen variables as a group reliably distinguished between those dogs that survived versus those which died or were euthanized ($\chi^2 = 27.4$, df (5); $P < 0.001$). The Nagelkerke R2 of 0.58 indicated a moderately strong relationship between the prediction and grouping. The overall correct prediction for the model was 81.6% (70% for non-survival and 89.7% for survival). The overall odds ratio for the complete model is 1.45. The Wald criterion demonstrated that only age and lactate made significant contributions to the prediction ($P = 0.018$ and $P = 0.005$, respectively). For every additional year of age, the odds of survival decreased by 0.7. For every 1 mmol/L increase in serum lactate level the odds of survival decreased by 0.5. While pre-operative bilirubin, ALP and PCV as individual variables did not contribute significantly to the model, when these variables were removed from the model development, the overall correct prediction decreased to only 75.5% with a decrease in survival prediction to 79.3%.

The strongest post-operative prediction model included those variables from the pre-operative prediction model (age, PCV, pre-operative bilirubin, ALP, and lactate) along with post-operative serum albumin level as a categorical variable (< 1 versus ≥ 1) [$\chi^2 = 25.1$, df (6); $P < 0.001$]. The Nagelkerke R2 of 0.72 indicated a moderately strong relationship between the prediction and grouping. The overall correct prediction for the model was 85.7% (90.9% for non-survival and 83.3% for survival). The overall odds ratio for the complete model is 2.18. The Wald criterion demonstrated that only lactate made a significant contribution to the prediction ($P = 0.05$) with a trend for post-operative albumin ($P = 0.06$). While age, pre-operative bilirubin, ALP, and PCV as individual variables did not contribute significantly to the model, when these variables were removed from the model development, the overall correct prediction decreased to only 80% with a decrease in death/euthanized prediction to 72.7%.

Discussion

The results of our study did not support our hypothesis that shorter TTI impacted outcome. Factors that were significant independently and as part of a predictive model were age, requiring vasopressors, lactate, pre-operative PCV, serum ALP, serum total bilirubin, and post-operative serum albumin.

A previous study of septic peritonitis found that survivors had significantly lower pre-operative serum values for the liver enzymes alanine aminotransferase and γ-glutamyl transferase than did non-survivors (11). While our study found similar results, these should be interpreted cautiously. There were 2 patients in the group that died which had biliary tract obstruction and consequently severely elevated ALP and bilirubin, affecting the mean. Packed cell volume has also been associated with prognosis in animals and humans with critical illness and sepsis (12). However, PCV can vary due to dehydration or IV fluid dilution, and although the difference was significant, the mean PCV of non-survivors was still within the reference range. While not likely to be useful on their own, initial PCV, serum ALP, and total bilirubin may be useful components of a prognostic or risk model for patients with septic peritonitis, as they could be sentinels of systemic illness.

Increased patient age was negatively associated with survival, which, to the authors’ knowledge, has not been reported for septic peritonitis in animals. While increased age has been associated with a poorer prognosis in humans with abdominal sepsis (13,14) there is also a strong chance that, within our population, a euthanasia bias played a role in the significance of age. While a frank discussion regarding costs and prognosis is always undertaken with an owner prior to surgery, owners may view these differently depending upon the age of their pet.

Pre-operative serum lactate of > 3 mmol/L was associated with a higher mortality rate. Lactate is an end product of anaerobic glycolysis, and increased plasma lactate is seen with inadequate tissue perfusion and subsequent hypoxia (15). In assessing dogs with GDV, one study showed that mortality was higher in patients with a lactate of > 9.0 mmol/L, and another showed that an initial lactate cutoff of 7.4 mmol/L was accurate for predicting gastric necrosis and outcome (16,17). Cortellini et al (18) found that in patients with septic peritonitis, survivors had lower mean initial lactate concentration and an inability to normalize the hyperlactatemia was associated with a poorer prognosis.

Pre-operative hypoalbuminemia is associated with increased risk of anastomotic leakage, and development of post-operative septic peritonitis (19,20). Furthermore, low serum albumin levels have been predictive of non-survival in both human and veterinary studies of abdominal sepsis and other critical illnesses (10,20,21). Goldwasser et al (21) found a 24% to 56% increase in the estimated odds of death for every 2.5 g/L decrease in serum albumin concentration, and concluded that serum albumin level was a highly sensitive indicator of preclinical disease and disease severity, and potentially had direct protective mechanisms. This association may be due to albumin’s role in maintaining intravascular volume through colloid osmotic pressure (COP), providing drug and hormone binding capacity, protection from oxidative damage, blood pH buffering, and mediation of coagulation. While albumin is not a specific component used in wound repair, hypoalbuminemia is associated with delayed wound healing (22).

Prior studies of septic peritonitis in dogs that found no association between albumin and outcome examined pre-operative, but not post-operative serum albumin values (5,11,23). Our study found an association between post-operative serum albumin and survival, similar to that found by Craft and Powell (8). Albumin can be lost at an accelerated rate in the septic patient via leakage through endothelial and peritoneal membranes, which can be compounded by the dilution effects of aggressive crystalloid therapy (22). Thus, the post-operative value may represent their “true” serum albumin level and be of
more value in predicting survival and guiding transfusion after surgery.

Many factors related to abdominal surgery can influence blood pressure, including anesthesia-induced vasodilation and myocardial depression, acute hemorrhage, hypothermia from an open abdomen, obstruction of venous return secondary to positive pressure ventilation, dorsal recumbency, and packing or retraction of organs to isolate a viscus (24). These factors may have confounded the true relationship between blood pressure and survival in our study. When examining cases in which the hypotension only occurred outside of surgery and anesthesia, there was no association between hypotension or vasopressor use and survival.

Cases which required vasopressors likely represent patients in more severe or even refractory shock, where physiologic compensation mechanisms and intravascular volume restoration fail to correct hypotension, as is often seen with sepsis and systemic inflammatory response syndrome. Circulating inflammatory hormones can have vasodilatory effects on blood vessels, causing NO-mediated vascular smooth muscle relaxation, and septic patients are more sensitive to the hypotensive effects of drugs (25). Septic shock can also create a critical illness-related corticosteroid insufficiency, exacerbating a patient’s inability to generate appropriate systemic vascular resistance (26). While merely being hypotensive was not significantly associated with survival, the requirement for vasopressor therapy may be indicative of more severe disease. Patients in our study which received vasopressors had significantly higher preoperative lactate and survival, the requirement for vasopressor therapy may be indicative of more severe disease. Prior veterinary studies have shown similar results, with survivors receiving fewer vasopressors, and those animals with septic shock having worse outcomes (5,10,27). In addition, Grimes et al (20) found that intraoperative hypotension was a risk factor for post-operative septic peritonitis and death in patients undergoing GI surgery. Also, human patients with septic shock are at higher risk of mortality than those with just severe sepsis (28).

Despite multiple methods of data analysis, we found no correlation between time from admission until surgery and survival, nor any correlation between duration of symptoms and survival. One possible explanation is that we did not have a large enough sample size to detect a difference, i.e., type II error. The small sample size could also potentially conceal significant disease-specific associations between surgical delay and outcome. Intra-operative euthanasia may have confounded the results in the case of patients which had a short TTI, but in which the owners were not expecting a diagnosis of septic peritonitis, and elected euthanasia based upon the change of projected cost or prognosis, or perceived post-operative quality of life in the mind of the owner. However we purposefully included patients euthanized during surgery because the decision to euthanize was often based on the surgeon's recommendation regarding either unresectable masses or perceived post-operative quality of life. Furthermore, even with patients which were euthanized excluded from the analysis, there was still no significant difference in survival based upon TTI.

Controlled delay of surgery at the discretion of the primary surgeon for pre-operative stabilization/optimization may also have weakened the expected association between TTI and survival. Conversely, an overzealous urge to take patients to surgery prematurely could have contributed to the outcome.

Previous veterinary studies of septic peritonitis have shown a lack of association between outcome and duration of symptoms (3) or between outcome and time from admission until surgery (10). In addition, a study investigating the impact of early antibiotic administration could not demonstrate a significant difference in survival in patients with early administration of antibiotics (9).

While it seems intuitive that early surgical intervention should be paramount in these cases, the concept of rapid surgical source control is based mainly in dogma, as there is a lack of evidence regarding the ideal time for surgical intervention in septic peritonitis (28). In humans, many studies have shown that expeditious implementation of resuscitation bundles and early antimicrobial prophylaxis improve outcomes of patients with sepsis (29), but few studies have shown marked improvement in outcome with early surgical intervention (28). Furthermore, the majority of human studies on TTI examine necrotizing soft tissue infections and pancreatitis, while studies examining TTI in cases of abdominal perforation and subsequent sepsis are rare. Two relatively small studies (14,30) showed increased mortality in patients in whom surgery was delayed by 24 and 48 h, and a much larger retrospective cohort study found that in patients with a perforated gastric ulcer, there was an increase in the 30-day mortality of 2.4% per hour of surgical delay (31). However, that latter group recently published results of a slightly larger retrospective study of more recent cases that showed no association between surgical delay and outcome (32).

Facilitating shorter times from hospital entry until source control is critical, but rapid transfer to the operating room is not likely to succeed independently of proper resuscitation of septic patients, with end points of goal directed therapy that are targeted before surgical intervention. A semi-prospective study from Moore et al (33) found that when compared against national database of patients, a hospital with a dedicated “acute care surgery” service had improved survival rates, attributing this result to compliance with guidelines from the Surviving Sepsis campaign mandating early acquisition of cultures and baseline laboratory analyses, prompt goal directed fluid resuscitation, administration of antibiotics within 1 h of diagnosis, and rapid surgical source control (< 6 h).

A recent prospective study in humans with gastrointestinal perforation found that when early goal-directed therapy was combined with early surgical source control, time until surgery was a critical determinant of survival. There was a 0% survival rate in those patients for whom surgery occurred more than 6 h after admission. The authors concluded that humans with gastrointestinal perforation should be operated on within 1 to 2 h of diagnosis, regardless of a successful response to resuscitation efforts (34).

Study limitations include its retrospective nature and a low sample size. The data include cases managed by 7 surgeons, and this lack of standardized treatment protocols undoubtedly impacts outcome. Owners potentially contributed to the high rate of non-survival due to an inability or unwillingness
to pursue expensive, intensive hospitalization in the face of a guarded prognosis. That confounding effect was minimized due to inclusion of only patients that were taken to surgery; however, there were some cases in which septic peritonitis was not discovered until surgery, requiring owners to rethink their decision to continue.

Mortality rates regarding septic peritonitis in this and other studies should be interpreted with caution because euthanasia was not distinguished from natural death, and intraoperative euthanasia or death was not distinguished from post-operative euthanasia or death. The decision to euthanize may have been made before definitive source control was attempted due to the perceived negative prognosis or anticipated cost and quality of life after extensive bowel resection. Prospective studies in which the reason for euthanasia is recorded would be helpful in order to better define the true prognosis with this condition. However, the survival rate in our study was 60%, which is similar to other reports with a comparable population.

In conclusion, we found that time from admission to surgical intervention in patients with septic peritonitis did not affect outcome and that several pre- and post-operative variables (age, PCV, ALP, bilirubin, lactate, albumin) appeared to have value in predicting outcome. These variables may be useful in future development of a prediction model or scoring system for patients with septic peritonitis and may help clinicians inform owners of prognosis prior to surgical intervention. To further investigate the importance of rapid source control, future prospective studies should focus not simply on expediting transfer to the operating room, but on better adherence to the Acute Care Surgery Model, in which patients with a diagnosis of septic peritonitis are treated in accordance with the evidence-based guidelines of the Surviving Sepsis Campaign. Computer-based decision-making protocols may help standardize and promote compliance (9,35).

References


AFSCAN Welcomes KRUUSE as an Additional Main Sponsor

Global veterinary equipment supplier KRUUSE has increased its sponsorship of the African Small Companion Animal Network (AFSCAN), an initiative run by the World Small Animal Veterinary Association’s (WSAVA) charitable Foundation, to enhance standards of veterinary care for companion animals in Sub-Saharan Africa. In so doing, it has become an additional Main Sponsor alongside Zoetis, the Main Sponsor since AFSCAN was launched in 2014.

KRUUSE will focus on supporting AFSCAN’s educational activities, together with the work it is doing to develop training and distance learning CE programs for veterinarians and other veterinary professionals in the five countries participating in the project — Kenya, Namibia, Nigeria, Tanzania and Uganda. KRUUSE will, for instance, work with digital services provider Vetstream, also a supporter of AFSCAN, on a series of webinars and to enable access to Vetstream and other educational modules.

In addition to advancing standard of veterinary care through education and CE, AFSCAN is facilitating the creation of a sustainable network of small companion animal veterinary associations (SAVAs) in the participating countries. In addition, it supports rabies control projects in Africa in partnership with Mission Rabies and the development of surveillance systems to monitor infectious and parasitic diseases in companion animals. Launched in 2014 and backed by global animal health company Zoetis, AFSCAN is also supported by a Consortium of other sponsors, of which KRUUSE is a founder member.

The World Small Animal Veterinary Association (WSAVA) is an umbrella organization representing almost 160,000 veterinarians globally through 94 member associations. The WSAVA Foundation was founded in 2009 with the aim of acquiring funds for activities that can be delivered by clinical and laboratory specialists for the benefit of veterinarians globally. Visit www.afscan.org for more information.

New VET conference in Toronto

The inaugural Veterinary Education Today (VET) conference and medical exposition took place in Toronto, September 29 to October 1, 2016 at The International Centre. More than 475 veterinary clinicians from across Canada attended the newest option for a low-cost, high-quality continuing education (CE) conference. Affordable conference fees, free parking, convenient location, relevant content, and excellent networking all contributed to the overall success of the conference.

“The feedback we are getting from delegates is overwhelmingly positive,” says Dr. Duncan Hockley, director of the Western College of Veterinary Medicine’s (WCVM) Veterinary Medical Centre and planning committee chair for VET. “Hundreds of delegates made a point of thanking us for creating this conference and delivering world-class practical CE for our industry, and they are already asking when registration will open for next year.”

More than 80 per cent of delegates rated the WCVM CE program as Very Good to Excellent, and more than 90 per cent validated the education was relevant to their practice.

Conference delegates had 30 different CE sessions to choose from, tailored to companion animal, bovine and equine tracks; earning up to 12 RACE approved CE credit hours. Optional small-group pre-conference workshops offered participants the chance to advance their skills through seminars on wellness, social media, medical imaging and pet rehabilitation. Neil Pasricha, the New York Times bestselling author, set the tone for the conference with his engaging opening keynote on workplace happiness. The exhibit area featured more than 60 companies representing all aspects of the industry from equipment to food to the latest technology. Delegates loved the wellness lounge where they received complimentary massages, relaxed and recharged their energy.

“We wanted VET to deliver a unique experience for both delegates and exhibitors,” said Steve Dempsey, senior vice president of Diversified Communications Canada, organizers of VET. “Without a doubt we exceeded expectations. Planning has already started for 2017 and we are forecasting VET to grow significantly based on the feedback we’ve been receiving so far.”
Article

Survey of Ontario veterinarians’ knowledge and attitudes on pain in dogs and cats in 2012

Adam Beswick, Cate Dewey, Ron Johnson, James Dowsett-Cooper, Lee Niel

Abstract — Appropriate management of animal pain is a critical component of optimal animal welfare in small animal veterinary clinics. An online convenience survey was used to examine the knowledge and attitudes of practicing veterinarians in Ontario about pain in dogs (n = 100) and cats (n = 139). Veterinarian participants showed strong agreement with the need for appropriate animal pain relief, and low agreement with lack of analgesic use due to cost or side effects. All of the surgical procedures included in the survey were ranked as being moderately to highly painful, but female veterinarians had higher median rankings. Importantly, 78% of veterinarians thought their knowledge about pain recognition was sufficient. Selection bias might have resulted in overestimates of attitudes about pain in comparison to the general veterinary population. However, these results suggest that knowledge and attitudes related to pain assessment and treatment in dogs and cats have improved since the last similar survey in 2001.

Résumé — Sondage sur les connaissances et les attitudes des vétérinaires de l’Ontario à propos de la douleur chez les chiens et les chats en 2012. La gestion appropriée de la douleur animale est une composante critique du bien-être animal dans les cliniques vétérinaires pour petits animaux. Un sondage de convenance en ligne a été mené pour examiner les connaissances et les attitudes des vétérinaires praticiens en Ontario à propos de la douleur chez les chiens (n = 100) et les chats (n = 139). Les participants vétérinaires se sont dits fortement en accord avec le besoin d’analgésie appropriée pour soulager la douleur des animaux et très peu en accord avec l’absence d’utilisation des analgésiques en raison du coût ou des effets secondaires. Toutes les interventions chirurgicales incluses dans le sondage étaient classées comme étant modérément à très douloureuses, mais les femmes vétérinaires présentaient des classement moyens supérieurs. Fait important, 78 % des vétérinaires croyaient que leurs connaissances à propos de la reconnaissance de la douleur étaient suffisantes. Le biais de sélection pourrait s’être traduit par des surestimations des attitudes à propos de la douleur comparativement à la population vétérinaire en général. Cependant, ces résultats suggèrent que les connaissances et les attitudes se rapportant à l’évaluation de la douleur et au traitement des chiens et des chats se sont améliorées depuis le dernier sondage semblable réalisé en 2001.

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Introduction

Appropriate assessment and treatment of animal pain are critical for ensuring optimal animal welfare in small animal veterinary clinics. Health outcomes and overall animal welfare may be impaired by pain and stress associated with inadequate analgesia (1,2). Factors that can influence appropriate pain management include staff knowledge and attitudes about pain assessment and treatment.

Practices surrounding pain relief for companion animals are constantly evolving. Early studies in the 1990’s suggested that most practitioners were providing analgesics for orthopedic surgeries, but few practitioners were doing so for ovariohysterectomy or castration (3–6). However, studies through the 2000’s have shown a steady increase in reported use of analgesics (7–11), with a recent study from the United Kingdom suggesting that more than 99% of veterinarians are providing some form of perioperative analgesia for ovariohysterectomy and castration (12). However, further research is necessary to determine whether this increased usage of analgesics after surgery is widespread. A comparison of 2 Canadian studies conducted during the 1990’s and 2000’s shows a dramatic increase in the use of analgesics by veterinarians, but a significant number of animals were still left untreated at the time of the later study (4,9). For example, in the early 2000’s, approximately 9% of veterinarians were classified as not providing any pre- or post-operative analgesics for either ovariohysterectomies or castrations for dogs. No recent studies on this topic have been completed in Canada.
Recent studies suggest that most veterinarians have a high level of awareness about animal pain, and that they are in agreement with the need for appropriate pain relief in companion animals. For example, a study from New Zealand suggested that most veterinarians agreed that animals should be given the same considerations for pain relief as humans, and that pain prevention was better than pain relief (13). Similarly, a French study found that 99.5% of participating veterinarians reported moderate to extreme concern about the pain of their patients (8). However, previous studies demonstrated that individual veterinarians vary in their perceptions of the level of pain associated with various procedures, and their concerns about possible risks and disadvantages associated with analgesic use. For example, postoperative pain in animals was rated as more severe by female veterinarians compared with males, and by more recent graduates compared with older graduates (4,5,9). Veterinarians were more likely to be analgesic users if they were female, a more recent graduate, had higher pain perceptions scores, or were less concerned about adverse reactions (14,15). Thus, it is important to understand current attitudes and their potential effect on analgesic use.

Veterinarian knowledge on topics related to animal pain can also play an important role in informing practical pain management strategies. Pelzer and Leysen (16) assessed general sources of information and found that the most important sources for practicing veterinarians at that time were books, other practitioners, and journal articles. In a more recent study, veterinarians in New Zealand assessed sources of information specifically addressing recognition and treatment of pain, and ranked continuing education lectures and experience gained in practice as being the most valuable sources of information (13). An understanding of sources of knowledge on this topic is important for informing teaching and continuing education practices in the future.

The last study to assess the perspectives of Canadian veterinarians about pain relief in dogs and cats was conducted in 2001. The objective of this study was to examine current knowledge and attitudes of Ontario veterinarians about pain management in dogs and cats following surgery, and to assess the effects of demographics, including gender and year of graduation. The current paper is focused on a subset of data resulting from this survey that relates to veterinarian attitudes about pain relief, perceptions of pain following various surgeries, confidence with pain recognition, and importance of various clinical indicators of pain, and preferred sources of information about pain recognition.

Materials and methods
The current questionnaire was developed based on previous surveys used to examine veterinarian perspectives on animal pain and analgesic use (4,9,13,17). In order to assess clarity, face validity, and length, the questionnaire was pretested by a group of graduate students with DVMs at the Ontario Veterinary College and 2 groups of 6 veterinarians in private practice who were selected to represent a range of geographic locations, years of graduation, gender, and practice types.

Data were collected through a self-administered questionnaire using Limesurvey, an online survey tool. All participants were licensed veterinarians in Ontario, had an e-mail address, were members of the Ontario Veterinary Medical Association (OVMA), and regularly treated dogs and/or cats in their practice. Participants were recruited through advertisements in the OVMA magazine “Focus,” as well as the online newsletter “Newshound.” The survey was conducted from September 13th, 2012 through January 6th, 2013. Veterinarians who completed the survey were included in a draw to win one registration for the next annual OVMA annual conference. This study was approved by the University of Guelph Research Ethics Board (ref: 12FE031).

Separate, similar questionnaires were available for dogs and cats, and participating veterinarians were directed to complete either one or both questionnaires. If the participants chose to complete both questionnaires, they had the choice of which one to complete first. If the veterinarians chose to complete only one of the questionnaires, they were assigned to the dog questionnaire if their year of graduation was an odd number, and the cat questionnaire if their year of graduation was an even number.

The questionnaire included demographic information and 6 distinct sections addressing different aspects of veterinarians' attitudes and practices on pain assessment and use of analgesics. The section on demographic information included gender, age, year of graduation, and details of post-graduate training. The year of graduation variable was categorized post-collection into 4 groups: pre-1981, 1982–1991, 1992–2001, 2002–2012. Analysis involved responses to 3 sections of the questionnaire that were focused on attitudes, knowledge, and practices in relation to pain relief and pain assessment.

The first section assessed attitudes toward pain relief in dogs and cats by providing participants with statements about pain relief and asking them to provide a numbered response from 1 (strongly disagree) to 5 (strongly agree). For the second section, veterinarians were asked to rate the amount of pain they perceived an animal to experience in the 12 h following particular surgeries if no analgesia was provided. Participants answered on a scale from 1 (no pain at all) to 5 (worst pain imaginable). The specified surgeries listed were: ovariohysterectomy, castration, dental with major extractions, fracture repair, exploratory laparotomy, onychectomy (cat survey only), and thoracotomy. Additionally, participants were asked to rank the importance of common clinical signs of pain in dogs and cats on a scale of 1 (not important at all) to 5 (extremely important) following surgery. Finally, the third section assessed whether or not participants considered their knowledge about recognizing pain to be sufficient, and asked them to rank the importance of various types of continuing education resources such as journal articles, conferences, and on-line resources, to improve their knowledge of pain recognition.

Statistics
Participants completed the survey anonymously and it was not possible to identify individuals who completed both the cat and dog survey. Because of this, data from the 2 surveys could not be considered strictly dependent or independent, and direct comparison between the cat and dog surveys was determined to be inappropriate.
All statistical analyses were performed using SPSS version 21.0 (IBM Corp., Armonk, New York, USA). The OVMA provided demographic information for the OVMA membership for the 2014/2015 membership period for comparison with participant data. To determine whether our sample was representative of the general OVMA membership, we compared the number of participants in our sample against the OVMA membership data across all year of graduation periods (before 1974, 1975–1984, 1985–1994, 1995–2004, 2005–2012) using the Chi-square test. We also compared participation for men and women between our participants and the OVMA membership for each of the year of graduation periods provided by the OVMA (before 1970, 1970 to 2010 for each 5-year bin, and 2010 to 2012) using either Chi-square or Fisher’s exact test. Note that the year of graduation periods differ from those used for our analyses.

In addition, associations between gender and year of graduation for the participant data were evaluated using a Chi-square test. Descriptive statistics were computed separately for the dog and cat surveys, and data are presented as either means, or medians with first (Q1) and third (Q3) quartiles. For binary outcome variables (i.e., Yes/No for sufficient knowledge about recognizing pain), effects of gender and year of graduation were examined using the Chi-square test. For ordinal outcome variables (i.e., agreement with attitude statements, ranking of pain following surgery, ranking of importance of clinical signs of pain, ranking of importance of continuing education resources), effects of gender and year of graduation were examined using the Mann-Whitney and Kruskal-Wallis tests, respectively. Statistical results were considered significant at P < 0.05.

## Results

In total, 239 surveys were completed, including 100 dog and 139 cat surveys. Only 10 veterinarians completed both the cat and dog surveys. According to the OVMA data there were 1416 small animal and 410 mixed animal veterinarians with OVMA memberships in 2014/2015; assuming that membership numbers were similar in 2012, this indicates an approximate response rate of 13%. Demographic characteristics of participating veterinarians are summarized in Table 1. On average, female veterinarians graduated more recently than male veterinarians in both the dog (mean 2000 versus 1989, P < 0.01) and cat (mean 2000 versus 1989, P < 0.01) surveys. Furthermore, there were significant associations between gender and year of graduation for both the dog survey participants (P < 0.001), and the cat survey participants (P < 0.001).

The number of participants included within each year of graduation period did not differ significantly from expected participation based on the OVMA membership data (P > 0.1). Within gender, year of graduation data for our participants were similar to the OVMA membership data, with a few exceptions. A higher percentage of women who belonged to the OVMA participated compared with men who belonged to the OVMA [16.6% versus 11%; odds ratio (OR) = 1.81, 95% confidence interval (CI): 1.3 to 2.4, P < 0.001]. Fewer women who graduated from 1990 to 1994 participated in the survey than were represented in the OVMA member data (7% versus 13%; P < 0.01). In contrast, for the 2010 to 2012 period, a higher proportion of women participated in the survey than were represented in the OVMA member data (19% versus 13%; P < 0.05). Finally, the proportion of men who graduated between 1995 and 1999 and who participated in the survey was less than the proportion of these men in the OVMA member data (8.5% versus 14.4%; P < 0.001).

### Attitudes toward pain

Male and female veterinarians were asked to rate their level of agreement with various statements related to attitudes towards the management of animal pain, and median rankings are presented in Table 2. Responses of males and females generally agreed, but differed significantly for 1 statement on the dog survey, and 3 statements on the cat survey. An effect of year of graduation was observed for only 1 statement: veterinarians who graduated more recently reported a higher degree of agreement with the phrase “I feel more constrained by concerns over owner budget from using the degree of pain relief I feel is ideal” than did older veterinarians (P < 0.005).

### Pain rankings

For the 5 surgeries included in both the dog and cat survey, the lowest pain scores were reported for castration, and the highest scores were reported for thoracotomy (Table 3). Compared with male veterinarians, female veterinarians perceived dogs to

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**Table 1.** Demographic characteristics of Ontario veterinarians who responded to the dog and cat surveys on attitudes and knowledge about pain, 2012

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Dog survey (n = 100)</th>
<th>Cat survey (n = 139)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gender</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>30%</td>
<td>30%</td>
</tr>
<tr>
<td>Female</td>
<td>66%</td>
<td>69%</td>
</tr>
<tr>
<td>Year of graduation</td>
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<td></td>
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<tr>
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<td>1%</td>
</tr>
<tr>
<td>1966–1981</td>
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<td>6%</td>
</tr>
<tr>
<td>Female</td>
<td>4%</td>
<td>4%</td>
</tr>
<tr>
<td>1982–1991</td>
<td>13%</td>
<td>14%</td>
</tr>
<tr>
<td>Female</td>
<td>11%</td>
<td>12%</td>
</tr>
<tr>
<td>1992–2001</td>
<td>5%</td>
<td>5%</td>
</tr>
<tr>
<td>Female</td>
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<td>16%</td>
</tr>
<tr>
<td>2002–2012</td>
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<td>4%</td>
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<tr>
<td>Female</td>
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<td>36%</td>
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<tr>
<td>Veterinary school</td>
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<td>84%</td>
</tr>
<tr>
<td>Other</td>
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<td>16%</td>
</tr>
<tr>
<td>Type of practice</td>
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<tr>
<td>Small animal</td>
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<td>81%</td>
</tr>
<tr>
<td>Mixed</td>
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<tr>
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</tr>
<tr>
<td>Internship</td>
<td>3%</td>
<td>0%</td>
</tr>
<tr>
<td>Residency</td>
<td>1%</td>
<td>1%</td>
</tr>
</tbody>
</table>

OVC — Ontario Veterinary College.
experience more pain for ovariohysterectomy and exploratory laparotomy, and perceived cats to experience more pain for all procedures listed except fracture repair and castration. There were no significant differences in pain rankings based on year of graduation for either the dog or cat surveys.

Pain recognition

Most veterinarians indicated that their knowledge about recognizing pain is sufficient; 77.7% of the dog survey participants and 77.5% of the cat survey participants responded positively to this question. No significant effects of gender or year of graduation were found for either the dog or cat survey.

Participants ranked the importance of all of the listed pain indicators as greater than 3 on a 5-point scale (Table 4). For both dogs and cats the 3 highest ranked clinical indicators of pain were “Attempts to bite when surgical site palpated,” “Abnormal Posture,” and “Snarls/Hisses when surgical site palpated” (median = 5 for dogs and cats). Neither gender nor year of graduation had a significant effect on the mean importance rankings for any of the clinical signs for either the dog or cat survey.

Sources of information

Veterinarian rankings of the importance of various sources of information for continuing education are summarized in Table 5. Additional sources of information that veterinarians reported which were not listed as options on the questionnaires included the following: Veterinary Information Network website (VIN), consultations, personal experience/pets, input from colleagues and support staff, and membership in professional organizations such as the International Veterinary Academy of Pain Management and the American Association of Feline Practitioners.

In the dog survey, there was an effect of year of graduation on participant rankings of lectures at conferences and meetings (P = 0.008), and commercial literature/data sheets (P = 0.002), with a numerical trend for higher rankings for these materials as year of graduation became more recent. In the cat survey, more recent graduates reported that commercial literature/data sheets (P = 0.017) and reviewing information on the internet (P = 0.034) were more important sources than was the case for less recent graduates.

Discussion

The results suggest that veterinarians in Ontario are in agreement about the value and necessity of effective management of postoperative pain in companion cats and dogs. Participants showed strong agreement (median of 5 out of 5) with statements supporting the need for pain relief for animals and the use of preventive analgesics, and no gender differences were detected for responses to these key attitude statements. Participants also

---

Table 2. Median (Q1, Q3) level of agreement of Ontario veterinarians with statements regarding attitudes about pain in dogs and cats. Responses are on a 5-point scale (1 is strongly disagree and 5 is strongly agree)

<table>
<thead>
<tr>
<th>Statements regarding attitudes towards pain</th>
<th>Dog survey participants (n = 100)</th>
<th>Cat survey participants (n = 139)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Female</td>
<td>Male</td>
</tr>
<tr>
<td>Pain prevention is better than pain relief</td>
<td>5 (5,5)</td>
<td>5 (5,5)</td>
</tr>
<tr>
<td>Animals should be given the same consideration for pain relief as humans</td>
<td>5 (5,5)</td>
<td>5 (5,5)</td>
</tr>
<tr>
<td>The rate of recovery from a surgical procedure is improved by the use of analgesia</td>
<td>5 (5,5)</td>
<td>5 (4.5)</td>
</tr>
<tr>
<td>It is important to accurately calculate dose rates of analgesic drugs</td>
<td>5 (5,5)</td>
<td>5 (5,5)</td>
</tr>
<tr>
<td>I use standard analgesic doses based on estimated body weights</td>
<td>2 (1.4)</td>
<td>3 (1.5)</td>
</tr>
<tr>
<td>The potential side effects of using analgesia outweigh the benefits</td>
<td>2 (1.3)</td>
<td>2 (1.2)</td>
</tr>
<tr>
<td>Using pain relief prolongs recovery from anesthesia</td>
<td>1.5 (1.3)</td>
<td>1 (1.2)</td>
</tr>
<tr>
<td>I feel constrained by concerns over owner budget from using the degree of pain relief I feel is ideal</td>
<td>1 (1.2)</td>
<td>1 (1.1)</td>
</tr>
<tr>
<td>I am constrained by practice policy from using the degree of pain</td>
<td>1 (1.1)</td>
<td>1 (1.1)</td>
</tr>
<tr>
<td>Pain assessment</td>
<td>1 (1.1)</td>
<td>1 (1.2)</td>
</tr>
</tbody>
</table>

* P-values indicate within question gender effects as assessed using Mann-Whitney tests.

Table 3. Ontario veterinarians’ median (Q1, Q3) ratings of pain in dogs and cats following various surgeries, with responses on a 5 point scale (1 is no pain at all and 5 is the worst pain imaginable)

<table>
<thead>
<tr>
<th>Pain assessment</th>
<th>Dog survey participants (n = 100)</th>
<th>Cat survey participants (n = 139)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Female</td>
<td>Male</td>
</tr>
<tr>
<td>Thoracotomy</td>
<td>5 (5,5)</td>
<td>5 (5,5)</td>
</tr>
<tr>
<td>Fracture repair</td>
<td>5 (5,5)</td>
<td>5 (5,5)</td>
</tr>
<tr>
<td>Onychectomy</td>
<td>——</td>
<td>——</td>
</tr>
<tr>
<td>Dental with major extraction</td>
<td>4 (4.5)</td>
<td>4 (4.5)</td>
</tr>
<tr>
<td>Exploratory laparotomy</td>
<td>4 (4.5)</td>
<td>4 (4.4)</td>
</tr>
<tr>
<td>Ovariohysterectomy</td>
<td>4 (4.4)</td>
<td>4 (3.4)</td>
</tr>
<tr>
<td>Castration</td>
<td>3 (3.4)</td>
<td>3 (3.4)</td>
</tr>
</tbody>
</table>

* P-values indicate differences between gender as assessed using Mann-Whitney tests.
* Onychectomy is not typically performed in dogs; therefore, this procedure was not included on the dog survey.
showed moderate to strong disagreement (median of 1 to 2 out of 5) with statements citing cost and side effects as reasons for not using analgesia for both the dog and cat surveys. Our results are consistent with recent studies assessing attitudes about animal pain in veterinarians in other countries. For example, a study of veterinarians from France found that 99.5% of participants were “moderately” or “extremely” concerned about pain relief in dogs and cats (8). Furthermore, the response trends for the current study are similar to those from other studies that have used the same statements to assess attitudes. Direct comparisons between these studies are not possible due to use of different measurement scales; however, veterinarians in New Zealand showed similar trends for all statements (13), and veterinarians in Brazil generally agreed with the need for pain management for animals and the use of preventive analgesics, and disagreed that pain is good because it keeps animals inactive (18).

The degree of pain a veterinarian perceives an animal to be experiencing has previously been recognized as an important factor in determining whether or not the veterinarian will use analgesia (14,15). Veterinarians rated all of the surgeries included in the current study as moderately to highly painful, with higher levels of pain reported for surgical procedures that are more invasive. However, gender had an effect on pain ratings for some of the reported surgeries, and where differences were found, females consistently rated the surgeries as more painful than did males. Similar gender effects have been found in previous studies (7,10,12,13,18). For respondents to the cat survey, female veterinarians reported higher pain scores than did males in response to 5 of the 7 specified surgeries. This gender difference was seen in only 2 of the 6 surgeries of the dog survey. This difference suggests that there might be more variation in opinion among veterinarians about how much pain is experienced by cats as compared to dogs following common surgical procedures. If so, this could reflect an underlying difference in the species-related discrimination in the way pain is assessed by veterinarians. Indeed, a previous study suggested that veterinarians interpreted identical behavioral expressions of pain in dogs and cats differently; dogs were perceived to be experiencing more pain than cats (19). These results are not surprising, as cats have been suggested to be less behaviorally reactive to pain stimuli than dogs, even though it is thought they are likely to experience pain in a similar manner (20). Thus, reduced behavioral expressions of pain may account for the lack of consistent pain assessment between the species by veterinarians. This suggests that it is important to account for species differences in clinical signs associated with pain when attempting to quantify pain in the clinical setting.

Our results suggest that the nature of information gathering among veterinarians has shifted over the past 15 y. In 1991, Pelzer and Leysen (16) found that the most important sources of information for practicing veterinarians in the United States were journals, books, and continuing education. More recently, Hewson et al (9) found that Canadian veterinarians were placing a similar importance on these same sources for information about analgesia, in addition to discussions with other veterinary practitioners. Importantly, in the latter study Internet-based information was ranked as the least important source of information. In the current study, we found that experience gained in practice and continuing education lectures were ranked as most important, but that journal articles and textbooks were rated as being only moderately important. Our findings are consistent with other research that suggests that pain assessment is improved through experience and training (21). However, as might be expected given the change to society’s use of the Internet, participants in the current study ranked Internet-based information as moderately important. Overall, there appears to have been a shift in recent years towards the Internet as an alternative source of information, with a decline in the perceived importance of books and journal articles. Thus, making relevant information about pain recognition available via the Internet is important to ensure new research findings are widely disseminated to veterinarians.

For both the cat and the dog surveys, most veterinarians (78%) indicated that they have sufficient knowledge on recognizing animal pain. However, we were unable to determine whether this perceived knowledge is predictive of actual ability and appropriate use of analgesics. There was limited variation in the mean response scores to questions asking participants...
to quantify the importance of different clinical signs of pain; median responses were between 3 and 5, suggesting that all of the listed indicators were ranked as moderately to highly important. These results correspond well with the WSAVA Guidelines for Recognition, Assessment and Treatment of Pain, which indicate that responses to pain may vary between individuals and with different procedures (22). These guidelines suggest using a range of behavioral indicators to assess animal pain with a particular focus on responses to interactions and palpation, which matches the responses of the current participants. Since proper treatment of animal pain is dependent on accurate recognition of related signs, it is important that future research assess the actual abilities of veterinarians to detect pain, and related influences on appropriate use of analgesics.

For the cat version of the survey, there was an oversight in question design for 1 question in the pain assessment section. Participants were asked to quantify the importance of various clinical signs, on a scale of 1 to 5, but the text did not explain the relative value of the scale as was done in the rest of the survey. This oversight may limit the validity of the results in this section of the survey. However, reported values for this section of the cat survey were similar to those for the same section of the properly referenced scale of the dog survey, suggesting that most respondents followed the scale as it had been presented in other sections of the survey.

Analysis of our demographic data indicates that the gender of the veterinarian and the year of graduation variables were not independent; female veterinarians in our sample were more likely to be recent graduates compared with male veterinarians. To account for this lack of independence we analyzed data for male and female veterinarians separately and found that year of graduation was not influential on our results for pain perception or attitudes toward pain. While recent veterinary graduates are more likely to be female, based on the lack of significant effects for year of graduation we believe that gender is responsible for driving the trends observed in the current sample. This is interesting given that knowledge about pain recognition and management has increased in recent years; thus, recent graduates should have increased knowledge on these topics compared with older graduates. It is possible that continuing education on this topic is sufficient to overcome deficiencies for older graduates. Alternatively, it is possible that we did not have sufficient power to detect year of graduation effects since sample sizes for each survey were small.

As is generally the case for voluntary surveys, the recruitment methods used for this survey likely introduced some level of bias into the sample. People are more likely to respond to surveys on topics which are of importance to them, which might have resulted in a bias towards participants who are more knowledgeable about and sympathetic towards animal pain than the general veterinary population. If present, this bias could have numerous effects including increased analgesic use, improved attitudes about pain management, increased rankings of pain severity, and increased ratings of knowledge about pain recognition. The comparison of our demographic data to that from the 2014–2015 OVMA membership suggests that our sample was relatively representative both in general and when assessed by gender for year of graduation, but we found an overall bias towards higher representation by women, with higher participation than expected for women who graduated most recently. However, we found few effects of year of graduation, suggesting that this did not have a major influence on the current data. A bias towards female participants is somewhat concerning, therefore most of the data are presented separately for males and females in order to minimize related effects. However, the overall response rate was low and information regarding the attitudes and use of analgesics by non-responders is not available. Given that there is a strong possibility that study participants were individuals who are particularly interested in the subject, and hence, more likely to use analgesics, participant attitudes about post-operative pain and analgesic use are likely overestimated.

Veterinarians for this survey were recruited through the OVMA; because membership is not mandatory for Ontario veterinarians, it is possible that persons who chose to be members might have had increased commitment and access to ongoing education and peer evaluation when compared to non-members. Additionally, the survey was administered online, which may have led to an underrepresentation of older veterinarians if they were less comfortable and/or capable of using the internet and computer technology. However, when the current demographic data are compared to the OVMA membership data this does not appear to be the case.

Multiple comparisons were made during analysis for the current data, which increases the possibility that some of the significant effects that were identified are actually due to Type 1 error. Correction for multiple comparisons using Bonferroni was considered to be too conservative for the current data set, given the relatively small sample size and the exploratory nature of the analyses. However, all of the effects that were identified were in the predicted direction based on previous literature, and in many cases we found similar effects for both cats and dogs, even though the participants were largely different between the 2 surveys [in some cases data for the other species showed similar trends (P < 0.1) which did not meet the threshold for significance]. The only exceptions were pain ratings for “Dental with Major Extractions,” which were higher for women than men for cat participants only, and agreement with the statement “I use standard analgesic doses based on estimated body weights,” which was higher for men than women for cat participants only. This suggests that other than the noted exceptions, significant results were, in fact, true effects, but further research is necessary to explore these results in a more comprehensive manner.

Our results suggest that Ontario veterinarians have a positive attitude about pain relief for cats and dogs, but that some minor gender differences exist in attitudes and level of pain attributed to different procedures. In addition, sources of continuing education used by veterinarians have undergone a shift from academic journals and textbooks to continuing education lectures and online resources, which provide insight into continuing education opportunities for the future.

Acknowledgements
We appreciate the help of Dr. Nathan Lachowsky who provided expertise in the use of LimeSurvey. We acknowledge the financial
support of the OVC Pet Trust which provided a research grant to RJ and CD, and the participation of the veterinarians who gave freely of their time and expertise.

References


Influence of parity of birth and suckled sows on piglet nasal mucosal colonization with *Haemophilus parasuis*

Marion Brean, Sam Abraham, Michelle Hebart, Roy N. Kirkwood

**Abstract** — Litters of primiparous and multiparous sows were switched at 12 d and nasally swabbed at 12, 18, and 23 d for detection of *Haemophilus parasuis*. At lactation days 12 and 23, mucosal colonization rates for multiparous and primiparous litters were 0% versus 33% and 26% versus 60%, respectively.

**Résumé** — Effet de la parité des truies biologiques et adoptives sur la colonisation de la muqueuse nasale des porcelets par *Haemophilus parasuis*. Les portées issues de truies primipares et de truies multipares ont été échangées à 12 jours d’âge. Des prélèvements nasaux ont été réalisés à 12, 18 et 23 jours d’âge afin de détecter la présence d’*Haemophilus parasuis*. Au 12ème et au 23ème jour de lactation, les taux de colonisation de la muqueuse des portées élevées par des truies multipares et des portées élevées par des truies primipares étaient respectivement de 0 % contre 33 % et de 26 % contre 60 %.

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The term “early colonizers” was coined by Pijoan (1) to describe commensal bacteria that colonize the pig’s mucosal surfaces during the first 2 wk of life such as *Haemophilus parasuis* which, depending on the serotype, may or may not be pathogenic. Assuming adequate colostrum intake by the piglets, their passive immunity will protect them against these early colonizers, although the degree of protection will progressively decline during lactation and, by about 14 d, the level of protection fails to prevent colonization but maintains protection against disease until the pig’s own active immunity develops some weeks later (2). This controlled pathogen exposure allows the development of immunological defenses and so limits the likelihood of disease carriage into the nursery.

The sow’s colostrum is an essential source of energy, maternal antibodies, and immune cells and ensures the passive protection of piglets until their own immune system matures (3). An effect of sow parity on colostrum and milk quality and quantity has been described. Specifically, colostrum and milk yields were lower from primiparous than from higher parity sows (4) and the concentration of IgG in colostrum was lower from primiparous than from multiparous sows (5,6). A potentially reduced passive immunity of piglets born to primiparous sows due to their lower colostrum yield and IgG content may impact the dynamics of mucosal colonization of bacteria such as *H. parasuis*. Indeed, a delayed mucosal *H. parasuis* colonization was observed in piglets from primiparous, compared to those from multiparous sows (7). Possibly, the young primiparous sows did not provide the infectious pressure of older sows and, presumably, a delayed mucosal colonization would also apply to other potential respiratory or enteric pathogens. The net effect would be that pigs are colonized at an older age when the already limited passive protection is even further reduced. The relatively poor immunological status of pigs born to young sows may increase the risk of their carrying pathogens into the nursery. The consequence of this would be a destabilization of nursery health with higher veterinary inputs and slower growth (8). This problem can be countered using parity segregated pig flows but would require sufficient pigs for the separate flows.

The present study was undertaken to determine effects of sow parity on piglet mucosal colonization with *H. parasuis* when entire litters were cross-fostered between 10 and 15 d of age. We hypothesized that pigs born to primiparous sows but nursed by multiparous sows would have earlier mucosal colonization by *H. parasuis* than would pigs born to and remaining with their primiparous sow.

This experiment was approved by the University of Adelaide Animal Ethics Committee. A total of 22 Large White × Landrace sows [11 primiparous (P1) and 11 multiparous (P3+)] and their litters were assigned. Sows and litters were housed in farrowing pens with conventional farrowing crates and received a standard lactation diet [14.1 MJ DE/kg body weight (BW),

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Table 1. Effect of piglet birth sow parity and nurse sow parity on piglet nasal mucosal colonization by Haemophilus parasuis

<table>
<thead>
<tr>
<th>Age at swabbing</th>
<th>P1/p1</th>
<th>P3/p3</th>
<th>P1/p3</th>
<th>P3/p1</th>
</tr>
</thead>
<tbody>
<tr>
<td>Litters&lt;sup&gt;a&lt;/sup&gt;</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>12 d</td>
<td>4/6</td>
<td>0/5</td>
<td>0/5</td>
<td>1/6</td>
</tr>
<tr>
<td>18 d</td>
<td>6/6</td>
<td>2/5</td>
<td>3/5</td>
<td>2/6</td>
</tr>
<tr>
<td>23 d</td>
<td>6/6</td>
<td>3/5</td>
<td>3/5</td>
<td>2/6</td>
</tr>
<tr>
<td>Piglets&lt;sup&gt;b&lt;/sup&gt;</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>12 d</td>
<td>15/30&lt;sup&gt;c&lt;/sup&gt;</td>
<td>0/25&lt;sup&gt;d&lt;/sup&gt;</td>
<td>0/25&lt;sup&gt;d&lt;/sup&gt;</td>
<td>5/30&lt;sup&gt;d&lt;/sup&gt;</td>
</tr>
<tr>
<td>18 d</td>
<td>23/30&lt;sup&gt;c&lt;/sup&gt;</td>
<td>2/25&lt;sup&gt;d&lt;/sup&gt;</td>
<td>5/25&lt;sup&gt;d&lt;/sup&gt;</td>
<td>6/30&lt;sup&gt;d&lt;/sup&gt;</td>
</tr>
<tr>
<td>23 d</td>
<td>27/30&lt;sup&gt;c&lt;/sup&gt;</td>
<td>3/25&lt;sup&gt;d&lt;/sup&gt;</td>
<td>10/25&lt;sup&gt;d&lt;/sup&gt;</td>
<td>9/30&lt;sup&gt;d&lt;/sup&gt;</td>
</tr>
</tbody>
</table>

<sup>a</sup> Uppercase P refers to the nurse sow parity while lowercase p refers to birth parity of the litter (e.g., P1/p3 means a P1 sow nursing P3 piglets after litter transfer); P3 includes parities 3 or older.

<sup>b</sup> Litters where at least 1 of 5 piglets were positive for H. parasuis. Means were compared using Fisher’s exact test at litter transfer and by logistic regression preweaning. Means followed by different letters (c,d) differ significantly, P < 0.05.

16.5% CP 1.0% total lysine] fed-to-appetite until piglets were weaned at 28 d of age. At 12.3 ± 0.3 d of age entire litters were exchanged between P1 and P3+ sows, with a maximum age difference of 3 d, or were not exchanged, to create 4 treatment groups: 6 P1 sows nursing P1 litters, 5 P3+ sows nursing P3+ litters, 5 P1 sows nursing P3+ litters, 6 P3+ sows nursing P1 litters.

Sow behavior towards the fostered litter was monitored for 1 h after cross-fostering. At the time of litter transfer, 5 randomly selected piglets per litter were ear tagged. These piglets were nasally swabbed at litter transfer and again 6 d and 11 d later for H. parasuis culture and polymerase chain reaction (PCR).

In order to identify H. parasuis, swabs were initially cultured on Chocolate Agar and Sheep Blood Agar (SBA) plates with Staphylococcus aureus streak inoculation (V factor) (9). The plates were incubated at 37°C for 48 h and H. parasuis cultures were identified as small halo transparent clusters of colonies around the S. aureus stabs. Presumptive H. parasuis colonies were transferred onto another SBA plate (with S. aureus streak inoculation) and incubated for 48 h at 37°C. If H. parasuis-like colonies were identified by sub-culturing, the colonies were subjected to a catalase test and Gram staining. If the isolate was dependent on S. aureus for growth, catalase positive, Gram-negative, and grew on chocolate agar, DNA was extracted and H. parasuis was confirmed by 16S RNA PCR (9). In addition to culturing, an additional nasal swab was collected from every animal and was subjected to direct DNA extraction to detect the presence of H. parasuis by PCR (9). The animal was considered positive for H. parasuis if H. parasuis was cultured and confirmed by PCR or if the direct H. parasuis PCR from the swabs was positive.

The DNA was extracted as per methods described previously (10). In short, 4 to 6 bacterial colonies or freshly obtained nasal swabs were suspended in 1 mL of sterile water and tubes were centrifuged for 1 min at 10 730 × g. Supernatant was removed and 200 μL of 6% Chelex was added to the bacterial pellet. Tubes were vortexed for 10 s and incubated at 56°C for 20 min. Tubes were then re-vortexed for 10 s and incubated at 100°C for 8 min. Finally, tubes were centrifuged for 5 min at 10 730 × g and stored at 4°C (10).

To detect the presence of H. parasuis 16S RNA, PCR was performed as previously reported (9). The PCR was performed to detect the presence of H. parasuis from DNA extracted from nasal swabs and to confirm the detection of H. parasuis from culture. The PCR was performed using 2 specific primers: HPS-forward (5’ GTG TG AGG AAG GTT GTT 3’) and HPS-reverse (5’ GCC TTC GTC ACC CTC TG TGT 3’) (9). The PCR was performed in a 25-μL reaction mixture containing 2 μL of extracted DNA, 16.8 μL of PCR H2O, 5 μL of 5x PCR Buffer (My Taq PCR Buffer, Bioline, Australia), 0.5 μL of each primer (50 μM) and 0.2 μL of My Taq<sup>TM</sup> DNA Polymerase (Bioline, Australia). The PCR was carried out for 30 cycles consisting of denaturation for 30 s at 95°C, annealing for 30 s at 59°C and extension for 1 min at 72°C using a thermal cycler. The PCR products were run in agarose gel for 75 min at 120 V. Gels were stained with RedGel and put in a box for 1 h before being photographed.

Data analyses were performed using ASReml 3.0 (VSN International, Hemel, Hempstead, UK). Age and parity effects on proportions of litters and piglets colonized by H. parasuis prior to litter swap were examined using Fisher’s exact test. Proportions of litters colonized preweaning were examined using a binomial regression with a logit link function.

Patterns of mucosal colonization by H. parasuis appeared to be affected by parity of the birth sow, with litters of P1 sows having more piglets colonized at the time of litter transfer and at 18 and 23 d than did those of litters born to P3+ sows (P < 0.001).

At litter transfer, litters of P1 sows born to P1 sows were 0%, 0%, 20%, 80%, 100%, and 100% colonized. All litters were colonized by 18 d with high colonization rates (Table 1). Final colonization rates were 80%, 80%, 80%, 100%, 100% and 100%.

For P3+ litters born by P3+ sows, no piglet was colonized at the time of litter transfer with relatively few pigs becoming colonized during lactation (Table 1). Final colonization rates were 0%, 0%, 20%, 20%, and 20%.

For P3+ litters born by P1 sows, no pig was colonized at the time of litter transfer but more became colonized during lactation compared to pigs born to P3+ sows (Table 1). Final colonization rates were 0%, 0%, 40%, 80%, and 80%.

For P1 litters born by P3+ sows, 1 litter had 100% colonization at litter transfer with a second litter becoming colonized by 18 d. Final colonization rates were 0%, 0%, 80%, 80%, and 100%.

We observed no aggression of the sow towards the piglets or amongst the piglets. Sow aggression towards fostered piglets, and aggression between piglets, is minimized by completing cross-fostering by 24 h after farrowing. When fostering part litters at 4 to 7 d of age, sow aggression towards piglets was increased and successful suckling bouts decreased (11). We transferred piglets at about 10 d of age without behavioral consequences for the sow or litter. This is likely due to the total absence of the sow’s own litter and the transfer of entire litters causing less disruption to eat order.

In the present study, no piglets born to P3+ sows were positive for H. parasuis at the time of litter transfer. In comparison,
33% of piglets born to P1 sows were positive for H. parasuis when transferred at approximately 12 d of age. These data contrast with those of earlier workers who found that at 14 d of age, 53% of piglets derived from multiparous sows yielded a positive culture of H. parasuis while none of the piglets derived from primiparous sows were positive (7). The present data indicate that piglets born to older sows are likely to have a delayed colonization by H. parasuis, and likely other mucosal commensals, possibly due to an enhanced passive immunity of these piglets. Indeed, it has been shown that H. parasuis colonization of piglets was delayed and the heterogeneity of H. parasuis strains isolated was reduced when their sows received H. parasuis vaccination prepartum (12). The significance of the current findings for nursery pig health is unclear since it has been hypothesized that a low level of H. parasuis colonization at weaning could predispose to clinical disease in the nursery (1). However, although speculative, it is possible that the lower colonization levels in piglets from our multiparous sows reflects an improved level of passive protection at nursery entry and that in the absence of a subpopulation of shedding pigs (i.e., primiparous progeny) it is passive protection at nursery entry and that in the absence of a

References

Acknowledgment
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Reduction of serum 25-hydroxyvitamin D concentrations with intravenous lipid emulsion in a dog

Brittany Heggem Perry, Maureen McMichael, Markus Rick, Emily Jewell

Abstract — The recommended daily allowance of vitamin D has been increased. Toxicosis in pets may increase as a result. A dog ingested ~ 200 000 IU of vitamin D, serum concentrations were above the reference range (RR) and decreased to the RR after lipid treatment. This is the first known report of lipid treatment for hypervitaminosis D.

Résumé — Réduction des concentrations sériques de 25-hydroxyvitamine D à l’aide d’une émulsion intraveineuse de lipides chez un chien. L’apport quotidien recommandé de vitamine D a été accru. La toxicose chez les animaux de compagnie peut augmenter en raison de cette hausse. Un chien a ingéré ~ 200 000 UI de vitamine D, les concentrations sériques étaient supérieures à la fourchette de référence (FR) et a chuté à la FR après le traitement aux lipides. Il s’agit du premier rapport connu de traitement aux lipides pour la toxicose à l’hypervitaminose D.

Vitamin D deficiency has recently been associated with increased rates of cancer (1), Alzheimer’s disease (2), multiple sclerosis (3), bacterial and viral infections (4,5), inflammation (6), and congestive heart failure (6). As a result of apparently widespread deficiency, new guidelines have been published increasing the recommended daily allowance significantly for adults, children, and infants (7). These guidelines coincide with the widespread availability of high concentration vitamin D supplements, which can be obtained over the counter (8). The potential for acute toxicosis in veterinary patients is likely to increase as a result of this increased exposure.

The physiology of vitamin D has recently been reviewed for veterinary medicine (9,10). Briefly, vitamin D is present in nature in 2 active forms: vitamin D₂ (ergocalciferol) and vitamin D₃ (cholecalciferol). Ergocalciferol is found mostly in plant matter while cholecalciferol can be found in the soft tissue of animals. Cholecalciferol can be naturally produced in the mammalian body from the precursor 7-dehydrocholesterol, which is found in the skin and is converted to cholecalciferol when exposed to ultraviolet light in some species. Both ergocalciferol and cholecalciferol can be consumed and rapidly absorbed from the gastrointestinal system and then converted into the active metabolite 1,25-dihydroxyvitamin D (calcitriol) via the kidneys. The highest concentrations of calcitriol are found in the serum 48 to 96 h after vitamin D exposure (10). Calcitriol, in turn, increases calcium absorption in the intestines, mobilizes calcium from the bone, and increases calcium reabsorption from the kidneys resulting in a rise in the serum concentration of calcium and phosphorus. All forms of cholecalciferol are highly lipophilic and therefore can remain in the fat stores within the body for long periods of time with a slow release (11).

Vitamin D intoxication in veterinary patients is most commonly due to accidental ingestion of cholecalciferol containing rodenticides or human medication and dietary supplements (12,13). The clinical signs of cholecalciferol toxicosis are associated with the resulting hypercalcemia and hyperphosphatemia and their detrimental effects on the renal, central nervous, muscular, gastrointestinal, and cardiovascular systems. If left untreated, these patients proceed into acute renal failure and soft tissue calcification. With high level exposures clinical signs can be seen as soon as 12 to 72 h after ingestion (10). Acute ingestion of cholecalciferol-containing products should be medically addressed quickly.

Intravenous lipid emulsions (ILE) are being used with increasing frequency in both human and veterinary medicine to treat acute systemic intoxications ranging from local anesthetic drugs to other lipophilic drug poisonings (14–17). Treatment with ILE has been shown to reverse the cardiotoxic effects of local anesthetic overdose as well as other medications such as beta blockers, calcium channel blockers, parasiticides, herbicides, and a variety of psychotropic agents. As a result, ILE is currently...
The dog in this case report could have ingested a maximum amount of 200 000 IU of vitamin D. Hypercalcemia was not evident in the immediate period post ingestion. Since intravenous fluids were not started until after the final serum sample was collected, lipid therapy, which was the only intervention to decrease the serum concentration of vitamin D, is likely to be responsible for the decrease in this case. In addition, the short time frame of the lipid treatment and the slow elimination of vitamin D, make it unlikely that the vitamin D concentration decreased due to normal elimination. Although the dog was treated with activated charcoal before lipid treatment was administered this could only have decreased gastrointestinal absorption, it would not directly reduce serum concentrations of vitamin D.

Hypervitaminosis D, defined as any value of 25, OH-D3 above the reference range, is thought to be a precursor to vitamin D intoxication and may be present in patients with normal calcium concentrations (18). Recently, accidental overdose in an infant was reported with documented ingestion of 240 000 IU of vitamin D without laboratory evidence of hypercalcemia (18). Another report in a child documented accidental ingestion of 2 400 000 IU (600 000 IU/day over 4 d) and this patient presented with hypercalcemia that persisted for 14 d, suggesting that the toxic threshold for vitamin D may be quite high (19).

In recent years, there has been an upsurge in recommendations for higher levels and more frequent oral vitamin D supplementation. Both forms of vitamin D, ergocalciferol and cholecalciferol, are available as manufactured nutritional supplements and have been shown to increase the serum concentration of 25, OH-D3. While it appears that both forms are efficacious, cholecalciferol is considered to be more potent than ergocalciferol, and is therefore 10 times more toxic in humans. It is not clear which form dogs absorb more readily (8).

Most veterinary reports of vitamin D toxicosis involve consumption of cholecalciferol-based rodenticides, erroneous cholecalciferol concentrations in commercial pet food, consumption of human anti-psoriatic medications, or over supplementation of livestock (12,13,20). To the authors’ knowledge, this is the first reported case of hypervitaminosis D following consumption of human over-the-counter vitamin D supplements.

Intravenous lipid emulsions have been used with increasing frequency to treat acute systemic toxicities involving local anesthetics and other lipophilic, non-anesthetic drugs. Reviews of recent case reports and uses of intravenous lipid emulsions in veterinary medicine have been recently published (21). Several mechanisms of action have been suggested with the most widely accepted theory based on the idea of a “lipid sink” (21). The increased lipid concentration introduced into the plasma is thought to create a new pharmacokinetic equilibrium which converts the drug from the tissue to the aqueous plasma phase, and then to the lipid phase. Lipophilic substances are attracted to the high concentration of fat and a concentration gradient being used in human resuscitation due to cardiac arrest from unknown drug overdoses when generic first-line treatment has failed.

The owner of a 2 year-old male, castrated Pomeranian-Shih Tzu mix dog, weighing 8.5 kg, reported that she found a bottle of Vitamin D3 (Nature's Bounty, Bohemia, New York, USA) that had been chewed open and she estimated that 90 to 100 capsules were missing. Each capsule contained soybean oil, gelatin, and vegetable glycerin while providing 2000 IU (50 μg) of cholecalciferol. At the maximum possible consumption, the dog would have ingested 200 000 IU (5000 μg). The owner unsuccessfully attempted to induce emesis by administering oral hydrogen peroxide to the dog and then brought him to the veterinarian the next morning, approximately 12 h after suspected ingestion.

On presentation, the dog’s initial physical examination was unremarkable with vital signs all within normal reference ranges. The veterinarian administered 4.5 g of activated charcoal in a 45-mL slurry (Toxiban; Lloyd, Shenandoah, Iowa, USA) by mouth and then drew blood for a serum chemistry profile. Serum was immediately frozen for later evaluation of cholecalciferol concentration. At that time, all values on the serum biochemistry panel were within normal limits except for phosphorus, which was mildly decreased [1.4 mmol/L, reference range (RR): 1.7 to 3.4 mmol/L]. The serum calcium concentration was 2.8 mmol/L (RR: 2.0 to 3.2 mmol/L). Intralipid 20%, (Baxter Healthcare Corporation, Deerfield, Illinois, USA), a 20% intravenous fat emulsion, was administered as a bolus dose of 1.5 mL/kg body weight (BW) given over 15 min and then followed with a constant rate infusion at 0.5 mL/kg BW/min for 30 min. Additional serum samples were taken at 60 and 120 min post-collection of the lipid infusion. The samples were immediately frozen and shipped to the Michigan State University Diagnostic Center for Population and Animal Health for 25-hydroxyvitamin D (25, OH-D3) level analysis. The 25, OH-D3 was measured with a commercially available and validated radioimmunoassay post acetoneitrile extraction (DiaSorin 25-Hydroxyvitamin D 125I RIA kit, Stillwater, Minnesota, USA). The assay has 100% specificity for 24, 25-(OH)2-D2; 24,25-(OH)2-D3; 25,26-(OH)2-D2; and 25,26-(OH)2-D3. There is only 0.8% cross reactivity with un-hydroxylated vitamin D.

The patient was placed on IV 0.9% saline after collection of the final serum sample. After 24 h the patient was discharged on a low calcium prescription diet (Hill’s KD; Hill’s, Topeka, Kansas, USA). The dog was returned 48 h later for recheck biochemistry panel, which was unremarkable aside from an elevated total bilirubin of 37.6 μmol/L (RR: 0 to 15.4 μmol/L). The serum calcium concentration at this time was 2.8 mmol/L. Pre-lipid infusion serum 25, OH-D3 concentrations were above the reference range and decreased into the normal range after lipid infusion. The values were as follows: pre-lipid infusion (224 nmol/L), 30 min post-lipid infusion (193 nmol/L), 60 min post-lipid infusion (143 nmol/L) (RR: 60 to 215 nmol/L).

Table 1. Serum 25 hydroxyvitamin D concentrations pre- and post-infusion of intravenous lipid

<table>
<thead>
<tr>
<th>Sample</th>
<th>Result (nmol/L)</th>
<th>Reference range (canine) (nmol/L)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-minute — before lipid infusion</td>
<td>224</td>
<td>60 to 215</td>
</tr>
<tr>
<td>60-minute after lipid infusion</td>
<td>193</td>
<td>60 to 215</td>
</tr>
<tr>
<td>120-minute after lipid infusion</td>
<td>143</td>
<td>60 to 215</td>
</tr>
</tbody>
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forms between the tissue and blood, causing the drug to move away from fat deposits within the body. As a result, we hypothesized that the lipophilic nature of vitamin D would allow the intravenous lipid emulsion to exert the same “lipid sink” effect, thereby decreasing the amount of circulating active drug and reducing toxicity. To the authors’ knowledge, this is the first report of hypervitaminosis D treated with intravenous lipid emulsion. Although the dog herein likely ingested a sub-lethal dose of vitamin D the lipid emulsion was able to successfully reduce the serum concentration of 25, OH-D3 quickly. This may point to lipid emulsion as a possible treatment in vitamin D intoxication of unknown or lethal amounts. In most cases of vitamin D ingestion the clinician does not know the serum concentration of vitamin D for at least a week if samples are sent out at all. This can be very frustrating because hypercalcemia may manifest while waiting on vitamin D concentrations. Veterinarians can monitor serum calcium concentrations as a marker of toxicity but waiting until hypercalcemia develops might not be in the best interest of the pet. Future studies should focus on whether early treatment of vitamin D overdose with lipid emulsion prevents the hypercalcemia of vitamin D intoxication. Prevention of the consequences of hypercalcemia could be lifesaving in some animals. As a result of these findings, further consideration should be given to intravenous lipid emulsions in cases of severe, acute cholecalciferol intoxication.

References

Successful foaling by a Standardbred mare with a ruptured prepubic tendon

Kerry J.V. Schutten

Abstract — A 12-year-old Standardbred mare was diagnosed with a ruptured prepubic tendon 1 month prepartum. The mare was treated with analgesia, stall rest, and an abdominal support wrap that was tightened daily. Both a live foal born 1 month later and the mare are doing well.

Résumé — Poulinage réussi par une jument Standardbred ayant une rupture du tendon prépubien. Un mois avant la parturition, une rupture du tendon prépubien a été diagnostiquée chez une jument Standardbred âgée de 12 ans. La jument a été traitée à l’aide d’analgésiques, d’un repos en stalles et d’un pansement de soutien resserré tous les jours. Le poulain vivant né un mois plus tard et la jument se portent bien.

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A 12-year-old Standardbred mare was presented 1 mo prepartum with signs consistent with colic. She had reduced appetite, appeared restless, and was kicking and stretching regularly. Initially her heart rate was 60 beats/min and temperature was 38.4°C. Rectal examination indicated that the foal was alive and there were no abnormal findings of the gastrointestinal tract. Auscultation revealed hypermotility of the left gut. The mare was given 15 mL of flunixin meglumine (Banamine, 83 mg/mL; Merck Animal Health, Kenilworth, New Jersey, USA), IV. The owner was advised to provide stall rest. The mare improved with analgesia and her heart rate dropped to 48 beats/min.

Two days later, the mare was re-examined due to a return of clinical signs despite continued therapy with oral flunixin meglumine paste (Banamine, 50 mg/g; Merck Animal Health) and the owner reported that there was ventral edema. The mare was bright, alert, and responsive, but again was stretching and kicking regularly and was reluctant to walk. The mare had a rectal temperature of 37.7°C and a mildly elevated pulse of 48 beats/min after receiving flunixin meglumine the night before. Upon examination, there was obvious ventral edema extending from the udder to the xyphoid cartilage that had not been present on the initial visit. The tail head and ischial tuberosities were elevated, giving the appearance of lordosis of the spine. The vulva also appeared to be elevated from its normal position. Upon rectal palpation and ultrasound examination, the foal was determined to be alive and in a normal position. Based on the presentation of the mare, and especially the tipped forward pelvis creating a characteristic lordosis and “saw-horse stance,” a diagnosis of ruptured prepubic tendon was made. Further diagnostics to determine the site and extent of the rupture, and to definitively rule out other types of ventral rupture such as an abdominal wall herniation, were not undertaken. The decision was made to treat the mare conservatively on-farm, and the owner was advised of the poor prognosis for both mare and foal associated with such a high risk pregnancy. The mare was treated with butorphanol tartrate (Torbugesic, 10 mg/mL; Zoetis Canada, Kirkland, Quebec), 1 mL, IV, flunixin meglumine (Banamine, 50 mg/g; Merck Animal Health), 15 mL, IV, and the owner was advised to give oral flunixin meglumine as needed to control signs of pain. It was recommended to keep the mare on stall rest, and an abdominal support band was prescribed which was donated by the Ontario Veterinary College (Figure 1). Based on the difficult foaling that was anticipated, the owner installed a baby monitor to watch the mare at all times, and was instructed to call for veterinary assistance whenever signs of impending foaling began. The owner and veterinary team wished to avoid the high risks involved with inducing parturition, and so the decision was made to continue to monitor the mare and attempt to aid the mare in natural foaling.

Over the following month, the mare remained in stable condition with only intermittent need for pain control. The abdominal wrap was tightened daily by the owner as the ventral edema continued to decline over time. The mare continued to eat well, and did not show any more signs of colic. A pre-foaling visit at roughly 340 d gestation revealed normal physiological parameters, with continued cranial and dorsal elevation of the
pelvis and ventral edema. No colostrum was present, and the foal was found to be alive via rectal ultrasound examination. The owner was advised to continue to keep the abdominal wrap tightened and to increase vigilance of monitoring for any signs of impending parturition.

The mare foaled 4 d after the last visit by the equine veterinarian at 2 am. The barn owner found the mare cast in her stall against the wall with the foal half way out of the vulva, and she was able to assist the mare in delivering a live filly. When the veterinarian arrived, the mare was found to be stable although the placenta had not yet passed, and the foal was already standing and attempting to nurse. The mare had colostrum, but due to the ventral edema the foal was unable to find the udder. The colostrum was manually extracted and the foal was fed via a bottle, with instructions to the owner to continue to encourage the foal to nurse on her own.

The placenta failed to pass, and at 12 pm the same day, an examination revealed that it was firmly adhered to the uterine body. The mare appeared otherwise bright, alert, and responsive with normal physiological parameters other than a heart rate of 60 beats/min. The placenta was infused with 2 L of Lactated Ringer’s Solution, and with gentle traction the placenta was removed in full after administering oxytocin (Oxytocin Injection, 20 IU per mL; Bayer, Mississauga, Ontario), 1 mL, IV twice during the procedure. The owner was advised to give 1 mL of oxytocin IM every 3 h thereafter. A long-acting cephalosporin (Excede Sterile Suspension, 200 mg/mL; Zoetis Canada), 16 mL injection, IM, was also administered. At this visit a foalside IgG snap test (IDEXX Laboratories, Westbrook, Maine, USA) revealed IgG levels of 8 g/L at roughly 12 h of age. The foal was examined thoroughly and found to be healthy with no abnormalities. The owner was advised to continue to use the abdominal wrap for 1 wk to help decrease edema and allow strength to return to the body wall.

At the time of the writing, the foal was 27 d old and continuing to do well. The foal was able to nurse following the initial bottle feeding, and continued to do so with no difficulties. The abdominal wrap was taken off the mare 1 wk after foaling due to pressure sores that were beginning to develop along the dorsal body wall. The mare continued to have an elevated tail head with mild lordosis of the spine, but improved in strength. The owner is aware that the mare should not be bred again, and is intending to retire the horse to pasture.

**Discussion**

The prepubic tendon is a connective tissue band that in the horse acts as the site of insertion for many structures on the cranial side of the pubic bones, including the rectus abdominis muscle (1,2). As a result, when the prepubic tendon is ruptured, support of the ventral and lateral abdominal wall and of the abdominal organs is lost (3). There are few peer-reviewed reports of ventral tears in prepumt mares despite a wide amount of anecdotal information (4), and as such practitioners must rely on their own assessment of the clinical picture to diagnose a rupture, and to evaluate the best course of action for treatment. Differential diagnoses for a prepubic tendon rupture include abdominal wall herniation due to rupture of the rectus abdominis, oblique, or transversus muscles (3). These can be difficult to definitively distinguish and are often considered a single condition, included with rupture of the prepubic tendon as a ventral rupture or a ventral body wall defect (3,4). Transabdominal ultrasound may be useful for definitive diagnosis of the involved structures, but excessive edema can limit its efficacy (3,4).

Rupture of the prepubic tendon occurs most commonly in draft breeds, or secondary to conditions that increase weight in the abdomen, such as hydrallantois, fetal giants, or twins (3–6). Trauma has also been reported as a cause of ruptured prepubic tendon, and in many cases an inciting cause is not identified (4). In the present case, the mare had a recent history of regular kicking with both hind legs at pasture mates, which may have been a predisposing factor.

The presenting signs of prepubic tendon rupture often overlap with those of other causes of abdominal pain, but there are features that can help to distinguish it as a cause. Owners typically report lethargy and anorexia initially, with colic signs secondary to pain (7). Ventral tears can be extremely painful, especially with a complete tear, and the mare is often tachycardic and reluctant to walk (7) or to lie down (5). As the condition progresses, lordosis may occur, as the pelvis tips cranially without stabilization by the abdominal muscles (3,8). This can result in what is sometimes referred to as a typical “saw-horse stance” with elevation of the tail head and ischial tuberosities (4,5). Marked ventral edema is a very consistent finding, resulting from compression of the veins which drain the ventral abdomen or due to the associated muscle damage (3,8). It is also very common for the udder to be cranially displaced and congested (3,8). Some studies have reported bloody discharge and severe edema of the udder with increased severity of the tear, although in this case these findings were not present (7).

In this case, a diagnosis of ruptured prepubic tendon was made by the clinician based on the specific clinical findings of a typical “saw-horse stance,” excessive ventral edema, and the cranial displacement of the mammary glands; further diagnostics were not pursued (4,5).
Historically, the recommendation in the case of a ruptured prepubic tendon or other ventral body wall defect has been intervention via induction of parturition or elective cesarian section when the foal was thought to be at term (4,5,8). Prior to induction, conservative treatment with abdominal support, stall rest, and analgesia has been strongly recommended to avoid further debilitation of the mare (4,7). With those recommendations, the focus has been more on invasive treatment with a goal of saving the foal often with loss of the mare. The prognosis has been considered poor for both mare and foal with a complete rupture, with euthanasia the most likely outcome (3,8). However, recent literature suggests that conservative treatment and avoiding invasive intervention may lead to fewer complications and increased success in foaling, due to the potential risks associated with early induction or cesarian section in mares (4). A 2008 retrospective case series by Ross et al (4) followed 13 mares that were presented with body wall defects, 5 of which received intervention, and 8 of which were treated conservatively. The authors concluded that avoiding intervention and allowing natural parturition can improve foal survival without compromising the survivability of the mare (4). Conservative management was thus recommended as the treatment of choice for mares with body wall defects when possible (4). However, not all mares can be comfortably controlled in this way. Cases in which the tear is too severe or is rapidly enlarging, or where pain cannot be controlled, will necessitate intervention and/or euthanasia (4). The mare in this case was well-managed by analgesia and stall rest, and the rupture appeared incomplete based on the moderate severity of clinical signs, making this mare a good candidate for conservative management.

Any mare with a history of a ruptured prepubic tendon should be retired from breeding due to the high level of risk for both mare and foal in subsequent gestations (9). The mare in this report has been retired from breeding and pleasure riding, and continues to improve in strength. This case report provides an excellent example of the successful outcome for both mare and foal with conservative treatment of a ruptured prepubic tendon, given the right candidate and excellent supervision near the time of parturition. Although this mare will never fully regain abdominal wall integrity, she was able to foal with assistance, and nurse and rear her foal naturally.

Acknowledgments

I wish to thank Drs. Amy Bennett, Scott Reid, and Suzanne Laidlaw for their impressive skill and effort in dealing with this difficult case, and for their advice and expertise in the writing of this report. I also thank the staff and veterinarians at Main Street Animal Hospital for their support and mentorship during my externship placement.

References

Be exhilarated.

Travel to beautiful Charlottetown, P.E.I. to participate in the 2017 CVMA Convention. Join peers and colleagues and be exhilarated by east coast beauty and hospitality. Attend CVMA signature events, stellar CE sessions and more!
Catheters, calving, and conundrums: Field notes of a first year veterinarian

Adrienne Johnston

It’s a sentiment that’s commonly expressed by final year vet students, and one that I remember well: the looming sense of uncertainty that sets in as graduation approaches. Life as a vet student is a veritable marathon, to use a tired metaphor, but at least the ultimate goal is clear. We commit years of our lives, trudging through seemingly endless hours of academic sludge with a single, all-consuming purpose: BECOME A VETERINARIAN! When I finally finished school, I remembered feeling both elated and vaguely lost. My first thought was, “I made it!” — followed closely by, “Uh, now what?”

What I knew for sure was that I was ready for a change of scenery and a good old-fashioned, freewheeling adventure. So, I set out in my trusty little Volkswagen and drove east to join a mixed animal practice in small town Nova Scotia. It wasn’t long before I was answering my first middle-of-the-night emergency call, a scenario that would soon become all too familiar: a pit bull with a face full of porcupine quills, and a panicked owner on the other end of the line explaining, “I don’t have much money to spend...” The first ethical dilemma of my professional career! How exciting!

Memories of my first year are a mixed bag of ups and downs, speckled with a handful of shining moments that helped to build my confidence. I recall pulling up to a dairy farm for a calving one afternoon, to be greeted with a look of skepticism from an old-school farmer: I was a 5’4” woman practicing large animal medicine in a region accustomed to taller, stronger, “maler” veterinarians. The cow in question had a uterine torsion, and it was clear that my skills were on trial. The male vets in my practice typically relied on upper body strength to manually de-torse a uterus, which was clearly not an option for me. Instead, using one of the casting methods I’d practiced on farms as a student, I laid the cow down, allowing us to roll her over with relative ease. She gave birth to a live calf, and I gained some credibility. (“Well, Mrs. Jones, we don’t see a lot of sugar gliders/hedgehogs/potbellied pigs here, but I learned something when it did, I would hit the books, chat with a colleague, or log onto VIN and get back to my client later with the pearls I was able to dig up. (“Well, Mrs. Jones, we don’t see a lot of sugar gliders/hedgehogs/potbellied pigs here, but I learned something interesting about them, which might be relevant to your little guy…”). I believe that people recognize when you are genuinely invested in their animals’ health, and that a willingness to seek out the answers you don’t have confidence about. Like most vets, I have a mildly obsessive type A personality, and don’t love to acknowledge my glaring human fallibility. One of the most valuable lessons gleaned from my first year is that it’s easier on my mental health when I can be kind to myself in these moments of self-doubt. Hindsight can be a kick in the teeth, but when I do make mistakes — as all humans do, doctors or not! — I try to approach them as opportunities for growth rather than reasons to self-flagellate.

I’ve learned that it’s okay that I don’t know everything. To my knowledge, I’ve never had a client lose confidence in me for telling them honestly, “I don’t know the answer to your question.” This happened fairly regularly during my first year of practice. When it did, I would hit the books, chat with a colleague, or log onto VIN and get back to my client later with the pearls I was able to dig up. (“Well, Mrs. Jones, we don’t see a lot of sugar gliders/hedgehogs/potbellied pigs here, but I learned something interesting about them, which might be relevant to your little guy…”). I believe that people recognize when you are genuinely invested in their animals’ health, and that a willingness to seek out the answers you don’t have can go a long way toward building a trusting veterinarian-client relationship.

Life is chaotic and fickle and unpredictable, and professional interests can shift in unexpected ways. Five years out of school, I now work in a more populated centre, and have a greater focus on companion and exotic animal medicine — somewhere I never thought I’d be, though I love it! Still, I cherish the wild and wonderful memories from my early days in rural practice: the simulated pioneer village where I treated farm animals, assisted by men and women dressed in period costumes; the injured bald eagle who was brought into the clinic one day...
by a government employee; the crayon-on-construction-paper “thank you” card that I received from a young girl whose cat was recovering from a life-saving foreign body surgery. I wouldn’t trade these moments for anything.

That said: the transition from student to veterinarian can be a bit of a shock to the system. It’s a sobering moment, when you suddenly realize that you are the one who is supposed to have all the answers. If there’s one thing that I’d encourage new veterinary graduates to bear in mind, it’s this: If you’ve made it this far, you already have the tools you need to be a great vet. Imposter syndrome is a heck of a beast, but you’ve got this, Doc. I promise.

Veterinary Dentistry: Self-Assessment Color Review, 2nd edition


This self-assessment book is meant to test the knowledge of the reader and to promote further study. It is comprised of 228 clinical cases and associated questions to serve as both a challenge and a review. It is not an in-depth textbook and is neither systematic nor comprehensive. However, when used in combination with other reference texts, it is an interesting way to evaluate and expand your knowledge base.

The book is formatted to have 2 to 3 clinical cases/questions per page with the answers on the reverse of the page. The questions are in random order and cover a broad range of topics from exotic and large animals, to the basics such as instruments and techniques, to more advanced endodontic procedures, even including questions about embryogenesis and developmental abnormalities. It also does a good job of covering common everyday topics such as dental home care information for clients, periodontal disease, and resorptive lesions.

The book has a lot of pictures which is a big asset and very helpful for learning. It also has a list of suggested reading material to aid in further study. Since the cases are random, it can be difficult to find information if you have a specific question, but there is a classification of questions (both species-specific and topic-based) as well as an Index at the back for quick reference.

This book would be most useful for a student learning about dentistry, as well as for the general practitioner who has some down-time and wants to brush up on their knowledge and identify areas in which they are weak and could use improvement. It would not be very helpful if you had a specific problem/case and wanted a comprehensive study into that particular issue.

The strengths of this book are the pictures and the case-based approach, which lends itself to critical thinking and forces the reader to analyze a case and come up with a diagnosis/treatment plan, etc. This is a much more interesting methodology than simply reading a comprehensive dental textbook. I liked how the book included some cases of oral pathology as a symptom of a systemic problem, such as oral ulcerations in a dog with systemic lupus erythematosus. Some unique cases are documented from which I learned something new, such as the condition of sialodenosis.

The biggest weakness for me was the focus placed on advanced procedures, both surgical and endodontic e.g., root canal therapy, which are not practical for a general practitioner. More space could have been used for topics such as extraction techniques.

Overall, the case-based approach was an interesting presentation of a difficult topic, but it’s value as a comprehensive reference text for daily use in general practice is limited.

Reviewed by Lisa Rymes, BSc, DVM, Veterinary Associate, Victoria Veterinary Clinic, 628 Victoria Avenue, Regina, Saskatchewan S4N 0R1.
Many people believe that treating species perceived as companion animals like family members, typically as one of the children, means that these animals will receive the best of care. When they first established their veterinary practice, Drs. Mulcahy and Bosch were among them. However, as they became more experienced, they realized that making such a connection was too simplistic.

“One of the first things we discovered is that clients' perceptions of what it means to treat their animals as members of their families can differ dramatically,” explains Dr. Mulcahy. “In retrospect, this shouldn't have surprised us because there's a lot of variation in how parents treat their children too.”

For example, the veterinarians’ client base includes a population of “helicopter” clients that rivals that of the helicopter parents seen by local pediatricians. Theirs include clients who hover over their eating, urinating, defecating, or even just playing dogs and cats to ensure themselves that all is well. These clients become even more excessively attentive when their animals succumb to “nervous stomachs,” nonspecific recurrent bouts of diarrhea and physical injuries, whether coincidental or unintended side-effects of this overly solicitous human behavior.

It did not take long for the practitioners to acknowledge that this segment of their client base contributed a significant amount of income to their practice. However, they also realized these cases often involved time-consuming, complex bond and communication challenges as well as medical ones that left them feeling physically and mentally drained. Eventually, the communications aspects of these interactions caused them to dread seeing these clients and their animals. When they reached that point, the practitioners decided that they needed to take a preventive instead of reactive approach to these clients lest they alienate them.

“I still remember the first time I used it,” Dr. Bosch reminisces. "It was when I saw Ms. Wadleigh and Moses the first time. He was a perfectly normal high-energy male kitten, but she was obviously anxious and insecure. She kept constantly fussing over him and seeing every little thing he did as actually or potentially pathological. But instead of trying to rush through the examination process as quickly as possible to end the agony for all of us like I used to, I did exactly the opposite.”

The veterinarian describes how he first explained every step of the examination to the client, including what he or his technician was going to do as well as why, and how the kitten might respond to this. By giving Ms. Wadleigh this information up-front, Dr. Bosch eliminated those fears of the unknown that feed anxiety. Then throughout his examination of the kitten, Dr. Bosch shared his observations and conclusions with the client. This benefitted Ms. Wadleigh because it caused her to focus on the veterinarian and the kitten instead of her fears. The knowledge she gained about her animal also made her feel more confident about her pet. Equally important, the client became more relaxed which, in turn, helped her animal relax and facilitated his examination.

Although both practitioners admit that these initial appointments with these clients do take longer, this investment more than pays for itself in the long run.

“At first we thought that educating these people could cost us more because we wouldn't see them as often as we did when they were worried about every little thing,” admitted Dr. Mulcahy. “But we decided to do it anyhow because we didn't see those angst-driven interactions as healthy for any of us. Then we discovered that the more confident they felt about their ability to care for their animals, the more proactive and objective they became about their animals’ health and behavior.”

Dr. Bosch nods in agreement then adds, “For all the energy these people were putting into hyper-vigilance, they often missed those first, often subtle signs of impending problems. Their anxiety also made it more difficult for them to process what we were telling them, which was a source of great frustration. But once we gave them the tools to become more relaxed and involved in the process, we didn't see them less. We saw them sooner, and the interactions were more rewarding for all of us.”
The veterinarians also discovered that although some anxious clients still preferred to get in and out of the examination room with their animals as fast as possible, there were others like Ms. Wadleigh who wanted to be more fully engaged in their animals’ veterinary appointments. When these people learned about the veterinarians’ alternative option, they began coming to the practice too.

In addition to the anxious helicoptering clients who perceive their animals as family members, Drs. Mulcahy and Bosch also see those who treat their animals more like unpaid servants. “We call these animals Cinderellas because their owners see the animal’s value strictly in terms of what the animal does for them,” Dr. Mulcahy explains. “If the animal fails to fulfill their expectations, at best they lose interest in providing anything but the most basic care. At worst, they want the animal gone.”

Among the animals that fall under this heading are working dogs whose skills their owners depend on to herd their flocks, protect their livestock, or assist in hunts needed to supply food for the human household. When in their prime, these animals may play such a key role in their owners’ success that these people willingly will ensure their animals receive the best veterinary care. However, when the animals no longer function optimally, these clients perceive them the same way they perceive a piece of equipment that no longer does the job. The animals become a liability not worth the cost to maintain.

Some practitioners refer to two other populations of animals that fall under this heading as “burn-out fodder.” They do this because, unlike the previous clients, those in this group often present their animals as beloved family pets. One population consists of animals used in competitive events whose value to their owners is directly linked to the animal’s ability to win. Were these people parents of children, they would be called “Stage Moms” or “Stage Dads.” When all is going well, they are fully engaged in their animal’s care and often want only the best. At the same time though, any needed recovery time from illness or injury may be determined far more by the timing of the next show, meet, or race than any veterinary recommendations to ensure the animal’s well-being.

Communicating with these clients can be frustrating because so much of their identities is tied up in their animals’ performance that they consider themselves the ultimate authority on their animals’ welfare. In such situations, couching any recommendations for the animal’s immediate welfare in terms of future successes may be helpful. For example, the veterinarian may point out that missing the upcoming event may enable the animal to compete far more successfully in a more prestigious competition in 2 months.

“The down side is that we need to keep track of such events and not let our personal feelings regarding what we think about such human-animal relationships undermine our interactions with these people,” notes Dr. Bosch. “Sometimes that’s difficult!”

But once again the veterinarians find that any costs of doing this are exceeded by the benefits in the long run.

The second burn-out fodder population consists of family pets their owners expect to function as service, assistance, or support animals for themselves or others. Unlike working animals bred, selected, and specifically trained to perform these functions by those trained to do this, these animals gain their responsibilities simply because they are there. Following a child’s diagnosis of autism spectrum disorder, Skippy gets pressed into service to comfort the child 24/7. Well-meaning, but naïve, human healthcare professionals even may suggest parents do this. When these animals become overwhelmed and develop problems, their owners want immediate cures.

Drs. Bosch and Mulcahy found that taking a comprehensive One Health approach worked for them in these cases. This involves meetings with the clients and human healthcare providers to determine their therapeutic expectations of the animal, plus trainers or behaviorists to determine if these are feasible. Sometimes proper training and frequent rest and play breaks for the animal away from the human patient solves the problem. But if the family pet lacks the physical and mental wherewithal to perform these functions successfully for their loved ones, clients are advised to consider adding an animal with the proper credentials.

Above all, what the veterinarians learned from all of these cases is that all they can do is to provide these clients with the information and tools that will enable those people to put their animals’ needs ahead of their own. However, they have no control over how much these clients actually will do to create a more equitable relationship with their animals or how long it will take them to do this. All the practitioners can do is to do their best, and let it go.
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