Pyloric obstruction due to massive eosinophilic infiltration in a young adult dog

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Dear Editor,
I have become jaded toward the Ontario Veterinary College (OVC) and the admissions process.

I, along with many colleagues who have been practicing for 20 to 30 years, are finding there to be an inherent sense of entitlement and dysfunctional work ethic among too many recent graduates. Why are final year students interviewing admission applicants? This only adds to the entitlement issue and they have no idea of what it means to be in our profession.

Not sure what the answer is and I’m sure readers will think the old guys like me are out of touch but there is no substitute for experience.

Paul Francis, OVC graduate, 1983

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Veterinary School Admission — A Response

Dear Editor,
The Ontario Veterinary College (OVC) welcomes the opportunity to respond to Dr. Paul Francis’ recent letter to the Journal. The College is always happy to collaborate with the profession on matters of mutual interest; of which admissions is certainly one.

For readers who are not familiar with the current admission process at OVC, applicants are required to have first gained veterinary experience, typically in practice situations, and commonly hundreds of hours of such experience are reported by candidates. The applicants can also gain relevant experience in research settings, industry, and other domains in which they are working with veterinarians. By requiring this experience, the College ensures that applicants do, in fact, have a good understanding of veterinary medicine. Through submission to OVC of standardized referee assessments and letters of reference, the employment and volunteer experiences are verified by at least two veterinarians with whom the candidate has worked or volunteered. A third required letter of reference can come from another veterinarian or someone else with whom the applicant has been in a supervised employment or volunteer relationship.

In their application package that candidates submit to the OVC Admission Committee, a Background Information Form (including statements explaining why they wish to be a veterinarian), the referee forms and letters of reference described above, and their academic grades from their last two full-time semesters and from eight required subjects. The Committee reviews the top 220 applications as stratified by grades and determines who will be offered an interview (200 applicants are interviewed each year).

We use the Multiple Mini Interview (MMI) format, which has been evaluated by ourselves (Oliver et al, 2014) and others (Pau et al, 2013) as being reliable, acceptable, and feasible in selecting candidates for veterinary medicine. The MMI is an eight-station interview in which applicants circulate from station to station every 10 minutes. They are presented with a specific scenario at each station and are asked to respond to what the people described in the scenario (which may be themselves, a member of the public, or a veterinarian) should do and say in response to questions posed in the scenario presented. Each scenario has been specifically designed to assess applicants’ abilities in the area of ethical behavior, sound judgment, communication, critical and creative thinking, and empathy. These characteristics were selected based on a survey of all Ontario veterinarians in 2011 (1312 responses received), the analysis of which we have published (Conlon et al, 2012).

The MMI interviewers are paired so that across the eight stations each applicant is assessed by 16 people using standardized rubrics, which have been carefully constructed to validate the appropriate responses from the applicants. In the 2017 cycle, 74 faculty members and alumni, and 81 DVM students participated as interviewers. The students are paired with either an OVC faculty member or an alumnus. Since evaluation of the candidates is done in a very structured way, we have every confidence that all reviewers are assessing the candidates’ responses in a fair and equitable manner and have analyzed the data from previous years and found no significant differences in interview scores from the DVM students when compared to faculty and alumni scores.

On the point that Dr. Francis raises concerning applicants with second careers, we are strongly committed to making the opportunity to apply to OVC available to all Ontario residents. This includes those people who have decided later in life that being a veterinarian is a new career opportunity for them. These
decisions are well thought through, especially because these applicants have often given up a job, salary, and benefits, and potentially have had to change their family’s location. We agree that many people have a sense that their chosen career path very early on is veterinary medicine, but we respectfully reject the idea that these are the only candidates who will be successful in our profession.

Thank you again for the opportunity to respond.
Yours truly,
Jeffrey J. Wichtel, BVSc, PhD, Dip.ACT
Professor and Dean
President’s Message
Le mot de la présidente

International support and collaboration
Collaboration et soutien internationaux

This past August, I attended the International Veterinary Officers Coalition (IVOC) meeting in Incheon, South Korea.

The purpose of IVOC is to promote dialogue and collaboration among the chief elected and chief executive officers of the 6 member organizations: Australian Veterinary Association (AVA), New Zealand Veterinary Association (NZVA), American Veterinary Medical Association (AVMA), Canadian Veterinary Medical Association (CVMA), South African Veterinary Association (SAVA), and the British Veterinary Association (BVA).

Benefits for member nations are the following:
• The ability to share common positions where appropriate on international veterinary matters.
• The ability to share common positions related to the policies and operations of international veterinary organizations.
• The exchange of information on common issues that affect the member countries, and strategies and programs for addressing these issues.
• Exploration of reciprocal benefits for members of the IVOC associations.

Some of the topics for discussion at the meeting were the future of the profession, telemedicine, animal welfare, member wellness, and antimicrobial use. We also discussed IVOC’s involvement in international leadership and advocacy, and sharing programs and services among the member nations. Briefly, this is what some member nations have been working on.

The BVA: Brexit has taken up a considerable amount of time, and has shown stakeholders just how important veterinarians are with respect to trade, consumer confidence, and public trust. Some of the other priorities for the BVA are the serious health and welfare problems of brachycephalic breeds. It is also ensuring antimicrobial resistance and mandatory closed-circuit television surveillance in slaughterhouses stay on the parliamentary and public agendas.

The AVA continues to promote member wellness where the emphasis is not on suicide prevention but rather on overall wellness. As we all know, well-being is not just a veterinary

En août dernier, j’ai assisté à la réunion de l’International Veterinary Officers Coalition (IVOC) qui s’est tenue à Incheon, en Corée du Sud.

L’IVOC a pour but de promouvoir le dialogue et la collaboration entre les premiers dirigeants élus et les présidents-directeurs généraux des six organisations membres : l’Australian Veterinary Association (AVA), la New Zealand Veterinary Association (NZVA), l’American Veterinary Medical Association (AVMA), l’Association canadienne des médecins vétérinaires (ACMV), la South African Veterinary Association (SAVA) et la British Veterinary Association (BVA).

Les avantages pour les pays membres sont les suivants :
• La capacité de partager des positions communes sur des questions vétérinaires internationales lorsque cela est approprié.
• La capacité de partager des positions communes se rapportant aux politiques et à la gestion des organisations vétérinaires internationales.
• L’échange d’information sur des enjeux communs qui touchent les pays membres ainsi que sur les stratégies de programmes pour aborder ces enjeux.
• L’exploration d’avantages réciproques pour les membres des associations de l’IVOC.

Parmi les sujets de discussion à la réunion, citons l’avenir de la profession, la télémédecine, le bien-être animal, le bien-être des membres et l’utilisation des antimicrobiens. Nous avons aussi discuté de la participation de l’IVOC au leadership et à la défense des intérêts à l’échelle internationale ainsi que du partage des programmes et des services entre les pays membres. Brivement, voici quelques-uns des projets auxquels travaillent les pays membres.

La BVA : Le Brexit a occupé une place considérable parmi les projets de la BVA et a aussi permis de démontrer aux intervenants à quel point les médecins vétérinaires sont importants sur le plan du commerce, de la confiance des consommateurs et de la confiance du public. Parmi les priorités de la BVA, citons les graves problèmes de santé et de bien-être des races brachycéphales. La BVA travaille aussi afin d’assurer que l’antibiorésistance et la

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profession issue, well-being is a societal issue. The AVA continues to support new graduates of veterinary medicine by helping them transition into work and then continuing this support up to 4 years after graduation. It has connected over 400 final-year students with a mentor. They are also running a program called "mental health first aid — education for practices," and funding a study on workforce/workplace issues.

At the CVMA, antimicrobial resistance (AMR), prudent use and surveillance, continue to be top priorities. The Association has received project funding from the Agriculture and Agri-Food Canada (AAFC) to renew the 2008 Veterinary Anti-Microbial Prudent Use Guidelines. This initiative will be finalized by March 2018. As a result of broad stakeholder input received during a March 2017 CVMA-hosted, Canadian Food Inspection Agency (CFIA) — funded workshop on Antimicrobial Use (AMU) Surveillance, the CVMA has gained new insights and obtained key information on national requirements for AMU surveillance data collection and analysis from a variety of species groups.

The CVMA consults with 27 government agencies and interest groups. The CVMA's continued collaborations with such associations as the World Veterinary Association (WVA), World Small Animal Veterinary Association (WSAVA), PanVet, Federation of Veterinarians of Europe (FVE), and IVOC have resulted in sharing information, programs, joint position statements, and engaging with the WVA and WSAVA in urging the United Nations not to restrict the availability of ketamine.

The CVMA continues to work on the well-being of its members by providing support, articles, and links to other resources on the website. Some other tangible benefits to CVMA members as a result of collaboration with other associations are access to more than 900 e-learning sessions, Partners for Healthy Pets resources, a mentorship program, and free access to Clinician's Brief. The core values continue to be animal welfare and national issues. You can review CVMA's recent activities in our 2016 Annual Report, which can be found in the July 2017 issue of The CVJ.

The United Nations (UN) General Assembly adopted a resolution "transforming our world: The 2030 agenda for sustainable development" — in no place does it mention animal welfare. The BVA is working on a position statement on the UN sustainable development goals. Our job as an organization representing the veterinary profession is to get animals and animal welfare included in this position statement, and this is something that IVOC can lend a voice to, as well as other issues such as food safety. And we can contribute to these goals by supporting other associations such as the WVA and WSAVA.

Troye McPherson
Ethical question of the month — November 2017

Researchers have been investigating methods to delay sexual maturation in farmed Arctic char to improve meat quality and cost of production. They concluded that withholding feed for up to 18 weeks at 10°C is an effective approach to delay sexual maturation and improve the economic viability of farming Arctic char. The researchers state that the unfed fish maintained good health and welfare during this period of food deprivation, based on their lack of aggression, their inactive behavior, lack of protein depletion, use of lipid reserves, and the return of normal appetites after reintroduction of food. Wild char do survive for long periods of time without food at temperatures several degrees below 10°C; however, some believe there is insufficient data to conclude that farmed Arctic char do not suffer from food deprivation at 10°C. The Canadian Council on Animal Care (CCAC) guidelines state that feed deprivation of fish for a few days is not overly distressful, while the Royal Society for the Prevention of Cruelty to Animals (RSPCA) welfare standards for farmed Atlantic salmon (in the same family as Arctic char) state that it is unacceptable to deprive salmon of food for perceived flesh quality reasons. Should char farms implement 18 weeks of total feed deprivation to improve their economic viability when the effects on the welfare of the fish are not fully understood?

Submitted by John O’Halloran, Old Ridge, New Brunswick

References


Question de déontologie du mois — Novembre 2017

Les chercheurs étudient des méthodes qui retarderont la maturation sexuelle de l’omble arctique d’élevage afin d’améliorer la qualité de la viande et le coût de production. Ils ont conclu que la privation de nourriture pendant jusqu’à 18 semaines à 10 °C est une approche efficace pour retarder la maturation sexuelle et améliorer la viabilité économique de l’élevage de l’omble arctique. Les chercheurs affirment que les poissons non nourris

Responses to the case presented are welcome. Please limit your reply to approximately 50 words and forward along with your name and address to: Ethical Choices, c/o Dr. Tim Blackwell, 6486 E. Garafastra, Townline, Belwood, Ontario N0B 1J0; telephone: (519) 846-3413; fax: (519) 846-8178; e-mail: tim.e.blackwell@gmail.com
Suggested ethical questions of the month are also welcome! All ethical questions or scenarios in the ethics column are based on actual events, which are changed, including names, locations, species, etc., to protect the confidentiality of the parties involved.

Les réponses au cas présenté sont les bienvenues. Veuillez limiter votre réponse à environ 50 mots et nous la faire parvenir par la poste avec vos nom et adresse à l’adresse suivante : Choix déontologiques, a/s du Dr Tim Blackwell, 6486, E. Garafastra, 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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maintiennent une bonne santé et un bien-être satisfaisant durant cette période de privation alimentaire en se fondant sur l’absence d’agression, leur comportement inactif, l’absence de déplétion des protéines, l’utilisation des réserves de lipides et le retour de l’appétit normal après la réintroduction des aliments. L’omble arctique sauvage peut survivre pendant de longues périodes de temps sans nourriture à des températures de plusieurs degrés inférieures à 10 °C, cependant, certains croient que les données sont insuffisantes pour conclure que l’omble arctique d’élevage ne souffre pas de privation alimentaire à 10 °C. Les lignes directrices du Conseil canadien de protection des animaux (CCPC) stipulent que la privation alimentaire pendant quelques jours pour les poissons n’est pas trop traumatisante, tandis que les normes de bien-être de la Royal Society for the Prevention of Cruelty to Animals (RSPCA) pour le saumon d’élevage (dans la même famille que l’omble arctique) stipulent qu’il est inacceptable de priver le saumon de nourriture pour des raisons de perception de la qualité de la chair. Les fermes d’élevage de l’omble arctique devraient-elle mettre en œuvre 18 semaines de privation alimentaire totale afin d’améliorer la viabilité économique lorsque les effets sur le bien-être du poisson ne sont pas pleinement compris?

Soumise par John O’Halloran, Old Ridge (Nouveau-Brunswick)

Bibliographie

Ethical question of the month — August 2017
Veterinarians work at provincial sales barns in Ontario to oversee animal health. One of their responsibilities is to euthanize animals that are deemed unfit for sale. A large proportion of cattle to be euthanized at sales barn are cull cows in transit to slaughter that are deemed unfit for transport. Veterinarians, livestock caretakers, and the general public understand the rationale for these cases of humane euthanasia.

Young bull calves are another class of livestock that come to sales barns and are euthanized by veterinarians. These calves are intended to be sold to local veal or beef producers. However, if calves appear sick on sale day they are left unsold. At the end of the sale day the sales barn veterinarian is asked to euthanize them. These calves have a reasonable chance of responding to treatment if given time and nursing care. However sales barns are not designed for this purpose and owners don’t want calves returned to the farm. The same veterinarian who euthanizes cull cows in good conscience is reluctant to euthanize calves he/she believes have a good chance for recovery.

Is there an ethically sound basis for such a distinction?

Submitted by Ann Godkin, Elora (Ontario)

Question de déontologie du mois — Août 2017
Des médecins vétérinaires travaillent dans les enchères de bestiaux provinciales en Ontario afin de superviser la santé animale. L’une de leurs responsabilités consiste à euthanasier les animaux qui sont jugés impropre à la vente. Une grande proportion du bétail à euthanasier dans les enchères de bestiaux se compose de vaches de réforme en transit vers l’abattoir qui sont jugées inaptes au transport. Les vétérinaires, les préposés au bétail et le grand public comprennent la justification de ces cas d’euthanasie sans cruauté.
Les jeunes taureaux sont une autre catégorie de bestiaux qui viennent dans les enchères et sont euthanasiés par les vétérinaires. Ces veaux sont destinés à la vente à des producteurs de veaux ou de bovins de boucherie locaux. Cependant, si les veaux semblent malades le jour de la vente, ils demeurent invendus. À la fin de la journée des enchères, on demande au vétérinaire présent de les euthaniser. Ces veaux ont une chance raisonnable de répondre au traitement si on leur en donne le temps et qu’on leur prodigue des soins. Cependant, les enchères de bestiaux ne sont pas conçues à cette fin et les propriétaires ne veulent pas que les veaux retournent à la ferme. Le même vétérinaire qui euthanasie les vaches de réforme est réticent à euthanasier des veaux qui, selon son opinion, ont de bonnes chances de se rétablir. Existe-t-il des fondements éthiques pour une telle distinction?

Soumise par Ann Godkin, Elora (Ontario)

Sale barn veterinarian who does not wish to euthanize sick bull calves — A comment

I understand the hesitation of Dr. Godkin to euthanize these young calves; it is a waste of food and a total disrespect for the rights of animals. I would not do it myself.

Jean-Louis Forgues, DVM, Saint-Charles-Borromée, Quebec

An ethicist’s commentary on sale barn veterinarian who does not wish to euthanize sick bull calves

As I know from personal experience, being a sale barn veterinarian with compassion and a good conscience is not an easy task. The reason for this is the constant and relentless pressure to maximize the income production of the animals sent to the sales. Given this sort of pressure, before public sensitivity to animal suffering increased, animals were sent to sale when they were very sick or suffering major injuries just to squeeze an iota of profit from them. Anyone who ever went to a sale barn would have seen humanity at its worst — greed wrapped up in cruelty. On one occasion, a calf with a broken leg was being sold. Because the animal was in great pain, it would not move quickly enough to suit the abusive workers who see themselves as “cowboys,” when in fact they are as far from being true cowboys as anyone could be. One of these troglodytes was beating the calf with a stick. It took a great deal of self-control for my rancher friends and me not to jump into the arena and soundly beat the worker.

For this reason, a sale barn veterinarian at root concerned about the animals is a rare individual. Yet I have known a number of such people. In my home state of Colorado, it was a sale barn veterinarian who successfully pushed for a law banning the shipping of “downer animals” more than 25 years ago, an activity that did not make him many friends in the sale barn community, although the ranchers were very supportive. As one of my rancher friends put it, “we should eat our mistakes not ship them!”

In the scenario presented, we clearly have a paradigm case of a sale barn veterinarian possessed of good ethics and concern for the animals. With sale barns ever increasingly watched by animal advocates and journalists, such a person is an invaluable asset to a sale barn, both for reasons of ethics and for reasons of public relations. For this reason alone, it behooves management to take the concerns of such a person very seriously, if only because they are hard to find, and losing such a veterinarian would be a major loss to the facility.

The veterinarian in this case is absolutely correct. There is indeed a huge moral difference between an animal too sick or badly injured to be shipped to slaughter, and one that can be restored to health with a moderate amount of care. Some might affirm that there is no such difference — after all, all of these animals are destined to be killed. Such an attitude is unconscionable. As John F. Kennedy once remarked about human beings, “in the long run we are all dead.” That is true, but provides absolutely no justification for ignoring quality of life while people live. Exactly the same point holds true of the bull calves in this case, which line of reasoning is probably what the veterinarian finds problematic.

Were I the owner of the sale barn, that is precisely the sort of veterinarian I would wish to employ. On the one hand, the veterinarian is strong enough to function in what is undoubtedly a very difficult job. On the other hand, despite the difficulty, he or she has not abandoned either ethics or compassion. I would therefore solicit from the veterinarian an economically viable strategy for treating these animals so that they can have a life that is not truncated. Obviously, if the animal can be made better with relatively little effort, it can live longer and be more economically productive than if it is simply killed. And, equally important, the veterinarian can feel as if he or she is doing something more congenial to the sort of job he or she became a veterinarian to do.

Nor can we forget the priceless public relations dimension of such a decision, particularly if one finds a congenial reporter who will cover the story accurately and stress how this particular sale barn is differentiated from others. There is no public relations as good as doing the right thing for the right reasons.

Bernard E. Rollin, PhD
Join WVC for a once-in-a-lifetime stay at Los Suenos Marriott Ocean & Golf Resort in Herradura, Costa Rica for 5-nights. In the heart of the rainforest, Los Suenos is minutes away from picturesque nature preserves and the world-famous Jaco Beach. Indulge in a host of activities including horseback riding, zip-lining, and hiking.

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**Earn 12 hours of CE in Feline Medicine & Surgery featuring Michael Lappin, DVM, DACVIM (SAIM) & Catriona MacPhail, DVM, PhD, DACVS**

In this lecture series, Hot Topics in Feline Infectious Diseases and Soft Tissue Surgery, Drs. Lappin and MacPhail will use a case-based approach to update the attendees on approximately 30 Hot Topics in feline infectious diseases and soft tissue surgery. Topics will include diagnosis and treatment of Bartonella, Giardia, Hemoplasmas, Tritrichomonas, and URI. The latest updates on GI diseases and urinary surgical procedures will be highlighted as well.

Visit wvc.org for more information and to register today.
1. Which of the following is the most appropriate systemic therapy for *Malassezia* dermatitis?
   A. Griseofulvin  
   B. Ketoconazole  
   C. Fenbendazole  
   D. Thiabendazole  
   E. Miconazole

2. Which of the following statements is NOT correct regarding the etiology of congenital PSS?
   A. Intrahepatic congenital PSS results from failure of the fetal ductus venosus to close.  
   B. Extrahepatic congenital PSS results from developmental malformation of the vitelline system.  
   C. Intrahepatic congenital PSS connects the hepatic vein and caudal vena cava.  
   D. Extrahepatic congenital PSS connects the portal vein or left gastric vein and caudal vena cava.

3. Which of the following statements is correct regarding canine brucellosis?
   A. Transmission is via respiratory secretions.  
   B. Only male dogs show clinical signs of infection.  
   C. Testing is not necessary in a breeding dog that exhibits no clinical signs of brucellosis.  
   D. False positives are common with the rapid slide agglutination test (RSAT).  
   E. False negatives are common with the RSAT.

4. Which of the following is most likely to be the source of the viral infection causing equine sarcoïds?
   A. Equine herpesvirus  
   B. Equine papillomavirus  
   C. Bovine papillomavirus  
   D. Bovine herpesvirus  
   E. Ovine papillomavirus

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5. Which of the following is an appropriate method of euthanasia for a dairy producer to employ?
A. Barbiturate, IV
B. Blunt head trauma
C. Gunshot to the head
D. Ammonium chloride, (Roccal-D), intravenously
E. Potassium chloride, intravenously

5. Laquelle des méthodes suivantes constitue une méthode d’euthanasie appropriée à utiliser par un producteur laitier?
A. barbituriques par voie intraveineuse;
B. traumatisme fermé à la tête;
C. coup de fusil à la tête;
D. chlorure d’ammonium (Roccal-D) par voie intraveineuse;
E. chlorure de potassium par voie intraveineuse.

(See p. 1175 for answers./Voir les réponses à la page 1175.)
2018 CVMA Awards
Nominations are Open!

Each year, through its awards program, the Canadian Veterinary Medical Association (CVMA) proudly recognizes individuals who have demonstrated significant accomplishments, exemplary leadership and tireless commitment to Canada’s veterinary community. Nominations for the 2018 CVMA Awards are being accepted from now until January 31, 2018.

Award eligibility
Award nominees (excluding those nominated for Honorary Membership) must be current CVMA members to be eligible for nomination; however, they can be nominated by non-CVMA members. We invite you to consider nominating a deserving colleague for one of the following CVMA’s prestigious awards:

CVMA Humane Award
Established by the CVMA in 1986, and sponsored by Merck Animal Health, this award recognizes leadership in the care and well-being of animals. The award, consisting of $1000 and a plaque, is presented to a CVMA member whose work is judged to have contributed significantly to the welfare and well-being of animals.

CVMA Industry Award
Instituted in 1996, the CVMA Industry Award publicly acknowledges and celebrates the role of industry in veterinary medicine. The award formally recognizes a CVMA member for their contributions to the advancement of veterinary medicine.

Merck Veterinary Award
Established in 1985, and sponsored by Merck Animal Health, this award is presented to a CVMA member whose work in food animal production practice, clinical research, or basic sciences is judged to have contributed significantly to the advancement of food animal medicine and surgery, including herd health management. The award consists of $1000 and a plaque.

Small Animal Practitioner Award
Sponsored by Petsecure Pet Health Insurance, this award is presented to a CVMA member whose work in small animal practice, clinical research or basic sciences is judged to have contributed significantly to the advancement of small animal medicine, surgery, or the management of a small animal practice. The award consists of $1000 and a plaque.

Prix de l’ACMV 2018
Ouverture des mises en candidature!

Chaque année, dans le cadre de son programme de prix, l’Association canadienne des médecins vétérinaires (ACMV) reconnaît fièrement des personnes qui ont accompli des réalisations exceptionnelles et ont fait preuve d’un leadership exemplaire ainsi que d’un dévouement infatigable envers la collectivité vétérinaire du Canada. Les mises en candidature pour les Prix de l’ACMV 2017 seront acceptées jusqu’au 31 janvier 2018.

Admissibilité aux prix
Les personnes mises en candidature (sauf celles mises en candidature pour le titre de membre honoraire) doivent être membres en règle de l’ACMV pour être admissibles à la mise en candidature. Cependant, elles peuvent être mises en candidature par des non-membres de l’ACMV. Nous vous invitons à considérer la mise en candidature d’un collègue méritant à l’un des prestigieux prix de l’ACMV suivants :

Prix humanitaire de l’ACMV
Créé par l’ACMV en 1986 et commandité par Merck Santé Animale, ce prix reconnaît leadership à l’égard du soin et du bien-être des animaux. Le prix, qui comporte une bourse de 1000 $ et une plaque, est décerné à un membre de l’ACMV dont le travail représente une contribution importante au bien-être des animaux.

Prix de l’industrie de l’ACMV

Prix vétérinaire Merck
Établi en 1985 et commandité par Merck Santé Animale, ce prix est décerné à un membre de l’ACMV dont le travail en pratique de la production des animaux destinés à l’alimentation, en recherche clinique ou en sciences fondamentales représente une contribution importante pour l’avancement de la médecine et de la chirurgie des animaux destinés à l’alimentation, y compris la gestion de la santé du troupeau. Le prix comporte une bourse de 1000 $ et une plaque.

Prix du praticien des petits animaux
Commandité par Petsecure assurance maladie pour animaux, ce prix est décerné à un membre de l’ACMV dont le travail en pratique des petits animaux, en recherche clinique ou en sciences fondamentales représente une contribution importante à l’avancement de la médecine et de la chirurgie des petits animaux ou à la gestion d’une pratique pour petits animaux. Le prix comporte une bourse de 1000 $ et une plaque.

Prix de la pratique de l’année de l’ACMV
Instauré en 2013, le Prix de la pratique de l’année comporte une bourse de 1000 $ et une plaque. Ce prix est commandité par la Banque Scotia, un leader au chapitre des services bancaires pour les...
CVMA Practice of the Year Award
Established in 2013, the Practice of the Year Award consists of $1000 and a plaque and is sponsored by Scotiabank, a leader in banking services for professionals. The award recognizes a veterinary practice team for outstanding achievement within their local community. Such achievements may include innovations in the provision of veterinary services, commitment to work-life balance, meaningful community or charitable involvement, or implementation of “green” practice procedures.

CVMA Life Membership
Life Membership is presented to a CVMA member for long and outstanding service on CVMA Council, Executive, boards, and committees or for outstanding contributions to the veterinary profession. The Life Member is presented with a framed certificate and shall be invited to attend meetings of the Association, and shall not be liable to pay dues, but shall enjoy all the rights and privileges of membership.

CVMA Honorary Membership
Honorary membership is presented to an individual who has rendered distinguished service to the profession, whether residing in Canada or elsewhere. The Honorary Member does not pay fees and cannot vote at meetings, or hold any elected office in the CVMA.

Nomination package
Selection of award recipients is based solely on the information provided in the nomination package. Please follow these steps to ensure all required documents are included with your nomination package:

1. Submit a completed nomination form. A copy of this form is included in this issue of The CVJ. The form is also available for download under the CVMA Awards section of our website (www.canadianveterinarians.net).

2. Include the following supporting documents as part of the nomination package:
   • Outline of nominee’s key professional accomplishments (maximum of 1000 words)
   • Letters of support (maximum of 5 letters; each letter 500 words or less)
   • Newspaper articles (maximum of 2 articles written within the last 2 years)
   • Articles written by nominee (maximum of 3 web links to articles).

Nomination packages are due by January 31, 2018, via e-mail (communications@cvma-acmv.org), by fax to 613-236-9681, or by mail to the CVMA office at 339 Booth Street, Ottawa, ON K1R 7K1.

Please visit the CVMA Awards section of the website or contact Communications at 1-800-567-2862, ext. 125 for further information.
Programme des futurs leaders de l’ACMV

Le Programme des futurs leaders (PFL) de l’ACMV a débuté en 2010 sous forme d’un atelier d’une journée dans le but d’appuyer et de développer les compétences de leadership parmi les vétérinaires canadiens et d’inspirer le leadership au sein de la profession vétérinaire.

Le PFL 2017 de l’ACMV a été mis en œuvre grâce à l’appui des associations provinciales de médecins vétérinaires et le commanditaire exclusif, Virox Animal Health. Si vous aimeriez en apprendre davantage à propos du Programme des futurs leaders et sur la façon d’y participer, veuillez contacter Sarah Cunningham, (scunningham@cvma-acmv.org).

La série Pleins feux sur le PFL soulignera l’expérience de quelques-uns des participants au programme. Présentons maintenant le Dr. Brendon Laing, de Mobile Pet Services de Toronto.

1. Pourquoi désiriez-vous participer au PFL de l’ACMV?

   Il a toujours été important pour moi de développer des qualités de leadership. J’ai eu la chance de participer au Programme des futurs leaders par l’entremise de l’Ontario Veterinary Medical Association. En tant que membre du conseil d’administration, j’estimais qu’il était important de cultiver mon leadership et j’étais ravi d’avoir l’occasion d’assister au PFL!

2. Quel a été le fait saillant du programme pour vous?

   My greatest takeaway from the program was Dr. DeBowes’ ability to relate his teaching back to being a veterinarian. I found this profoundly helpful because he knows first-hand the struggles that we as veterinarians experience; most notably, how to identify and address low staff morale that plagues many veterinary teams.

   My greatest takeaway from the program was Dr. DeBowes’ ability to relate his teaching back to being a veterinarian. I found this profoundly helpful because he knows first-hand the struggles that we as veterinarians experience; most notably, how to identify and address low staff morale that plagues many veterinary teams.

   Ce qui m’a le plus impressionné lors du programme a été la capacité du Dr. DeBowes d’établir un lien avec l’exercice de la profession de vétérinaire. J’ai trouvé cet aspect extrêmement utile parce qu’il a connu de première main les expériences vécues par les vétérinaires et, surtout, il sait comment identifier et aborder le faible moral des employés dont sont victimes beaucoup d’équipes vétérinaires.

3. Décrivez une action particulière que vous effectuez différemment après votre participation au PFL?

   Après avoir assisté au PFL, j’étais beaucoup plus conscient de veiller au moral de l’équipe de la clinique. Ce que j’ai appris auprès du Dr. DeBowes est que ce travail s’appuie sur la communication et la confiance. En mettant l’accent sur le perfectionnement des capacités des membres de l’équipe et en faisant confiance à chaque membre individuel de l’équipe, j’ai réussi à grandement améliorer le moral à la clinique et l’équipe est plus heureuse et accomplie. Et maintenant, les employés participent activement à la clinique et ils sont des moteurs du changement! Ce nouvel environnement s’est traduit par une meilleure expérience pour les parents d’animaux de compagnie et, croyez-moi, ils ont remarqué.

4. Croyez-vous qu’il est important pour les autres participants à la collectivité vétérinaire de devenir plus actifs dans la formation au leadership? Pourquoi?

   La formation au leadership devrait être offerte à tous les vétérinaires. Nous passons tous des années à étudier pour devenir des professionnels médicaux informés et compassionnés, mais il existe une lacune importante dans notre base de connaissances en ce qui concerne les affaires, la gestion et
3. Describe one specific action that you are doing differently after participating in the ELP?

After attending the ELP, I’ve been much more conscious of building team morale within the clinic. What I learned from Dr. DeBowes is that this starts with communication and trust. Focusing on growing team members’ abilities and believing in them individually has greatly improved the morale in the clinic, making for a happier, more fulfilled team. By doing so, the team has been more engaged and are now the drivers of change! This new environment has translated into a better experience for pet parents, and believe me, they are noticing.

4. Do you think it is important for others within the veterinary community to become more active in leadership training? Why?

Leadership training should be standard for all veterinarians. We all spend years training to become knowledgeable and compassionate medical professionals, but there’s a massive gap in our knowledge base when it comes to business, management and leadership. It doesn’t matter where we practice, if we’re associates or owners, all veterinarians need to act as leaders within their team. Spending just a couple hours or days a year improving our leadership skills will create meaningful changes in our ability to lead others and ultimately in the care that we provide our patients.

Are You Taking Full Advantage of Your CVMA Membership?

Your Canadian Veterinary Medical Association (CVMA) membership entitles you to privileges that help you achieve professional, personal and financial success. As your national veterinary medical association, the CVMA has significant purchasing power and is continually providing members with added value by offering exclusive, relevant discounted services to veterinarians and veterinary practices. These savings can more than cover the cost of your annual membership fee. A few of the CVMAs discounted services offered to members are highlighted below.

The Canadian Veterinary Journal’s Online Classified Advertising

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One Health Day and World Antibiotic Awareness Week Raise the Importance of a One Health Approach to Address Antimicrobial Resistance

La Journée Une seule santé et la Semaine mondiale pour un bon usage des antibiotiques soulignent l'importance de l'approche Une seule santé afin d'aborder la résistance aux antimicrobiens

The Canadian Veterinary Medical Association (CVMA) strongly supports the involvement of veterinarians in One Health as they play a key role in improving the health and welfare of the animals they treat in a manner that also protects and supports human health and a healthy environment.

The One Health approach is particularly relevant to the development of collaborative strategies for responsible antimicrobial use and thereby supporting the control of antimicrobial resistance (AMR).

“With AMR recognized as a growing threat in Canada and around the world, it is crucial that public health, veterinary, agricultural, and regulatory communities work together to minimize the emergence and continued spread of antimicrobial resistance,” says Dr. Troye McPherson, 2017–18 CVMA president.

In February 2017, the CMVA facilitated a workshop to begin the foundational work to build a national surveillance of antimicrobial use (AMU) in animals by the veterinary community. Funded by the Canadian Food Inspection Agency, key partners in animal and human health gathered to develop a collective understanding of the existing state of AMU surveillance in the veterinary context, and to identify information gaps and requirements to design efficient and effective data/information gathering methods. The workshop was the first phase of what is expected to be a multi-year project.

In a separate project funded by Agriculture and Agri-Food Canada, the CVMA commenced the review and renewal of the CVMA Guidelines for the Prudent Use of Veterinary Antimicrobial Medications (2008). The project will develop guidelines for prudent AMU across the 6 species groups (swine, poultry, beef, dairy, small ruminants and companion animals) and pilot a prototype tool set to review effectiveness and guide further improvements. Participants in the initial workshop in May 2017 included Canadian veterinarians, veterinary researchers and educators, government officials and species-group stakeholders.

In September 2017, the Government of Canada, through Health Canada, released a document titled Tackling Antimicrobial Resistance and Antimicrobial Use: A Pan-Canadian Framework for Action. Held up as an example of leading guidance on antimicrobial stewardship was the document Veterinary Oversight of Antimicrobial Use — A Pan-Canadian Framework.
for Professional Standards for Veterinarians, developed as a collaboration between the CVMA’s Veterinary Pharmaceutical Stewardship Advisory Group and the Canadian Council of Veterinary Registrars. The Framework represents a significant step by the veterinary profession in Canada towards addressing the new veterinary responsibilities for oversight of antimicrobials to accompany current and ongoing changes to federal policies and regulations. The Framework can be downloaded from the CVMA website, under the Policy & Advocacy tab. (www.canadianveterinarians.net/documents/pan-canadian-framework).

In recent months, the CVMA joined a sub-committee of the Canadian Animal Health Products Regulatory Advisory Committee (CAHPRAC) to discuss the implementation and impacts of Health Canada’s moving all medically important antimicrobials to the Prescription Drug List by December 2018. The sub-committee members include, in addition to the CVMA, participants from the drug industry, food producers, feed producers, Health Canada, and Canadian Food Inspection Agency. It recognizes the importance of collaboration and helping to develop plans around consistent communication regarding the transition, engagement of stakeholders, and implementation of key timelines. Visit the Veterinary Oversight of Antimicrobial Use in Animals in Canada section of the CVMA website (www.canadianveterinarians.net), under the Policy & Advocacy tab, to find out more.

Through a One Health approach, the CVMA will continue to help Canada’s commitment to responding to the threat of AMR, as described in the Federal Action Plan on Antimicrobial Resistance and Use in Canada: Building on the Federal Framework for Action that can be found on the Canada.ca website.

One Health Day takes place on November 3, 2017. The goal is to raise awareness of the One Health approach for managing complex health problems involving people, animals and the environment. For more information, visit the One Health Commission’s website (www.onehealthcommission.org).

World Antibiotic Awareness Week runs from November 13 to 19, 2017. It aims to increase awareness of global antibiotic resistance and to encourage best practices among the general public, health workers and policy makers to avoid the further emergence and spread of antibiotic resistance. Visit the World Health Organization website for more information.


Dans le cadre de l’approche Une seule santé, l’ACMV poursuivra l’engagement du Canada afin de lutter contre la menace de l’antibiorésistance, tel qu’il est décrit dans le Plan d’action fédéral sur la résistance et le recours aux antimicrobiens au Canada : Prolongement du cadre d’action fédéral et que l’on peut trouver sur le site Web Canada.ca.

La Journée Une seule santé se déroulera le 3 novembre 2017. Son but consiste à rehausser la sensibilisation à l’égard de l’approche Une seule santé pour la gestion de problèmes de santé complexes touchant les personnes, les animaux et l’environnement. Pour en savoir davantage, visitez le site Web de la One Health Commission au (www.onehealthcommission.org).

Obituary
Dr. Joan Tailyour

Joan Tailyour was one of the first female veterinarians in Canada’s national veterinary service. Raised in the Okanagan Valley, Joan was home schooled in her early years and spent many afternoons exploring the area on horseback before finishing her secondary schooling in England. In 1942 Joan enlisted in the Royal Canadian Air Force wherein she held several wartime postings. Following graduation from the Ontario Veterinary College in 1950 Joan joined the Health of Animals Branch where she provided outstanding laboratory services to veterinarians in the field and mentored many who went on to serve in senior executive roles in the Public Service of Canada. She was an active competitive horsewoman as a rider, instructor, and again a mentor to many. Love for animals, especially horses, was a major part of her life. Joan retired to Kelowna, British Columbia with memories of a rich, challenging life that included global travels, a worldwide network of friends and an abiding interest in animal welfare.

Joan passed away peacefully at 102 years of age. Thanks are owed to her close friends and staff of the Westbank First Nation’s Pine Acres home for exemplary care in Joan’s final years. These included special moments such as a surprise visit by “Peppy”, a beautiful Quarter Horse on her 100th birthday.

Donations in memory may be made to any local SPCA or to the Dr. Joan Tailyour Fund to foster animal welfare with a special focus on horses established by the Central Okanagan Foundation 306–1726 Dolphin Avenue, Kelowna, BC V1Y 9R9.

Nécrologie
Dr. Joan Tailyour

Joan Tailyour a été l’une des premières femmes vétérinaires à travailler au sein du service vétérinaire national du Canada. Joan a grandi dans la vallée de l’Okanagan et a été éduquée à la maison pendant les premières années scolaires et elle a passé de nombreux après-midis à explorer la région à cheval avant de terminer l’école secondaire en Angleterre. En 1942, Joan s’est enrôlée dans l’Aviation royale canadienne où elle a occupé de nombreux postes pendant la guerre. Après l’obtention d’un diplôme à l’Ontario Veterinary College en 1950, Joan est entrée au service de la Direction générale de la santé des animaux où elle a fourni des services de laboratoire exceptionnels aux vétérinaires sur le terrain, tout en servant de mentor à un grand nombre d’entre eux qui ont ensuite occupé des postes de hauts fonctionnaires au sein de la Fonction publique du Canada. C’était une femme de cheval de concours active en tant que cavalière, instructrice et mentor auprès de nombreuses personnes. Son amour pour les animaux, particulièrement les chevaux, représentait une partie importante de sa vie. Joan a pris sa retraite à Kelowna, en Colombie-Britannique avec des souvenirs d’une vie enrichissante et difficile qui incluait des voyages dans le monde, un réseau international d’amis et un vif intérêt pour le bien-être animal.

Joan est décédée paisiblement à l’âge de 102 ans. Nous remercions ses proches amis et le personnel de la résidence Pine Acres de la Première nation Westbank pour des soins exemplaires prodigués à Joan pendant ses dernières années, qui incluaient des moments mémorables dont une visite surprise de «Peppy» un splendide cheval Quarter Horse à l’occasion de son 100e anniversaire.

Des dons peuvent être faits à sa mémoire à une SPCA locale ou au fonds Dr. Joan Tailyour Fund afin de promouvoir le bien-être animal, particulièrement les chevaux, qui a été établi par la Central Okanagan Foundation, au 306–1726 Dolphin Avenue, Kelowna (Colombie-Britannique) V1Y 9R9.
Obituary

Dr. Doug Maplesden

In his 98th year, Dr. Doug Maplesden passed away in Santa Fe, New Mexico, on July 24, 2017. He leaves behind a loving family that includes his wife Joan, children, stepchildren, grandchildren, and 11 great grandchildren. Prior to graduating from the Ontario Veterinary College (OVC) in 1950, Doug had attended high school in Milton and Acton and had served in the Royal Canadian Air Force in World War II. After graduation, Doug practiced in Seaforth, Ontario and in Walnut Springs, Texas, before joining the faculty at OVC. Along with Jack Cote, Doug provided leadership for the newly established “farm service,” an ambulatory clinic that served the farm community and taught veterinary students problem solving on the farm.

During his time on faculty at OVC Doug was awarded an MSA degree from the Ontario Agricultural College and a PhD in nutrition from Cornell University. He attained the rank of professor at OVC before leaving the college to take up the position of veterinary director at the Canadian pharmaceutical company Stevenson, Turner and Boyce.

Doug played a major role in getting The Canadian Veterinary Journal off to a good start. He was the journal’s first business manager in 1960 and its editor-in-chief in 1962 and 1963.

In 1963 Doug moved to New Jersey, where he headed the Animal Health section of the US pharmaceutical company, Ciba Corporation. Doug returned to Canada in 1980 as dean of the OVC and held that position until 1984 when he went back to the United States to pursue his passion for writing, an activity that he shared with wife Joan. Doug’s writing in the field of science included research articles, lay publications, books on health and nutrition, and a book on Frank Schofield. Doug and Joan also wrote extensively in the field of fiction, that included notable thrillers. He also wrote poetry during his later years in New Mexico.

Doug was a leader and outstanding contributor to his community. His volunteer activities included president of a Chamber of Commerce, board director of a Power Squadron, associate editor of a public health journal. He will be missed by colleagues and friends who knew him as a brilliant man with a warm and affable personality.

Nécrologie

D’ Doug Maplesden


Pendant ses fonctions au sein du corps professoral de l’OVC, Doug a obtenu une maîtrise en sciences agricoles de l’Ontario Agricultural College et un Ph.D. en nutrition de l’Université Cornell. Il obtenu le rang de professeur à l’OVC avant de quitter le collège pour assumer les fonctions de directeur vétérinaire à la compagnie pharmaceutique canadienne Stevenson, Turner and Boyce.

Doug a joué un rôle majeur afin d’assurer le succès du lancement de La Revue vétérinaire canadienne, car il en a été le premier directeur commercial en 1960 ainsi que son rédacteur en chef en 1962 et en 1963.

En 1963, Doug est déménagé au New Jersey, où il a dirigé la section de santé animale d’une compagnie pharmaceutique américaine, Ciba Corporation. Doug est revenu au Canada en 1980 à titre de doyen de l’OVC et il a occupé ce poste jusqu’en 1984 lorsqu’il est retourné aux États-Unis pour donner libre cours à sa passion pour l’écriture, une activité qu’il partageait avec sa femme Joan. Les écrits de Doug dans le domaine de la science ont inclus des articles de recherche, des publications de vulgarisation, des livres sur la santé et la nutrition et un livre sur Frank Schofield. Doug et Joan ont aussi écrit d’innombrables ouvrages de fiction, dont des romans à suspense dignes de mention. Il a aussi écrit de la poésie durant ses dernières années passées au Nouveau-Mexique.

Doug était un leader et un collaborateur exceptionnel au sein de sa collectivité. Ses postes bénévoles ont inclus celui de président de la Chambre de commerce, d’administrateur d’une organisation de bateaux à moteur et de rédacteur associé d’une revue sur les sciences de la santé. Il manquera à ses collègues et à ses amis qui le connaissaient comme un homme brillant à la personnalité chaleureuse et affable.
Case Report  

Pyloric obstruction due to massive eosinophilic infiltration in a young adult dog

Alexandros O. Konstantinidis, Mathios E. Mylonakis, Dimitra Psalla, Nectarios Soubasis, Dimitrios Papadimitriou, Timoleon S. Rallis

Abstract — A 16-month-old dog was presented with chronic vomiting, anorexia, progressive weight loss, and melena. Exploratory laparotomy revealed a massive pyloric eosinophilic infiltration leading to pyloric obstruction that was treated successfully with pylorectomy. This is a novel clinical presentation of eosinophilic gastritis and highlights the need to consider it as a differential diagnosis for pyloric obstruction.

Résumé — Obstruction pylorique causée par une infiltration éosinophilique chez un jeune chien adulte. Un chien âgé de 16 mois a été présenté avec des vomissements chroniques, de l’anorexie, une perte de poids progressive et la méléna. Une laparotomie exploratoire a révélé une infiltration éosinophilique pylorique massive qui causait une obstruction pylorique qui a été traitée avec succès par la pylorométrie. C’est une présentation clinique nouvelle de la gastrite éosinophilique et elle souligne le besoin de la considérer comme un diagnostic différentiel pour l’obstruction pylorique.

Can Vet J 2017;58:1164–1166

C
anine eosinophilic gastroenterocolitis (EGE) is a chronic idiopathic inflammatory disease that may cause vomiting and/or diarrhea, which is sometimes hemorrhagic, and typically waxes and wanes (1–6). Clinical signs are determined by the affected segment(s) of the gastrointestinal (GI) tract and the depth of mural involvement. In dogs, concurrent gastric and intestinal eosinophilic infiltration is the most common anatomic variant (1,5,7), but eosinophilic gastritis (EG) as the sole histopathological diagnosis has also been reported (8). Rarely, clinical signs of intestinal obstruction due to EGE may occur (3,5).

To the authors’ knowledge, EG presenting as pyloric obstruction has not been reported previously in the dog. This report describes a case of gastric obstruction in a young adult dog due to massive pyloric eosinophilic infiltration that was subject to successful surgical and medical management.

Case description
A 16-month-old, spayed female mixed-breed dog weighing 27 kg was presented with a 2-month history of chronic vomiting (partially digested food expelled several hours after feeding) and anorexia, weight loss, and melena during the previous 10 d.

The dog lived indoors and was up-to-date with vaccinations and intestinal parasite and ectoparasite prophylaxis. Dietary modifications and medical treatments with metoclopramide and ranitidine had previously been implemented and resulted in partial clinical remission, but 10 d before admission the dog had worsened considerably.

Upon presentation, the dog was alert, but a poor body condition score (2/5), dehydration (7%), excessive salivation, melena, and pain on palpation of the cranial abdomen were observed. A complete blood (cell) count (CBC) indicated only a mild mature neutrophilia (8.7 × 10⁹/L, reference range: 3.9 to 8.0 × 10⁹/L).

Results of serum biochemistry, venous blood gas analysis, and urinalysis were normal. Sequential fecal examinations (T elemann and Faust methods) for parasite ova were negative. Thoracic and abdominal radiographs were normal. On abdominal ultrasonography, an elongated solid mass 3 cm × 1 cm was detected in the pyloric antrum, with significant thickening of the wall and narrowing of the gastric outlet tract. The appearance of the gastric fundus and body and the rest of the GI tract was normal.

Exploratory laparotomy, followed by a gastrotomy incision, revealed a markedly thickened pyloric wall and an elongated solid mass of 3 cm × 1 cm arising from the pyloric antrum (Figure 1) obstructing the pylorus (in excess of 90%). Full-thickness biopsies were obtained from the gastric body. A pylorectomy with gastroduodenostomy was performed. Margins of resection for the pylorométrie were approximately 2 cm from the pylorus. Impression cytology smears were taken from the pyloric mass, while the mass and full-thickness biopsies of the gastric body were submitted for histopathological examination.

After surgery, ranitidine (Zantac; GlaxoSmithKline, Athens, Greece), 2 mg/kg body weight (BW), IV, q12h, metoclopramide

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(Primperan; Sanofi-Aventis, Athens, Greece), 0.2 mg/kg BW, IV, q8h, cefuroxime (Zinacef; GlaxoSmithKline, Athens, Greece), 15 mg/kg BW, IV, q8h, and a highly digestible commercial diet (Hill’s Prescription Diet Canine i/d; Hill’s Pet Nutrition, Athens, Greece) were given for 7 d. Cytology of the pyloric mass revealed numerous normally appearing eosinophils. Histological examination of the excised pyloric mass revealed erosion and ulceration of the mucosa, an underlying fibrous reaction, and a severe eosinophilic infiltration with occasional neutrophils, macrophages, lymphocytes, and plasma cells (Figures 2, 3). Multifocal eosinophilic microabscesses were also identified in the mucosa, submucosa, and muscularis. Fibrosis and inflammation extended into the muscularis mucosa (Figure 4). Epithelium adjacent to the excised part was intact, while mild lympho-plasmacytic gastroenteritis was observed in the full-thickness biopsies from the gastric body.

Based on the clinical, surgical, cytological, and histopathological evidence, massive pyloric eosinophilic infiltration (presumably eosinophilic pyloritis) with resulting obstruction was diagnosed. The dog was prescribed a hypoallergenic diet (Hill’s Prescription Diet Canine z/d ULTRA Allergen-Free; Hill’s Pet Nutrition, Athens, Greece), and a broad-spectrum anthelmintic (pyrantel embonate, febantel and praziquantel, Drontal Plus; Bayer Animal Health GmbH, Leverkusen, Germany) was administered orally for 3 d. For the next 9 mo after surgery, the dog remained in complete clinical remission, based on telephone communication with the owner. However, at this time, the dog was readmitted after a severe traffic accident and was euthanized at the owner’s request. Postmortem, gross examination of the GI tract revealed no pathological findings; histopathological examination showed mild lympho-plasmacytic gastroenteritis and no evidence of recurrence of the gastric mass.

**Discussion**

Canine eosinophilic gastritis (EG) is a variant of inflammatory bowel disease (IBD) and lacks an established underlying etiology (9). To the authors’ knowledge, this is the first report providing evidence that a segmental EG in the form of massive pyloric eosinophilic infiltration (likely eosinophilic pyloritis), may be presented as a space-occupying mass obstructing almost entirely the pyloric outlet. This case illustrates the need to consider pyloric eosinophilic infiltration as a differential diagnosis in acquired pyloric obstruction in the dog. Non-obstructive focal or multifocal eosinophilic masses of the GI tract (including the pyloroduodenal junction) were previously reported in a case series (10). The diagnosis of EG requires the exclusion of other causes of gastric eosinophilic inflammation: mainly gastric parasites (9). In this case, fecal examination failed to document any parasitic infection. Historically, intestinal obstruction in EGE has been anecdotally reported in dogs (5,6). In humans, diffuse gastric or gastroenteric eosinophilic inflammation may be associated with obstructive symptoms; however, segmental eosinophilic inflammation of the pylorus causing gastric outlet obstruction is a rare occurrence (11–16). In human medicine, steroids comprise the cornerstone of medical treatment. If disease is localized to a defined segment of the gastrointestinal tract and causes obstruction, surgical resection is indicated and may be curative. However, after resection, recurrence of symptoms in other segments of the gastrointestinal tract is possible (17).

Historically, the age pattern (young animals) and the clinical manifestations of the dogs affected by EG are similar to those of the dog described herein (1,9,18). Dogs with GI eosinophilic inflammation may be more prone to mucosal ulceration with subsequent melena, compared to other variants of IBD, which may account for the persistent melena noticed in this case (5). In the present case, mild mature neutrophilia was seen on CBC, but eosinophilia was not documented, and besides, blood eosinophilia is not invariably present (5,8).

Ultrasonographic examination is sensitive in demonstrating increased gastrointestinal wall thickness and/or enlarged mesenteric lymph nodes in the dog (5). In this case it also showed gastric wall thickening and pyloric obstruction, which was later confirmed on gastrotomy. In eosinophilic gastroenteritis, the whole gastrointestinal tract may be involved, and infiltration of the muscle layers tends to be associated with obstructive phenomena. Importantly, the eosinophilic pyloric infiltration should be differentiated from other pyloric and gastric lesions that cause pyloric stenosis or obstruction in the dog such as...
chronic hypertrophic pyloric gastropathy, granulomatous gastritis (including pythiosis) or polyps and tumors in the area, but also from external causes of compression like neoplasms of the abdominal cavity, peripyloric masses, and pancreatic abscesses (19–22).

Glucocorticoids constitute the mainstay of treatment for the long-term management of EG in dogs, with or without concurrent dietary measures (9). In this dog, following the surgical excision of the pyloric mass, medical treatment consisted of antiparasitic treatment and a hypoallergenic diet and was associated with a long-lasting remission. Therefore, the possibility exists for sustained remission in dogs with localized pyloric eosinophilic infiltration without the use of glucocorticoids, although recurrence of symptoms may necessitate treatment with glucocorticoids later in its life.

This report describes the first case of massive pyloric eosinophilic infiltration (likely eosinophilic pyloritis) manifested as pyloric obstruction in a dog and treated with pylorectomy. It also highlights the need to consider pyloric eosinophilic infiltration as a possible differential diagnosis for canine acquired gastric outlet obstruction.

References
Case Report  
Rapport de cas

Diastolic heart failure associated with hemangiosarcoma infiltrating left ventricular walls in a dog

Tatsuyuki Osuga, Kensuke Nakamura, Tomoya Morita, Yumiko Kagawa, Hiroshi Ohta, Mitsuyoshi Takiguchi

Abstract — A 9-year-old Shetland sheepdog was diagnosed with cardiogenic pulmonary edema. Echocardiography revealed focally thickened left ventricular free wall and interventricular septum and left atrial dilation. Left ventricular systolic function was preserved. Doppler echocardiography of transmitral flow indicated restrictive left ventricular filling. Cardiac histopathology demonstrated hemangiosarcoma infiltrating the left ventricular walls.


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Cardiac tumors occur infrequently in the canine population. A previous large retrospective study reported 1383 dogs with cardiac tumors from a population of 729 265 dogs (0.19% incidence) in a veterinary medical database from 1983 to 1995 (1). The most common primary cardiac tumor in dogs is hemangiosarcoma, followed by aortic body tumors, whereas common secondary (metastatic) cardiac tumors include hemangiosarcoma, carcinoma, and lymphoma (1,2). The clinical manifestations caused by cardiac tumors are more closely associated with their anatomic location and resultant hemodynamic changes than with their histologic types. Clinical signs are commonly related to cardiac tamponade caused by pericardial effusion, arrhythmia, or obstruction of ventricular inflow or outflow tract secondary to an intracavitary or intramural lesion (3–6).

Cardiogenic pulmonary edema is a rare clinical manifestation in dogs with cardiac tumors, and has been reported to be associated with systolic heart failure secondary to hemangiosarcoma infiltrating into the left ventricular wall (3), left ventricular inflow tract obstruction secondary to a myxoma involving the mitral leaflets (7), and mitral regurgitation related to a schwannoma involving the mitral leaflets (8). This report describes the first canine case of cardiogenic pulmonary edema associated with diastolic heart failure secondary to cardiac hemangiosarcoma involving the left ventricular walls.

Case description

A 9-year-old, spayed female, Shetland sheepdog weighing 16.4 kg was referred for evaluation of acute dyspnea. Cardiogenic pulmonary edema was suspected by the referring veterinarian based on the presence of a sinus tachycardia (heart rate: 164 beats/min) and radiographic findings including cardiomegaly, a perihilar alveolar pattern, and pulmonary venous distension. The respiratory status had partially improved with 2 intravenous boluses of 1.2 mg/kg furosemide (Lasix Injection; Sanofi K. K., Tokyo, Japan) administered by the referring veterinarian. In addition, the patient had a 1-week history of a head tilt to the left and bilateral elevations of the third eyelids. There was no additional significant medical history.

On presentation, cardiac auscultation revealed a regular rhythm (heart rate: 112 beats/min) with no detectable cardiac murmur. The dog was tachypneic (respiratory rate: 60 breaths/min) with harsh lung sounds and pink mucous membranes. The patient was normothermic. As well as the head tilt and bilateral elevation of third eyelids, neurological examination revealed bilateral dilated pupils unresponsive to light, bilateral atrophy of the temporal and masseter muscles, and positional horizontal nystagmus with fast phase toward the right and ventrolateral strabismus in the left eye. Decreased postural
Reactions in left thoracic and pelvic limbs were observed, and spinal reflexes in those legs were exaggerated. The mental status, vision, and gait were normal. Otoscopic evaluation of the ear canal and tympanic membrane revealed no abnormalities. These neurological findings indicated a diffuse or multifocal brainstem lesion. Blood was obtained for evaluation of a complete blood (cell) count (CBC), blood chemistry, and hemostatic panel including prothrombin time, activated partial thromboplastin time, fibrinogen concentration, and D-dimer concentration. The results were unremarkable except for an elevated plasma D-dimer concentration [3.71 mg/L, reference range (RR): < 1.00 mg/L].

Thoracic radiographs indicated cardiomegaly (vertebral heart score 11.5, RR: < 10.5) comprised primarily of left ventricular and atrial enlargement with a perihilar alveolar pattern and pulmonary venous distension, indicating the presence of cardiogenic pulmonary edema (9).

Two-dimensional echocardiography revealed focal left ventricular thickenings involving the anterior, lateral, posterior, inferior, and septal walls of the left ventricle [body weight (BW)-normalized thicknesses 0.55 to 0.87, RR: < 0.53] (10). The thickened left ventricular posterior wall contained an ill-delineated hyperechoic area (Figures 1A, 1B).

The BW-normalized left ventricular internal diameters at end-diastole (1.68, RR: 1.27 to 1.85) and end-systole (1.03, RR: 0.71 to 1.26) along with the fractional shortening (35.2%, RR: 23% to 47%) were within the RRs (10). The left atrium was dilated [left atrial to aortic diameter ratio (LA/Ao) from the right parasternal short axis view 3.0, RR: < 1.6] (11). The right ventricular free wall was thickened (BW-normalized thickness 3.88, RR: < 3.73) (12). There was an isoechoic pedunculated nodular mass (12.3 × 8.7 mm) involving the ventricular aspect of the pulmonary valve leaflet (Figure 1C). All other cardiac structures appeared normal. Color-flow Doppler evaluation identified no abnormalities except for trivial mitral regurgitation. Pulsed-wave Doppler echocardiography of transmitral flow indicated severe left ventricular diastolic dysfunction with elevated filling pressure (restrictive left ventricular filling) [early diastolic transmitral velocity (E) 0.65 m/s; late diastolic transmitral velocity (A) 0.22 m/s; ratio of E to A (E/A) 3.0].

Other left ventricular diastolic parameters were as follows (the RRs appropriate for the age, heart rate, and breed of the patient were unavailable): deceleration time of early diastolic transmitral flow (Edt) 53 ms; early diastolic septal mitral annular velocity (E') derived from tissue Doppler imaging 3.0 cm/s; isovolumic relaxation time (IVRT) derived from septal mitral annular velocity (IVRT).
Figure 2. Postmortem appearance of the heart of the dog. Longitudinal cross-section through the left ventricle demonstrating the thickened left ventricular free wall and papillary muscle with multiple dark red mottled foci diffusely located throughout the myocardium.

A cardiac necropsy was performed by a board-certified veterinary pathologist. The necropsy of other organs was declined by the owner. The left ventricular free wall and papillary muscles, interventricular septum, and right ventricular free wall were markedly thickened with multiple dark red mottled foci diffusely located throughout the myocardium (Figure 2). No macroscopic lesions were observed in the atrial walls, valves, and pericardium. Histologically, all of the dark red foci in the left ventricular free wall and papillary muscles, interventricular septum, and right ventricular free wall were consistent with hemorrhages. The hemorrhagic lesions contained neoplastic mesenchymal cells, forming solid cellular aggregates and irregular, slit-like spaces lined by the neoplastic cells. The tumor cells showed features of malignancy, including moderate anisocytosis, moderate nuclear atypia, and low mitotic activity. There was occasional cardiomyofiber degeneration within the hemorrhagic lesions. Neoplastic involvement of the atrial walls, valves, and pericardium was not evident. The final diagnosis was hemangiosarcoma.

Discussion

Diastolic heart failure is generally defined as heart failure with preserved ventricular systolic function (15). In the present case, on the basis of the echocardiographic evidence of preserved left ventricular systolic function (i.e., normal left ventricular internal diameter at end-systole and fractional shortening), the pulmonary edema could have been associated with diastolic heart failure secondary to neoplastic invasion of the left ventricular walls. To our knowledge, there have been no reports of cardiogenic pulmonary edema associated with diastolic heart failure related to intramural ventricular tumors in veterinary medicine. In humans, however, cardiogenic pulmonary edema secondary to diastolic heart failure has been reported to occur in hematopoietic tumors (e.g., lymphoma) involving the left ventricular walls (16).

The underlying mechanism of diastolic heart failure is ventricular diastolic dysfunction, which can lead to abnormal ventricular filling (i.e., decreased ventricular end-diastolic volume or maintained ventricular end-diastolic volume with increased ventricular filling pressure). Therefore, diastolic heart failure ideally should be diagnosed on the basis of the clinical evidence of ventricular diastolic dysfunction. However, the clinical diagnosis of diastolic heart failure generally does not require evidence of ventricular diastolic dysfunction for the following reasons (15). Firstly, the left heart catheterization, the gold standard for evaluation of left ventricular diastolic properties, is impractical due to its invasiveness and limited availability. Secondly, despite its noninvasiveness and widespread availability, Doppler echocardiography is much less reliable for evaluation of left ventricular diastolic function than the left heart catheterization. This is mainly because: i) the eventual changes in Doppler echocardiographic indices are intricately determined by a multitude of cardiovascular factors (e.g., active ventricular myocardial relaxation, passive ventricular myocardial compliance, ventricular filling pressure); and ii) the confounding influences of physiological variables (e.g., age, heart rate) on Doppler echocardiographic indices may require establishment of...
the reference ranges appropriate for the physiological variables of the individual patients (15,17).

In the present case, some echocardiographic findings at the initial presentation could have indicated left ventricular diastolic dysfunction. The left atrial enlargement evidenced by the increase in LA/Ao could have reflected chronic effects of left ventricular diastolic dysfunction (17). Also, the increase in E/A, the backbone of the Doppler echocardiographic evaluation of left ventricular diastolic function, could have indicated severe left ventricular diastolic dysfunction with elevated filling pressure (restrictive left ventricular filling) (17). The supplemental Doppler echocardiographic indices of left ventricular diastolic function (i.e., E$, E’$, IVRT$, E/E’$) seemed difficult to interpret only at the initial presentation due to lack of the reference ranges appropriate for the age, heart rate, and breed herein. However, the changes in these indices following medical treatments (i.e., the increases in E$, E’$, and IVRT, and the decrease in E/E’$) could have been due to the improvements in left ventricular diastolic function and filling pressure, considering the concurrent improvements in clinical signs, left atrial size, and E/A.

Echocardiography indicated thickening of the right ventricular free wall in addition to the left ventricular walls. The thickened right ventricular free wall could have been mainly due to neoplastic invasion of the right ventricular wall detected at cardiac necropsy. However, the possibility that pulmonary hypertension associated with left-sided heart disease might also have caused the thickening of the right ventricular free wall cannot be ruled out because tricuspid and pulmonary regurgitations, which could have enabled the estimation of the pulmonary arterial pressure, could not be detected on echocardiography.

Cardiac necropsy in this case revealed that neoplastic cells exclusively infiltrated the ventricular walls without any intracardiac mass formation. Although a full necropsy could not be performed, the origin of the tumor could have been the ventricular walls based on a lack of detectable lesions by ante-mortem diagnostic imaging. The clinical presentations related to intramural tumors located in the left ventricle and interventricular septum are variable, including arrhythmia (e.g., ventricular tachycardia, third-degree atrioventricular block) (18), systolic heart failure (3), pericardial effusion, or left ventricular outflow tract obstruction (5). Furthermore, it is possible that cardiac tumors infiltrating the left ventricular wall and interventricular septum did not cause any cardiac symptoms (2).

In addition to cardiogenic pulmonary edema, this dog exhibited acute, non-progressive neurological signs indicating a brainstem lesion. Ante- and postmortem examinations of the brain could not be conducted. Considering the clinical course, the underlying diseases, and the possible intracardiac thrombus on echocardiography, these signs might have occurred secondary to cerebrovascular disease. Canine hemangiosarcoma can cause various neurological signs related to cerebrovascular disease associated with brain metastases and coagulopathy (19).

The early ante-mortem histologic diagnosis of cardiac tumors can be useful for appropriate treatment and prognostication. Although echocardiography is an invaluable diagnostic test for the detection of intracardiac lesions, the accuracy of echocardiography-based presumptive histologic diagnosis of cardiac tumors is not high (6,20). Cytology of pericardial effusions or intracardiac lesions and histopathology of intracardiac lesions are necessary for ante-mortem histologic diagnosis (6,21). Transvenous endomyocardial biopsy allowed the ante-mortem diagnosis of hemangiosarcoma infiltrating the left ventricular wall of a previously reported dog (3). Therefore, in the present case, this procedure could have enabled the early diagnosis of hemangiosarcoma.

References
Case Report  Rapport de cas

Presumptive chronic pyrrolizidine alkaloid poisoning in 2 pygmy goats due to ingestion of tansy ragwort (*Jacobaea vulgaris*) in southwestern British Columbia

Heather Anholt, Ann Britton

**Abstract** — Two pygmy goats from a herd of 3 animals in British Columbia died within 24 hours of exhibiting lethargy. Histopathology revealed liver failure and tansy ragwort (*Jacobaea vulgaris*) was discovered in the goats’ pasture. Goats are typically resistant to the toxic effects of tansy ragwort. This is the first report of presumed tansy ragwort toxicity in goats in North America.


A pigmy goat on a small farm in the Fraser Valley was first noted to be lethargic the morning of March 3rd, 2015, and died that afternoon. The goat belonged to a herd of 3 animals and had year-round access to pasture, hay, and corn, oats, and barley (COB).

**Case description**

A 5-year-old female pygmy goat was submitted for postmortem examination to the British Columbia Animal Health Centre (AHC) on March 4, 2015. On postmortem examination, the animal was in excellent body condition. The rumen contained rich green feed material and there were normal formed feces in the colon. Segments of jejunum were dilated with watery contents. There was scattered petechial and ecchymotic hemorrhage throughout the epicardium. The liver was diffusely tan/gray with scattered capsular petechia, and the gallbladder wall was markedly edematous.

Histopathology of the liver revealed moderate generalized vacuolation of centro-acinar and mid-zonal hepatocytes, with hepatocellular megalocytosis, megalokaryosis, and occasional binucleation (Figure 1). Necrotic hepatocytes were individually scattered and Kupffer cells frequently contained a green-brown granular pigment. In the renal cortices, the tubular epithelial cells were hyper eosinophilic with loss of cellular detail. There was extensive pericardial hemorrhage.

The wall of the gallbladder was edematous, with bacilli colonizing its mucosal surface. Culture for the bacilli yielded heavy growth of *Clostridium perfringens* and toxin typing was positive for type A. Toxin exposure from the clostridia or an exogenous source was suspected and liver tissue was sent to Michigan State University Diagnostic Center for Population & Animal Health for toxicology. None of the compounds screened for by gas chromatography mass spectrometry (GC/MS) were present. The GC/MS test screens for over 100 000 organic molecules, including pesticides, herbicides, pharmaceuticals, industrial chemicals, and natural toxins. It does not screen for dehydropyrrolizidine alkaloid metabolites.

On July 9th, 2015 a 3-year-old female pygmy goat from the same group was presented to the Animal health Centre (AHC) with a 24-hour history of lethargy followed by sudden death. On postmortem examination, the animal was in good body condition, with congestion of the oral mucous membranes and a mild increase in pericardial fluid with moderate petechiation of the epicardial surface of the heart. The spleen was shrunken. The liver was pale with tan brown mottling in the caudate and right lateral lobes. The gallbladder was distended with bile and the bile duct was patent. There was increased watery fluid in the abomasum, small intestine, and cecum, and moderate edema of the abomasal rugae. Fecal pellets were soft and incompletely formed.
Culture of the gastrointestinal tract failed to isolate clostridia; however, heavy growth of non-hemolytic *Escherichia coli* was cultured from the bladder. Although postmortem examination found no evidence of parasitic disease, routine fecal floatation indicated a heavy load of strongyles.

Histopathology of the liver demonstrated moderate general-ized macro- and micro-vesicular hepatocellular cytoplasmic vacuolation suggestive of lipid. Moderate bile ductule hyperplasia often extended into adjacent sinusoids. There was mild to moderate portal and septate fibrosis, and a mild, mainly lymphocytic, increase in portal inflammatory cells (Figures 2, 3).

The remaining goat was given away and lost to follow-up.

Clinical course, postmortem findings, and histopathology results pointed to toxin exposure and moderate hepatic lipidosis contributing to liver failure in both goats. Examination of the goats’ pasture discovered large numbers of tansy ragwort (*Jacobaea vulgaris*, formerly *Senecio jacobaea*), a biennial plant native to Europe, is now naturalized throughout Ontario, the Maritime provinces, and southwestern British Columbia. Members of the genus *Jacobaea* produce several secondary plant compounds guarding them against herbivores and insects. Toxicity varies considerably among species. Tansy ragwort’s toxicity to livestock is due mainly to pyrrolizidine alkaloids (PAs), specifically dehydropyrrolizidine alkaloids with a 1–2 unsaturation. Tansy ragwort causes agricultural revenue losses worldwide; in fact, pasture management for ragwort species is required by law in Australia, Ireland, and the UK (1,2). More than 26 animal species, including humans, are susceptible (1).

Pyrrolizidine alkaloids (PA) are hepatotoxic, carcinogenic, fetotoxic, and teratogenic (1). Absorbed from the small intestine, they reach the liver via the portal circulation. Their toxicity is due to a product of metabolism; hepatic microsomal enzymes dehydrogenate PA to pyrrole derivatives, which are thought to alkylate DNA and other macromolecules in the hepatocytes, inhibiting mitosis and cell division (1).

Histologically, PA toxicity leads to hepatocellular karyomegaly, cytomegaly, and in some cases vacuolar changes. The hepatocytes eventually reach a critical mass and cell death, hepatic fibrosis, and secondary biliary hyperplasia result (1,3). Toxic hepatocellular injury often leads to micro- and macro-vesicular cytoplasmic vacuolation (lipidosis) due to interference with the complex pathway of hepatocellular lipid metabolism; throughput of lipid in the hepatocyte is diminished and leads to accumulation within the cytoplasm (4).

Postmortem examination typically reveals an enlarged firm liver, ascites, and patchy gastroenteritis, and usually indicates a chronic exposure with slow hepatic degeneration, although acute hepatic necrosis can occur at very high doses (1,5).

### Figure 1.
Goat 1 – liver. Hepatocellular vacuolation, binucleated hepatocytes, megalokaryosis, and megalocytosis are evident. Bridging portal fibrosis and bile ductule hyperplasia are absent. Arrowheads indicate hepatocytes with intense eosinophilic cytoplasm and loss of nuclear basophilia indicative of cell degeneration. Hematoxylin and eosin (H&E) stain. Bar = 50 μm.

### Figure 2.
Goat 2 – liver. Macro- and micro-vesicular cytoplasmic vacuolation of hepatocytes is widespread. Bridging portal fibrosis (arrow), bile ductule hyperplasia (small arrowhead) and hepatocellular cytoplasmic vacuolation, both micro-vesicular (open arrowhead) and macrovesicular (closed arrowhead) are shown. H&E stain. Bar = 100 μm.

### Discussion

Tansy ragwort (*Jacobaea vulgaris*, formerly *Senecio jacobaea*), a biennial plant native to Europe, is now naturalized throughout Ontario, the Maritime provinces, and southwestern British Columbia. Members of the genus *Jacobaea* produce several secondary plant compounds guarding them against herbivores and insects. Toxicity varies considerably among species. Tansy ragwort’s toxicity to livestock is due mainly to pyrrolizidine alkaloids (PAs), specifically dehydropyrrolizidine alkaloids with a 1–2 unsaturation. Tansy ragwort causes agricultural revenue losses worldwide; in fact, pasture management for ragwort species is required by law in Australia, Ireland, and the UK (1,2). More than 26 animal species, including humans, are susceptible (1).

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Pale livers with extensive hepatocellular degeneration, vacuolation, and megalocytosis, and megalokaryosis in both animals were consistent with other pathology reports of PA toxicity in goats (6–8). Although fibrosis and bile duct proliferation are commonly reported in the literature, histopathology in this case revealed these findings only in the second goat (1,6). The second goat could have been more resistant to PA toxicity, or shown greater aversion to the ragwort, causing a prolonged exposure to a lower dose. Alternatively, it is possible this was a subacute event, with chronic changes from a previous exposure.

Goeger et al (6) fed a 10% tansy ragwort ration to goats for 9 to 24 mo, and documented pathological findings. Chronic interstitial nephritis was noted. In this case, the first goat exhibited hypereosinophilia and loss of cellular detail of the renal tubular epithelial cells, but renal pathology was not detected in the second goat. Interstitial nephritis is rarely associated with clinical disease in ruminants although it can be a postmortem finding in goats (5). The renal pathology in this case was likely incidental. While the Goeger study (6) did not observe ascites or edema of the abomasum or mesentery, we observed edema of the gallbladder in the first goat herein, and edema of the abomasal rugae in the second. Abomasal edema was reported in a study of 5 Nubian goats that died of PA toxicity (9).

Clinical signs of acute PA toxicity include lethargy, weakness, and abdominal pain without loss of body condition. Death follows within a few days to weeks (5). Clinical signs of chronic PA toxicity reflect impaired hepatic perfusion due to fibrosis and decreased liver function, resulting in progressive weight loss, anorexia, lethargy, abdominal pain, and icterus. However, even in cases of chronic exposure, an acute hepatic insufficiency syndrome can present as sudden lethargy, anorexia, and ataxia, with rapid clinical deterioration and death (4,5). Hepatic encephalopathy is commonly a feature, as hepatic failure results in systemic accumulation of ammonia and other toxic metabolites, leading to neurotransmitter disturbances and cerebral edema (5). Histologically, status spongiosis is observed, particularly at points of confluence between the white and gray matter of the cerebral cortex, cerebellum, and brainstem (5). Moderate status spongiosis affected the cerebral and cerebellar white matter in the second goat. However, a veterinary examination and hematology were not performed antemortem and icterus was not observed. Consequently, hepatic encephalopathy cannot be definitively established.

Both the acute and progressive syndromes of chronic exposure were reported in 2006 in a herd of beef cows in Ontario exposed for 3 mo to J. vulgaris on pasture. Clinical signs of encephalopathy were not observed (4).

In clinical cases, toxicosis and hepatic insufficiency are suspected based on hematology. Hyperammonemia, bilirubinemia, and hypoalbuminemia are reliably seen, and bromsulphalein clearance rate is impaired. Serum gamma glutamyl transpeptidase (GGT) and glutamate dehydrogenase (GLDH) are also early indicators of hepatic injury in ruminants, but may return to normal levels in the later stages of disease (3,5). Liver biopsy and histopathology can be useful in estimating the degree of liver damage antemortem (3). However, a diagnosis of PA toxicosis is only confirmed with positive identification of pyrrole derivatives in the liver or blood, and in many cases only a presumptive diagnosis can be reached (5).

Differential diagnoses considered were blue-green algae, copper and iron toxicity, aflatoxins, various phytotoxins, and metabolic disease. Blue-green algae were unlikely as there was no body of water in the pasture and the goats drank municipal water. Non-fatal iron and copper toxicity cause acute hepatocellular necrosis, which may trigger portal fibrosis and biliary hyperplasia. However, megalocytosis and karyomegaly are not seen. At lower levels of chronic aflatoxin exposure, histological lesions can be similar to those caused by chronic PA toxicity, with megalocytosis, cell necrosis, bile ductule proliferation, and occasionally lipidosis. In the case of aflatoxin exposure, hepatocellular polyploidy is rare and megalocytosis is usually also seen in the renal proximal tubular epithelium. However, megalocytosis of the renal tubular epithelium was reported in a horse with PA toxicity (10). Hepatic lipidosis and secondary...
ketosis was ruled out due to the presence of megalocytosis, the good body condition of the goats, the absence of a chronic concomitant disease that would induce fat mobilization, and the observation that hepatocellular vacuolation is reported in goats experimentally fed PAs (6).

In the absence of toxin detection, the presence of multinucleated hepatocytes, the long-term opportunity for PA exposure, and the absence of opportunity for exposure to aflatoxins strongly influenced etiologic interpretation of PA toxicity in this case. In addition to tansy ragwort, other important plant genera responsible for liver disease in ruminants in North America include Crotalaria, Cynoglossum, Amsinckia, and Senecio (11). Tansy ragwort was the only candidate identified on pasture.

There is no established lethal dose for PA in livestock, although general parameters have been established (1). Ruminants are more resistant to the hepatotoxic effects of PAs than are monogastrics. Sheep may be the most resistant ruminants, needing to consume 100% of their body weight over a few months to produce chronic toxicity. Goats are more resistant than cattle (1,6).

Species and individual variation in susceptibility are thought to be due to differences in ruminal microflora, which degrade PA and decrease the amount entering hepatic portal circulation (1). Plants on pasture (or PA levels in contaminated fodder) are rarely abundant enough to cause acute toxicity, and PA poisoning in ruminants is almost always due to chronic exposure (1).

The goats in this case were 3- and 5-years-old, and had been maintained on the same pasture for their entire lives. Tansy ragwort may not have existed on the pasture at this density for the goats’ entire lifespans, and could have been a more recent intruder. The weed is a skilled invader of unmanaged pastures and invasion risk is high if plants are identified within 50 m (2).

The density of tansy ragwort in the pasture was high (Figure 4). Due to frequent mowing, the density of tansy ragwort in the hay may have been less than on the pasture (2). If the poor pasture quality encouraged ragwort consumption and contamination of the hay was as high as 20%, the goats could have consumed 0.2 kg of tansy ragwort each day, or 100% of their body weight over 3 mo. This estimate is consistent with a study by Goeger et al (6), in which 120% of body weight fed over 5 mo was sufficient to cause chronic toxicity in goats, whereas 5% to 20% was well-tolerated (1). Similarly, Knight and Walter (11) report the chronic lethal dose in goats to be 1.2 to 4.4 kg/kg of body weight. A potential peracute toxicity in the first goat would require an unusually high rate of tansy ragwort consumption. Dosages for peracute toxicity in goats are not known because the time-dose relationship and individual differences are variable (1).

Treatment for PA toxicosis is symptomatic and often unsuccessful. Identifying other affected animals and preventing further exposure should be the primary focus and pasture management can be an effective tool for limiting exposure. Except under drought conditions, cattle and horses will typically not graze ragwort species, and ingestion of quantities sufficient to cause disease usually only occurs if the plants have been baled or ensiled in feed (12,13). Sheep and goats, on the other hand, will willingly browse ragworts, although they do not appear to relish it (6,14).

Pasture management to control ragwort aims to reduce the number of plants and prevent existing plants from going to seed. This can be achieved by mechanical, chemical, or biological means. Intensive mowing before flowering reduces seed production. Proper pasture management also helps prevent spread, as ragwort tends to establish where soil is exposed and forage is in poor condition (15).

Application of nitrogen in high quantities (100 kg/hectare y) can reduce the occurrence of common ragwort by 80% (16). Herbicides have been tested with variable success; 2,4-D is effective at the seedling and young rosette stage, and dicamba when the plants are more advanced. However, clovers are also vulnerable to these herbicides (16,17). Biological control using the cinnabar moth (Tyria jacobaeae) and the flea beetle (Longitarsus jacobaeae) has been very effective (2), but implementation of these biological agents in British Columbia has not yielded dramatic results (16).

Pyrrolizidine alkaloid toxicosis in livestock is a public health concern. These alkaloids are excreted in the milk, and neonates and small children are at greater risk because they are more physiologically susceptible to intoxication and because milk constitutes a large part of their diet (1). The goats in this case served as pets and posed no risk to human health.

The pathology in this case was typical of subacute to chronic PA exposure despite the short course of observed clinical disease, good body condition, and absence of icterus. The hepatocyte karyomegaly in both goats, and the bile ductule hyperplasia and septate fibrosis in the second goat, ruled out an acute exposure event. Indeed, acute onset of hepatic insufficiency and rapid clinical deterioration is a syndrome of chronic tansy ragwort toxicity reported in the literature (5). Because septate fibrosis and bile ductule hyperplasia were not observed in the first goat, subacute exposure cannot be ruled out. Nevertheless, it seems unlikely that these goats would have voluntarily eaten enough tansy ragwort over 3 to 6 d to elicit a subacute toxicity (1,5).

Poisoning from J. vulgaris is unusual in goats, and to our knowledge this is the first report of this occurrence in North America. Although goats willingly browse ragwort species, they are highly resistant to its toxic effects and overt disease is uncommon.

Acknowledgment

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References


Answers to Quiz Corner
Les réponses du test éclair

1. B) A and C do not have activity against Malassezia organisms; D and E are only available as topical treatments.

2. C) Intrahepatic congenital PSS connects the portal vein and caudal vena cava, often via the left hepatic vein. Choices A, B, and D are correct.

3. D) Transmission is via semen, vaginal discharge, urine, or aborted fetal tissue. Both males and females can show clinical signs. Dogs with no clinical signs can still be infected with brucellosis. False negatives are uncommon with the RSAT.

4. C) The correct answer is bovine papillomavirus. The other viruses have not been detected in equine sarcoid tumors.

5. C) Farmers should not have access to barbiturates for administration. Potassium and ammonium chlorides are unacceptable because of lack of anesthesia and blunt head trauma because it is not always reliable. Use of an appropriate gauge rifle is effective and acceptable.


7. Les médicaments A et C ne sont pas efficaces contre les organismes Malassezia; les médicaments D et E sont disponibles seulement comme traitements topiques.
Long-term outcomes following plate stabilization to address spontaneous luxation of the long digital extensor tendon of origin in 2 dogs

Michelle M.M. Hasiuk, Kevin A. Drygas, Daniel D. Lewis

Abstract — Two dogs with spontaneous luxation of the long digital extensor tendon of origin were managed by performing a sulcoplasty and applying a plate bridging the extensor sulcus. Lameness resolved and neither dog had recurrence of lameness 59 and 15 months following surgery.

Résumé — Résultats à long terme après la stabilisation par plaque pour régler la luxation spontanée de l’extenseur antérieur des phalanges d’origine chez 2 chiens. Deux chiens souffrant d’une luxation spontanée du tendon du muscle long extenseur des doigts ont été gérés en réalisant une sulcoplastie et en appliquant une plaque reliant le sulcus de l’extenseur. La boiterie s’est résorbée et ni l’un ni l’autre des chiens n’a eu de récurrence de boiterie après 59 et 15 mois après la chirurgie.

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The long digital extensor (LDE) muscle has its origin in the extensor fossa on the lateral condyle of the femur (1–7). The tendon of origin, which is encapsulated in a synovial sheath, courses distally, traversing the stifle and extending into the extensor sulcus located on the craniolateral aspect of the proximal tibia (2–6). The tendon is maintained in the sulcus by a thin, retinacular-like restraining band of fibrous tissue (3,4,8). An osseous protuberance, referred to as the tubercle of Gerdy in humans (9), forms the caudolateral margin of the extensor sulcus and functions to maintain the position of the tendon in the sulcus (6,9). The spindle-shaped muscular portion of the LDE is positioned between the cranial tibial muscle and the fibularis longus muscle on the craniolateral aspect of the crus (5). The muscle traverses the length of the tibia with the distal tendon dividing into 4 branches near the tarsus and inserting on the third phalanx of digits II through V (1,3,5,7). The LDE muscle functions primarily to flex the tarsocrural joint and to extend the digits (1,3–6).

Spontaneous luxation of the LDE tendon of origin is an uncommon cause of pelvic limb lameness in dogs (2,3,6,10). Although spontaneous luxation of the tendon of origin of the LDE and treatment options are described in numerous textbooks (2,6,7,10–13), there is limited specific case information regarding the clinical abnormalities, surgical treatment intricacies, and clinical outcomes of dogs affected with this condition (1,3,8). The objective of this report is to describe the presenting clinical abnormalities and surgical management utilizing plate stabilization to maintain reduction in 2 dogs with pelvic limb lameness ascribed to spontaneous luxation of the LDE tendon of origin. Direct long-term functional outcome was obtained in 1 dog and indirect long-term outcome was obtained for the second dog.

Case description

Two dogs were referred for evaluation of left pelvic limb lameness. Dog #1 was a 6-year-old, 14.2 kg, castrated male Pembroke Welsh Corgi. Dog #2 was a 3-year-old, 12.7 kg, spayed female Shetland sheepdog. There was no known history of trauma or an inciting incident in either dog. The duration of lameness was 1 mo for Dog #1 and 3 mo for Dog #2. Dog #1’s lameness improved with exercise restriction and administration of carprofen (Rimadyl; Zoetis, Parsippany, New Jersey, USA), 1.8 mg/kg body weight (BW) q12h, but did not resolve completely. Dog #2 had not received treatment before referral.

On presentation, Dog #1 had a moderate persistent weight-bearing lameness at a walk and a trot. Dog #2 was not lame while walking, but shifted more weight to the right pelvic limb when standing. Both dogs intermittently maintained the affected limb off the ground in flexion while trotting. Dog #2 had mild palpable atrophy of the quadriceps muscles and caudal thigh musculature. Intermittent luxation of the LDE tendon of origin caudolateral to the tubercle of Gerdy was elicited on palpation in both dogs: obvious visual and palpable cranial and caudal movement of the tendon was detected during flexion and extension of both dogs’ left stifle.

Both dogs were sedated and bilateral stifle radiographs were obtained. Mild effusion and mild osteoarthritis were noted in
the left stifle of Dog #1 (Figure 1). The right stifle was normal. Dog #2 had moderate effusion and mild osteoarthrosis of the left stifle. The right stifle had mild degenerative changes, but there was no effusion. Pelvic radiographs were unremarkable in both dogs. Neither dog had appreciable medial buttress, patellar luxation, cranial tibial thrust, or cranial drawer when palpated under sedation.

Both dogs were anesthetized and a standard left lateral parapatellar arthrotomy was performed (14). The cranial and caudal cruciate ligaments as well as the cranial poles of the menisci were normal. Mild osteophyte formation was present along the abaxial surfaces of the femoral trochlear ridges and at the origin of the LDE tendon in both dogs. The LDE tendon of origin was edematous and inflamed with neovascularization. The LDE tendon of origin luxated caudal to the extensor sulcus when the stifle flexed in both dogs (Figure 2). The tendon returned to the sulcus when both dogs' stifles were extended, but the tendon did not seat normally within the sulcus due to fibrous proliferation within the extensor sulcus. Fibrous, proliferative synovial tissue enveloped the LDE tendon of origin in Dog #2 and the band of fibrous tissue which normally restraints the tendon in the sulcus could not be identified in either dog.

The proliferative fibrous tissue surrounding and lining the extensor sulcus was removed with rongeurs and a groove sulcoplasty was carried out using a 4-mm bone rasp. The sulcoplasty allowed for normal seating of the tendon below the prominence to the tubercle of Gerdy. Following sulcoplasty, stifle flexion and extension no longer resulted in luxation of the tendon. With the LDE tendon of origin repositioned in the sulcus, a 3-hole, 2.0-mm dynamic compression plate was contoured and applied, bridging the proximal extent of the extensor sulcus. The plate was secured to the proximal tibia using one 2.0-mm screw placed cranial and one 2.0-mm screw placed caudal to the sulcus (Figure 3). The joint capsule and fascia were closed in a simple continuous pattern using 2-0 PDS (Ethicon, Sommerville, New Jersey, USA). Subcutaneous tissues were opposed using 3-0 Monocryl (Ethicon). Skin was closed using 4-0 Monocryl (Ethicon) in an intradermal pattern. Stifle radiographs confirmed proper implant positioning (Figure 4). Dog #2 was administered an injection of cefovecin (Covenia; Zoetis), 8 mg/kg BW, SC after surgery.

Both dogs were discharged the day following surgery and the owners were instructed to administer carprofen (Rimadyl; Zoetis), 2.2 mg/kg BW, q12h for 7 d, and tramadol (Amneal Pharmaceuticals, Hauppauge, New York, USA), 4 mg/kg BW, every 8 to 12 h as needed for pain. Dog #1 was also prescribed cefpodoxime proxetil (Simplicef; Zoetis), 10.6 mg/kg BW, q24h for 8 d. Discharge instructions included exercise restriction, which consisted of confining the dog to a crate or small room when unattended and short walks outside on a leash mainly for urination and defecation.

The incisions had healed without complications when both dogs were re-evaluated 2 wk after surgery. Each dog was using the limb consistently at a walk and trot, with only a mild persistent weight-bearing left pelvic limb lameness. The stifles were comfortable on palpation and the LDE tendon of origin did

![Figure 1. Lateromedial (a) and craniocaudal (b) radiographs of Dog #1 showing the affected stifle during the dog’s initial evaluation for lameness. There is mild effusion and early osteoarthritis of the left stifle.](image)
not luxate as the joint was moved through a range of motion. Neither dog exhibited lameness when examined at 4 and 8 wk after surgery. The LDE tendon of origin did not luxate as either dog’s left stifle was flexed and extended. Radiographs of the left stifle showed that the position of the implant was unchanged in each dog. No complications were noted in association with the surgery. Improvement of the previously noted effusion with static degenerative changes was noted on the follow-up radiographs. A gradual return to normal activity was recommended after the 8-wk post-operative evaluation. Dog #1 was also evaluated 12 wk after surgery. No lameness was noted and palpation of the left stifle was unremarkable.

Dog #1 was re-examined 5 y following surgery to obtain long-term results (15). The owner reported a normal level of activity without lameness. During the orthopedic examination, lameness was not observed at a walk or a trot. Pain was not elicited on hyperextension of either stifle. Neither stifle had palpable effusion, medial buttress, or crepitus. Luxation of
the LDE tendon of origin could not be elicited as the left stifle was moved through a range of motion. The dog maintained a normal, square posture at a sit. The dog was walked over a force platform (Model# OR6-6-1000; Advanced Mechanical Technology, Newton, Massachusetts, USA) and there was mild asymmetry between the pelvic limbs (Table 1). The dog was sedated and radiographs of both stifles were obtained. The left stifle had mild effusion with moderate osteoarthrosis, principally affecting the lateral compartment of the joint (Figure 5). Mild coxofemoral osteoarthrosis was noted bilaterally. While the dog was sedated, pelvic limb circumference (Gulick tape measure; manufacturer unknown, Vietnam) and joint flexion and extension angles (Goniometer; IMEX Veterinary, Longview, Texas, USA) were measured (Table 1). Palpable bilateral coxofemoral laxity was detected, but neither patella could be luxated. Cranial tibial thrust and cranial drawer could not be elicited on examination under sedation. Direct long-term evaluation was not available for Dog #2; however, the owner was contacted 15 mo after surgery and reported that the dog had not had any recurrence of lameness and was currently being used to herd sheep.

Discussion

Spontaneous LDE tendon luxation has only been previously reported in 2 dogs, 1 of which was affected bilaterally (1,3). A third dog, reported by Bennett and Campbell (8), had a mal-union femoral fracture, which resulted in femoral varus and coxofemoral joint incongruency: these conformational abnormalities or the inciting trauma presumably contributed to this dog developing luxation of the LDE tendon of origin. Long digital extensor tendon luxation has also been reported as a consequence of tibial plateau leveling osteotomy (4) and tibial tuberosity transposition (16). The condition has also purportedly been associated with patellar luxation (2). Etiology for spontaneous luxation of the LDE tendon of origin is unknown (1,3), and no underlying cause has been proposed for this condition (2,6). At the time of diagnosis, the dogs herein were of similar age to the dogs in previous reports (1,3). There are not enough reported cases to determine if there is an age, gender, occupation, or breed predilection for spontaneous LDE luxation.

The lameness associated with LDE tendon luxation can be variable, ranging from none to a marked lameness with intermittent periods of non-weight-bearing lameness (1–3,6,10–12). In the current report, Dog #1 had a persistent weight-bearing lameness at a walk, whereas Dog #2 was not lame while walking, but shifted more weight to the contralateral pelvic limb when standing. Both dogs intermittently held the affected limb up in flexion when trotting.

Consistent with prior descriptions (1–4,6–8,12), a popping sensation was detected in both dogs as the tendon luxated and reduced during stifle flexion and extension. The popping can be audible and visually recognized in shorthaired dogs or dogs in which the hair has been clipped over the stifle (1,3,8). The popping sensation can be confused with a meniscal click or patellar luxation (2,17). Neither of the dogs reported here had a patella luxation or instability associated with cranial cruciate ligament insufficiency on palpation. Both dogs had radiographic evidence of stifle effusion and degenerative changes which could be consistent with cranial cruciate ligament disease. The cruciate ligaments and the visible portions of the menisci were found to be normal at surgery. Lameness in both dogs resolved after the LDE luxation was addressed and neither dog developed lameness, thrust, or drawer following surgery. Similar radiographic effusion and degenerative changes have been reported and were ascribed to inflammation produced by the intermittent luxation of the LDE tendon of origin (3).

At surgery, the band of tissue that normally restrains the tendon within the sulcus was unidentifiable in both dogs. Displacement of any tendon requires disruption of the tendon’s restraining connective tissues (4,7,8). Neither of these cases had a history of trauma. Of the 3 reported cases (1,3,8), only 1 dog had a known history of prior trauma (8). We suspect that traumatic disruption of the restraining band was the underlying cause of luxation in our cases, as the restraining fibrous band was not identifiable at surgery.

Pathology of the extensor sulcus was not described in previous reports of dogs affected with LDE tendon luxation (1,3,8), but a sulculoplasty was performed in these dogs to remove proliferative fibrous tissue and address remodeling which limited effective seating of the tendon within the sulcus. A shallow sulcus can be a consequence of osseous proliferation (4) and a bone rasp was used to increase the depth of the sulcus in our cases. Alternatively, rongeurs or a pneumatic burr could have been used to perform the sulculoplasties (6).
Previous reports of the surgical stabilization of the LDE tendon describe using a small drill bit or Kirschner wire to create bone tunnels through the cranial and caudal prominences of the extensor sulcus: suture or small gauge wire was secured through the bone tunnels to maintain the tendon in the sulcus (1–4,6–8,10–13). If the protruberances are not large enough to accommodate drilling bone tunnels, sutures can be anchored in periosteum and fascia (2,6). The use of a staple, fashioned from a Kirschner wire, has also been described (4). In our dogs, a contoured, 3-hole 2.0-mm plate was placed over the sulcus and secured with 2 screws to provide a permanent restraint to accommodate bone tunnels. This technique was simple and effective as documented at the time of long-term evaluation in Dog #1.

Reduction of the LDE tendon luxation was maintained following surgery in both dogs reported here as well as in previously reported cases (1,3,8). Our favorable perioperative outcomes (15) were similar to previous reports (1,3); however, limited details and follow-up evaluations were available in previous reports (1,3). Both of the dogs reported here had mild weight-bearing lameness 2 wk following surgery. Luxation of the LDE tendon could not be elicited on palpation. Neither dog was lame when both walking and trotting and the LDE tendon did not luxate during stifle range of motion. On long-term follow-up radiographs for Dog #1, progression of osteoarthritis was more advanced in the left stifle than the right. The degenerative changes were most pronounced on the lateral aspect of the stifle, consistent with the location of the origin and the tract of the LDE tendon within the extensor sulcus. There was also remodeling of the intermediate ridge of the tibia and proliferative osteophytes on the lateral femoral condyle. Objective measures of limb function revealed nominal differences between pelvic limbs, which may be attributable to the degenerative changes noted on radiographs. Despite these degenerative changes, Dog #1 continued to have normal use of the affected limb. Although we were not able to conduct a direct long-term outcome assessment for Dog #2, the owners did not perceive that their dog had any lameness and they reported that the dog was actively working on their farm. These positive long-term results validate the efficacy of our surgical technique for this uncommon cause of pelvic limb lameness in dogs.

**Acknowledgment**

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**References**

Development of a minimally invasive approach to equine cervical articular facet joints for placement of an ND:YAG LASER

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Abstract – The purpose of this study was to develop a minimally invasive approach to equine cervical articular facet joints for application of an ND:YAG LASER and to evaluate the effects of the laser fiber on the surrounding tissue. Under general anesthesia, an ND:YAG LASER was used to apply 2000 J of energy to 5 cervical articular facet joints in 3 horses (15 joints total). Horses were euthanized and the cervical facets and spinal cords were examined grossly and histologically. Gross pathology of the articular facets revealed evidence of articular cartilage charring and diffuse roughening of the surface. Histopathology confirmed coagulative necrosis. This novel technique allowed access to the cervical articular facet joints with the ND:YAG LASER and has the potential to allow performance of a minimally invasive facilitated ankylosis procedure. Further validation in sedated, standing horses is required to establish safety and efficacy of this technique.


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Introduction

Osteoarthritis of the cervical articular facet joints is a performance limiting condition in horses of various sport disciplines. Degenerative changes between the 6th and 7th cervical vertebrae have been reported on postmortem examination in 50% of normal mature horses (1). Osteoarthritis of the cervical articular facet joints causes enlargement of the joint capsule and periarticular new bone formation (2). These degenerative changes can lead to neck pain, lameness, or subsequent spinal cord compression and ataxia (1,3,4). Cervical stenotic myelopathy secondary to osteoarthritis of the caudal cervical articular facets is more common in older horses; younger horses (< 5 years) are more likely to have a developmental cervical malformation condition (5,6).

Conservative management of caudal cervical articular facet osteoarthritis may include local intra-articular injection of corticosteroids and administration of a systemic non-steroidal anti-inflammatories (7,8). A 25% to 71% subjective improvement in performance or return to normal function was reported based on owner assessment following intra-articular cervical facet injections for treatment of osteoarthritis (8). Aside from this report, no objective or quantitative data are available to determine the long-term success rate of this conservative therapy. The surgical treatment of choice for cervical stenotic myelopathy is ventral interbody fusion. This procedure requires specialized equipment, and an experienced surgeon and anesthesia team to ensure a smooth recovery. Complications reported following
ventral interbody fusion include seroma formation, infection, fracture, migration of the implant, laryngeal hemiplegia, and Horner’s syndrome (9).

Horses with interbody fusions between the 6th and 7th cervical vertebrae have a worse prognosis for return to use and higher incidence of complications during recovery from anesthesia compared with horses treated at C3 to C4 (10,11). Surgical success rates reported by most surgeons are approximately 60% (9–12) and success is commonly defined as a 1 to 2 grade improvement in ataxia.

LASER-facilitated ankylosis of the distal tarsal joints and posterior joints in horses has been reported with favorable outcome (13–15). Previous studies have found that LASER treatment heats chondrocytes above 50°C, resulting in cell death (13,14). This method was reported to facilitate ankylosis of the distal tarsal joints and return 23/24 Western performance horses to soundness following surgery (13). The successful use of a LASER in combination with 3 parallel 5.5-mm screws placed in lag fashion for arthrodesis of the proximal interphalangeal joint has also been described. This technique is particularly useful in horses with significant osteoarthritis within the joint and allows for immediate improvement in comfort of the treated horses (16). The use of diode or ND:YAG LASERs within joints has been postulated to damage the nervous tissue within the joint preventing the transmission of a painful stimulus and providing an immediate decrease in pain (16).

The use of LASER on cervical articular facet joints has not been reported. LASER-facilitated ankylosis could aid in immobilization of the joint which may prevent dynamic compression of the spinal cord and decrease local inflammation. A minimally invasive technique could potentially be done in a standing sedated animal, reducing the complications associated with the previously mentioned interbody fusion techniques. However, the first step is to develop a minimally invasive approach to the cervical articular facet joints for placement of an ND:YAG LASER and evaluate for potential adverse effects on the spinal cord.

The purpose of this study was to i) develop a minimally invasive approach to the cervical articular facet joints; and ii) determine the gross cartilage destruction that can be obtained using this technique. We hypothesized that a minimally invasive procedure could be developed to place an ND:YAG LASER fiber safely and consistently within the articular facet joints and that the ND:YAG LASER within the joint would cause pathology to the articular surface of the joint and not to the spinal cord.

Materials and methods

This study was performed in 15 cervical facet joints from 3 horses (ages 7 to 19 y, weighing between 400 and 550 kg) donated for reasons unrelated to cervical disease. The horses were randomly assigned to have the procedure carried out on the cervical articular facet joints of either the right or left side of the neck. The horses had not received any non-steroidal anti-inflammatory drugs in the last 7 d and did not receive any anti-inflammatory drugs before the treatment. This protocol was reviewed and approved by the Michigan State University Institutional Animal Care and Use Committee.

Anesthesia

After sedation with xylazine hydrochloride (Akorn Animal Health, Lake Forest, Illinois, USA), 1.1 mg/kg body weight (BW), IV, general anesthesia was induced with ketamine hydrochloride (Akorn Animal Health), 2.2 mg/kg BW, IV, and diazepam (Hospira, Lake Forest, Illinois, USA), 0.1 mg/kg BW, IV. The horses were randomly placed in either left or right lateral recumbency and maintained on isoflurane in oxygen. Horses were monitored during anesthesia with conventional techniques by an experienced anesthesia technician. Following completion of the procedure, the horses were maintained under general anesthesia for 60 min to allow time for an acute inflammatory response to the LASER application and were then euthanized using pentobarbital (Vertech Pharmaceuticals, Dearborn, Michigan, USA), 0.22 mg/kg BW, IV.

LASER technique

The lateral aspect of the neck from C2-3 to C6-7 was clipped and aseptically prepared. The facet joints were located by ultrasound as described by Berg et al (17) and Nielson et al (18) using a General Electric LOGIQ P5 veterinary ultrasound sound system (GE Healthcare, Chicago, Illinois, USA) with a 10-4 MHz microconvex curvilinear transducer. The transducer was positioned transverse to the line of the vertebrae and the widest joint space and best access to the joint was located prior to injection and imaged using 10 MHz. An 18-gauge, 8.89-cm spinal needle was inserted into the C2-3 facet joint under ultrasound guidance. The joint was then distended with 5 to 15 mL of sterile saline (until back pressure was detected), the spinal needle was removed, and a 14-gauge, 12.7-cm intravenous catheter (Abbott Animal Health, Stephenville, Texas, USA) was then ultrasonographically guided into the distended facet joint. The stylet was removed and the 1.05 mm × 2.5 m ND:YAG LASER contact fiber (Surgical Laser Technologies, Montgomeryville, Pennsylvania, USA) was inserted through the 14-G catheter and advanced 5 mm beyond the sleeve, after which 2000 J were then applied to the cervical facet joint. This procedure was repeated unilaterally for each cervical facet joint beginning at C2-3 and extending to C6-7.

Gross and histologic pathology evaluation

Each horse was presented for necropsy within 2 h of euthanasia. Cervical vertebrae were disarticulated, and the spinal cord segment within the vertebral canal of each vertebra was removed; a labeled tag was clipped to the left cranial aspect of the dura mater of each cord segment to retain anatomic perspective. Spinal cord segments were placed in 10% neutral buffered formalin for at least 7 d so that the tissues would be adequately fixed before processing for histopathologic examination.

Two transverse and 2 longitudinal sections of spinal cord were cut from both ends of each segment at the level of each intervertebral disc from C2-C3 through C6-C7. The 4 segments spanned a length of 2.5 cm centered over the disc. Thus, a total of 20 cervical spinal cord sections were prepared from each of the 3 necropsied horses.

The disarticulated cervical vertebrae were examined for lesions, and all cranial and caudal articular facets were photographed. A
Figure 1. Gross pathology of the facet joints demonstrating the various grades following laser application. In all images, the left facet joint is the non-treated side and the right is the laser treated side. A – Grade 1 with the cranial and caudal articulations. B – Grade 2 with the cranial and caudal articulation. C – Grade 3 with the cranial and caudal articulation.
subjective grading scale was developed to determine articular cartilage surface damage; Grade 1 — the cartilage surface has diffuse cobblestone surface texture with no char marks; Grade 2 — the cartilage has cobblestone appearance with a char mark on either the cranial or caudal facet; Grade 3 — cartilage has cobblestone appearance with char mark on both the cranial and caudal facet (Figure 1).

Articular facets were then removed from the vertebrae at their bases with a Hobart band saw (model 5K49SH22208; Hobart, Troy, Ohio, USA) and placed in formalin fixative for at least 2 wk. Following fixation, thin (5- to 6-mm wide) sections of the facets were cut using a Techcut5 Precision High Speed saw (Allied High Tech Products, Rancho Dominguez, California, USA) through standard sites of the articular surfaces and at the margins of articular surfaces where gross lesions were noted. The thin bone sections were placed in RapidCal decalcification solution (BBC Biochemical, Mount Vernon, Washington, USA) for 24 h to soften them in preparation for histopathology. Transverse and parasagittal longitudinal sections were cut from the ends of the collected spinal cord segments, from the caudal aspect of the C2 segment through the cranial aspect of the C7 segment. Decalcified bone and spinal cord sections were then processed routinely, embedded in paraffin, sectioned at 5 μm, and stained with hematoxylin and eosin.

Results

Ultrasound-guided LASER technique

Placement of the spinal needle and distension of the cervical articular facet joints were easily performed. The ultrasound image of each cervical facet joint was easily obtained and the 18-gauge spinal needle was directed into the joint space and distended with saline (Figure 2). With distension of the joint, the catheter was visualized entering each articular cervical facet joint and the LASER fiber passed readily through the lumen of the 14-gauge catheter into the joint space. In most cases, a smoke plume and bubbling joint fluid could be seen exiting the external portion of the catheter (Figure 3). Horse 1 had a mild amount of periarticular irregularity of the C5-6 and C6-7 articular facets noted on ultrasound examination; however, these joints were still easily accessible with the catheter and LASER fiber. The total procedure time per joint was approximately 5 min.

Gross pathology

Gross pathology performed on Horse 1 revealed dark charred marks on the articular cartilage of all left cervical articular facet joints except C2-C3. The charred marks between C5-C6 and C6-C7 involved both the cranial and caudal portions of the joint (Grade 3) while only the cranial most facet of C4-C5 was affected and only the caudal most facet of C3-C4 was affected (Grade 2).

Gross pathology performed on Horse 2 revealed charred marks on the articular cartilage of all left cervical articular facet joints. The charred marks between C4-C5, C5-C6, and C6-C7 were located on either the cranial or caudal facets (Grade 2), while C3-C4 and C2-C3 had no gross pathology of the cartilage.

Gross pathology performed on Horse 3 revealed evidence of Grade 1 articular damage including diffuse granular roughening or cobblestone appearance of the cranial and caudal facets of the right cervical articular facet joints C3-C4, C4-C5, C6-C7. There was 1 Grade 2 lesion between C2-C3 and 1 Grade 3 lesion between C5-C6.

Overall, using the grading scale, there were 3 Grade 3 lesions, 6 Grade 2 lesions, 3 Grade 1 lesions, and 3 joints that had no evidence of pathology from the LASER. In addition to these findings, gross evidence of epidural hemorrhage was present in the caudal 2- to 3-cm segment of spinal cord within the C3 vertebrae, C4 and C5 vertebrae, primarily on the right side.

Spinal cord histopathology

Horse 1 (treated on the left side) had no significant histologic lesions in the spinal cord. Horse 2 (treated on the left side) had a few extravascular neutrophils loosely scattered in 2 areas of...
the leptomeninges of the cranial C5 spinal cord segment, and in 1 area of the leptomeninges of the caudal C6 spinal cord. There were no other significant histologic lesions in the spinal cord. Horse 3 (treated on the right side) had a few extravascular neutrophils that were loosely scattered in 1 area of the leptomeninges of the caudal C5 spinal cord segment, and in 2 areas of the leptomeninges of the caudal C6 spinal cord segment. There were no other significant histologic lesions in the spinal cord.

**Bone histopathology**

Due to similar gross findings on all articular facets of all horses, histopathology of the articular facets was performed on Horse 1 only. Two bone sections, cut cranially to caudally, were prepared from the middle of the articular surfaces of facets on the treated left side; 1 section was 7 to 10 mm more medial than the other section. One similarly cut (made cranially to caudally) bone section was prepared from the middle of the articular surface of each corresponding facet on the untreated right side. Additional bone sections were cut from areas where the LASER treatment had created a grossly apparent, brown-black mark or depression in the articular facet; these lesions generally were at the lateral margins of the articular surfaces, or just medial to the lateral margin.

Acute or recent bone lesions were observed only where grossly apparent, brown-black marks were noted on articular cartilaginous surfaces. These lesions were located on the: 1) left caudal facet of C3; 2) left caudal facet of C5; 3) left cranial facet of C6; 4) left caudal facet of C6; and 5) left cranial facet of C7. At all of these sites, the articular cartilage was thinner than the surrounding cartilage, had an irregular surface contour, and was granular and amphiphilic, indicating coagulative necrosis. At most of these sites, the articular cartilaginous surface was coated with a thin layer of orange-brown to black material (LASER treatment residue). On the left caudal facet of C3 and the left cranial facet of C6, the coagulative necrosis extended into the subchondral bone. There was no evidence of inflammation at any of these sites. Mild irregularities in the articular cartilage were noted on some articular facets, with thinning or extension of a thin band of fibrous tissue across the surface being most common. These changes were deemed to be chronic and degenerative, and gross images of the articular facets supported this interpretation.

**Additional soft tissue histopathology**

Skeletal muscle and other soft tissues near the articular facets of the C2-C3 and C3-C4 intervertebral joints in Horse 3 showed small dark brown to black marks on the treated right side, and these tissues were collected for histopathology. Some skeletal myofibers were hypereosinophilic (indicating mild degeneration, with cross-striations still evident), and were adjacent to small, irregular aggregates of orange-brown to black material (associated with the LASER treatment). Small numbers of neutrophils were marginated in a few nearby capillaries, or were extravasated into the surrounding connective tissue. One section from the C3-C4 area included adipose tissue and what was believed to be synovium, and these tissues contained small numbers of extravasated, loosely scattered neutrophils as well.

**Discussion**

This is the first study to describe access to the cervical articular facets joints with an ND:YAG LASER. The effect of the LASER on the articular surface, spinal cord, and surrounding soft tissue was described postmortem by gross pathology as well as histopathology. Our study shows that an ND:YAG LASER can be placed into the equine cervical articular facet joints. Whether the damage caused by the LASER would be significant enough to induce ankylosis of the cervical facets would need to be examined in live horses recovered from general anesthesia or in horses that had the procedure performed under standing sedation. This approach requires further validation and outcome evaluation in live horses before it can be recommended in clinical practice.

One of the main advantages of LASER facilitated ankylosis is its potential to be a minimally invasive method of cervical articular facet fusion in older horses with osteoarthritis of the caudal cervical facet joints. Clinically, this may provide a useful treatment option for horses with chronic osteoarthritis that is non-responsive to conservative medical management (intra-articular corticosteroid injections). Additionally, while this proof of concept study was carried out under general anesthesia, ultrasound-guided insertion of the LASER fiber into the cervical facet joints in the standing horse would offer the advantage of avoiding general anesthesia in an older horse that may have neurologic deficits.

In our study there was gross evidence of charring on the articular cartilage that corresponded to evidence of coagulative necrosis histopathologically in the affected sections. There was no evidence of inflammation present and this was likely a reflection of the limited time scale chosen for this project; horses were alive for only 60 min after LASER treatment. The subjective grading scale was used to try and quantify damage to the articular surface. Histopathology and cartilage staining would be required to determine the true effect on the cartilage.

Ankylosis via LASER has been reported with good outcome in the distal tarsal joints (13) and it has been suggested that LASER energy causes vaporization of synovial fluid followed by chondrocyte death, thereby allowing ankylosis, and that contraction of the joint capsule due to heating of the collagen may provide additional joint stability (13–15). Pathologic findings on LASER treated distal tarsal joints by Scruton et al (15) were similar to those in the current study. In the Scruton study, there was evidence of necrotic char and subchondral bone blanching grossly and histopathologic evidence of fibrous tissue at the laser-treated areas that contained small amounts of woven bone bridging across the joint surfaces at 5 mo after LASER treatment. That same study measured chondrocyte death with confocal LASER microscopy in conjunction with vital cell staining and found significantly more chondrocyte death following LASER treatment compared with intra-articular drilling (15).

In addition to its efficacy, LASER-facilitated ankylosis in the distal tarsal joints has been reported to be minimally painful during the post-operative period compared with surgical drilling and intra-articular sodium monioiodoacetate injection (13–15,19). This may be due to an effect of the LASER on nerves within the subchondral bone, synovium, and joint.
capsule (13, 14, 19) and would be advantageous in horses with painful osteoarthritis of the caudal cervical articular facets.

There are several potential concerns that should be considered if the technique is to be used in clinical cases. There was a significant amount of hemorrhage within the epidural space in Horse 3. Hemorrhage, and inflammation in and surrounding the spinal cord could have grave consequences. The use of ultrasound to guide entry into the articular facet joints by an experienced operator is critical to ensure the LASER is placed correctly. In addition, the long-term objective of facilitating ankylosis relies on the body’s response to the LASER by articular fusion. This fusion requires monitoring live horses over a period of months to years. Assuming fusion occurs, there may also be a risk of exuberant periosteal reaction and periarticular bone formation. If excess bone formation protrudes into the spinal canal, there is a potential for compression of the spinal cord and increased neurologic deficits.

There are several limitations of this study. The horses selected for this study were only required to be free of cervical neck pain; no radiography or ultrasonography was performed to evaluate the cervical vertebrae for pathology. Additionally, these horses were essentially free of osteoarthritis and entry to the cervical articular facet joints was relatively easy; this may be more challenging in clinical cases with significant joint pathology. The placement of the LASER fiber within the joint was not difficult; however, we cannot be sure of the exact location of the fiber within the joint and we can only assume the energy of the LASER is diffusely affecting the entire joint. An ND:YAG LASER was chosen based on availability of the LASER at our institution; however, a diode LASER could theoretically be used with similar results.

In conclusion, our results show that an approach to the cervical articular facet joints and introduction of a LASER fiber is possible in anesthetized horses. The effect on the cartilage is unknown and would require further study. This effect could be anticipated to facilitate ankylosis over a period of months to a year when performed in live horses. Further study is required in live horses to determine the safety and efficacy of this technique.

References

Evaluation of the sterility of single-dose medications used in a multiple-dose fashion

Elizabeth P. Martin, Jean Mukherjee, Claire R. Sharp, Virginia B. Sinnott-Stutzman

Abstract — Bacterial proliferation was evaluated in single-dose medications used in a multi-dose fashion and when medications were intentionally inoculated with bacteria. Of 5 experimentally punctured medications, 1 of 75 vials (50% dextrose) became contaminated. When intentionally inoculated, hydroxyethyl starch and heparinized saline supported microbial growth. Based on these findings, it is recommended that hydroxyethyl starch and heparinized saline not be used in a multi-dose fashion.

Résumé — Évaluation de la stérilité des médicaments à dose unique utilisés pour plusieurs doses. On a évalué la prolifération bactérienne dans les médicaments à dose unique utilisés pour plusieurs doses et lorsque les médicaments sont intentionnellement inoculés avec des bactéries. Parmi les cinq médicaments ayant subi une ponction expérimentale, 1 des 75 flacons (50 % dextrose) a été contaminé. Lorsqu’ils étaient inoculés intentionnellement, l’hydroxyéthylcellulose et le soluté physiologique hépariné supportaient la croissance microbienne. En se basant sur ces résultats, il est recommandé que l’hydroxyéthylcellulose et le soluté physiologique hépariné ne soient pas utilisés pour plusieurs doses.

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Introduction

Many medications manufactured for human patients are used in an off-label manner in the veterinary field. Medications labeled as single dose vials that are commonly used in a multiple dose fashion in veterinary hospitals are of concern (1). Single dose vials lack antimicrobial preservative and are manufactured to be used only as a single dose administered to a single patient (2–4). By contrast, multiple dose vials typically contain an antimicrobial preservative or have antimicrobial properties, such as high osmolarity, designed to inhibit proliferation of contaminating bacteria that might enter with multiple punctures (2,3). Because it is against the safe injection practices of the Centers for Disease Control and Prevention and the World Health Organization to use single dose vials in a multi-dose fashion in humans, there are no prospective studies that have evaluated whether this practice places veterinary patients at risk for infection (2–4).

Reports of disease transmission in humans from improper injection practices using single dose and multi-dose vials appear periodically in public health literature (5–10). Point-prevalence studies evaluating contamination of multi-dose vials in human hospitals have revealed contamination rates of 0.9% to 5.6% (5,6). At a veterinary teaching hospital, the multi-dose vial contamination rate was 18%, with most growth occurring in preservative-free saline (single dose vial) being used to dilute medications before administration (1). It is therefore vital to investigate whether using single dose vial medications in a multi-dose fashion will result in microbial contamination.

This investigation was designed to evaluate single dose vial medications commonly used in a veterinary emergency setting in an off-label, multi-dose fashion. The first objective of the study was to prospectively evaluate the contamination of single dose vials used in a multi-dose fashion under simulated clinical conditions, and to determine whether the medications under study would support bacterial proliferation over time. The second objective was to determine whether single dose vials intentionally inoculated with bacteria would support bacterial proliferation over time. Pseudomonas aeruginosa and Staphylococcus aureus were the bacteria that were selected because...
of their importance as nosocomial pathogens (11,12,13). We hypothesized that certain single dose vial medications would not support bacterial growth, despite use in multi-dose fashion and intentional inoculation.

Materials and methods

Medications

The following medications were evaluated: 6% hydroxyethylstarch in 0.9% NaCl (Hespan; Braun, Irvine, California, USA), 20% mannitol in water (Mannitol Injection 20%; NeoGenVet, Lexington, Kentucky, USA), 50% dextrose in water (Dextrose 50% Injection; VetOne, MWI, Boise, Idaho, USA), 7.2% hypertonic saline (Equi-Phar Equine 7 HSS; VEDCO, St. Joseph, Missouri, USA), 50% dextrose in water (50% Injection; VetOne, MWI, Boise, Idaho, USA), and 10 U/mL heparinized 0.9% saline (0.9% Sodium Chloride Injection, USP; Hospira, Lake Forest, Illinois, USA; Heparin Sodium Injection, Sagent Pharmaceuticals, Schaumburg, Illinois, USA) (Table 1). Each medication container had a rubber bung for introduction of a hypodermic needle and withdrawal of fluid. All study medications were clearly labeled as study medications to avoid accidental clinical use. Medications were clearly labeled as study medications to avoid accidental clinical use.

Experimental puncture study

Fifteen containers of each medication (6% hydroxyethylstarch in 0.9% NaCl, 20% mannitol in water, 50% dextrose in water, 7.2% hypertonic saline, and 10 U/mL heparinized 0.9% saline) were divided into 3 groups of 5 containers each based on puncture frequency — 5 punctures/day, 1 puncture/day, and 1 puncture/week. This puncture schedule was designed to mimic frequent, moderate, and infrequent use, respectively.

A veterinary technician was randomly chosen to perform the medication container punctures beginning on Day 0 through Day 27. Randomization was accomplished by non-algorithmic means (drawing sealed envelopes) with no limitation on the frequency with which a technician could be chosen. Technicians were provided with 22-gauge (G) needles attached to 3-mL syringes (Nipro Medical Corporation, Miami, Florida, USA) for each puncture and instructed to withdraw 0.2 mL of medication per puncture. The only guidance was on how many punctures to perform.

No further procedures were conducted with the withdrawn medication fluid. On Day 0, before the start of the puncture schedule by the technicians and then on Days 1, 7, 14, and 28, a designated investigator (EPM) removed 1 mL of medication for individual culture using a sterile 3-mL syringe with an attached 22-G needle and then transferred each sample into a 3-mL sterile plain red top tube (BD Vacutainer). Samples were shipped overnight on icepacks to a commercial veterinary microbiology laboratory (IDEXX Laboratories, North Grafton, Massachusetts, USA) for quantitative aerobic culture and microbial identification. A 100 μL volume of each sample was streaked onto a Tryptic Soy Agar plate containing 5% sheep blood and a MacConkey agar plate and incubated at 37°C in the presence and absence of 5% CO₂, respectively. The plates were examined for growth after 24 and 48 h. If there was bacterial growth, the number of colony-forming units (CFU) was determined and isolated organisms were sent for identification using the Vitek XL system (BioMérieux, Marcy-l’Étoile, France). When automated processes failed to identify an organism or the identification was suspected to be incorrect, standard biochemical reactions and colony morphology were used for identification.

Saline flush syringes

On Day 0, the randomly selected technician prepared heparinized flush syringes by removing 1 mL of 10 000 U/mL heparin from a new bottle and injected it into a 1 L bag of 0.9% NaCl. The technician then used the resulting solution to make twenty 3-mL flushes using 3-mL syringes with attached 22-G needles. The 20 syringes were divided into 4 groups of 5; each set of 5 syringes was assigned to be cultured on Days 1, 7, 14, or 28. On Day 0, 1 mL of the newly heparinized saline was removed and a 100 μL sample was cultured immediately to check for sterility. On Days 1, 7, 14, and 28, 0.2 mL was

Table 1. Characteristics of the fluids evaluated in this study relative to canine plasma.

<table>
<thead>
<tr>
<th>Fluid type</th>
<th>pH</th>
<th>Osmolarity (mOsm/L)</th>
<th>Buffer</th>
<th>Additional ingredients</th>
</tr>
</thead>
<tbody>
<tr>
<td>Canine plasma</td>
<td>7.4</td>
<td>290–310 mOsm/L</td>
<td>n/a</td>
<td>n/a</td>
</tr>
<tr>
<td>6% Hydroxyethylstarch</td>
<td>5.9</td>
<td>309 mOsm/L</td>
<td>none</td>
<td>Na: 154 mEq/L</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Cl: 154 mEq/L</td>
</tr>
<tr>
<td>Mannitol</td>
<td>4.5–7.0</td>
<td>1098 mOsm/L</td>
<td>none</td>
<td>n/a</td>
</tr>
<tr>
<td>50% Dextrose</td>
<td>3.5–6.5</td>
<td>2525 mOsm/L</td>
<td>none</td>
<td>n/a</td>
</tr>
<tr>
<td>Heparin</td>
<td>5.0–7.0</td>
<td>287 mOsm/L</td>
<td>none</td>
<td>n/a</td>
</tr>
<tr>
<td>0.9% NaCl</td>
<td>5.5</td>
<td>308 mOsm/L</td>
<td>none</td>
<td>Na: 154 mEq/L</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Cl: 154 mEq/L</td>
</tr>
<tr>
<td>Hypertonic saline 7.2%</td>
<td>5.0</td>
<td>2464 mOsm/L</td>
<td>none</td>
<td>Na: 1232 mEq/L</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Cl: 1232 mEq/L</td>
</tr>
</tbody>
</table>

Data from Product Information Sheets for a HESpan; b Mannitol 20%; c Dextrose 50%; d Heparin; e 0.9% NaCl; f 7.2% Hypertonic saline.

n/a — Not available.
withdrawn for culture from each of 5 syringes within the designated group and pooled into a sterile 3-mL red top tube (BD Vacutainer).

Samples were shipped overnight on icepacks to IDEXX Laboratories, North Grafton, Massachusetts, for quantitative aerobic culture and microbial identification as described for the experimental puncture study.

**Intentional medication contamination**

To simulate low-level contamination, likely to occur in a clinical setting, 5 containers of each of the 5 medications were intentionally inoculated on Day 0 with 2 strains of bacteria each — *Staphylococcus aureus* (strain ATCC 6538) and *Pseudomonas aeruginosa* (strain ATCC 9027). Bacteria were reconstituted as directed by the manufacturer (Quant-Cult Plus Remel Microbiology Products; Lenexa, Kansas, USA). Based on the manufacturer’s quantitation, approximately 300 CFUs of each bacterial species was inoculated into each medication container. Initial estimated concentrations for each bacterial species were 6 CFU/mL 50% dextrose, 3 CFU/mL 20% mannitol, 0.6 CFU/mL 6% hydroxyethylstarch, 0.3 CFU/mL for heparinized saline, and 0.3 CFU/mL for 7.2% hypertonic saline. A veterinary technician was randomly chosen to perform medication container punctures 5 times each day as described for the experimental puncture study beginning on Day 0 and ending on Day 27.

On Day 0, immediately prior to intentional contamination and initiation of the puncture schedule by the technicians, and then on Days 1, 7, 14, and 28, a designated investigator (EPM) removed 0.2 mL of medication for culture from each of the 5 containers within a designated group. Medication withdrawn from containers within a group was pooled in a 3-mL sterile plain red top tube (BD Vacutainer), then shipped and subjected to microbial culture and quantification of isolated bacteria as described for the experimental puncture study.

A follow-up study was conducted using high levels of each bacterial strain to evaluate whether the medications selected supported or inhibited bacterial growth. Two containers of each of the 5 medications were intentionally inoculated on Day 0 with *S. aureus* (ATCC 6538) or *P. aeruginosa* (ATCC 9027). The 2 bacterial strains (Culti Loops; Remel Microbiology Products) were subcultured multiple times and single colonies were used to inoculate ~25 mL sterile brain heart infusion (BHI) broth (Difco, Becton Dickinson, Sparks, Maryland, USA). The absorbance at 600 nm ($A_{600}$) was determined following incubation with shaking at 37°C for ~6 h. Log-phase cultures were used to prepare serial dilutions of each bacterial strain and each medication container was inoculated on Day 0 with either *S. aureus* (ATCC 6538) or *P. aeruginosa* (ATCC 9027) to achieve a final concentration of 1000 CFU/mL. On Day 0, immediately before and immediately after intentional contamination, and subsequently on Days 1, 2, 3, 4, 5, and 6, 0.5 mL of liquid was removed from each medication container and serially diluted 1:5 in sterile PBS across a 12-well dilution boat. A 200-μL volume of the undiluted sample and each serial dilution was spread onto separate Columbia agar plates containing 5% sheep blood (Remel). Colonies were counted after overnight incubation at 37°C, and CFU/mL were determined for each sample at each time point.

**Statistical methods**

This investigation was designed to detect single dose vial medications with a high risk of contamination. Assuming 100% recovery of viable organisms if contamination and proliferation above the limit of detection occurred at any time point, this investigation was powered to have a 95% chance of detecting a 45% contamination rate. As the incidence of positive cultures was extremely low, statistical methods to determine relative risk of contamination were not carried out.

**Results**

In the experimental puncture study, *Micrococcus luteus* (< 100 CFU/mL) was isolated on culture Day 7 from a single container of 50% Dextrose that had been punctured once weekly. No other test medications that underwent experimental puncture were positive for bacterial growth throughout the study.

Following intentional inoculation with low doses of *P. aeruginosa* and *S. aureus*, only *P. aeruginosa* was isolated from 6% hydroxyethylstarch and heparinized 0.9% saline. Growth was first detected on Day 7, increased by Day 14, and then decreased by Day 28.

After intentional inoculation with *P. aeruginosa* at 1000 CFU/mL, marked growth was observed in heparinized 0.9% saline (6.3 × 10³ CFU/mL by Day 6). Sustained moderate growth was also observed in 6% hydroxyethylstarch. Growth was also observed in 20% mannitol and in 7.2% hypertonic saline; however, this was no longer evident by Days 4 and 6, respectively. No growth was observed in 50% dextrose.

The bacteria persisted for variable lengths of time after intentional inoculation with *S. aureus* at 1000 CFU/mL, but no proliferation was observed.

**Discussion**

This study sought to determine whether commonly used medications could become contaminated and sustain bacterial growth. Single dose vial medications of 6% hydroxyethylstarch in 0.9% NaCl, 20% mannitol in water, 50% dextrose in water, 7.2% hypertonic saline, and 10 U/mL heparinized 0.9% saline were chosen because they are commonly used in veterinary emergency hospitals. These vial medications represent a wide spectrum of pH and tonicity (Table 1), which may impact each medication’s inherent ability to sustain bacterial growth. The first part of this study examined the potential for contamination when medications were experimentally punctured multiple times per day or week. The second part of this study examined the potential for microbial growth following intentional contamination.

Following experimental puncture, 1 to 5 times/day or once each week over a 28-day period, a single vial of 50% dextrose yielded a positive aerobic bacterial culture of *M. luteus*, with no subsequent growth noted throughout this period of time. *Micrococcus luteus* is typically a non-pathogenic, Gram-positive human skin commensal, although clinical infections may occur in immune-compromised individuals (14). A transient positive growth...
culture with subsequent clearing of the inoculum suggests 50% dextrose is hostile to microbial growth, but whether it meets USP or British Pharmacopeia standards for antibacterial properties is beyond the scope of this investigation.

Following intentional inoculation with 300 CFU P. aeruginosa and S. aureus, both 6% HES and heparinized saline supported a 1000× increase in P. aeruginosa. This suggests that even if a relatively minute contamination occurs, bacterial proliferation may continue unopposed by any inherent property of the solution and use as multi-dose vials could result in iatrogenic bacteremia.

It is unclear why some single dose vial medications supported microbial growth when intentionally contaminated while others did not. Of particular interest are the medications that did not support proliferation. Interestingly, these are all solutions that are hyperosmolar to canine plasma. While osmotic tolerance mechanisms exist among select bacterial species, several prior investigations have revealed that hyperosmolar solutions can reduce bacterial survival (15–17). Further investigation into the effects and mechanisms of osmolarity, as well as other chemical properties of medications which may prove hostile to bacterial growth, would aid in our understanding of the risk for bacterial contamination of preservative-free medications used in a multi-dose fashion. Examples of potentially impactful chemical properties include pH, carbohydrate source, buffering solution and solution viscosity.

Overall, this investigation revealed that accidental contamination events could occur when single dose vials were used in a multiple dose fashion in controlled, experimental conditions, and that microbial proliferation was possible with the introduction of a small bacterial inoculum into certain medications. Based on the ability of 6% hydroxyethylstarch and heparinized 0.9% saline to support proliferation of P. aeruginosa when intentionally inoculated even with low levels of bacteria (< 10 CFU/mL), the use of these medications in a multi-dose fashion should be considered a patient safety risk. Although the other medications did not support bacterial proliferation when inoculated with low levels of bacteria, it would be inappropriate to infer that the use of preservative-free 50% dextrose, hypertonic saline, or mannitol in a multiple dose fashion is safe, given that our initial inoculum was below the limits of detection for this portion of the study. A high contamination rate selected in our power analysis, to eliminate drugs for consideration as appropriate to infer that the use of preservative-free 50% dextrose, hypertonic saline, or mannitol in a multiple dose fashion should be considered a patient safety risk. Although the other medications did not support bacterial proliferation when inoculated with low levels of bacteria, it would be inappropriate to infer that the use of preservative-free 50% dextrose, hypertonic saline, or mannitol in a multiple dose fashion is safe, given that our initial inoculum was below the limits of detection for this portion of the study. A high contamination rate selected in our power analysis, to eliminate drugs for consideration as appropriate to infer that the use of preservative-free 50% dextrose, hypertonic saline, or mannitol in a multiple dose fashion should be considered a patient safety risk.

Inoculation with a high level of bacteria (1000 CFU/mL) revealed that all of these medications, with the exception of 50% dextrose, can support persistence and/or growth of P. aeruginosa and S. aureus for some time. Limitations of the study are that the number of medications and organisms evaluated was limited and that bacterial culture is a relatively insensitive technique. However, the results suggest that further investigation into contamination of medications is warranted, particularly in reference to multiple punctures over a period of time and length of storage following initial entry.

Acknowledgments

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References

Ovariohysterectomy requires more post-operative analgesia than orchiectomy in dogs and cats

Carolina Quarterone, Stelio Pacca Loureiro Luna, Nadia Crosignani, Flávia Augusta de Oliveira, Carlize Lopes, Alfredo Feio da Maia Lima, Antonio Jose de Araújo Aguiar

Abstract — The requirement for post-operative analgesia after ovariohysterectomy (OH) versus orchiectomy in dogs and cats was compared. Twelve male and 12 female cats and 12 male and 12 female dogs received meloxicam, 0.1 mg/kg body weight, PO, 2 h before surgery. Eleven female cats and 3 female dogs received rescue analgesia ($P = 0.002$). No male of either species required rescue analgesia. The number of cats receiving rescue analgesia was greater in females than in males ($P < 0.0001$). One should not rely solely on preoperative short-acting opioid and preemptive use of NSAIDs to control postoperative pain following OH, in dogs or cats. Postoperative pain after OH should be assessed for at least 2 h for cats and 4 h for dogs, using species-specific validated tools, to ensure proper postoperative pain diagnosis and management. Male dogs and cats subjected to orchiectomy required less postoperative analgesia intervention than female dogs and cats submitted to OH.

Résumé — L’ovariohystérectomie nécessite d’avantage d’antalgiques post-opératoires que l’orchiectomie chez les chiens et les chats. Dans cette étude, nous avons comparé le besoin en antalgiques post-opératoires après l’OH versus l’orchiectomie chez les chiens et les chats. Douze mâles et 12 femelles, chats et chiens, ont reçu 0,1 mg/kg de Méloxicam par voie orale, 2h avant chirurgie. Onze chattes et trois chiennes ont eu besoin d’antalgiques de secours ($P = 0.002$). Aucun mâle de l’une ou l’autre espèce n’en a eu besoin. Chez les chats, les besoins en antalgiques de secours étaient plus élevés chez les femelles que les mâles ($P < 0.0001$). Il est donc primordial de ne pas se fier uniquement aux opioïdes à action courte préopératoire, et à l’utilisation préventive des AINS, pour contrôler la douleur post-opératoire après OH, tant chez le chien que chez le chat. L’évaluation de la douleur post-opératoire après l’OH devrait être suivie pendant au moins 2 heures pour les chats, et 4 heures pour les chiens, en utilisant des outils validés et spécifiques pour chaque espèce, afin d’assurer un diagnostic et une prise en charge post-opératoire appropriées à la douleur. Chez les chiens et les chats, les mâles soumis à l’orchiectomie ont nécessité moins d’intervention d’antalgiques post-opératoires que les femelles soumises à l’OH.

Introduction

Ovariohysterectomy (OH) and orchiectomy are the most common surgical procedures in dogs and cats and are used as clinical models for studies assessing pain (1,2). Studies investigating the attitudes of veterinarians indicate that cats receive lower pain scores for surgery than do dogs (3–7). The treatment of pain in cats has been historically neglected (3–7) and although this scenario is changing (7), for the time being, the use of analgesics in cats is still lower than that in dogs (4–7). The main reasons for this situation are the difficulty in recognizing and treating pain in cats (8) and the use of adapted and non-validated scales in some studies (9).

Given that male dogs and cats receive less analgesia than females, that cats receive less analgesia and are given lower pain scores for surgery than dogs (3,6), and that several studies have used only non-steroidal anti-inflammatory drugs (NSAIDs) for postoperative analgesia in dogs and cats submitted to castration and ovariohysterectomy (10–12), it is important to compare the postoperative requirement of analgesia in dogs and cats after castration and OH (13,14).
Based on the hypothesis that OH causes greater expression of pain than orchiectomy; this study had the objective of comparing the requirement for post-operative analgesia after OH versus orchiectomy in dogs and cats.

**Materials and methods**

This study was approved by the Institution’s Ethics Committee on Animal Experimentation under protocols 124 and 125/2013 and all procedures were performed with the owner’s consent.

**Animals**

The study included 12 male dogs [weight: 6.5 to 40.5 kg; mean: 20.3 ± 12.2 kg standard deviation (SD) and age: 11 to 480 mo; mean: 20.8 ± 13.7 mo], 12 female dogs (weight: 5.8 to 29 kg; mean: 14.8 ± 8.6 kg and age: 12 to 84 mo; mean: 44 ± 23.6 mo), 12 male cats (weight: 2.3 to 5.5 kg; mean: 3.91 ± 0.96 kg and age: 6 to 24 mo; mean: 12 ± 4.32 mo) and 12 female cats (weight: 1.9 to 3.3 kg; mean: 2.58 ± 0.41 kg and age: 6 to 12 mo; mean 8 ± 2.54 mo). The dogs and cats were of various breeds. The animals were considered healthy based on clinical, physical, and laboratory tests including those for a complete blood (cell) count (red blood cells and white blood cells), total plasma protein, liver parameters (aspartate aminotransferase, alanine aminotransferase, and alkaline phosphatase assays), and kidney function (urea and creatinine measurements).

Prior to the start of the study, the animals were allowed to adapt to the environment and to the observer for 24 h; food and water were withheld for 12 h and 4 h, respectively, before surgery.

**Experimental design**

Two hours before surgery, the animals received meloxicam (Maxicam; Ourofino Agronegocio LTDA; Cravinhos SP, Brazil) 0.1 mg/kg body weight (BW), PO. One hour later all animals received acepromazine (Acepram 0.2%; Vetnil Indústria e Comércio de Produtos Veterinários LTDA, Louveira SP, Brazil), 0.05 mg/kg BW, IM. After 15 min, the right or left cephalic vein was cannulated using a 20- or 22-gauge (G) over-the-needle catheter for administration of lactated Ringer’s solution (Ringer lactato; Halexistar Indústria Farmacêutica LTDA, Rodovia BR 153 Km 03, Goiania, GO, Brazil) at 5 mL/kg BW/h during anesthesia. Anesthesia was then induced with propofol (Propovan; Cristália Produtos Químicos e Farmacêuticos LTDA, Itapira SP, Brazil), 5 mg/kg BW, IV, to effect. After orotracheal intubation with a cuffed tube, anesthesia was maintained with isoflurane (Isoforane; Cristália Produtos Químicos e Farmacêuticos LTDA) in oxygen. The Ayre T-piece breathing system was used for animals weighing < 5 kg at 500 mL/kg BW per min fresh gas flow, and a rebreathing system was used for animals > 5 kg BW at 30 mL/kg per min fresh gas flow. For intraoperative analgesia, fentanyl (Fentanest; Cristália Produtos Químicos e Farmacêuticos LTDA) 2 μg/kg BW, IV was administered IV for 1 min, starting 2 min before skin incision.

The animals were placed in dorsal decubitus position on a thermal mattress for surgery. Before and during surgery, the following variables were assessed and maintained within normal ranges: heart rate (PM60 Vet Pulse oximeter; Mindray Medical International; Shenzhen; China), respiratory rate, indirect systolic pressure (Doppler ultrasound systems; Parks Medical Electronics, Aloha, Oregon, USA), oxygen saturation (PM60 Vet Pulse oximeter; Mindray Medical International), and rectal temperature (Inco term; Mod. Flexterm, Porto Alegre RS, Brazil). The duration of surgery and of anesthesia were recorded.

Ovariectomy was performed by a surgical technique using a Snook hook to expose the ovaries after a ventral retroumbilical abdominal incision of 2 cm, while orchiectomy was performed by pre-scrotal and scrotal methods in dogs and cats, respectively.

**Post-operative evaluation**

An experienced evaluator assessed pain before (baseline) and 1, 2, 4, 8, and 24 h post-surgery after extubation of the trachea, by the UNESP-Botucatu Multidimensional Composite Pain Scale (UBMCPS) for cats (8) and by the Modified Glasgow Pain Scale (MGPS) for dogs (15). Rescue analgesia was applied upon reaching a score of 33% of the total MGPS for dogs (score ≥ 3.3) and 27% of the UBMCPS for cats (score ≥ 8). For this purpose, morphine (Dimorf; Cristália Produtos Químicos e Farmacêuticos LTDA) was used at doses of 0.3 and 0.5 mg/kg BW, IM, in cats and dogs, respectively. The animals were assessed 30 min after the rescue; this protocol was repeated if necessary.

Sedation was assessed by the sedation score in both species as previously described (16–18), in which 0 = an awake state and 21 = a deeply sedated state. After the last assessment of pain, the animals were treated with meloxicam (orally), the study was terminated, and the animals were released to the owners’ care.

**Statistical analysis**

Data were analyzed using the Shapiro-Wilk test. For the weight, age, and duration of surgery, the t-test for independent samples was used. Fisher’s exact test was used to compare the number of rescue analgesia treatments among groups. All tests were analyzed at the 5% significance level using the statistical software packages (SAS version 9.3; SAS Institute, Cary, North Carolina, USA; Sigmasstat 3.5; Systat Software, San Jose, California, USA; Graphpad Prism 7; GraphPad Software, La Jolla, California, USA).

**Results**

The surgery lasted on average 2.67 ± 0.98, 7.42 ± 2.07, 3.9 ± 1, and 7.42 ± 2.2 min for the male cats, female cats, male dogs, and female dogs, respectively. The duration of surgery for females was longer than that for males in both species (P < 0.0001). Female dogs were older than male dogs (P = 0.008) and male cats were older than female cats (P = 0.01). There was no difference in temperature between genders at the end of surgery (female dogs 37.03 ± 0.51°C, male dogs 36.9 ± 0.69°C, female cats 36.4 ± 0.45°C and male cats 36.9 ± 0.96°C).

Sedation scores were higher compared with the baseline at 1 h post-operation in cats and dogs and the scores were higher at 1 and 2 h for female dogs compared with male dogs.
A total of 11 female cats and 3 female dogs received rescue analgesia ($P = 0.002$). These consisted of 3 female cats at 1 h post-surgery and 8 female cats at 2 h post-surgery and 3 female dogs at 2 h post-surgery. One dog and 1 cat required additional rescue analgesia 30 min after the rescue at 2 h post-surgery. No male of either species required rescue analgesia. The number of rescue analgesias was greater in female ($n = 11$) than in male cats ($n = 0$) ($P < 0.0001$).

## Discussion

The results confirmed the hypothesis that OH produces higher expression of pain, and that female dogs and cats express more pain after OH than males do after orchietomy. Although ovaries and testes have the same innervation, i.e., the genitourinary nerve originates from the L3–L4 segment (19), OH is a more invasive procedure which involves laparotomy. In contrast to a previous study (20), no male of either species required rescue analgesia, most likely due to the use of different pain scales. Otherwise, as in the present study, behavior score was about 30% greater after OH compared to castration in cats (21). We speculate that the factors that most intensify the pain scores for females were the duration and trauma of surgery, the opening and manipulation of the abdominal cavity, the pulling of the ovarian pedicle, and the peritoneal incision, but this warrants further research.

The authors recognize that any evaluation to quantify pain is subjective and although it is difficult to compare genders which might have different behaviors, the present study used a current instrument (MGPS) to assess pain in dogs and a validated scale (UBMCPS) to assess pain in cats, which take into consideration species-specific behaviors, to improve reliability of the data (15,22) and minimize the failure of analgesia in these species. The MGPS and UBMCPS have been commonly used to guide rescue analgesia (1,2,23). In previous studies, the differences between male and female cats subjected to surgical sterilization were not so evident, most likely due to the use of adapted and non-validated scales to assess pain in cats (9,21,24).

Current guidelines recommend trans-operative local anesthesia and the use of NSAIDs for postoperative analgesia after OH (13). In this study, local anesthesia was not used and this was possibly at least one of the reasons why female dogs and cats required supplemental postoperative analgesia. Pre-emptive use of local anesthesia, as recommended by the guidelines, apparently reduces post-operative pain and is important for controlling pain after OH in both cats and dogs, even when the procedure is rapid and performed by an experienced surgeon. It is also important that follow-up pain assessment and potential analgesic requirements be anticipated for any surgical procedure.

The only source of post-operative analgesia was the NSAID, unless there was a need for rescue analgesia. Fentanyl was chosen as a short acting trans-operative opioid, to avoid residual post-operative analgesia. The time to effect of fentanyl is apparently short, as thermal threshold was increased 1 minute after administration of fentanyl, 2 µg/kg BW per min, in neonatal dogs (25). Therefore, by the time the ovarian pedicle was clamped, the analgesic effect of fentanyl was apparently present (26) and by the time post-operative pain was assessed, the effect of fentanyl had abated compared to longer acting opioids (25,26).

Animals receiving rescue analgesia were removed from the data analysis. Because 11 female cats received rescue analgesia, there was an insufficient number of animals available for statistical analysis of postoperative pain scores and results were evaluated on the basis of requirement of rescue analgesia and not on differences in pain scores.

A smaller dose of morphine was used for post-operative analgesia in cats compared to dogs, because previous studies reported that the pharmacokinetics of 0.2 mg/kg BW of morphine in cats (27) was similar to that in dogs (0.5 mg/kg BW) (28,29). The elimination of morphine metabolites in cats is more prolonged than in dogs; therefore, it is usually recommended that smaller doses and longer intervals of administration of morphine be used in cats (13).

One limitation of the present study was that the surgery was rapid and performed by an experienced surgeon, which might have contributed to the low post-operative pain scores. However, when comparing the duration of the surgical procedure, the surgeon's experience, and the size of the incision, only the latter influenced the pain scores in response to palpation of the surgical wound in female dogs subjected to OH (1).

Veterinarians generally assign higher pain scores and provide more analgesic treatment to dogs undergoing surgery than they do to cats (3–5,14,30). Despite evidence of great concern and improvements in the attitudes toward assessing and treating pain in animals (6,30), greater attention should be given to analgesia in cats.

This study showed that one should not rely solely on pre-operative short-acting opioid and pre-emptive use of NSAIDs to control postoperative pain following OH in dogs and cats. Postoperative pain assessment after OH should be performed beyond the 1-hour period and during the period of hospitalization for at least 2 h for cats and 4 h for dogs, using species-specific validated tools, to ensure proper postoperative pain diagnosis and management.

In conclusion, male dogs and cats subjected to orchietomy required less post-operative analgesia intervention than female dogs and cats submitted to OH.

## Acknowledgments

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## References


Sudden acquired retinal degeneration syndrome in western Canada: 93 cases

Marina L. Leis, Danica Lucyshyn, Bianca S. Bauer, Bruce H. Grahn, Lynne S. Sandmeyer

Abstract — This study reviewed clinical data from dogs diagnosed with sudden acquired retinal degeneration syndrome (SARDS) in western Canada. Medical records from the Western College of Veterinary Medicine from 2002 to 2016 showed that 93 cases of SARDS were diagnosed based on presentation for sudden blindness and a bilaterally extinguished electroretinogram. The most common pure breeds were the miniature schnauzer, dachshund, and pug. The mean age at diagnosis was 8.1 years and males and females were equally affected. Most of the dogs were presented with normal non-chromatic, but abnormal chromatic pupillary light reflexes. The incidence of retinal degeneration as detected via ophthalmoscopy increased over time after SARDS diagnosis. Polyuria, polydipsia, polyphagia, weight gain, elevated liver enzyme values, isosthenuria, and proteinuria were common clinical and laboratory findings. Chromatic pupillary light reflex testing may be more valuable than non-chromatic pupillary light testing in detecting pupil response abnormalities in dogs with SARDS, although electroretinography remains the definitive diagnostic test.

Résumé — Syndrome de la rétine silencieuse dans l’Ouest canadien : 93 cas. Cette étude a examiné les données cliniques provenant de chiens diagnostiqués avec le syndrome de la rétine silencieuse (syndrome de cécité soudaine acquise) dans l’Ouest canadien. Les dossiers médicaux du Western College of Veterinary Medicine de 2002 à 2016 ont montré que 93 cas du syndrome de la rétine silencieuse ont été diagnostiqués en se basant sur la présentation pour une cécité soudaine et un électrorétinogramme bilatéral sans incandescence. Les races les plus communes étaient le Schnauzer miniature, le Dachshund et le Pug. L’âge moyen au diagnostic était de 8,1 ans et les mâles et les femelles étaient également affectés. La plupart des chiens présentaient des réflexes pupillaires normaux à la lumière non chromatique mais des réflexes anormaux à la lumière chromatique. L’incidence de la dégénération rétinienne détectée par l’ophthalmoscopie a augmenté au fil du temps après le diagnostic du syndrome de la rétine silencieuse. La polyurie, la polydipsie, la polyphagie, le gain de poids, des valeurs d’enzymes hépatiques élevées, l’isosthénurie et la protéinurie étaient des résultats cliniques et de laboratoire communs. Le réflexe à la lumière pupillaire chromatique peut être plus utile que le test de la lumière pupillaire non chromatique pour détecter les anomalies de la réponse pupillaire chez les chiens atteints du syndrome de la rétine silencieuse, quoique l’électrorétinographie demeure le test diagnostique définitif.

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Introduction

Sudden acquired retinal degeneration syndrome (SARDS) is a prevalent cause of sudden, irreversible blindness in dogs (1–4) associated with apoptosis of photoreceptors of the retina (5,6). The condition was first described in 1984 (7) but despite considerable investigative efforts over the past 3 decades, its etiology and pathogenesis remain elusive.

This syndrome is currently diagnosed based on a history of acute vision loss, a fundic examination that lacks sufficient abnormalities to correlate with the degree of vision loss, and an extinguished electroretinogram indicating a lack of photoreceptor function. Significant retinal degeneration manifests weeks to months following vision loss (1,2,7). Dogs diagnosed with SARDS are frequently overweight, middle-aged or older, small breed, mixed-breed, and predominantly female (2,3,7–9). Breed predilections for SARDS have been reported in miniature schnauzers, cocker spaniels, dachshunds, Maltese, and pugs (2,4).

Affected dogs often present with clinical signs of polyuria, polydipsia, and polyphagia (8–11). Laboratory abnormalities in dogs affected by SARDS frequently include lymphopenia,
neutrophilia, proteinuria, increased serum cholesterol, alkaline phosphatase, aspartate aminotransferase, and alanine aminotransferase (1,2,8,9,11); however, it is uncertain how these are related to the disease. This syndrome is rarely a cause for enucleation or euthanasia (3) and affected eyes, therefore, are seldom available for histologic examination. Secondary ocular complications have not been reported with SARDS and most dogs adapt well to blindness. Consequently, many affected dogs are not re-evaluated by a veterinarian and are lost to follow-up.

In 2015, members of the American College of Veterinary Ophthalmologists identified SARDS as the ophthalmic condition with both the greatest requirement for, and potential benefit to be gained from, further research (1). There have been no SARDS-related studies conducted in Canada; therefore, this retrospective case series provides a valuable baseline for further research in addition to improving our understanding of SARDS within the broader global context. The objective of this study was to describe the signalment, onset, and duration of blindness, ocular examination abnormalities, and clinicopathologic findings of dogs diagnosed with SARDS at the Western College of Veterinary Medicine (WCVM).

Materials and methods

Electronic and paper medical records were searched to identify dogs diagnosed with SARDS at the WCVM in Saskatoon, Saskatchewan from January, 2002 to November, 2016. All cases met the study’s inclusion criteria of having a diagnosis of SARDS based on presentation for blindness, an ophthalmic examination performed by a diplomate of the American College of Veterinary Ophthalmologists, a fundic examination that was either normal or mildly altered, and a bilaterally extinguished electroretinogram (ERG). Exclusion criteria included a duration of blindness prior to ophthalmic examination exceeding 6 mo, ERG recordings revealing asymmetrical retinal function, and fundic examination revealing moderate to severe retinal degeneration that could explain vision loss.

Data collected for each case meeting the inclusion criteria included signalment, geographic origin of the dog, month and year of presentation, concurrent systemic disease, medications and vaccinations administered 6 mo before diagnosis, ophthalmic examination findings, nature and duration of vision loss, pupillary light reflexes including chromatic pupillary light reflexes when available, and laboratory findings when available. The proportion of animals that had data available for each parameter was determined. Confidence intervals (95% CI) for proportions of each parameter were generated with R (version 3.3.1) statistics package. Means and standard deviations were calculated for age and duration of blindness before presentation, using SPSS version 24 (IBM, Armonk, New York, USA). A Mann-Whitney U-test for nonparametric data was used to compare the median duration of blindness in dogs with and without fundic changes using SPSS version 24 (IBM, Armonk). Statistical significance was set at \( P < 0.05 \).

Results

Ninety-three dogs met the inclusion criteria. Purebred dogs comprised 63.4% (59/93; 95% CI: 52.7 to 73.0) of the study population and were more common than crossbred dogs at 36.6% (34/93; 95% CI: 27.0 to 47.2). The most common breeds represented were the miniature schnauzer (12.9%, 12/93; 95% CI: 7.1 to 21.8), dachshund (10.8%, 10/93; 95% CI: 5.5 to 19.3), pug (9.7%, 9/93; 95% CI: 4.8 to 18.0), cocker spaniel (4.3%, 4/93; 95% CI: 1.2 to 11.2), Maltese (3.2%, 3/93; 95% CI: 1.3 to 10.0), and Jack Russell terrier (3.2%, 3/93; 95% CI: 1.2 to 11.2). The most common signalment comprised 63.4% (59/93; 95% CI: 52.7 to 73.0) of the study population. Males comprised 63.4% (59/93; 95% CI: 52.7 to 73.0) of the study population. Males comprised 63.4% (59/93; 95% CI: 52.7 to 73.0) of the study population. Males comprised 63.4% (59/93; 95% CI: 52.7 to 73.0) of the study population. Males comprised 63.4% (59/93; 95% CI: 52.7 to 73.0) of the study population. Males comprised 63.4% (59/93; 95% CI: 52.7 to 73.0) of the study population. Males comprised 63.4% (59/93; 95% CI: 52.7 to 73.0) of the study population.

Table 1. Proportions of the most common breeds diagnosed with SARDS and proportions of those same breeds examined by the Ophthalmology Service during the study period.

<table>
<thead>
<tr>
<th>Breed</th>
<th>SARDS</th>
<th>Ophthalmology referrals</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>% (n/total)</td>
<td>95% CI</td>
</tr>
<tr>
<td>Miniature schnauzer</td>
<td>12.9 (12/93)</td>
<td>7.1 to 21.8</td>
</tr>
<tr>
<td>Dachshund</td>
<td>10.8 (10/93)</td>
<td>5.5 to 19.3</td>
</tr>
<tr>
<td>Pug</td>
<td>9.7 (9/93)</td>
<td>4.8 to 18.0</td>
</tr>
<tr>
<td>Cocker spaniel</td>
<td>5.4 (5/93)</td>
<td>2.0 to 12.6</td>
</tr>
<tr>
<td>Shih tzu</td>
<td>4.3 (4/93)</td>
<td>1.2 to 11.2</td>
</tr>
<tr>
<td>Maltese</td>
<td>3.2 (3/93)</td>
<td>0.8 to 10.0</td>
</tr>
<tr>
<td>Jack Russell terrier</td>
<td>3.2 (3/93)</td>
<td>0.8 to 10.0</td>
</tr>
</tbody>
</table>

As described by owners, the onset of blindness in SARDS dogs was sudden in 93.7% of cases (59/63; 95% CI: 83.7 to 97.9), progressive in 4.8% (3/63; 95% CI: 1.2 to 14.1), and episodic in 1.6% (1/63; 95% CI: 0.08 to 9.6). Duration of blindness was measured from the time the owners reported noticing their dog first went blind, as recorded in the medical history.
until the time of SARDS diagnosis. The mean duration of blindness prior to SARDS diagnosis was 36 +/− 4.5 d (n = 78; 95% CI: 27.5 to 45.4). Pupillary light reflexes (PLRs) with a white light were normal in 69.9% of cases (65/93; 95% CI: 59.3 to 78.7), incomplete in 25.8% (24/93; 95% CI: 17.5 to 36.1), and absent in 4.3% (4/93; 95% CI: 1.4 to 11.2). Chromatic or colorimetric PLR data were available for 12.9% of cases (12/93).

Of these, PLRs with a red light were normal in 8.3% of cases (1/12; 95% CI: 0.4 to 40.2), incomplete in 33.3% (4/12; 95% CI: 11.2 to 64.5), and absent in 58.3% (7/12; 95% CI: 28.5 to 83.5). Pupillary light reflexes with a blue light were normal in 91.7% of cases (11/12; 95% CI: 59.7 to 99.5), incomplete in 8.3% (1/12; 95% CI: 0.4 to 40.2), and absent in none. Excluding age-related findings, cataract (37.6%, 35/93; 95% CI: 28.0 to 48.3) was the most common finding where incipient cataract was predominant (34%, 32/93; 95% CI: 25.0 to 45.0).

Other concurrent ocular findings included corneal abnormalities (25.8%, 24/93; 95% CI: 17.5 to 36.1), conjunctival hyperemia (18.3%, 17/93; 95% CI: 11.3 to 28.0), adnexal abnormalities (15.1%, 14/93; 95% CI: 8.7 to 24.3), vitreal abnormalities (14.0%, 13/93; 95% CI: 8.0 to 23.0), and keratoconjunctivitis sicca (4.3%, 4/93; 95% CI: 1.4 to 11.2). A normal fundus examination was recorded in 52.7% (49/93; 95% CI: 42.1 to 63.0) of cases. Ophthalmoscopic abnormalities observed in the remainder of cases included mild tapetal hyperreflectivity and/or mild vascular attenuation (34.4%, 32/94; 95% CI: 25.0 to 45.0), altered tapetal reflectivity (14.0%, 13/93; 95% CI: 7.9 to 23.0), and pinpoint retinal hemorrhage (2.2%, 2/93; 95% CI: 0.3 to 8.2). The median duration of blindness from cases without fundus changes was 14 +/− 4.5 d (n = 41) and differed significantly from the median duration of blindness from cases with fundus changes [30 +/− 7.8 d (n = 37) (P = 0.009)].

Information regarding medications or vaccines administered 6 mo prior to SARDS diagnosis was available for 38 dogs (40.9%). Of these animals, 36.8% (14/38; 95% CI: 22.3 to 54.0) received no medications and 63.2% (24/38; 95% CI: 46.0 to 77.7) received medications. A total of 31.6% of dogs (12/38; 95% CI: 18.0 to 48.8) received topical and/or systemic antibiotics, 28.9% (11/38; 95% CI: 16.0 to 46.1) received topical and/or systemic anti-inflammatory medication, and 5.3% (2/38; 95% CI: 0.9 to 19.0) received medication for hyperadrenocorticism in the 6 mo before diagnosis of SARDS. Dogs that were vaccinated 6 mo prior to diagnosis comprised 15.8% (6/38; 95% CI: 6.6 to 31.9) of cases.

Information regarding the presence of polyuria, polydipsia, polyphagia, and weight gain was available for 29.0% (27/93) of cases. Of these animals, 66.7% (18/27; 95% CI: 46.0 to 82.7) were polyuric and polydipsic, 51.9% (14/27; 95% CI: 32.2 to 70.8) were polyphagic, and 48.1% (13/27; 95% CI: 29.5 to 67.6) gained weight. Data were available for the presence or absence of concurrent systemic disease in 40.0% (37/93) of cases. Of these, 24.3% (9/37; 95% CI: 12.3 to 41.5) had urinary tract disease, 18.9% (7/37; 95% CI: 8.5 to 35.7) had dermatologic disease, 13.5% (5/37; 95% CI: 5.1 to 29.5) had gastrointestinal disease, 10.8% (4/37; 95% CI: 3.5 to 26.3) had cardiovascular disease, 5.4% (2/37; 95% CI: 0.9 to 19.5) had orthopedic disease, and 2.7% (1/37; 95% CI: 0.1 to 15.8) had diabetes mellitus. Among 6 dogs evaluated by adrenocorticotropic hormone stimulation testing (n = 3) or low dose dexamethasone suppression testing (n = 3), 2 were diagnosed with hyperadrenocorticism (5.4%, 2/37; 95% CI: 0.9 to 19.5). The dogs that tested positive for hyperadrenocorticism were not retested following their initial diagnosis.

The most common biochemical abnormality was an increase in 1 or more liver enzymes [alanine aminotransferase (ALT), alkaline phosphatase (ALP), gamma-glutamyltransferase (GGT), glutamate dehydrogenase (GLDH), sorbitol dehydrogenase (SDH)] (71.4%, 15/21; 95% CI: 47.6 to 87.8) and hypercholesterolemia (47.6%, 10/21; 95% CI: 26.4 to 69.6). Where data were available, dogs diagnosed with SARDS with an abnormal USG (< 1.020) comprised 41.2% (7/17; 95% CI: 19.4 to 66.5), whereas dogs with a normal USG comprised 58.8% (10/17; 95% CI: 33.5 to 80.6). Of these 17 dogs, 76.5% had proteinuria (13/17; 95% CI: 50.0 to 92.2) and 23.5% did not have proteinuria (4/17; 95% CI: 7.8 to 50.2). Urine culture results were negative for all 5 dogs for which the test was performed.

Discussion

The proportions of breeds affected by SARDS in this study were consistent with similar reports indicating a preponderance for mixed breeds and pure breeds including dachshunds, miniature schnauzers, pugs, cocker spaniels, and Maltese (2–4,9,12–14). When considering all pure breeds as a group, our results indicate that pure breed dogs are more commonly affected than are mixed breed dogs. The mean age at SARDS diagnosis in our study was 8.1 y, which is similar to other reports in which the mean age at the time of SARDS diagnosis was between 8 and 9 y (2–4,8,9,12–14). Females are often said to be overrepresented in dogs with SARDS (3,4,8,9); however, the proportion of females in our study was 51.6% which aligns with other reports in which no gender predilection was found (2,12). Most of the dogs we examined originated from Saskatchewan, and the provincial distribution of cases observed in the study is a result of the geographic location of the veterinary hospital and reflective of our general referral population. Similar to other studies (3), we observed an even distribution of SARDS cases over the course of the year which argues against seasonality as a factor in the incidence of SARDS, contrary to the original SARDS report in which clustering in December and January was observed (7).

The onset of blindness as reported by owners was sudden in most cases, which is an expected historical finding in SARDS. Seventy percent of dogs in our study had normal pupillary light reflexes, 25% had reduced pupillary light reflexes, and 5% had absent pupillary light reflexes in response to a non-chronic, white light stimulus. Though this contradicts the generally accepted notion that the majority of SARDS dogs present with diminished pupillary light reflexes in response to white light (1,2,7), surprisingly little data are published on expected pupillary light reflexes in SARDS dogs. Differentiating rod-cone mediated pupillary light reflexes from intrinsic melanopsin-mediated pupillary light reflexes can be achieved by comparing pupil responses to red and blue light as red light has a wavelength that does not overlap with melanopsin sensitivity.
(15). As such, pupillary light reflexes in healthy canine eyes are elicited with red and blue lights but in dogs with SARDS are only elicited by high-intensity blue light. This was shown in a study in which dogs with SARDS displayed miosis while dogs with optic pathway disease displayed mydriasis in response to a blue light stimulus (13). In our study, chromatic pupillary light reflex testing was initiated in the latter period of the study and thus performed on a small number of dogs but showed that only 8% had a normal pupillary light reflex with red light and over 90% had a normal pupillary light reflex with blue light. Our results, combined with previous studies, suggest that though colorimetric pupillary light reflexes are not completely reliable, they may be more useful than conventional white light-elicited pupillary light reflexes in the detection of pupil response abnormalities in dogs with SARDS. In addition, it is important to note that this specific chromatic pupillary light reflex finding is also observed in diseases such as retinal detachment in which the outer retina is affected and the inner retina remains intact (15). Thus, an extinguished electroretinogram in the face of a normal ophthalmoscopic examination is required to attain a definitive diagnosis of SARDS.

The most common concurrent ocular abnormality detected in our study was cataract at a rate affecting 38%, the majority of which were incipient in nature, which is comparable to other studies reporting concomitant cataract (2,8). Conjunctival hyperemia was found in 18% of dogs in our study, similar to a previous study which reported that 27% of dogs with SARDS displayed conjunctival hyperemia (2). Adnexal and corneal abnormalities were also reported in our study but, similar to other observed ocular comorbidities, were thought to be incidental findings. Fundic examinations revealed mild retinal degeneration manifested by mild tapetal hyperreflectivity and mild retinal vascular attenuation in 34% of cases, which is a similar proportion to some reports (2,9) but lower than other reports (7,8). The higher proportion of dogs with clinically observable retinal degeneration in these latter studies may be due to a longer duration of disease before examination. Indeed, the duration of blindness before diagnosis of SARDS was significantly longer in dogs with fundic changes (30 d) than in dogs with normal fundic examinations (14 d) in our study. This finding is in agreement with reports of ophthalmoscopic signs of retinal degeneration being visible only weeks to months after diagnosis of SARDS (1,7,15). Unlike ophthalmoscopic signs of retinal degeneration, pinpoint retinal hemorrhage observed in 2 cases were considered incidental findings. Despite a lack of follow-up, it is our impression that SARDS is a quiet ocular disease that does not result in secondary ocular complications (9).

Little data are available regarding exposure to medications, vaccines, or toxins prior to diagnosis of SARDS. The most common medications dogs with SARDS were administered in the 6 mo before diagnosis were topical or systemic antibiotics and topical or systemic anti-inflammatory agents. Sixteen percent of dogs were vaccinated in the 6 mo before diagnosis of SARDS. Conclusive evidence that there is a link between exposure to medicinal compounds and SARDS has yet to be presented.

Polyuria, polyphagia, polydipsia, and obesity are consistent findings in dogs with SARDS (2,3,7–9,11,16). In the cases for which data were available in our study, 67% were polyuric and polydipsic, half were polyphagic, and half had reported weight gain. Polyuria and polydipsia seem to be specific to dogs with SARDS as a previous study found polyuria and polydipsia to be reported in 38% of dogs with SARDS and only 5% of dogs with blindness due to neurologic disease (2). Conversely, obesity is a widespread clinical finding regardless of the presence or type of systemic disease and therefore is a nonspecific finding. Adipose tissue is an endocrine organ capable of both being influenced by glucocorticoids and causing hyperactivation of the hypothalamic-pituitary-adrenal axis and therefore multiple interactions may be at play (17–19). The literature often refers to hyperadrenocorticism-like clinical signs in dogs with SARDS and an association with hyperadrenocorticism (9). Interestingly, dogs with hyperadrenocorticism concurrent to noncompressive acute vision loss (SARDS-like) were reported to have elevated serum concentrations of cortisol, triglycerides, and glucose compared to dogs with hyperadrenocorticism without vision loss (10). The authors of this study proposed that these serum changes may have resulted in the observed altered retinal blood flow and may play a role in the pathogenesis of blindness in their study population. Despite these reports, hyperadrenocorticism is infrequently diagnosed in dogs with SARDS (1,3) and likewise, only 2 dogs in our study were diagnosed with and were receiving treatment for hyperadrenocorticism. It has also been suggested that a single adrenal function test in a case of SARDS is not definitive evidence of concurrent hyperadrenocorticism due to changes in the hypothalamic-pituitary-adrenal axis that may be a result of stress or other unrelated illness (11). Indeed, it is our impression that a positive test for hyperadrenocorticism warrants repeat testing to exclude a transient, stress-related response.

The most common systemic comorbidity identified in our study was urinary tract disease, followed by dermatologic disease and gastrointestinal disease. A plethora of systemic diseases has been reported to be present in conjunction with SARDS, including cardiovascular disease, hypersensitivity-related diseases, endocrinopathies, and periodontal disease (2,3,8) and are therefore thought to be incidental findings rather than playing a role in etiopathogenesis. The most common serum biochemical abnormality herein was an elevation of liver enzymes and hypercholesterolemia, which aligns with reports of patients with SARDS having a subclinical hepatopathy (2,7,8,14,16). An increased incidence of isosthenuria and proteinuria has also been reported similar to our study (2,8,9). However, age and breed matched control dogs were not represented in our study.

There is limited evidence to suggest that an immune-mediated process is at the root of the development of SARDS, resembling cancer-associated retinopathy in humans. Specifically, neuron-specific enolase autoantibodies were detected in 25% of the dogs with SARDS and not in the control animals, although it is unclear whether these were a cause or a result of outer retinal pathology (16). Other evidence suggesting an immune-mediated etiology for SARDS is relatively outdated (5,20) or non-peer-reviewed (21). More recent studies have been unsuccessful in demonstrating identifiable anti-retinal autoantibodies in the serum of dogs affected by SARDS compared with normal
dogs (12,14). Despite a lack of convincing evidence to support an immune-mediated process, intravenous immunoglobulin has been administered as therapy for dogs with SARDS and is purported to restore some degree of vision (21,22).

Limitations of the present study include inconsistently performed diagnostic workups for the majority of cases as well as inherent limitations that accompany retrospective studies. However, our report exceeds the case numbers of most retrospective studies published to date and is also the first retrospective report on SARDS in Canada. The data presented herein are useful as a descriptive baseline for future studies but, in the absence of control animals, must be interpreted carefully and within the general ophthalmology referral population.

In conclusion, dogs diagnosed with SARDS in western Canada had a similar clinical picture to previously reported cases of SARDS and corroborates the preponderance of middle-aged, small breeds that present with signs of polyuria, polydipsis, and have subtle clinicopathologic abnormalities. Chromatic pupillary light reflex testing may be more valuable than non-chromatic pupillary light testing in detecting pupil response abnormalities in dogs with SARDS; however, electroretinography is indispensable for diagnosing SARDS. Future directions for research include advanced diagnostic imaging such as optical coherence tomography and genetic studies, given the preponderance of SARDS in certain breeds.

References
Review Article  Compte rendu

Basics of monitoring equipment

Tanya Duke-Novakovsky

Abstract — Monitoring equipment has become reliable and affordable for use in general veterinary practice. This article provides a guide to technology, troubleshooting, and obtaining quality data using 4 non-invasive techniques that are commonly used in practice. Pulse oximetry estimates oxygen saturation of hemoglobin in arterial blood, capnography measures the carbon dioxide content of inspired and expired gas, and either Doppler shift detection or oscillometry can be used to measure blood pressure. These useful non-invasive techniques all rely on adequate perfusion of the tissues for optimum function.

Résumé — Éléments fondamentaux de l’équipement de monitorage. L’équipement de monitorage est devenu fiable et abordable pour utilisation dans la pratique vétérinaire générale. Le présent article présente un guide sur la technologie, le diagnostic de panne et l’obtention de données de qualité en utilisant quatre techniques non invasives qui sont communément utilisées en pratique. L’oxymétrie pulsée estime la saturation en oxygène de l’hémoglobine dans le sang artériel, la capnographie mesure le contenu en gaz carbonique du gaz inspiré et expiré et la détection du déplacement Doppler ou l’oscillométrie peut être utilisée pour mesurer la pression artérielle. Ces techniques non invasives s’appuient toutes sur une perfusion adéquate des tissus pour une fonction optimale.

Introduction

Although a vigilant staff member can ensure a suitable depth of anesthesia in a patient using a “hands-on” approach, monitoring equipment can provide objective data to aid decision-making and anesthetic management. Four non-invasive techniques will be discussed and readers will be given a guide to the technology that is involved, troubleshooting, and obtaining quality data with these techniques. For all the methods discussed, adequate tissue perfusion is required to obtain reliable measurements. If the monitor cannot provide an accurate measurement, or it malfunctions or displays an error message, it may indicate tissue perfusion is compromised, and the animal’s physical condition should be checked by the attendant before dismissing the monitor as problematic. If more than one monitor simultaneously malfunctions, a potential cardiopulmonary collapse may be imminent or has occurred.

Pulse oximetry

Pulse oximetry continuously estimates the average saturation of hemoglobin (Hb) with oxygen (SpO₂) in pulsatile arterial blood (1). The pulse oximeter does not display the SpO₂ of venous blood because the veins do not have pulsatile flow. The ability of oxygen molecules to bind to Hb is related to the partial pressure of oxygen dissolved in plasma (pO₂) and this relationship is described by the oxygen Hb dissociation curve (Figure 1). The pO₂ of arterial blood (PaO₂) is dependent on the concentration of inspired oxygen, adequate lung ventilation and perfusion, and the ability of oxygen to diffuse across the alveolar/capillary junction. The PaO₂ in a healthy conscious mammal breathing air (21% oxygen) is normally in the range of 85 to 110 mmHg (11.3 to 14.7 kPa) and corresponds to an oxygen saturation value of 98% to 100% on the Hb dissociation curve and pulse oximeter (Figure 1). Hypoxemia is present when there is a PaO₂ < 60 mmHg (8 kPa) and this corresponds to an SpO₂ value of < 90% on the pulse oximeter (Figure 1). Normally, venous blood has a PvO₂ of 40 mmHg (5.3 kPa) and a corresponding oxygen saturation of 75% (Figure 1). There is some species variation with shape of the curve, and the curve can slightly shift to the left or right depending on whether the blood is passing through tissue beds (warmer, lower pH) or is contained within the pulmonary circulation (cooler, higher pH). Most pulse oximeters are programmed with the oxygen Hb dissociation curve for humans, and therefore may not be accurate in species with different curve characteristics, for example with avian blood.
A healthy mammal should normally have a $\text{PaO}_2$ of approximately 5 times the inspired oxygen concentration (in percent) (2–4). For example, an animal breathing 100% O$_2$ should have a $\text{PaO}_2$ of approximately 500 mmHg (66.7 kPa). $\text{PaO}_2$ values greater than 110 mmHg (14.7 kPa) cannot produce an oxygen saturation value higher than 100%. The only method to measure pO$_2$ in an arterial or venous blood sample is to use a wet-chemistry analyzer or point-of-care dry-chemistry cartridges. It is worth noting that if SpO$_2$ is 98% to 100%, the PaO$_2$ could lie anywhere between 100 mmHg (13.3 kPa) and approximately 500 mmHg (66.7 kPa) depending on efficiency of oxygen uptake within the lungs. If the animal is breathing 100% oxygen and the PaO$_2$ is only 100 mmHg (13.3 kPa), this would indicate a severe reduction in oxygen uptake. If the problem is not resolved and the animal then breathes air, there will be a decrease in PaO$_2$ to hypoxicemic levels. Therefore in some cases, knowing the value of PaO$_2$ can be important for case management and a blood gas analyzer is then used alongside a pulse oximeter.

The pulse oximeter has 2 light-emitting diodes (LEDs) which emit red (660 nm) and infrared (range: 905 to 950 nm) light and a photosensor positioned opposite the LED (transmittance probe). As the light passes through tissues, a certain amount is absorbed and less light is detected. The amount of light absorbed depends on the type of Hb and the wavelength of light. The LED cycles between switching each of the diodes on and off, and both are switched off many times a second in order to compare the light absorption at different periods of the cardiac cycle, and between the 2 different light wavelengths. De-oxyhemoglobin will absorb a different amount of each wavelength compared to oxyhemoglobin. The software algorithms calculate the percentage oxygen saturation of pulsatile arterial Hb by removing the background absorption from the tissue bed and non-pulsatile venous blood. The device takes about 5 to 10 s (several cardiac cycles) to search for a useful signal before it will provide a measurement and signal quality (strength) can be displayed using light bar indicators or by displaying the waveform (plethysmograph) (Figures 2, 3). Otherwise, the monitor may display error messages such as “artifact” or “poor signal.” The saturation measured is linked to an audible tone which decreases in frequency as the saturation falls. This audible signal can provide an alert for those not able to observe the visual signal.

The ear lobe transmission probes used for humans are useful for animals, whereas finger transmission probes can be more difficult to use (5). Ear lobe probes can be placed where well-perfused vascular tissue with a similar thickness to a human ear lobe can be sandwiched between the LED and photosensor. For anesthetized small animals the most commonly used sites include the tongue, lips, paws, vulva, and prepuce. This tissue thickness may be found in the center of a cat’s tongue or the lateral edge of a large dog’s tongue. With transmission probes, ensure the LED and photosensor are positioned directly opposite each other so there is no distortion of the signal. Ensure
the probe is not slipping off the tissue (Figure 2) because the photosensor in older first generation pulse oximeters can detect ambient light and produce erroneous measurements (approximately 85%) (1,5). Place the photosensor on the upper side of the tongue and the LED on the lower side to prevent the receiver detecting overhead artificial lighting. Placing wet gauze swabs between probe and tongue may improve signal quality by enhancing tissue perfusion, preserving correct alignment of the LED/photosensor or by shielding the photosensor from ambient light (6). Reflectance probes (Figure 2) can be placed on the hard palate, underside of the tail, within the rectum or esophagus or where a Doppler probe is often positioned on the front or back leg. The LED and photosensor are on the same plane and the LED sends light through vascular tissue and is reflected from a bony background to the photosensor.

Signal quality and strength can be shown by bar-indicators or by displaying the waveform. The ability of the software to isolate the signal of interest (arterial blood) from background tissue absorption of light depends on quality of arterial blood flow. Inability to detect a good signal quality can indicate the presence of severe hypotension and/or hypovolemia, or peripheral vasconstriction which could arise from use of alpha, agonist drugs or from hypothermia (7). Bradycardia, tachycardia, and cardiac arrhythmias can also interfere with signal quality. Anemia (packed cell volume < 10%) causes under-estimation of the true Hb saturation by an average of 5.4% in dogs, but may alert the clinician earlier to problems of oxygenation and oxygen delivery (8). The ability to detect a strong signal can also depend on the model and species in which each model is used, and may be due to the site of probe placement (9). Older pulse oximeters tend to become more inaccurate at Hb oxygen saturation < 70% (7). Second and third generation pulse oximeters compensate for motion artifact and perfusion states, respectively, but these may not be any better than first generation pulse oximeters in dogs (10). Dark pigmented areas also appear to interfere with signal quality in animals (5). The pulse oximeter cannot be used during cardiopulmonary resuscitation (CPR) when there is poor pulsatile flow even with good CPR technique.

The pulse oximeter cannot differentiate abnormal types of Hb [carboxyhemoglobin and methemoglobin (MetHb)] from normal de-oxyhemoglobin and oxyhemoglobin (11). Carbon monoxide poisoning forms carboxyhemoglobin and this can interfere with the ability of conventional pulse oximeters to accurately measure oxyhemoglobin saturation. The oxidation of ferrous iron (Fe²⁺) to ferric iron (Fe³⁺) results in MetHb and Fe³⁺ is incapable of carrying oxygen: it is normally present in concentrations of less than 1% in arterial blood. MetHb also shifts the O₂ dissociation curve of the Fe³⁺ form of Hb to the left (increasing O₂ affinity for Hb, decreasing O₂ release) and further affecting O₂ delivery to tissues. High concentrations of MetHb give blood a bluish or chocolate brown color. Pulse oximeters are available which use multiple wavelengths of light; these can detect these different types of Hb and have many other useful functions (http://www.masimo.com/Rainbow/about.htm). This model may be useful for monitoring animals with smoke inhalation (carboxyhemoglobin) or animals which have received an overdose of drugs (acetaminophen, prilocaine, benzocaine, sulfonamides, metoclopramide) or ingested toxins (onions, garlic, mothballs) which can promote formation of MetHb, especially in cats. It can also assess the signal strength and quality and relate it to the amount of tissue perfusion; this is called the perfusion index (PI) by the manufacturer (Figure 3) and has been found to be higher in dogs sedated with vasodilatory acepromazine compared to dexmedetomidine which produces peripheral vasconstriction (12). An increase in PI has been used to confirm successful blockade of the sciatic nerve by placing the probe on the lower extremity of the blocked hindlimb in dogs (13). The unit can also provide the plethysmograph variability index (PVI) which measures the variability within the pulse oximeter waveform during the inspiratory and expiratory phases of mechanical ventilation. Positive pressure lung ventilation can decrease venous return (and therefore cardiac output) and this effect can be severe in individuals with inadequate circulating volume. A high degree of variability indicates fluid therapy may be warranted to increase venous return and therefore cardiac output. Currently, the PVI is under investigation in anesthetized, mechanically ventilated, and volume-depleted dogs with promising results (14). This device can also estimate hemoglobin concentration and has been found to be useful in humans, but is not as reliable in anesthetized dogs (12).

The color of mucous membranes can be used to assess oxygenation by an observer, but the ability to recognize the blue color of de-oxygenated blood depends on the person’s ability to see and appreciate the color change, and on ambient lighting conditions. Furthermore, once the mucous membranes have an observable blue coloration, the animal is already severely hypoxemic. In general practice, pulse oximetry is useful to guide oxygen therapy and to monitor oxygenation during anesthesia. Hypoxemia is most likely to occur during heavy sedation, anesthetic induction, and during the recovery period when animals are often breathing an inspired oxygen concentration of 21% (air) instead of a higher inspired O₂ concentration (4,15). The pulse oximeter is useful for animals in respiratory distress and indicates when O₂ therapy is urgently required.

**Capnography**

Diverting or sidestream capnography continuously samples gases for carbon dioxide (CO₂) concentration in respiratory gases at the point where the endotracheal tube is attached to the breathing system during all phases of the respiratory cycle (4,16,17). A sampling port and tubing are used to aspirate the gas (50 to 200 mL/min) to the sampling cell housed within a monitor positioned away from the animal. The device uses infrared light absorption technology to measure the amount of CO₂ present in the sampling cell. The sampling line for sidestream capnography may be available in different lengths and long lines can delay the response time with a low sampling flow rate. Longer lines are often used where the monitor has to be placed far away from the patient. Most units have high sampling flow rates which cause inaccurate end-tidal CO₂ (ETCO₂) values with very small patients and high respiratory rates, and only a few units can allow the sampling flow rate to be lowered. Microstream devices using laser technology are now available which use sampling flow rates of 50 mL/min.
Water vapor can interfere with the measurement of CO₂ concentration and filters or water traps are used with sidestream devices (16). Sidestream capnographs should be connected to a waste gas scavenging system because the sampled gases also contain anesthetic agents, or should return the gases to the breathing system. Calibration gases may be required for some sidestream devices and others require calibration using ambient air before use (http://www.midmarkanimalhealth.com/products/monitoring). The infra-red analyzer may also be placed directly within the breathing system (non-diverting or mainstream capnography) (16). Mainstream devices use heat to prevent water vapor from forming, but these can still be prone to malfunction because of water condensation (16,17). These devices are bulky and can cause disconnections or place excessive traction on an insecure endotracheal tube. Mainstream units have a rapid response time, require no or few consumables, and do not remove gases from the breathing system. One mainstream capnograph was found to be slightly more accurate in measuring PaCO₂, compared to a sidestream capnograph in mechanically ventilated dogs, although both units were clinically useful (17). Measurements can be displayed graphically or by lighting diode bars (Figure 4). Nitrous oxide can cause overestimation of the CO₂ concentration and newer models automatically correct for the presence of this gas in the breathing system (18). On some older models, this correction needs to be done manually.

Inspired gas should be free of CO₂ and expired gases should have a high CO₂ concentration (4). The ETCO₂ is the point at which the last portion of alveolar gas is exhaled and just before the animal begins inspiration (Figure 5). The measurement of ETCO₂ represents the arterial partial pressure of CO₂ (PaCO₂). The ETCO₂ may be lower than PaCO₂ by 1 to 3 mmHg (0.1 to 0.4 kPa) in healthy anesthetized dogs (16,19) and cats. Capnographs can display the pCO₂ (mmHg or kPa) or can be programmed to display the percentage by volume of CO₂ compared to the entire gas sample. To derive the pCO₂ from percent values, divide the percentage by 100 and multiply the result by ambient atmospheric pressure. For example, 5% CO₂ is equivalent to 38 mmHg (5.1 kPa) at sea level.

Normal PaCO₂ ranges from 35 to 45 mmHg (4.7 to 6.0 kPa) and the respiratory center in the pons/medulla mainly controls lung ventilation by detecting changes in cellular pH related to PaCO₂ (16). This area of the brain is depressed during anesthesia and hypoventilation will produce a higher than normal PaCO₂ (Figure 6). Hypercapnia [ETCO₂ > 50 mmHg (7.3 kPa)] should be treated with mechanical lung ventilation or by continual hand ventilation if reducing depth of anesthesia is not an option. If mechanical ventilation is routinely applied, it is important that blood pressure is also assessed because mechanical ventilation can reduce venous return to the heart, especially in animals with circulating volume deficits (20). Some debilitated animals such as those with increased intracranial pressure may require strict control of lung ventilation and PaCO₂.

Severely low pulmonary perfusion can reduce delivery of CO₂ to the alveoli and result in a low ETCO₂ measurement, despite concurrent hypercapnia. A sudden drop in ETCO₂ of more than 15 mmHg (2 kPa) may indicate impending cardiac arrest because the cardiac output from the right side of the heart may have suddenly decreased lung perfusion. Conversely, during CPR, the capnograph can reveal the effectiveness of CPR attempts by indirectly assessing pulmonary perfusion and delivery of CO₂ to the alveoli. An ETCO₂ of > 10 mmHg (1.6 kPa) indicates good technique, but this value cannot compare with normal physiology (16,21).

Severe hypoventilation, apnea, or accidental endobronchial intubation can cause hypercapnia [ETCO₂ > 80 mmHg (10.7 kPa)], which can also result from breathing equipment failure. If the breathing system or an incompetent expiratory valve is not efficiently removing exhaled CO₂ to the scavenging system, the animal will rebreathe previously exhaled CO₂. An
The indication of breathing system failure to remove CO$_2$ will be observed as a high inspired CO$_2$ concentration (Figure 6). The high inspired CO$_2$ concentration will immediately direct the practitioner to fix the problem (low fresh gas flows, faulty one-way valves, or exhausted CO$_2$ absorber). If the sampling point is placed within an area of large apparatus dead space, the inspired CO$_2$ will also be higher compared to an arrangement with less apparatus dead space. Inspired levels of $> 10$ mmHg ($1.3$ kPa) require intervention to lower the inspired CO$_2$, whatever the cause (16).

When using a facemask applied to the animal, a catheter attached to the sidestream sampling line inserted into the face-mask with the distal end by the nares can be used to measure CO$_2$. Watching the capnograph can also aid the accurate placement of an endotracheal tube for example, tracheal intubation of rabbits.

In awake animals receiving oxygen therapy using bilateral nasal lines, ETCO$_2$ can be measured using one of the nasal lines (22). Flow of oxygen from the contralateral nasal line will not interfere with accuracy, but the ETCO$_2$ measurement is not reliable if the dog is panting. This system is also prone to water condensation blocking the sampling line.

Measurement error can be introduced by placing the gas sampling point close to a rapid egress of fresh gas from the breathing system resulting in dilution of the sampled gas (16). This is common with use of non-rebreathing systems, especially the Bain system, in cats and small dogs. A more reliable measurement can be obtained by placing a well-sealed and long intravenous catheter through the sampling port so the distal end of the catheter resides in the region of the proximal portion of the endotracheal tube and away from the fresh gas outlet (Figure 7).

A capnograph provides more information on lung ventilation, but observation of chest excursion and adequate breathing bag movement is still important. Signs of severe hypercapnia are tachycardia, deep red mucous membrane color, bounding pulse quality, and incisional oozing of blood. An increase in respiratory rate may be observed where there is breathing system failure. These signs may be more difficult to appreciate in cats or
debilitated animals and the observer must determine the cause of hypercapnia. A capnograph is useful for rapid detection of severe hypercapnia and can clearly indicate the origin of hypercapnia such as from the animal (apnea, hypoventilation) or equipment failure (breathing system malfunction) (16).

Volumetric capnography is an extension of this technology and incorporates the measurement of expired volumes using a pneumotachograph, with simultaneous measurement of exhaled CO₂ concentration. This device can provide information on dead space within the lung which may be important in pulmonary disease and long-term ventilator management of critically ill cats and dogs in the future (23).

Non-invasive blood pressure measurement
The 2 main non-invasive techniques for measuring systemic blood pressure use either an ultrasonic probe or oscillometers (24). Both rely on adequate perfusion of an extremity, usually a limb or the tail, where the cuff is placed. There have been many studies to test the ability of indirect techniques, and various models of oscillometer, to accurately reflect arterial blood pressure (24). Recommendations for accuracy and reliability have been developed to identify suitable techniques and oscillometers to be used in awake cats and dogs (25). The accuracy of indirect blood pressure measurement can depend on many factors and include: Doppler probe and cuff position (26), oscillometry cuff position (26–28), cuff width:limb or tail circumference ratio (29,30), cuff shape (31), body position (28,32), site of arterial catheter used for comparison (33,34), and method used for statistical analysis (35).

Averaging the measurements obtained from 3 to 5 separate readings can increase the reliability of the blood pressure measurement (28,36–41). Trends and serial measurements may be more important than obtaining 1 measurement, and other clinical findings also need to correlate with the data the device provides (42). Non-invasive blood pressure measuring devices can perform poorly in the presence of severe hypotension, and the clinician’s ability to assess cardiac output, peripheral pulse quality, and perfusion using a thorough physical examination still remains important (43). Loss of palpable metatarsal pulses has an 85% chance of detection of severe hypotension in cats, but these can still be present even if systolic pressure is < 90 mmHg (44). The Doppler technique may be more useful in detecting hypotension compared to an oscillometer (43,45,46).

The cuff requires good contact with the limb and excess or matted hair can interfere with obtaining a good quality signal. Placing the cuff over bony structures such as directly over the carpus does not produce a reliable signal for oscillometry. For every 10 cm the cuff is positioned above the heart, the pressure measurement obtained should be increased by 7.36 mmHg, and for every 10 cm the cuff is below the heart, the measurement should be reduced by 7.36 mmHg. Accuracy of the measurement depends on correct cuff width:limb circumference. If the cuff is too wide, it will require less cuff pressure to occlude arterial perfusion because there is more cuff surface area pressing on the limb and underestimation of true blood pressure can occur. If the cuff is too narrow, a higher cuff pressure is required to occlude perfusion and over-estimation will occur (24).

The Doppler technique uses a probe with a piezoelectric crystal ultrasound wave transmitter and receiver (Figure 8) (24). When the concave portion of the probe is correctly positioned over a peripheral artery (Figure 8) the ultrasound signal is reflected from red blood cells moving through the lumen of the artery. The reflected wavelength changes according to the different velocities of the cells; this is called a Doppler shift. The different reflected wavelengths are converted to audible frequencies and the characteristic “whooshing” sound. If anemia or peripheral vasoconstriction is present, the quality of the signal can be poor. Deterioration in sound quality may be clinically useful in identifying hypotension (43).

Ensure there is no air present between the probe and skin with a generous amount of ultrasound contact gel or the ultrasound signal will not be conducted to the body. Without moving the probe too much to prevent the loss of gel contact, the probe should be firmly attached to the body with sticky tape or flexible tape (Vetrap bandaging tape; 3M Animal Care Products, St. Paul, Minnesota, USA). Gels for lubricating endotracheal tubes should not be used as they can damage the probe.

Recommendations for the cuff width for the Doppler technique have been reported to be 36% (33), 40% (40), and up to 55% (41) of the limb circumference, placed proximal to the probe and level with the heart. The cuff is attached to an aneroid manometer and the cuff inflated to occlude the underlying
artery causing Doppler unit sounds to disappear (Figure 8). By slowly deflating the cuff, the pressure at which the first sounds can be heard to return is assumed to represent the systolic arterial pressure (SAP). There is continual debate as to whether this returning sound more accurately represents the mean arterial pressure (MAP) in cats (47), Doppler pressure is SAP (33), or is the SAP (48). Assuming the value is SAP provides a safety factor and prompts corrective treatment for hypotension earlier, compared to using the value to represent MAP. Using a change in Doppler sound to detect diastolic arterial pressure (DAP) is not accurate (47–49).

A Doppler probe can have other uses besides providing a value for SAP and heart rate. It provides a continuous audible indication of blood flow and a functional heartbeat. The probe can be placed on the eye during CPR, and detection of moving red cells through the retinal artery can indicate good technique. The Doppler unit can also be used for small or young dogs and cats, and exotic animals by placing the probe directly over the heart to provide an audible indication of blood flow through the heart chambers (Figure 9).

A pulse oximeter probe can be used in place of a Doppler probe (50). The cuff is inflated and a measurement can be obtained just as the waveform display is lost. As the cuff pressure is reduced, the waveform is displayed once more and the pressure measured at this point. The 2 measurements can be averaged to obtain the systolic blood pressure. Accuracy is similar to the Doppler but this instrument can be more difficult to use.

Oscillometric devices available nowadays are more accurate compared to units available 15 to 20 y ago and measure SAP, MAP, DAP, and heart rate (24). A cuff width of 40% (29) or between 40% and 60% (51) of the circumference of a limb or the tail has been recommended with oscillometry. The device automatically inflates the cuff to a pressure higher than SAP and gradually deflates the cuff in steps (Figure 10) (24). Arterial blood flow will produce a slight increase in volume of the limb and increase the cuff pressure with each pulsatile flow. When the device detects these small oscillations in cuff pressure it will display the average pressure as equivalent to SAP. As the cuff pressure decreases further, the pressure oscillations become larger until they peak in difference, and this point is assumed to be equivalent to MAP. The oscillations diminish as the cuff pressure is decreased further until the oscillations are not detected. At this point, the cuff pressure is taken as the equivalent to DAP (Figure 10). Because the cuff pressure changes from the pulsatile blood flow are small, the quality of the signal can be affected by movement or handling of the cuff while the instrument is taking a measurement.

High definition oscillometry uses advanced software algorithms to increase accuracy (http://www.VetDiagnostics.com/) and the manufacturer’s software signal quality display on computer (top left). Display top right indicates there is movement artifact and the results are not acceptable. Display (bottom) illustrates good signal quality and the results are acceptable.
accurately represent direct arterial pressure compared to using Doppler based measurements in anesthetized and conscious dogs (38). Another device (SunTech Vet 20) designed for dogs and cats is also available, but at the time of writing, it had not been validated in cats and dogs although it appears to give reasonable results in clinical practice (https://www.suntechmed.com/bp-products/veterinarian-blood-pressure-monitor) (Figure 12). Graphically displaying decreasing cuff pressure without analysis of the oscillation pressure changes does not provide signal quality.

The oscillometer can have difficulty finding the signal in low perfusion states, in the presence of cardiac arrhythmias and may have problems during hypertension. The device will fully deflate the cuff and display an error signal or a message if the search for the oscillations takes too long. The automatic deflation is to prevent the device depriving the distal extremity of vital blood flow. With hypertensive states, the device may continue to reset the peak cuff inflation pressure to higher levels in an attempt to find the oscillating pressure changes and may reach the safety cut-off time-point and stop the search completely. Equipment design safety features also make it impossible to accidentally connect an oscillometer cuff inflation tubing to a fluid therapy line and have the device pump air into the venous circulation.

In conclusion, these devices are useful adjuncts to monitoring of anesthesia. When considering the various units that are available, it is advisable to negotiate a trial period and/or demonstration of the device. There are also multimodal devices available which combine these several modalities into one physiological monitor. This has the advantage of using less space, but the disadvantage of losing all the modalities if repairs are required.

References

27. Fujiyama M, Sano H, Chambers JP, Gieseg M. Evaluation of an indirect oscillometric blood pressure monitor in anaesthetised dogs

Figure 12. Oscillometers from SunTech (https://www.suntechmed.com) and the petMAP (http://www.petmap.com) with pulse oximetry.


34. Parker K, Duke-Novakovski T, Carr A. Arterial blood pressure measured within the aortic root and compared with pressures obtained directly from the dorsal pedal artery, Doppler technique and a high definition oscillonometer in anaesthetized cats. Abstract presented at Association of Veterinary Anaesthetists Spring Meeting, Nottingham, UK. April, 2014.


Attitudes of western Canadian cow-calf producers towards the Code of Practice for the Care and Handling of Beef Cattle

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Abstract — This study describes western Canadian cow-calf producers’ attitudes towards the Code of Practice for the Care and Handling of Beef Cattle (COPB). Most respondents had not read the COPB. Of those familiar with the COPB, most agreed with it, but it did not have a major influence on their decisions.

Résumé — Attitudes des producteurs vache-veau de l’Ouest canadien envers le Code de pratiques pour le soin et la manipulation des bovins de boucherie. Cette étude décrit les attitudes des producteurs vache-veau de l’Ouest canadien envers le Code de pratiques pour le soin et la manipulation des bovins de boucherie (CPBB). La plupart des répondants n’avaient pas lu le CPBB. Parmi ceux qui le connaissaient, la plupart était d’accord avec son contenu, mais il n’avait pas une influence majeure sur leurs décisions.

Most food animal commodity organizations in Canada have developed voluntary Codes of Practice for the care and handling of their respective species (1). The Codes of Practice are national guidelines composed of requirements and recommendations that promote improved animal husbandry practices and can function as an educational tool for producers (1). Requirements are either mandated by legislation or are industry expectations of acceptable animal care and may be enforced by provincial or federal authorities or by the industry (1,2). Recommendations are complementary to requirements, promote producer education, and encourage the adoption of practices to improve animal welfare (1,2).

The Code Development Committee was composed of beef producers, animal welfare group representatives, provincial and federal government representatives, researchers, a transporter, a veterinarian, and a processor for the revision of the “Code of Practice for the Care and Handling of Beef Cattle” (COPB) (2).

The revision process included input from a scientific review committee that summarized animal management issues for a revised COPB. A 60-day comment period allowed the public to provide feedback during the Code development, which was taken into consideration before the COPB was finalized for publication in 2013 (1,2). Among other things, the revised COPB requires that pain mitigation be used when castrating calves older than 9 mo and dehorning calves after horn bud attachment (2).

All provinces may use the Codes of Practice as a reference for acceptable care, regardless of whether or not they are referenced in provincial acts. These Codes may be used in a court of law (personal communication; Jackie Wepruk, National Farm Animal Care Council, 2016). The COPB, therefore, is an important document that beef producers should be aware of when making on-farm management decisions.

Familiarity of beef producers with the COPB and their attitudes towards the COPB are currently unknown. Producer uptake of and compliance with COPB guidelines may be hindered by lack of producer familiarity or negative attitudes towards the COPB. The objectives of this study were to describe western Canadian cow-calf producers’ familiarity with the COPB and to explore producer attitudes towards it.

This study was part of the Western Canadian Cow-Calf Surveillance Network (WCCCSN), a 5-year longitudinal project that entailed repeated surveying and biological sampling of herds across 3 provinces. Producers were recruited through their veterinarian and eligibility was based on a minimum herd size of 100 cows, maintenance of records, and willingness to participate. Participants were selected to reflect the 2011 Census of Agriculture (3) regarding reported herd size (small = 100 to 299 and large ≥ 300) and provincial distribution.

A questionnaire was developed in collaboration with an expert panel, consisting of 3 representatives (producers, veterinarians, and researchers) from each of the prairie provinces
A questionnaire of 31 questions (4), including questions focusing on producer familiarity and agreement with the COPB, was distributed to all 109 WCCCSN participants (MB: n = 21, SK: n = 33, and AB: n = 55 (available from the corresponding author). Based on participant preference, 83 questionnaires were sent by mail and 26 were sent by e-mail. Participants were given 4 months to return the questionnaire, during which reminders were sent every 3 to 4 wk. Producer familiarity was measured using a 4-point scale (1 = not at all familiar to 4 = very familiar), and producer agreement was measured using a 7-point scale (1 = disagree with everything in the Code to 7 = agree with everything in the Code). Descriptive analysis of the data was conducted using a statistical program (STATA, version 13.0; StataCorp, College Station, Texas, USA).

To further investigate producers' attitudes towards the COPB, 15 respondents (5 from each province) were purposively selected for on-farm interviews based on questionnaire responses related to the use of pain and stress mitigation practices, producer perception of pain in cattle, and producers' COPB familiarity, as previously described (4). All interviews were conducted at the producers' residences, except for 1 interview by telephone due to weather conditions.

An interview guide including questions concerning producer attitudes towards the COPB was developed and piloted with university researchers and a cow-calf producer (available from the corresponding author). Only producers who indicated they were, to some degree, familiar with the COPB were asked about their attitudes towards the COPB. Interviews were audio-recorded and transcribed verbatim. As previously described (4,5), an inductive thematic content analysis was conducted using NVivo, version 10.2 (QSR International Pty, Doncaster, Victoria, Australia) to identify major and minor themes (6).

The response rate was high (86%) with 94 of the 109 distributed questionnaires being returned (MB: n = 17, SK: n = 31, and AB: n = 46). Over half the respondents had not read the COPB (53%; n = 50 of 94; Figure 1). For those who had heard about the COPB (73%; n = 69 of 94), magazines were the most common method by which respondents had heard about the COPB (58%; n = 40 of 69; Table 1). Only 29% (n = 20 of 69) of respondents reported that they heard about the COPB from their veterinarian. When respondents were asked to what extent they agreed or disagreed with COPB guidelines related to pain mitigation, 34% had no opinion (n = 23 of 67), 4% disagreed with many things (n = 3 of 67), 33% agreed with many things (n = 22 of 67), 25% agreed with most things (n = 17 of 67), 3% agreed with everything in the COPB (n = 2 of 67).

When interviewed about their attitudes towards the COPB (n = 15), those familiar with the COPB felt that these guidelines were beneficial to the industry. Many appreciated that the COPB was developed with members of the beef industry rather than solely by an outside third party. Many interviewees felt that the COPB was a good resource for less knowledgeable producers as it outlined appropriate animal care strategies.

“I think it helps to… set a bar because there may be producers that haven’t… upgraded their management and maybe aren’t as aware … that [the COPB] might guide their decision-making process” (Interviewee #4).

Some interviewees were adamant that those who do not follow the COPB should not be a part of the industry. Many interviewees felt that the COPB was developed with the consumer in mind, as a response to their concerns, and to increase their confidence in the beef industry. However, some interviewees expressed concern that the consumer was not aware of the animal care needs of cattle. Often interviewees would state that consumers tend to equate caring for cattle to how the consumer cares for their pets or themselves. Interviewees expressed that they cared about their cattle, but that they must have a certain level of detachment to successfully manage their operation.

“I have to be the best judge of the welfare and I still have to run it as a business with the welfare in mind … If their needs for food, nutrition, and shelter are met, they’re pretty content…” (Interviewee #10).

Many interviewees questioned the effectiveness of the COPB and doubted it would be enforceable in Canada. Many interviewees stated they were already following the COPB before its revision in 2013 and viewed the changes as “common sense.” Some interviewees stated that they would change their practices if they agreed with the COPB guidelines, but that it would
not dictate their actions. However, some acknowledged that they must follow the COPB if they wish to sell their cattle to certain markets.

“I’m just like anybody else, you don’t want to be forced to do it… if you don’t have to but if it makes legitimate sense… I guess we have to do some of it just to be able to sell animals to a certain market … If I don’t agree with [the COPB guidelines], then I’ll find a different way to sell the animal” (Interviewee #7).

The lack of familiarity of respondents with the COPB in this study was concerning. The COPB is intended to be an important source of information for producers to consider when making management decisions. The lack of familiarity reported in this study may suggest that the producers interviewed were unaware that the COPB could be used in a court of law. The familiarity and agreement of respondents with the COPB may be greater among this study’s respondents than among cow-calf producers outside the WCCCSN due to selection bias. Producers who agreed to participate in the WCCCSN may be more progressive in their herd management and actively search for information concerning the industry. This may indicate that more efforts are needed to familiarize producers with the COPB.

The results of this questionnaire were similar to those for dairy producers. A survey of dairy producers designed to rank their knowledge of the requirements of the “Code of Practice for the Care and Handling of Dairy Cattle” on a 5-point scale (1 = limited knowledge to 5 = extensive knowledge) resulted in a median score of 3 (IQR: 2–4) (7). This similarity indicates that both dairy and cow-calf producers are moderately familiar with their respective Code of Practice guidelines.

Previous studies have also identified magazines as a major source of information for producers (8,9). Although veterinarians have often been listed as a source of information on cattle health and welfare for producers (9,10), few respondents reported learning about the COPB from their veterinarian. This may indicate that veterinarians are not familiar with the COPB or that they do not discuss the COPB with their clients. Many COPB guidelines indicate that producers should seek veterinary advice regarding the requirements and recommendations. If veterinarians are unaware of the COPB, they may not be able to help their clients in following the guidelines. As a producer-trusted source of information, veterinarians may be an underutilized resource in educating producers about the Codes of Practice. Future extension efforts should familiarize veterinarians with the Codes of Practice and aim to increase veterinarian-producer communication about the COPB content and value.

Although producers may follow some of the COPB guidelines, there are areas that can be improved. As previously reported (4), many respondents met the COPB requirements stating that calves must receive pain control when castrated before 9 mo of age and dehorned before horn bud attachment (2). However, producers interviewed indicated that they did not adopt these practices because of the COPB, but because they viewed them as common sense. Alternatively, few respondents reported correctly confirming insensibility and death when euthanizing cattle on farm (5). It is unclear if respondents were not complying with this requirement because they did not know it was a requirement or they did not deem it important.

In conclusion, interviewed producers generally viewed the COPB as a benefit to the industry, a source of information for less knowledgeable producers, and a way to increase consumer confidence. However, producers doubted its effectiveness to modify producer behavior and it was not viewed as influential when making management decisions. Additionally, producers were not willing to change their practices just because the COPB required it. They would have to agree with the change and see value to their cattle and operation. This study has identified areas of management that could benefit from producer familiarity with the COPB, such as confirmation of death when euthanizing on the farm. Despite being a source of information for animal health, veterinarians were not a major source of information regarding the COPB. Efforts should be made to increase producer and veterinarian familiarity with the COPB. Educational tools, communicated through magazines and conferences, should be designed for veterinarians to optimize knowledge transfer of the COPB to producers. This may improve knowledge and use of better animal care strategies.

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References

WSAVA, Hill’s Announce 2017 ‘Next Generation’ Veterinary Award Winner

Dr. Luba Gancheva, a Bulgarian veterinarian who now lives and works in Romania, has been named by the World Small Animal Veterinary Association (WSAVA) and Hill’s Pet Nutrition as the winner of the 2017 ‘Next Generation’ Veterinary Award. The award acknowledges the work of a veterinarian who graduated within the past ten years and who has contributed significantly to the betterment of companion animals, the veterinary profession and society at large.

“Millennial vets carry the future of the profession with them,” said Dr. Jolle Kirpensteijn, Chief Professional Relations Officer at Hill’s Pet Nutrition. “Luba has demonstrated a strong commitment to improving the experiences and education of early-career veterinarians. She has also taken positive steps to connect these next-generation professionals with ones who are already established in the field.” Dr. Gancheva will be presented with her award at the WSAVA World Congress 2017, which takes place Sept. 25–28 in Copenhagen, Denmark. She will also give a lecture entitled: A high professional level of veterinary medicine is offered in the Balkans. True or false?

The Balkan Peninsula extends from Central Europe to the Mediterranean Sea and includes the countries of Albania, Bosnia and Herzegovina, Bulgaria, Croatia, Greece, Macedonia, Montenegro, Romania, Serbia, Slovenia and the European part of Turkey.

Dr. Gancheva graduated from the Faculty of Veterinary Medicine of the University of Forestry in Sofia, Bulgaria, in 2010, and began working in a small animal practice in the city. She demonstrated her commitment to continuing education and received a Master of Science in Infectious Diseases from Triaka University in Bulgaria. She now lives in Bucharest, Romania, and works at the Cabinet Filip Veterinarul animal hospital.

Her PhD thesis, entitled ‘Clinical Manifestation of Brucellosis in Dogs, caused by Brucella canis,’ was based on a study she conducted on the incidence of this disease in the Balkans. As a result of her thesis, Dr. Gancheva was invited to speak at two congresses in the Balkans, where she realized how enthusiastic her colleagues in the region were to continue their professional development.

In 2015, she launched an online veterinary journal called ‘Vets on the Balkans,’ with the goal of helping regional veterinarians work more collaboratively and share their experience and knowledge. The journal has presented more than 90 cases and has developed a strong readership. It has also built partnerships with many of the key companion animal veterinary associations in the region.

Building on this success, Dr. Gancheva in 2016 launched an initiative called ‘Learn and Travel with Vets in The Balkans’. The program enables veterinarians to increase their knowledge and experience by working in clinics in nearby countries. The first placements were made earlier this year, and they were supported through sponsorships and donations from 12 participating practices in Bulgaria, Turkey, Romania, Belgium, Italy and Croatia.

Dr. Käthi Brunner, Chair of the WSAVA’s Leadership and Nomination Committee, said: “Tackling the inequality of education and resources available to veterinarians depending on where in the world they are working is one of the key challenges facing the profession. Dr. Gancheva has taken some very practical steps to support the development of the profession in the Balkans, both through launching the journal and through the new ‘Learn and Travel’ scheme. We congratulate her and hope that both of these initiatives continue to prove successful. She is a great example of a Next Generation veterinarian who is showing a very personal commitment to raising standards of veterinary care.”

As the winner of the 2017 ‘Next Generation’ Veterinary Award, Dr. Gancheva will receive a monetary gift, an engraved plaque and a WSAVA certificate.

Dr. Gancheva said: “I would like to express my gratitude for the Award. It is the biggest honour of my life and I am excited to be part of WSAVA World Congress this year. During my lecture, I will present clinical reports from my journal from each country in the Balkans to show that, while we may have economic difficulties, our passion for knowledge and love for animals give us strength. When you cure an animal, you change the world for someone, so veterinarians change the world. Thank you WSAVA!”

Hill’s will fund Dr. Gancheva’s attendance at the 2017 WSAVA World Congress so that she can accept her award.

Candidates for the WSAVA, Hill’s Next Generation Award can come from any country and must meet the following criteria:

• Graduated within the past 10 years
• Active in continuing education
• Have a strong record in community service
• Working to bridge the gap between their generation and others

The WSAVA’s 101 member and affiliate associations represent more than 200 000 individual veterinarians from around the globe. They work together to advance the health and welfare of companion animals. Hill’s is the WSAVA’s most long-standing and significant industry partner.

Candidates for the 2018 Next Generation Award can nominate themselves by sending an email to yourwsava@wsava.org by Jan. 1, 2018. They should include a letter of intent, a CV and at least one reference letter. Further information can be found at www.wsava.org
Development of a video-based teaching tool on local anesthetic techniques in small animals

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Introduction

According to a survey performed by the World Small Animal Veterinary Association Global Pain Council (WSAVA-GPC) in 2013 involving several international small animal veterinary associations, local anesthetics are readily available regardless of the region of the world. However, their use was ranked lower than other analgesic modalities (1). Lack of familiarity with use and/or protocols was cited as the primary limiting factor to the use of local anesthetics. The survey was performed mostly for internal audit of the WSAVA-GPC without much scientific evidence on its validity. However, it is concerning for our profession that veterinarians do not routinely use local anesthetic techniques for treatment of perioperative pain in small animals.

Video-based learning provides effective training in medical education (2–4). Medical students tend to perform better in practical examination after video e-learning than illustration-based teaching modules (3). Additionally, computer-based video support systems were effective in oral health-care training for treatment of periodontal disease (5).

Appropriate peer-reviewed, open-access, high-definition video-based tools on local anesthetic techniques in small animal practice are lacking. These videos could contribute to teaching while reducing the use of live animals for this purpose, which also supports the concept of the 3Rs (Replacement, Reduction, and Refinement). These tools could reduce the gap between theory and application of these techniques in practice. This special report describes the development of a video-based teaching tool on local anesthetic techniques in small animals that could help to address this need.

Materials and methods

This project was approved by the local animal care committee of the Faculty of Veterinary Medicine and Animal Science, UNESP-Botucatu, Brazil (protocol number 112/2013), the institution at which videos were recorded. Two board-certified anesthesiologists (PS/SL) prepared a script for filming 13 local anesthetic techniques in dogs and cats based on the WSAVA-GPC guidelines (6), textbooks and peer-reviewed literature. Text included indications, contra-indications, description of anatomical landmarks and clinical application for each technique. The script was used as a guide for video recording. Four healthy adult dogs (2 research dogs and 2 client-owned dogs; 24.8 ± 12 kg), 1 canine cadaver, 1 feline skull, and 1 canine skull were used. Aseptic technique was used when appropriate. Intraperitoneal and intratesticular anesthesia were filmed during ovariohysterectomy and castration, respectively, after the owner’s written consent was obtained. The anesthetic protocol included use of methadone-propofol-isoflurane-meloxicam. All videos were filmed using a high-definition (1920 × 1080p) video camera (Canon EOS Rebel T5i). Video editing was conducted and reviewed, and legends were added. The final script was edited and peer-reviewed by an English-speaking board-certified anesthesiologist (PB) who later recorded audio. A list of materials, suggested drugs and their concentrations, and closing credits were included at the end of each video.

Results

Duration of video recording was approximately 12 h. Thirteen techniques were filmed; 1 technique was excluded due to technical issues. The following techniques were published: epidural anesthesia; femoral and sciatic nerve blocks; incisional and intraperitoneal anesthesia; intercostal block; intratesticular anesthesia; intravenous regional anesthesia; and mandibular, maxillary, mental, and palatine nerve blocks. The final product was published on the YouTube page of the Faculty of Veterinary Medicine, Université de Montréal as open-access (https://www.youtube.com/channel/UCaDaAco76nwBq7BWOE-dLeA). The online videos were used for teaching students at the university with positive responses at final course evaluation. Information was disseminated by various methods. The material was endorsed by the WSAVA-GPC and shared via social media (Facebook) by the authors and by the Chilean Society of Veterinary Anesthesia (SAVECH), the Spanish Society of Veterinary Anesthesia and Analgesia (SEAV), and the Mexican College of Veterinary Anesthesia and Analgesia as requested by the authors. Video
links were published on the WSAVA-GPC webpage with a brief description of content in English and French (http://www.wsava.org/sites/default/files/Local%20anesthetic%20educational%20videos_0.pdf). Videos were presented during lectures at the WSAVA annual meeting in Cartagena, Colombia, 2016 and the Southern European Veterinary Conference (SEVC) in Granada, Spain, 2016. An abstract (poster format) including a barcode for scanning and real-time assessment of videos was presented at the Association of Veterinary Anaesthetists (AVA) Spring meeting in Manchester, United Kingdom, 2017. Finally, these videos will be used as an important tool for teaching “dental local blocks” as part of the upcoming guidelines of the WSAVA Dental Standardization Committee (WSAVA-DSC).

In conclusion, development of this tool was feasible but required several hours of editing and significant financial resources. These videos provide an additional educational resource to the WSAVA-GPC and the WSAVA-DSC guidelines for recognition, assessment, and treatment of pain. The goal is to increase user comfort in the application of these techniques and thereby enhance pain management. Additionally, this material might contribute to a decrease in the use of live animals in teaching. Further studies are required to access the impact and effectiveness of this tool in small animal veterinary anesthesia.

Acknowledgments
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References
Morcellation for testes extraction in horses undergoing standing laparoscopic cryptorchidectomy

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Abstract — The major objective of this study was to describe the use of morcellation for standing laparoscopic cryptorchidectomy in 30 client-owned horses. A second objective was to describe a laparoscopic-assisted standing scrotal technique for removal of a descended testis in unilateral cryptorchids. Morcellation for extraction of abdominal testes is effective, efficient, and well-tolerated. Morcellation enabled safe and straightforward extraction of testes from the abdomen through an approximately 13- to 20-mm incision using a 2-portal technique. No incisional or morcellator-related complications occurred. Our laparoscopic-assisted standing scrotal technique for removal of a descended testis in unilateral cryptorchids entails intra-abdominal sealing and transection of the spermatic cord under laparoscopic viewing and subsequent removal of the testis through a scrotal incision. This technique enabled the surgeon to confirm hemostasis after transection of the spermatic cord and allowed tension-free removal of the descended testis. No intra-operative or incisional complications were encountered.

Résumé — Morcellement pour l’extraction des testicules chez les chevaux subissant une cryptorchidectomie laparascopique debout. L’objectif majeur de cette étude consistait à décrire l’utilisation du morcellement pour la cryptorchidectomie laparascopique debout chez 30 chevaux appartenant à des clients. Un second objectif était de décrire une technique scrotale debout assistée par laparoscopie pour l’enlèvement d’un testicule descendu pour les cryptorchides unilatéraux. Le morcellement pour l’extraction des testicules abdominaux est efficace et bien toléré. Le morcellement a permis une extraction sûre et simple des testicules par l’abdomen par une incision d’environ 13 à 20 mm à l’aide d’une technique à deux portails. Aucune complication cicatricielle ou liée au morcelleur ne s’est produite. Notre technique scrotale debout assistée par laparoscopie pour l’enlèvement des testicules descendus dans les cryptorchides unilatéraux implique un scellement intra-abdominal et le sectionnement transversal du cordon spermatique sous une vue laparascopique et l’enlèvement subséquent des testicules par une incision scrotale. Cette technique a permis au chirurgien de confirmer l’hémostase après le sectionnement transversal du cordon spermatique et a permis l’enlèvement sans tension des testicules descendus. Aucune complication intra-opératoire ou cicatricielle ne s’est produite.

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Introduction

Failure of one or both testes to descend into the scrotum is a well-recognized problem in male horses and a common reason for performing surgery (1,2). The location of undescended testes is classified as inguinal, complete abdominal, or incomplete abdominal according to the position of the testis and tail of the epididymis in relation to the vaginal ring (1,3).

Surgical techniques described for removal of testes retained in the abdomen in horses include traditional open approaches (4–8) and laparoscopy (standing or recumbent) (9–15). Identification of abdominal testes through a traditional approach, which relies on blind exploration of the abdomen or traction placed on the inguinal extension of the gubernaculum testis, is not always successful (3,16).

Standing laparoscopic techniques offer straightforward identification and excellent viewing of abdominal testes (9). Also, standing laparoscopy minimizes the potential for life-threatening complications that have been reported with traditional open approaches (3,8) and does not require general anesthesia.

Although some surgeons still prefer traditional open approaches (16), the use of standing laparoscopy for abdominal
cryptorchidectomy in horses has been increasing since its introduction in the early 1990's (9–11,14,15). Moreover, cryptorchidectomy is the most commonly performed laparoscopic procedure in horses (17,18).

In reported techniques of cryptorchidectomy in horses, extraction of testes from within the abdomen entails pulling the testes through the body wall at an extraction site. Even when performed laparoscopically, a portal incision must be enlarged to allow safe extraction of the intact retained testis (9–11,14,15).

In horses, the larger the incision in the paralumbar fossae, the higher the incisional complication rates, likely due to increased dead space formation and trauma to muscles in the abdominal wall (19). Incisional complication rates of up to 60% are reported for horses undergoing standing laparoscopy with large paralumbar fossae incisions for tissue extraction (20,21).

Additional difficulties that can be encountered upon extraction of abdominal testes include: i) Dropping a freed testis from grasping forceps (14) — if the dropped testis becomes unreachable with laparoscopic instruments, the surgeon's hand may have to be inserted into the abdomen to retrieve the testis (14); ii) Tearing or fragmentation of the testis due to excessive tension required for extraction through a thick body wall; and iii) Movement of the standing horse due to discomfort caused by excessive tension applied on the spermatic cord (10).

The advent of motorized morcellators introduced a streamlined method for removal of tissue during minimally invasive surgery. Morcellation enables fractional extraction of soft tissue from the abdomen, thus eliminating morbidity associated with a large flank incision otherwise necessary for removing a testis.

The purpose of this study was to describe the use of a motorized morcellator for extraction of abdominal testes via an existing portal during laparoscopic cryptorchidectomy in standing horses. An additional goal was to describe removal of the scrotal testis in horses undergoing unilateral cryptorchidectomy using a laparoscopic-assisted standing scrotal technique.

**Materials and methods**

**Inclusion criteria**

Medical records and intra-operative video recordings of horses undergoing unilateral and bilateral standing laparoscopic cryptorchidectomy from 2012 to 2016 were evaluated. Cases were selected based on the use of a motorized morcellator for extraction of testes from the abdominal cavity.

**Review of medical records and intraoperative videos**

Information retrieved for analysis included age, breed, method used for diagnosis of cryptorchidism, left testis location, right testis location, number of laparoscopic portals per retained testes, method used for hemostasis of testicular vessels, morcellator details (brand, model, blade size), times required for morcellation, surgical technique used for removal of normally descended testes when present, intra-operative complications and post-operative complications.

Owners were contacted by telephone to participate in a short follow-up survey. An impartial 3rd party with veterinary knowledge, who had no previous contact with the owners or cases, conducted the interviews. Owners were asked how effective the operation was at suppressing stallion-like behavior. Answers were categorized using the following scale: total suppression, partial suppression, not effective. Owners were also asked if there was any drainage from laparoscopic surgical sites after release of the horse from the hospital, whether there was any palpable or visible defect in the body wall at the laparoscopic surgical sites, if there were any complications associated with the scrotal surgical sites in horses undergoing removal of a normally descended testis, and what their overall satisfaction level was with the outcome of the surgery (high, moderate, low).

**Surgical technique**

To achieve a concave appearance to the paralumbar fossae and decrease digesta in the bowel, owners were instructed to feed horses with a low bulk diet (22) for 3 d before surgery. If needed, food was withheld for 24 h before the operation. Water was not withheld. An IV catheter (Radioopaque Polyurethane IV Catheter-Over-Needle (14 G × 13 cm); Mila International, Florence, Kentucky, USA) was aseptically placed in the jugular vein. Cefazolin (Steri-Pharma, Syracuse, New York, USA), 11 mg/kg body weight (BW), IV, q6h, gentamicin sulfate (Vetone MWI, Boise, Idaho, USA), 6.6 mg/kg BW, IV, q24h, and flunixin meglumine (Prevalin; Vetone MWI), 1.1 mg/kg BW, IV, q12h were administered 1 h before the operation and continued at regular intervals until 24 h after surgery. Immediately before the procedure, the horse was sedated with detomidine hydrochloride (Dormosedan; Zoetics, Kalamazoo, Michigan, USA), 0.01 mg/kg BW, IV and placed in standing stocks. Standing sedation was maintained by means of IV infusion of detomidine hydrochloride in Lactated Ringer's Solution (0.1 mg/mL) and titrated to effect. Thorough palpation of the inguinal-scrotal area was routinely carried out before and after sedation to confirm absence of testes in the scrotum and inguinal area. The rectum was manually evacuated of feces and transrectal palpation and ultrasound examination was performed. The tail was bandaged to prevent it from contaminating the surgical field. The urinary bladder was aseptically catheterized and emptied. The paralumbar fossae were clipped of hair with a No. 40 blade and aseptically prepared for surgery.

Portal sites were desensitized by infiltration of 2% mepivacaine hydrochloride into the dermis and abdominal wall musculature (15 to 30 mL/portal site). Towel clamp sites were infiltrated with approximately 5 mL of 2% mepivacaine hydrochloride (Carbocaine-V; Zoetics). A final sterile surgical scrub was performed following injection of the local anesthetic. A plastic-lined paper drape was placed over the patient's back and secured with penetrating towel clamps.

Anatomic landmarks for laparoscopic portals were as described by Lund et al (22) for standing laparoscopic ovariectomy. Briefly, 2 laparoscopic portals were established ipsilateral to the retained testicle. The laparoscope portal was located between the 17th and 18th ribs at the level or just below the ventral aspect of the tuber coxae. The instrument portal was located in the paralumbar fossa, midway between the last rib and the tuber coxae and immediately above the crus of the internal abdominal oblique muscle; approximately 3 to 5 cm ventral to the level of...
the abdominal wall musculature and then aimed in the direction of the abdominal cavity to grasp testis by one of its poles for morcellation (C). Note size of incision on body wall through which testes are removed from the abdomen when morcellation is used.

Regardless of the side of retention of the testis, we routinely establish the first portal between the last 2 ribs in the left side. Then, the other portals are placed under intra-abdominal laparoscopic guidance.

An approximately 13-mm skin incision was made to establish the laparoscope portal in the last intercostal space on the left side. A 12-mm × 11.5-cm laparoscopic cannula with a blunt-tip conical obturator (disposable 12-mm × 11.5-cm laparoscopic cannula; Autosuture-Step, Tyco Healthcare, Norwalk, Connecticut, USA) was used to penetrate the abdominal body wall. The cannula-obturator unit was inserted perpendicular to the abdominal wall musculature and then aimed in the direction of the opposite hip to avoid injury to the spleen. Entry to the abdominal cavity was confirmed by spontaneous air inflow into the abdomen and ultimately, insertion of the laparoscope and viewing of abdominal organs. A 10-mm, 57-cm, 30° laparoscope (Karl Storz, Golea, California, USA) was inserted and the other portals were established in similar fashion, under intra-abdominal laparoscopic guidance and using identical cannulas (disposable 12-mm × 11.5-cm laparoscopic cannula; Autosuture-Step, Tyco Healthcare) as the first portal. The incision for the instrument portal was 13-mm to 20-mm long to facilitate insertion of the morcellator. To allow viewing of the right abdominal wall for cannula placement, the laparoscope was directed from the left portal to the right side of the abdomen by passing it between the small colon and the bladder at the pelvic inlet and then advancing it in a cranial direction with the tip aiming slightly down. Once a field of view was established on the right side of the abdomen, the laparoscope was focused in a dorsal-cranial direction.

A visual exploration of the dorsal aspect of the cranial and caudal abdomen was performed routinely. The cannulas were set in the open position, and the abdominal cavity pressure was allowed to equilibrate to room pressure. Abdominal testes were found in the internal inguinal region. If surrounding bowel obscured viewing of the testis, gentle traction was applied on the cranial aspect of the mesorchium to elevate the testis into view. Once the retained testis was identified, an 18-gauge, 43-cm injection needle (Karl Storz) was placed through the cannula in the instrument portal and 20 to 35 mL of 2% mepivacaine hydrochloride was injected into the mesorchium under laparoscopic guidance. The injection needle was withdrawn, and a 10-mm × 37-cm bipolar vessel sealing device (LigaSure: Covidien Surgical, Mansfield, Massachusetts, USA) was placed through the instrument portal and used to seal and transect the spermatic cord. A small amount (2 to 3 cm) of caudal mesorchium was sealed without transection and left in place for suspension of the testis during morcellation. The cannula on the instrument portal was replaced with the barrel of the mechanical morcellator measuring either 13 mm × 14 cm (disposable Gynecare Morcellex tissue morcellator; Ethicon Endo Surgery, Blue Ash, Ohio, USA) or 20 mm × 20.5 cm (reusable MORESolution tissue morcellation system; Blue-Endo, Lenexa, Kansas, USA). A 10 mm × 46 cm Semm grasping forceps (Blue-Endo) was inserted through the barrel of the morcellator and used to grasp the testis by one of its poles (Figure 1). The forceps, with grasped testis, were then withdrawn to contact the morcellator barrel. A triggering mechanism was activated, and the conical blade was engaged. The testis was slowly withdrawn into the barrel and the engaged blade of the morcellator, and thus, the retained testis was removed from the abdominal cavity through an existing laparoscopic portal. A video of the morcellation viewed from the inside and the outside may be viewed by accessing the following link: https://www.youtube.com/watch?v=YnZk1O5r_Wc&feature=youtu.be. The testis was removed in sections of tubular tissue in the shape of the morcellator barrel (Figure 2). Adequate viewing of the morcellator blade and surrounding tissues was maintained to the best extent possible, especially during activation of the cutting blade. During morcellation, adjacent visceral surfaces were examined to ensure removal of any loose fragments of morcellated testicular tissue. The stump resulting from transection of the spermatic cord was inspected for hemostasis. This procedure was repeated on the other side in cases of standing bilateral cryptorchidectomy.

Instruments were removed from portals. Abdominal insufflation with carbon dioxide was rarely needed. If insufflation was used, suction was attached to the remaining cannulas, and excess gas was removed from the abdomen. Based on surgeon preference, skin incisions were closed with surgical staples or...
non-absorbable suture material in a simple interrupted pattern. Adhesive bandages [Elastikon adhesive tape (3-in); Johnson and Johnson, New Brunswick, New Jersey, USA] were applied to protect the incision sites.

If a normally descended testis was present at the time of cryptorchidectomy, this was extracted after removal of the retained testis using recumbent castration under IV general anesthesia and a scrotal approach with primary wound closure (23), or standing castration via scrotal incision after laparoscopic-guided transection of the spermatic cord using a bipolar vessel-sealing device (10-mm × 37-cm LigaSure; Covidien Surgical). The latter was performed immediately after extraction of the retained testis as a continuation of the standing surgery. Two laparoscopic portals were established under intra-abdominal laparoscopic guidance as previously described herein, ipsilateral to the normally descended testis. The spermatic cord of the normally descended testis was identified and desensitized, as previously described for retained testes. Then, the spermatic cord was transected within the abdominal cavity, under laparoscopic guidance using the bipolar vessel-sealing device. The stump resulting from complete transection of the spermatic cord was inspected to confirm hemostasis. Then, the scrotum was aseptically prepared for surgery and desensitized by intra-dermal infiltration of 2% mepivacaine hydrochloride along the proposed line of incision. Additionally, 10 to 20 mL of 2% mepivacaine hydrochloride was injected into the testicular parenchyma through an 18-gauge, 1.5-inch needle. A final aseptic surgical scrub was completed after injection of local anesthetic. A skin incision (length according to size of the testis) was made in the scrotum, parallel to the long axis of the testis and approximately 2 cm to the side of the median raphe. The incision was continued through the subcutaneous scrotal fascia and parietal vaginal tunic of the testis. The testicle and the epididymis were prolapsed through the scrotal incision. The ligament of the tail of the epididymis was transected using Mayo scissors. Thus, the testis, epididymis, and spermatic cord were removed by placing gentle traction on the testis.

Feeding was progressively reintroduced as soon as the animal was bright and alert following sedation (usually after 1 to 2 h after surgery). Phenylbutazone (Vetone MWI), 2.2 mg/kg BW, PO, q12h or flunixin meglumine (Banamine paste; Merk & Co., Whitehouse Station, New Jersey, USA), 0.5 mg/kg, PO, q12h was administered for 3 to 5 d after surgery. Horses were released from the hospital 1 to 3 d following surgery with instructions for 5 to 7 d of hand-walking for 10 to 20 min twice daily before returning to normal turnout or training. For those horses undergoing standing removal of a descended testis (open castration technique), trotting exercise was recommended for 5 to 7 d after hospital release. Removal of skin staples or suture from portal sites by the attending veterinarian was recommended at 14 d after surgery.

Results
Thirty client-owned horses met the inclusion criteria. The median age was 2 y (range: 1 to 11 y) and the mean age was 3.03 y. There were 23 Quarter horses, 2 Connemara ponies, 2 American paint horses, 1 Arabian, 1 Clydesdale, and 1 Thoroughbred. Inguinal-scrotal palpation was conducted in all cases upon arrival at our hospital and was repeated after pre-operative sedation. Additionally, transrectal palpation was performed after sedation in all cases. Combined, inguinal-scrotal and transrectal palpation allowed us to identify complete abdominal retention of the testis in 20 horses (8 bilateral cryptorchids, 7 unilateral cryptorchids with left testis retention, and 5 unilateral cryptorchids with right testis retention). In the remaining 10 horses, transrectal ultrasound was also required to ascertain the location of the retained testis (3 bilateral cryptorchids with incomplete abdominal retention of the testes, 3 unilateral cryptorchids with incomplete abdominal retention of the right testis, and 4 unilateral cryptorchids with complete abdominal retention of the left testis) for better surgical planning. In 2 of these horses (both bilateral cryptorchids with incomplete abdominal testes retention) transabdominal ultrasound was also conducted to increase reliability of pre-operative diagnosis.

Eleven of the 30 horses were bilateral cryptorchids (8/11 complete abdominal, 3/11 incomplete abdominal) and 19 were unilateral cryptorchids (11/19 left side retention, 8/19 right side retention). All left side retained testes were complete abdominal, whereas 3 of the 8 right side retained testes were incomplete abdominal. Five of the 19 unilateral cryptorchids had 1 testicle removed before admission at our hospital.

All 30 horses had standing laparoscopic cryptorchidectomy with testes extraction by morcellation using a 2-portal technique. In all cases, a bipolar vessel-sealing device was used for hemostasis and transection of the spermatic cord under laparoscopic guidance. Extraction of the testes was performed using the disposable morcellator in 13 horses and the reusable morcellator in 17 horses. Time for morcellation was based on video review for individual testes, with a median of 40.5 s (range: 27 to 122 s) and a mean of 56.5 s. Median time for morcellation when the disposable morcellator was used was 87 s (range: 48 to 122 s), whereas median time for morcellation when the reusable morcellator was used was 32 s (range: 27 to 46 s). Time for morcellation per testis decreased with increasing experience.

Fourteen horses undergoing unilateral cryptorchidectomy had a normally descended testis. Four of these horses underwent recumbent castration under IV general anesthesia via a scrotal approach with primary wound closure for removal of the descended testis. In the remaining 10 horses, the descended testis was removed with the horse in the standing position, via scrotal approach and open castration after laparoscopic-guided transection of the spermatic cord using a bipolar vessel-sealing device.

Intraoperative complications occurred in 1 of 30 horses and consisted of minor injury to the spleen upon insertion of the cannula at the intercostal portal on the left side. Mild bleeding occurred immediately, but it did not obscure viewing of the surgical field and resolved spontaneously.

After surgery, 1 of the horses had mildly elevated rectal temperature (38.9°C) that was detected approximately 12 h after surgery and remained for < 4 h. In this case, abdominal insufflation with CO₂ was not used during surgery. All other horses had normal physical parameters as well as normal appetite, fecal output, and water intake following the operation. Mild
subcutaneous emphysema around 1 or more of the portal sites developed in 3 of 30 horses \( \sim 24 \text{ h} \) after surgery and resolved with no intervention in 5 to 7 d. Follow-up information was available for 28 horses. Time for follow-up was from 1 to 37 mo. All the responders thought that the operation provided total suppression of stallion-like behavior. Regarding the incisions sites, all 28 owners reported that no drainage was seen from laparoscopic surgical sites after release of the horses from the hospital and no visible or palpable defects in the body wall were present at the laparoscopic surgical sites. Also, no post-operative complications occurred in association with the scrotal surgical sites in unilateral cryptorchids and the overall owner-satisfaction level was high in all cases.

**Discussion**

Morcellation enables successful extraction of abdominal testes through an existing portal during standing laparoscopic cryptorchidectomy. Although the use of morcellation carries additional costs (in our hospital horse owners are charged an additional morcellation-usage-fee of 50 US dollars) and requires proper skills training, this extraction technique is time efficient and all incisions healed primarily with no complications and excellent cosmetic appearance.

The use of a motorized morcellator in 30 horses undergoing laparoscopic cryptorchidectomy did not result in injuries to adjacent abdominal organs. However, iatrogenic injury during morcellation has been reported to occur in horses and humans (22,24). To prevent injury to surrounding tissues, the exposed morcellator blade and barrel must be within the visual field at all times; cautious distance should be maintained between the morcellator and surrounding viscera; and training in fundamental laparoscopic skills and morcellator use should be completed prior to performing surgery in clinical cases (25). Morcellation of cadaveric tissue specimens of different consistencies through the scrotal surgical sites is so common in horses undergoing laparoscopy that it rarely represents a problem for the surgeon or the horse (26). Mild subcutaneous emphysema developed in 3 horses after surgery. Occurrence of localized emphysema around portal sites is so common in horses undergoing laparoscopy that it is considered a variation to normal (26). In the 1 horse that developed post-operative pyrexia, the brief duration of the fever with the absence of additional clinical signs suggests a transient inflammatory response.

The use of prophylactic antimicrobials for laparoscopic cryptorchidectomy may not be indicated due to the very low rate of infection associated with this procedure (27). However, although rare, infection after laparoscopy could be devastating in horses. Thus, we consider it reasonable to administer a single IV dose of broad-spectrum antimicrobials to horses within \( 1 \text{ h} \) before laparoscopic cryptorchidectomy (28). The use of Cefazolin for \( 24 \text{ h} \) in this study, although probably unnecessary (27), was influenced by the number of doses in the bottles dispensed by our pharmacy.

Faster morcellation times were obtained with the reusable morcellator compared to the disposable morcellator. Although the larger blade used in the reusable morcellator could have contributed to this, similar findings were observed by Bekhit et al (29), who demonstrated that the reusable device was associated with faster and more effective tissue morcellation.

Previous techniques described for extraction of abdominal testes during standing laparoscopic cryptorchidectomy entail pulling of the intact testis through a body wall incision, with or without the aid of specimen retrieval bags (9–11,14,15). In horses, larger (\( \sim 120 \text{ mm} \)) paralumbar fossae incisions are predisposed to complications such as drainage, infection, and dehiscence (20,21). Paralumbar incisions between 80 and 130 mm are reported for testis extraction in horses undergoing standing laparoscopy (14). The morcellator barrel is either 13 or 20 mm in diameter and the associated skin incision is related to this size as is the separation of the underlying muscles. Furthermore, withdrawal of the morcellated testis through the barrel protects the incision from additional trauma that would otherwise occur from extraction through the incision (22).

The use of morcellation was reported to decrease the incidence of incisional complications as well as the associated cosmetic blemish in mares undergoing standing laparoscopy for removal of normal and enlarged ovaries (22,30).

Morcellation enabled straightforward extraction of the testes, with a median extraction time of 40.5 s per testis. Slippage of testes from grasping forceps or tearing of the testes during exteriorization through the abdominal wall, reported with previous techniques of testis extraction (14), did not occur in any of the operations in our study. Potential for dropping the intact testis into the abdomen when using morcellation was minimized, because the testis remained attached to the incompletely transected spermatic cord during morcellation. Any fragment of testis that becomes separated and free in the abdomen during the morcellation process is immediately located, grasped with the Semm forceps and removed through the morcellator barrel. If a fallen fragment of morcellated testis is lost its revascularization and subsequent testosterone production is unlikely (31).

Voermans et al (31) reported an absolute lack of revascularization in 123 abdominally retained testes left in situ after laparoscopic-guided ligation of the spermatic cord. Nevertheless, a potential improvement to our technique would be to combine it with the use of retrieval bags to eliminate the possibility of fragments of morcellated testes falling into the abdomen.

The use of morcellation for hysterectomy or myomectomy in women related to spreading of malignant tissue is being debated in the legal and scientific field (32,33). This obviously had an impact on availability of certain brands (i.e., Gynecare Morcellex), although morcellators and supplies from other manufacturers remain ready for purchase at reasonable prices for veterinarians in both the primary and secondhand market. Prevalence of testicular neoplasia in retained testes is very low in horses (2). Nevertheless, non-isolated morcellation (not performed within a retrieval bag) is not recommended if testicular neoplasia is suspected.

Our rationale to routinely establish the first portal (blind cannula insertion) between the last 2 ribs on the left side is...
2-fold. The peritoneum is more tightly adhered to the body wall in the caudal thoracic region than in the flank and therefore, risk of peritoneum detachment is reduced (26). Additionally, the presence of the spleen close to the abdominal wall on the left side may limit risk of bowel puncture upon insertion of the cannula (26). Despite this, peritoneum detachment or iatrogenic damage to viscera is not precluded and caution must be used during insertion of the cannula.

The recumbent scrotal approach with primary wound closure used in 4 horses is not our first choice for removal of descended testes in unilateral abdominal cryptorchids because it requires general anesthesia. However, this technique is an alternative for selected cases (i.e., fractious horses, breeds predisposed to inguinal herniation, ponies). A laparoscopic-assisted standing scrotal technique is currently used for removal of descended testis in horses undergoing standing laparoscopic cryptorchidectomy; this technique has several advantages. Removal of the descended testis in the standing horse avoids risks and expenses associated with general anesthesia. Laparoscopic viewing enables the surgeon to confirm hemostasis after transection of the spermatic cord (34). This technique enables tension-free removal of the descended testis, which results in better restraint of the standing sedated horse. Also, the use of vessel-sealing technology for hemostasis of testicular vessels prevents ligature slippage and decreases the chances of infection as no ligature material is left behind (35).

Limitations of the present study include gathering of data retrospectively from medical records and intra-operative videos, a limited number of horses, and lack of a control group. Reliance on owner perception for follow-up information coupled with a prolonged lapse of time between the surgery date and the follow-up survey may be considered limitations as well. Although the use of morcellation carries additional costs and requires proper skills training to minimize iatrogenic damage, in our experience, its use for laparoscopic extraction of abdominally retained testes in horses is advantageous. Morcellation enables safe and straightforward extraction of testes from the abdomen through an approximately 13- to 20-mm incision using a 2-portal technique.

Acknowledgments
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References
Unusual presentation of cyathostomiasis in an adult Thoroughbred mare

Emily Zakrajsek

Abstract — A recently purchased 16-year-old Thoroughbred mare with a history of recurrent colic and low body weight, also had lameness in 3 limbs, pain at the sacro-ilial joint, and increased corneal opacity of the right eye. Response to supportive therapy was poor and euthanasia was elected. A postmortem examination and histopathology confirmed cyathostomiasis within the large colon and cecum and chronic anterior uveitis of the right eye.

Résumé — Présentation inhabituelle de la cyathostomose chez une jument adulte Thoroughbred. Une jument Thoroughbred, âgée de 16 ans et récemment achetée, avec une anamnèse de coliques récurrentes et de faible poids corporel souffrait aussi de boiterie à trois membres, de douleurs dans l’articulation sacro-iliaque et d’opacité cornéenne accrue de l’œil droit. La réponse à une thérapie de soutien a été mauvaise et l’euthanasie a été choisie. Un examen post mortem et l’histopathologie ont confirmé une cyathostomose dans le gros côlon et le cæcum ainsi qu’une uvéite antérieure chronique de l’œil droit.

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In May 2017, the veterinarians at Temiskaming Veterinary Services in New Liskeard, Ontario were called to examine a 16-year-old Thoroughbred mare that had been recently purchased from the Simcoe area. The owners were aware that the mare was thin (BCS 2/5 as determined by the attending veterinarian) and wished to have her examined for additional clinical problems including a mild colic noted after transport. After thorough physical and lameness examinations the mare was found to show repeatable lameness in both forelimbs as well as the left hind limb. There was also a focal thickening of scar tissue at the right carpus suggesting previous trauma to that joint. Upon palpation of the spine a repeatable pain response was noted at the sacro-iliaic joint. The mare had not shed properly and there were patches of retained winter coat over the neck, abdomen, and limbs. The right eye had 3 to 4 round white spots on the cornea, corneal edema, and neovascularization. The eye did not appear to be a source of pain, and no squinting or discharge was present. A fluorescein stain showed no evidence of a corneal ulcer. All other findings were within normal limits and a brief dental examination was unremarkable with only mild points on the molars. Vaccines were up-to-date, while deworming status was unknown. A fecal floatation test was negative for parasites.

A complete blood (cell) count (CBC) identified a mildly low red blood cell count (RBC) [6.8 × 10^12/L; reference interval (RI): 6.9 to 10.7 × 10^12/L], an increased mean corpuscular volume (MCV) (57 fl; RI: 42 to 53 fl.), an increased mean corpuscular hematocrit (MCH, 21 pg; RI: 14 to 18 pg), and a mild basophilia (0.27 × 10^9/L; RI: 0.0 to 0.1 × 10^9/L), findings that are consistent with a mild hyperchromic, macrocytic regenerative anemia. Biochemistry revealed a mild hypoproteinememia (total protein 55 g/L; RI: 58 to 75 g/L), hypoglycemia (24 g/L; RI: 26 to 41 g/L), an increased level of potassium (4.4 mmol/L; RI: 3.1 to 4.3 mmol/L), a low sodium to potassium ratio (31; RI: 33 to 44), a low urea level (3.9 mmol/L; RI: 4.2 to 8.9 mmol/L), a low level of free bilirubin (15 μmol/L; RI: 18 to 55 μmol/L), and an increase in creatine kinase (CK) activity (471 U/L; RI: 108 to 430 U/L), with the latter most likely due to venipuncture to obtain the sample. The increase in potassium was likely due to sample hemolysis.

After the initial visit the owners were advised to start slowly increasing the caloric content in the diet and to administer firocoxib (Previcoxx; Merial, Baie D’Urfé, Quebec), 0.1 mg/kg body weight (BW), PO, q24h. A combination of tobramycin and dexamethasone eye drops (TobraDex 0.3%/0.1% ophthalmic suspension; Alcon, Mississauga, Ontario) were prescribed at 1 to 2 drops 3 times daily into the right eye, initially for 7 d but then continued for another 7 d after reassessment.

A fecal occult blood test (SUCCEED; Freedom Health, Aurora, Ohio, USA), was also performed a few days later after another mild colic episode and was H+ indicating hindgut lesions while ruling out a stomach ulcer. At that time there were no improvements in clinical signs and the owners were advised to continue medications as previously described. For the
following 3 wk the mare was seen periodically for mild colic and continued deterioration of muscle mass. An increase in respiratory effort was also noted on the final visit prior to euthanasia on June 9, 2017. At no time was diarrhea noted.

A postmortem examination revealed liquefaction of omental fat throughout the abdominal cavity and fibrin over the surfaces of the spleen and liver. Diffusely throughout the large intestinal and cecal mucosa red pinpoint dots surrounded by a pale rim were noted. The remainder of the body was grossly normal. Sections of the ileum, cecum, colon, omentum, liver, spleen, kidney, ovary, stomach, heart, and lungs were taken along with the right eye for histological analysis.

Histological reports confirmed eosinophilic colitis with intraluminal cyathostome larvae within the superficial mucosa (Figure 1), focal erosive enteritis, serous atrophy of omental fat and alveolar congestion and edema within the lung. Histological diagnosis for the eye was chronic anterior uveitis with corneal neovascularization, a finding consistent with equine recurrent uveitis (ERU).

Discussion

Currently considered to be the most significant intestinal parasites of horses, the group of over 40 small strongyles, collectively known as cyathostomes, are more often pathological in young horses that have yet to develop immunity to the organisms (1–4). Cyathostomiasis almost always presents with diarrhea, but should still be considered as a differential diagnosis in horses presenting with ill-thrift, particularly in the late winter or early spring when encysted larvae emerge from the mucosa (5,6). When parasite burdens are high this emergence can cause widespread damage to the intestinal wall leading first to protein and consequent weight loss, carrying a poor prognosis for the host (1,4). Diagnosis of this condition can be difficult as fecal floatation for the parasites is often negative during the larval stages and, due to the unknown and varying prepatent periods of the different cyathostomes, there is not a well-documented ideal time to run the test and detect the adult stages (1). Although the pinpoint mucosal lesions described in this case are characteristic, because the parasites suck plugs of intestinal mucosa into their buccal cavities they can only be seen through removing a section of intestine, which is impractical antemortem (1,5). The only definitive test for cyathostomiasis is histological demonstration of the larvae in the intestinal mucosa at necropsy (4,5).

In the case presented here the mare was older than is typical and had no instance of the characteristic diarrhea during her time with the current owner. She also didn’t present with the abdominal edema or pyrexia that are commonly seen (1,5). She did, however, show delayed shedding of the coat, which has been reported in several cases, along with periodic colic episodes and extreme weight loss (5). The older age of presentation could be due to lack of proper deworming at a younger age, allowing the extensive buildup of parasites within the gut over time (4). In recent years there has also been an increase in documented resistance to anthelmintics by these parasites and, with the concurrent decrease in the pathogenic effects of larger strongyles that are more susceptible to control through dewormers, this has led to an increase in clinical cases of cyathostomiasis even in older horses (4,5,7). High stocking density and failure to remove fecal matter promptly from pastures are also risk factors for the development of the disease (1,2,4); however, the incomplete history of the mare makes this difficult to assess. In addition, while macrocyclic lactones such as ivermectin may be one of the few classes of drugs still effective against the mature parasites, this mare presented with a massive number of encysted larvae and therefore the likelihood of success of dewormers in the few weeks prior to euthanasia would have been poor (1). With the additional conditions on the problem list the likelihood of complete recovery would ultimately have been low.

With regard to the concurrent ERU seen in this mare, there are a few possibilities for its relationship with the parasites. While infection with serovars of *Leptospira interrogans* is most commonly associated with the development of ERU due to suspected cross-reactivity between ocular tissues and membrane proteins of *Leptospira*, some studies have shown that other bacterial, viral, and parasitic diseases can also predispose horses to bouts of uveitis, likely through similar mechanisms (6,8). Strongyles, including cyathostomes, are included in this list of potential pathogens that may lead to uveitis (8). It is possible then that in this case the chronic infection with cyathostomes is what led to the chronic anterior uveitis in the mare; however, no serum antibody tests for *Leptospira interrogans* were performed and, due to the delay between infection with leptospiral organisms and the development of ERU, titers often correlate poorly with the ocular signs (8,9). It must also then be considered that due to the unknown vaccination and health history, a previous infection with *Leptospira* may have predisposed the mare to development of ERU. It is therefore possible that ERU was a separate development from the cyathostomiasis.

Due to the largely unknown history of the mare in this case, it is impossible to know how the various clinical conditions developed. It can be speculated that these problems were chronic and indicative of an uncaresed-for state before her purchase. As more sensitive tests are developed for the early recognition of cyathostomiasis it may eventually be possible to diagnose this
disease definitively prior to death of the animal. Until that time, this case highlights that equine practitioners should remain aware that the frequency of resistance to regular parasite control is increasing for small strongyles and that cyathostomiasis should remain a differential diagnosis even in older horses not showing some of the characteristic clinical signs such as diarrhea. Additionally, other means to prevent this potentially fatal disease, such as appropriate environmental management and selective treatment of animals harboring adult worms only, should be explored to offset the further development of resistance to widely used anthelmintic drugs (2,4).

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References


Book Review

One Health Case Studies: Addressing Complex Problems in a Changing World


This book is a collection of papers illustrating the difficulty and value of applying a One Health perspective to various issues in which a transdisciplinary approach has proven necessary either to seek understanding of the underlying problem, or to find a practicable solution. It begins with a definition of One Health, pointing out that it is more than just veterinarians and physicians working together to prevent zoonotic disease, and goes on to outline the difference between “One Health” and “One Medicine.” An important concept that comes up many times in the book is collaboration with people or groups with whom we would not normally work. A solid step outside of comfort zones and into humility is essential to engage with the myriad stakeholders affected by and seeking solutions to health issues. There are 4 main themes: Systems and Disease, Environmental Complexity, Agricultural Sustainability and Concepts, and Knowledge Transfer.

I thoroughly enjoyed reading the papers and found something interesting in each of them. However, with 28 articles, one does not have to read each paper to get the thrust of the concepts within each theme. There is enough variety that most will find their pet subject addressed whether it be parasitic or vectorborne disease, climate change, emerging markets and food security, or antimicrobial resistance, to name a few. Each paper shows why the problem presented would benefit from a One Health perspective, how the authors tried to incorporate transdisciplinarity to the research question, and the outcome. Usually the outcome is successful, in that the One Health approach helped to find an applicable solution. Also highlighted are the many challenges to this approach, as these are all complex problems that require more than just simple investigations.

The ideas within are definitely “preaching to the choir” to those of us familiar with the One Health philosophy. I would recommend this book to veterinary (or medical, agriculture, or economics, etc.) students, or anyone that is interested in exploring One Health concepts. It would also be a valuable addition to the desks of policymakers as they review the complex health and socioeconomic issues in their purview. I know I plan to refer to many of the pages in the years to come.

Reviewed by Rayna Gunvaldsen, BSA, DVM, MSc, District Veterinarian, Vancouver Island, Victoria, British Columbia.
Veterinary Practice Management
Gestion d’une clinique vétérinaire

A path outside of practice: Veterinarians employed in government, industry, and academe
Un cheminement à l’extérieur de la pratique privée : les vétérinaires travaillant pour le gouvernement, l’industrie et les universités

Chris Doherty

While the common public perception of a veterinarian is that of the friendly pet doctor in a white lab coat at the local veterinary hospital, or the trustworthy large animal doctor driving up to the farm in their pickup truck, the reality is that a large number of veterinarians are employed in fields outside of private practice. From roles in government, positions at academic institutions, to employment within the animal nutrition and pharmaceutical fields, there is no shortage of options available to today’s veterinarians.

Each year, the Canadian Veterinary Medical Association (CVMA) Business Management Program, the Ontario Veterinary Medical Association (OVMA) Business Development Program, and the Canadian Animal Health Institute (CAHI), commission a survey of veterinarians working in Government, Industry, and Academe (GIA). This survey provides information regarding the compensation, benefits, hours worked, etc., of veterinarians in GIA.

Veterinarians employed in GIA earned median annual compensation between $104,625 and $147,500, depending on the sector in which they are employed; median annual hours worked ranged from 1725 to 2112 per year (Table 1).

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Le Dr Doherty est diplômé de l’Ontario Veterinary College et travaille en tant qu’analyste économique pour l’Ontario Veterinary Medical Association.

Le présent article est rédigé dans le cadre du Programme de gestion commerciale de l’ACMV, qui est cocommandité par IDEXX Laboratories, Petsecure Insurance, Merck Santé Animale et la Banque Scotia.

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It should be clarified that not all of the positions available to veterinarians in GIA are necessarily attainable through earning only a DVM; particularly in academia, further educational qualifications are often necessary. Once stratified by these categories, it becomes apparent that additional educational qualifications beyond a DVM can dramatically increase median annual compensation. For example, those veterinarians with a DVM, MSc, and board-certified specialization earned a median of $150,000, compared to $105,000 for those with their DVM and no additional educational qualifications (Table 2).

Veterinarians in GIA received a median 4 weeks’ vacation, $2000 for Continuing Education fees, and 5 days off for Continuing Education events (Table 3).

Given these quantitative measurements, one of the benefits of a career in GIA becomes clear: competitive compensation and benefits. In assessing employment in these fields, however, there is much more to consider than compensation and benefits alone. Many of the pros and cons are less tangible and quantifiable than can be collected in our annual survey.

One of the common intangible upsides to a career in industry is the variety in responsibilities. “The role of a veterinarian working in industry could include technical support, marketing, management and sales related activities, often with the opportunity to grow,” explains Dr. Nicole Colapinto, a veterinarian with Merck Animal Health. “This variability keeps the job fresh and intellectually stimulating.”

Dr. Paige Golden, a veterinarian with Nestlé Purina PetCare Canada, echoes that sentiment. “My role has me wearing many different hats. I provide product information and nutritional consults to veterinary teams, train sales representatives, conduct seminars for veterinary professionals, and offer technical support for our marketing team. I love the fast-paced environment and constant variability day-to-day.”

Data from the survey support these assertions, with veterinarians in GIA citing a very wide breadth of employment responsibilities, ranging from administration, management, and 147,500 $, selon le secteur dans lequel ils travaillaient; le nombre médian d’heures travaillées se situaient entre 1725 et 2112 par année (Tableau 1).

Il faudrait préciser que ce ne sont pas tous les postes disponibles pour les vétérinaires du secteur GIU qui sont nécessairement offerts après l’obtention du seul diplôme de D.V.M.; d’autres titres de compétence sont souvent nécessaires, particulièrement dans les universités. Une fois que l’on réalise une stratification en fonction des études, on constate que des titres de compétence additionnels au-delà du D.V.M. peuvent grandement augmenter la rémunération annuelle médiane. Par exemple, les vétérinaires qui possèdent un D.V.M. et une M.Sc. et sont agréés par un conseil de spécialistes gagnent une médiane de 150 000 $, comparativement à 105 000 $ pour ceux ayant un D.V.M. et aucun autre diplôme (Tableau 2).

Les vétérinaires dans le secteur GIU recevaient une médiane de quatre semaines de vacances, de 2000 $ pour les frais de formation continue et de cinq jours de congé pour les activités de formation continue (Tableau 3).

Dans la comparaison de ces mesures quantitatives, l’un des avantages d’une carrière dans le secteur GIU devient clair : une rémunération et des avantages sociaux concurrentiels. Cependant, dans l’évaluation de l’emploi dans ces domaines, il y a beaucoup plus à considérer que la rémunération et les avantages sociaux en soi. Beaucoup des avantages et des désavantages sont moins concrets et quantifiables que ceux recueillis dans notre sondage annuel.

L’un des éléments positifs intangibles fréquents d’une carrière dans l’industrie est la diversité des responsabilités.
research and development, to teaching, technical services, and regulatory responsibilities.

“In addition, working as an industry veterinarian often affords possibilities to travel, and attend conferences and continuing education events as they pertain to your field,” says Dr. Colapinto, outlining one of the other benefits of a career in industry. This benefit, though, can also be a double-edged sword, as business travel and long hours can hamper work-life balance.

“These jobs can involve a lot of travelling. Between CE events and meetings, the number of days that I am away from home does add up,” points out Dr. Golden.

Another detriment, depending on one’s individual preferences, is the reduction in clinical responsibilities, leaving an industry veterinarian with fewer opportunities to interact with clients and their animals. As many originally entered the veterinary field driven by a desire to help and care for animals, this can result in missing the enjoyment of puppy appointments, or the bonds formed with clients, for example.

For veterinarians considering a career in industry, both Drs. Colapinto and Golden advocate connecting with those who currently work in the field, such as territory managers, to learn more about the various roles and responsibilities. From there, applying for positions that line up with an individual passion and finding a compatible corporate culture are keys to long-term success in the field.

While employment in GIA will carry with it both positive and negative aspects, many who have made the leap are very content in their career decisions. “I originally wanted to specialize in equine theriogenology in Kentucky,” states Dr. Golden. “I never imagined I would be living in Alberta, providing nutritional recommendations for dogs and cats. Yet, I have loved every minute of this journey, and wouldn’t change a thing about the path I took.”

«Le rôle d’un vétérinaire travaillant dans l’industrie pourrait inclure le soutien technique, le marketing, la gestion et des activités liées à la vente, souvent avec des possibilités de croissance», explique la Dʳ Nicole Colapinto, vétérinaire chez Merck Santé animale. «Cette diversité permet de conserver la nouveauté de l’emploi et d’assurer une stimulation intellectuelle.»

La Dʳ Paige Golden, vétérinaire chez Nestlé Purina soins des animaux familiers Canada, confirme ce sentiment.

«Mon rôle me permet d’assumer une foule de fonctions différentes. Je fournis des renseignements sur les produits et des consultations sur la nutrition aux équipes vétérinaires, je forme des représentants commerciaux, je présente des ateliers pour les professionnels vétérinaires et j’offre du soutien technique à notre équipe de marketing. J’adore l’environnement dynamique et la diversité constante d’une journée à l’autre.»

Les données du sondage appuie ces propos et les vétérinaires dans le secteur GIU citent un très vaste éventail de responsabilités, allant de l’administration à la gestion, en passant par la recherche et le développement, l’enseignement, les services techniques et les responsabilités réglementaires.

«De plus, le travail en tant que vétérinaire de l’industrie offre souvent des occasions de voyager et d’assister à des conférences et à des activités de formation continue dans notre domaine», dit la Dʳ Colapinto, en signalant l’un des autres avantages d’une carrière dans l’industrie.

Mais cet avantage peut aussi être une épée à double tranchant car les voyages d’affaires et les longues heures de travail peuvent nuire à l’équilibre travail-vie.

«Ces emplois peuvent exiger beaucoup de déplacements. Entre les événements de formation continue et les réunions, je peux être absente de la maison pendant de longues périodes», signale la Dʳ Golden.

Un autre inconvénient, selon les préférences individuelles d’une personne, est la réduction des responsabilités cliniques, ce qui laisse peu d’occasions au vétérinaire de l’industrie d’interagir avec les clients et leurs animaux. Vu que beaucoup de vétérinaires ont choisi la profession car ils désiraient aider et soigner les animaux, ils peuvent par exemple s’ennuyer de la joie des rendez-vous avec des chiots ou des relations établies avec des clients.

Pour les vétérinaires envisageant une carrière dans l’industrie, les Drés Colapinto et Golden recommandent toutes deux de parler à des personnes qui travaillent actuellement dans le domaine, comme les représentants de territoire, afin d’en apprendre davantage sur les diverses fonctions et responsabilités. Ensuite, pour assurer le succès à long terme dans le domaine, il s’agit de postuler des emplois qui correspondent aux passions individuelles et de trouver une culture corporative compatible.

Même si un emploi dans le secteur GIU comportera des aspects positifs et négatifs, bon nombre des personnes qui ont fait le saut sont très satisfaites de leurs décisions de carrière.

«Je voulais d’abord me spécialiser en thériogénologie équine», affirme la Dʳ Golden. «Je n’ai jamais imaginé que j’habiterais en Alberta et que fournirais des recommandations sur la nutrition pour les chiens et les chats. Pourtant, j’ai adoré toutes les minutes de ce parcours et je ne changerais rien au cheminement que j’ai suivi.»

Table 3/Tableau 3. Median value of benefits provided to veterinarians in government, industry, and academe./Valeur médiane des avantages sociaux fournis aux vétérinaires du gouvernement, de l'industrie et des universités.

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History and clinical signs

A 1.5-year-old female Pomeranian dog was referred to the ophthalmology service at the Western College of Veterinary Medicine because of anisocoria with a left fixed pupil and a red eye (Figure 1). The menace response was negative in the left eye and left direct and consensual pupillary light reflexes were negative while the palpebral, oculocephalic reflexes, and right direct pupillary light reflexes were present. The left pupil was larger than the right and anisocoria was substantially better in scotopic conditions. Schirmer tear tests (Schirmer Tear Test Strips; Alcon Canada, Mississauga, Ontario) were 25 and 27 mm/min in the right and left eyes, respectively. The intraocular pressures were estimated with a rebound tonometer (Tonovet; Tiolat Oy, Helsinki, Finland), and were 20 and 45 mmHg in the right and left eyes, respectively. The intraocular pressures were estimated with a rebound tonometer (Tonovet; Tiolat Oy, Helsinki, Finland), and were 20 and 45 mmHg in the right and left eyes, respectively. Topical ophthalmic tropicamide (Mydriacyl; Alcon Canada, Mississauga, Ontario) was applied to both corneas and the right pupil dilated within 20 min; the left remained fixed and semi-dilated. Biomicroscopic (Osram 64222; Carl Zeiss Canada, Don Mills, Ontario) and indirect ophthalmoscopic (Heine Omega 200; Heine Instruments Canada, Kitchener, Ontario) examinations were completed and a moderate left aqueous flare was present. Posterior segment examinations revealed no abnormalities on the right fundus and a morning glory retinal detachment on the left. Fluorescein stain (Fluorets; Bausch & Lomb Canada, Markham, Ontario) was applied and rinsed from the corneal surfaces and the eyes were examined under cobalt-filtered light; staining was negative. Abnormalities were limited to the left eye.

What are your clinical diagnoses, diagnostic and therapeutic plans, and prognosis?

Discussion

Our tentative clinical diagnoses were left exudative retinal detachment and endophthalmitis, and secondary glaucoma. Further diagnostics included physical examination, complete blood cell count, serum biochemical profile, and a urinalysis. Significant abnormalities were not found and subretinal aspirates for cytologic examination and bacterial and fungal cultures were declined. The owner requested that the affected globe be enucleated and decided to return to the referring veterinarian’s office. Unfortunately this did not happen and the case was lost to follow-up.

Retinal detachments occur in many forms including effusive, rhegmatogenous (associated with a tear), and tractional related to vitreous traction bands. Detachments may be partial or complete and may require appropriate systemic medical therapy, focal laser retinopexy, or vitrectomy, and posterior segment gas tamponade with silicone oil transfer (1).

It is important to note that effusive retinal detachments are differentiated into exudative and serous forms. Exudative detachments are displaced by cells and protein rich exudates; they usually do not respond well to medical management when they involve large areas of the retina. In contrast, serous retinal detachments have displacement by cell poor content (most are probably transudates). Serous retinal detachments are often associated with hypertension or mild choroiditis and they respond well to antihypertensive therapy (for the former) and systemic immunosuppression therapy (latter).

Exudative retinal detachments develop when inflammatory or neoplastic cellular exudates collect between the retinal pigment epithelium and the retina. This happens commonly after ocular perforation with foreign bodies and from septic implantation syndrome (2,3). Ocular mycosis (Blastomyces) is endemic in the prairies (4) and commonly enters the ocular circulatory system after respiratory infection is established. The organisms lodge in the choriocapillaris and break down the retinal pigment epithelial barrier allowing serum and cellular infiltrates (pyogranulomatous inflammation) to seep in through the retinal pigment epithelium. Similarly the choroid and ciliary body are common areas for metastatic neoplastic cells to lodge within the vascular system as they arrive from primary organ sites elsewhere.
in the body. As these neoplastic metastases grow significant cyclitis and chorioiditis develop and induce secondary exudative retinal detachments (5). The most appropriate diagnostic ocular workup by ophthalmologists for exudative retinal detachments is a subretinal aspirate with cytologic examination and bacterial and fungal culture. The specificity for identification of organisms and neoplastic cells is quite high with this form of aspirate. Most exudative retinal detachments develop secondary glaucoma and often hyphema, and medical management long-term is not often successful. Therefore transconjunctival enucleations are commonly recommended, as proposed in the case herein. Generally, most neoplastic or septic endophthalmitis globes are enucleated and the contents of the globe examined diagnostically; the optic nerve tissue is sectioned to ensure that sepsis is contained within the globe. Pre-operative therapy should include appropriate oral antimicrobials, anti-inflammatories, and topical antiglaucomas (when the intraocular pressure exceeds 30 mmHg). Antimicrobials should be continued for at least 1 wk after enucleation. The latter is advisable when the intraocular pressure exceeds 30 mmHg. Chronic exudative retinal detachments often induce secondary glaucoma related to posterior and anterior synechiae, proliferating fibrovascular membranes with associated inflammation, and hemorrhage (6). Topical and systemic antiglaucoma medications are often not successful in maintaining acceptable intraocular pressures, thus necessitating surgical therapy.

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