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Editorial

Surprising new findings on veterinarians’ mental health and well-being

De nouveaux résultats surprenants sur la santé et le bien-être des vétérinaires

Earlier this year Merck Animal Health (MAH) reported on the results of a study of mental health and well-being of veterinarians in the United States (1). The study was undertaken because of several publications that indicate veterinarians have a high rate of suicide associated with an exceptionally high level of mental distress, that high student debt is a serious concern, and that there is a problem with compassion fatigue and burnout. A research team was charged with conducting a study to investigate mental health and well-being of US veterinarians. The team designed a study to determine whether a mental health crisis exists in the profession in the US, to identify factors contributing to the crisis if it exists, and to provide advice on responding to it. Specific goals were to measure the frequency of mental illness and stress in the profession and to make comparisons to previous studies and to the US population.

The researchers sent invitations by e-mail to 20,000 randomly selected veterinarians and obtained 3,540 completed responses. They determined that the margin of error was +/- 1.6% at a 95% confidence level. The 6-item Kessler Psychological Distress scoring system was used to measure mental health and a series of standardized questions on satisfaction with life was used to measure well-being.

Major findings from the study were as follows. The prevalence of mental illness among veterinarians was not significantly different from that in the general population (5.3% of veterinarians were distressed, compared with 4.7% in the employed US population). This percentage is significantly lower than the 9.3% for US veterinarians reported in the Nett study in 2015 (2). However, 50% of veterinarians with mental illness were not receiving treatment. There was significant variation in the prevalence of mental illness among segments of the profession: younger veterinarians had a higher frequency of distress (8.7% for the 18 to 34 year group and 9.1% for the 35 to 44 years group) compared with older veterinarians (2.8% for the 55 to 64 years age group and 0.7% for the 65 years and over age group). In the 6-18 years age group, 1.6% at a confidence level of 1.6% was identified as having mental illness.

Plus tôt cette année, Merck Santé animale a publié un rapport sur les résultats d’une étude sur la santé mentale et le bien-être des vétérinaires aux États-Unis (1). L’étude avait été entreprise parce que plusieurs publications indiquaient que les vétérinaires affichaient un taux élevé de suicide qui était associé à un taux exceptionnellement élevé de détresse mentale, que la dette étudiante élevée représentaient une préoccupation importante et qu’il existait un problème d’usure de compassion et d’épuisement professionnel. Une équipe de recherche a été chargée de réaliser une enquête afin d’étudier la santé mentale et le bien-être des vétérinaires américains. L’équipe a donc conçu une étude afin de déterminer s’il existait une crise de santé mentale au sein de la profession aux États-Unis, d’identifier les facteurs contribuant à la crise le cas échéant et de fournir des conseils afin de gérer la situation. Les objectifs particuliers étaient de mesurer la fréquence de la maladie mentale et du stress au sein de la profession et d’effectuer des comparaisons avec des études antérieures et au sein de la population américaine.

Les chercheurs ont envoyé des invitations par courriel à 20 000 vétérinaires choisis au hasard et ils ont obtenu 3 540 sondages remplis. Ils ont déterminé que la marge d’erreur était de +/- 1.6 % avec un intervalle de confiance de 95 %. L’échelle de détresse psychologique à 6 questions de Kessler a été employée pour mesurer la santé mentale et une série de questions normalisées sur la satisfaction envers la vie a été utilisée pour mesurer le bien-être.

Les principales constatations de l’étude étaient les suivantes. La prévalence de la maladie mentale parmi les vétérinaires n’était pas significativement différente de celle au sein de la population en général (5,3 % des vétérinaires étaient en état de détresse, comparativement à 4,7 % des personnes ayant un emploi aux États-Unis). Ce pourcentage était significativement inférieur au chiffre de 9,3 % signalé pour les vétérinaires américains dans l’étude Nett publiée en 2015 (2). Cependant, 50 % des vétérinaires atteints de maladie mentale ne recevaient pas de traitement.
group). The critically important issues that were identified were high student debt, stress levels of veterinarians, and suicide rates. The level of distress among veterinarians with no student debt was 3% compared with 9.2% to 11.3% among those with student debt. The major self-reported conditions among those with mental health concerns were depression, compassion fatigue/burnout, and anxiety. Surprisingly, only 41% of respondents would recommend a career in veterinary medicine to a family member or friend.

Overall well-being in the profession was slightly less than that of the general population — 9.1% of veterinarians were suffering from poor well-being, compared with 7.3% in the general population. Female veterinarians were disproportionately affected by poor well-being. Younger veterinarians suffered from poor well-being more frequently than older veterinarians (10.3% to 12.3% for ages 18 to 54 compared with 2.0% to 7.9% for ages 55 and over).

There were recommendations for veterinary organizations, employers, and veterinarians. Organizations are advised to continue to develop and publicize wellness resources, help to reduce student debt and enhance financial conditions in the profession, and educate members on mental health signs and symptoms. Employers are asked to educate employees and promote a healthy work/life balance, develop mentorship programs to assist new employees, and consider assistance from veterinary social work professionals. Practitioners are advised to create stress management and financial management plans, using professionals to assist them and to budget time for health-promoting activities. There is an excellent commentary on the report by Dr. Marie Holowaychuk (3), which I would recommend.

The Merck study has come up with findings that are less alarming than those of other US studies as well as studies in the UK, a number of European countries, and Australia. The methodology in the Merck study is impressive and it is worthwhile finding out whether the data from earlier studies are flawed or whether different data from other countries are associated with different conditions under which veterinary medicine is practiced in various countries. Nonetheless, the finding that over 5% of veterinarians suffer severe mental illness such as depression is concerning and much remains to be done. The Merck study has identified student debt, highly stressed younger veterinarians, and failure to seek medical attention as areas that require more attention by the profession. These are areas on which veterinary organizations can start to focus their on-going campaigns to address concerns about mental health and well-being of veterinarians. Employers and colleagues also have a big role to play in assisting veterinarians in practice. It may be easier to prevent than treat mental illness. As a profession and as individuals we also need to take on leading roles in removing the stigma associated with mental health illness, a major block to seeking treatment by affected individuals.
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Ethical question of the month — October 2018

Some animal rights advocates argue that humane meat is an oxymoron. They believe killing an animal simply for human benefit is never humane. Other animal rights groups believe that advocating for humane meat improves the lives of more animals more rapidly than promoting a vegan lifestyle. Those involved in conventional animal agriculture believe that humanely raised livestock as well as veganism are passing fads and that modern livestock production has a smaller environmental footprint than humane meat. As a food animal veterinarian with both conventional and humanely raised livestock clients as well as friends and relatives who inquire about animal rights and veganism, you are looked to as a reliable source of information on these matters. It is a struggle, however, for you to stay current in veterinary practice without getting involved in animal welfare controversies. How should you respond to those who seek your council in these matters?

Question de déontologie du mois — Octobre 2018

Certains défenseurs des droits des animaux font valoir que la viande éthique est un oxymoron. Ils croient que le fait de tuer un animal simplement pour le bénéfice des humains n’est jamais un geste sans cruauté. D’autres groupes des droits des animaux croient que la préconisation d’une viande produite de manière éthique améliore la vie de plus d’animaux, plus rapidement, que la promotion d’un style de vie végétalien. D’autre part, les personnes travaillant dans l’agriculture animale conventionnelle croient que l’élevage éthique du bétail et le végétalisme sont des modes passagères et que la production du bétail moderne a une empreinte écologique inférieure à celle de la viande produite de manière éthique. Étant donné que vous êtes un vétérinaire pour animaux destinés à l’alimentation ayant des clients possédant du bétail élevé selon des méthodes conventionnelles et selon des méthodes éthiques, des amis et des parents qui désirent s’informer à propos des droits des animaux et du végétalisme se tournent vers vous comme source fiable d’information. Cependant, vous peinez à demeurer au courant de la pratique vétérinaire sans vous mêler à des controverses en matière de bien-être animal. Comment devriez-vous répondre aux personnes qui sollicitent vos conseils sur ces questions?

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

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

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

Les propositions de questions déontologiques sont toujours bienvenues! Toutes les questions et situations présentées dans cette chronique s’inspirent d’événements réels dont nous modifions certains éléments, comme les noms, les endroits ou les espèces, pour protéger l’anonymat des personnes en cause.

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Fur farming has unique welfare challenges. Among these is timely and effective euthanasia of individual animals suffering from injuries or disease from which recovery is unlikely. A captive bolt gun is a safe and effective method of euthanasia for traditional domestic species. However, farmed mink and foxes are difficult to restrain adequately (particularly mature individuals) to ensure proper placement of the gun. Efforts to humanely restrain farmed fur animals for euthanasia often result in additional stress and injuries to the animal and the caretaker. If a safe, practical, and humane means of euthanasia does not exist, is it acceptable to allow farmed fur animals to die naturally? Is there an alternative for today’s fur farmer?

These are a pair of very odd questions to be asking when in fact safe, practical, and humane methods of euthanasia of ranched or fur-farmed animals have been practiced for ages.

As a single example, harking back a quarter-century to the Canadian Council on Animal Care’s Guide to the Care and Use of Experimental Animals, appropriate methods would include “the use of carbon monoxide, carbon dioxide, and nitrogen ... or electrical stunning followed by cervical dislocation” (1).

Moreover, the National Farm Animal Care Council’s Code of Practice for the Care and Handling of Farmed Mink specifically mandates the recommendation of the American Veterinary Medical Association which “recognizes carbon monoxide (CO) as an approved method of euthanasia for mink” and specifies that “CO from a compressed cylinder must be used on all Canadian farms.” This requirement has been in effect since December 31, 2013 (2).

Bottom line: Asking questions which already have satisfactory solutions has little rationale, either practically or philosophically.

References

Dr. John B. Delack, Saskatoon, Saskatchewan

An ethicist’s commentary on ethical euthanasia

The facts presented in this month’s case are not complete and therefore much of the question is unclear. Upon conferring with expert veterinarians associated with the fur industry, we determined that the scenario as described would be rare. One expert veterinarian wrote to us that “to offer the concept of allowing an animal that has been determined to be in need of euthanasia to ‘die naturally’ is completely wrong from a scientific and most importantly from an ethical point of view.” There is certainly a great deal to debate regarding acceptability of diverse euthanasia methods. But one point that is eminently clear is that a natural death is not necessarily a good death. To take a ridiculously simplistic example, a person swimming in high tides may well drown, certainly a natural death, but not a good one. To take some paradigmatic animal-centered examples, being torn apart by a predator is certainly natural but far from desirable. Similarly, many animal diseases are certainly “natural,” but occasion exquisite suffering. In fact, it is quite cogent to argue that there is (or rather, ought to be) one certain benefit for animals raised for human use, namely a genuinely non-horrendous death. As every veterinarian knows, the word “euthanasia” etymologically means “good death.” Unfortunately, historically, as a result of ignorance, lack of concern, or simple stupidity, many modalities for performing “euthanasia” are woefully distant from a good death. I knew for example of one animal shelter that drowned animals it could not place into homes. Being bludgeoned to death is indeed also very far from genuine euthanasia. Similarly, utilizing automobile exhaust to kill animals, as again occurred historically with “animal shelters” disposing of unwanted animals, is greatly flawed.

There are some common methods of killing animals that fall far short of being genuine euthanasia. One paradigmatic example has been the use of carbon dioxide to kill animals in research, primarily small rodents. As anyone in veterinary medicine knows, carbon dioxide kills by suffocation. I have

Ethical question of the month — July 2018

Ethical euthanasia — A Comment

An ethicist’s commentary on ethical euthanasia
many scientist friends who have assured me that CO₂ is perfectly acceptable, since in some cases it is an anaesthetic. My response to such claims is to ask these people to put a chunk of dry ice (frozen CO₂) into a bag, and then take a deep breath from the air in the bag. The feeling that the air is literally being ripped away from you is most unpleasant and terrifying. (There is a reason that treating asthmatics, who cannot expel their CO₂ as a result of bronchial constriction, is a major priority in emergency rooms.) Furthermore, when CO₂ reaches mucous membranes, carbonic acid is formed, which burns.

My research indicates that the fur industry uses carbon monoxide (CO) for euthanasia when recovering pelts. Furthermore, the CO utilized is not derived from automobile exhaust, and is therefore pure. One cannot detect carbon monoxide, as it is colorless, odorless, and tasteless. (That is in fact why one should keep a carbon monoxide detector in one's home.) From the point of view of animal welfare, CO is an optimal euthanasia agent. What is problematic about it, is that it is extremely dangerous to operators who are involved in administering it, and its toxic effects are cumulative over time. It ends up binding with hemoglobin, in effect preventing the body from receiving the requisite amount of oxygen.

Euthanasia of fur animals such as mink generally occurs in large groups of animals. I have been unable to find out what method is used when an individual animal is sick, injured, or suffering, and thus requires euthanasia. I doubt that the industry would use a method aimed at large groups of animals for individuals, if only for reasons of cost. I would assume that an injection of pentobarbital would work if the animal can be handled, but mink are not tame. It is extremely distressing that we have been unable to find a required protocol for such cases, either by networking or searching the Web, leading to the possibility that the scenario described in this case could conceivably occur, under conditions in which euthanasia is required for individual animals.

Probably as important as what is used for euthanasia is the way the animals are handled prior to euthanasia. In recent years, largely thanks to the work of Temple Grandin, the cattle industry has taken major steps towards minimizing the stress resulting from pre-slaughter handling. The industry generally deploys stunners, or captive bolt pistols, which are placed appropriately against the animals' foreheads and ablate consciousness, virtually instantaneously. Unfortunately, the slaughter of other food animals is nowhere near as optimal. Pigs are frequently stunned by being placed into CO₂ tunnels or carousels. Poultry are hung by their feet from conveyor belts and then stunned by electric paddles that robotically are fitted to their heads. Immediately thereafter, they are mechanically eviscerated and dumped into scalding water. The stunning fails more than half the time, and poultry is not covered by the US Humane Slaughter Act. The industry is currently seeking better alternatives and my colleagues and I have worked on high-altitude hypoxia, which induces oxygen deprivation in the brain without suffocation, so the animals simply go to sleep.

Any euthanasia method can fail if it is administered by uncar ing or untrained workers. Since the animals are giving us their lives, we owe it to them morally to provide a peaceful and non-traumatic death. This in turn entails methods not causing pain and distress, gentle handling, and doing as much as possible to minimize the animals’ pain and fear. Pursuant to these goals, workers should be well-trained and equipment should always be in flawless condition.

Bernard E. Rollin, PhD
The quest for an intellectual challenge after moving to Singapore led veterinarian Anna Kokosinska to further study.

Wanting to explore her new home base and the surrounds of Asia rather than having to work weekends and being on call led Anna sought to spend her time more wisely with distance learning, leading her to Massey University’s Master of Veterinary Medicine (MVM).

"Furthering my veterinary career while still having the flexibility to travel and spend evenings with my husband and two rescue dogs, I chose to start the MVM programme," she says.

At a crossroads in her career, Anna was also deciding if she wanted to pursue further training as an Anatomic Pathologist or continue as a veterinarian in local practice.

"I felt the MVM training would give me the edge required for selection into the highly competitive residency training, and I was right!

"The MVM programme not only got me noticed and selected into an Anatomic Pathology residency, but also opened the door to some of the best connections not only at Massey, but also globally with the Pathology world," she says.

Completing the course from Singapore, Anna valued the flexibility of the distance learning with Massey.

"It allowed me to manage my own work hours in and around other commitments. The programme is extremely flexible and the online resources such as recorded lectures were very useful, so there were very few schedule commitments.

"There’s a wide range of units on offer with flexibility in timeline and required contact hours. I really felt like I was able to choose units that suited my intended specialisation and areas of interest," she says.

Another stand out for Anna were Massey’s educators, particularly for her Cardiorespiratory and Endocrinology units.

"Both are world experts in their fields and make these subjects far easier to tackle. By the end of these courses, I could confidently interpret an ECG and an echo, and those complicated Addison’s and Cushing’s cases no longer scared me!"

Anna feels the MVM has made a significant impact on her veterinary career and says, “Electing to complete the research component of the Masters was instrumental in broadening my professional network, not only throughout New Zealand but also globally given Massey’s breadth of contacts and partnerships.”

Through introductions and recommendations from the Massey University faculty, Anna is about to commence the final year of her Anatomic Pathology residency at the University of Georgia.

“I feel without the contacts that I made during the MVM course, this would not have been possible,” she says.

Find out more about Massey University’s Master of Veterinary Medicine at massey.ac.nz/mvm.
1. Which of the following cell types is a consistent finding when diagnosing pemphigus foliaceus?
   A. Macrophage
   B. Lymphocyte
   C. Plasma cell
   D. Acantholytic cell
   E. Spherocyte

2. Which of the following is most correct concerning epileptic seizures?
   A. They are caused by abnormal activity in the cerebral cortex.
   B. They are caused by abnormal activity in the cerebellum.
   C. They are always the result of previous trauma.
   D. They are the result of an increase in cerebral spinal fluid (CSF) pressure.
   E. They are caused by a neurodegenerative disorder of the forebrain.

3. Which of the following is true regarding treatment for disseminated intravascular coagulopathy (DIC)?
   A. Stored whole blood or RBCs are used as the sole treatment.
   B. Anticoagulants should be given.
   C. Stored whole blood or RBCs with plasma products are used for transfusion.
   D. Sulfas or nonsteroidal anti-inflammatory drugs should be given to inhibit platelets.

4. In equine anemia, which of the following is the preferred method for evaluation of regenerative response?
   A. Peripheral mean cell volume (MCV)
   B. Peripheral blood reticulocyte count
   C. Myeloid:erythroid (M:E) ratio
   D. Red blood cell (RBC) distribution width

1. Laquelle des cellules suivantes est compatible avec un diagnostic de pemphigus foliacé?
   A. macrophage;
   B. lymphocyte;
   C. plasmocyte;
   D. cellule acantholysée;
   E. sphérocyte.

2. Lequel des énoncés suivants est le plus exact à propos des crises épileptiques?
   A. Elles sont causées par l’activité anormale du cortex cérébral.
   B. Elles sont causées par l’activité anormale du cervelet.
   C. Elles sont toujours le résultat d’un traumatisme antérieur.
   D. Elles sont le résultat de l’augmentation de la pression du liquide céphalo-rachidien.
   E. Elles sont causées par un désordre neurodégénératif du prosencéphale.

3. Lequel des énoncés suivants est vrai à propos du traitement de la coagulopathie intravasculaire disséminée?
   A. Du sang entier entreposé ou des globules rouges sont utilisés comme seul traitement.
   B. Des anticoagulants doivent être administrés.
   C. Du sang entier entreposé ou des globules rouges avec des produits du plasma sont utilisés pour les transfusions.
   D. Des sulphas ou des anti-inflammatoires non stéroïdiens doivent être administrés pour inhiber les plaquettes.

4. Dans l’anémie équine, laquelle des méthodes suivantes est la préférée pour évaluer la réponse régénérative?
   A. volume globulaire moyen périphérique;
   B. numération des réticulocytes du sang périphérique;
   C. rapport myéloïde : érythroïde (M:E);
   D. indice de distribution érythrocytaire.
5. A flock of lambs is experiencing high morbidity and moderate mortality due to severe anemia and hypoproteinemia. Necropsy of some lambs reveals the presence of granular black abomasal contents. Which of the following is the most likely diagnosis?

A. Coccidiosis
B. Cryptosporidiosis
C. Haemonchosis
D. Colibacillosis
E. Clostridiosis

(See p. 1084 for answers./Voir les réponses à la page 1084.)

Questions and answers were derived from Review Questions and Answers for Veterinary Boards 2nd ed., a 5-volume series including Basic Sciences, Clinical Sciences, Small Animal Medicine and Surgery, Large Animal Medicine and Surgery, and Ancillary Topics, by kind permission of the publisher, Mosby–Year Book, Inc., St. Louis, Missouri.

70th CVMA Convention and Council Update

Thanks to the participants, speakers, sponsors, exhibitors, volunteers and staff, the 2018 CVMA Convention was a great success. With close to 1100 participants, the 2018 CVMA Convention had the greatest turnout in recent history. The events took place in the brand new facilities of the JW Marriott Parq Vancouver Hotel. The City of Vancouver really came through weather-wise, providing us with perfect summer weather while large parts of the country experienced unusual heat. The program featured 113 concurrent sessions provided by a total of 39 speakers. For the 4th year, the program was approved by the Registry of Approved Continuing Education (RACE). Some 310 participants registered for the social event, which took place on a beautiful summer evening on board The Magic Yacht Charters’ 3-level cruise vessel, The Magic Spirit. The event showcased Vancouver’s magnificent shoreline and allowed colleagues and friends to meet over food, beverage and entertainment.

CVMA Convention — Where Canada’s veterinarians meet

Every year the CVMA Convention attracts veterinarians from all areas of Canada and many international guests to meet, interact and learn. A large number of corporate meetings and events take place during the Convention. The following are just a few of them:

A full exhibit hall and full continuing education sessions made for an extremely successful 2018 CVMA Convention.

Le congrès 2018 de l’ACMV a connu un immense succès comme en témoignent un Salon des exposants achalandé et des salles combles pour les séances de formation continue.

70e congrès de l’ACMV et mise à jour du Conseil

Grâce aux participants, aux conférenciers, aux commanditaires, aux exposants, aux bénévoles et aux employés, le congrès de l’ACMV a connu un immense succès. Avec près de 1100 participants, le congrès 2018 de l’ACMV a connu la plus haute fréquentation observée récemment. Les activités se sont déroulées dans les nouvelles installations de l’hôtel JW Marriott Parq Vancouver. La ville de Vancouver nous a vraiment gâtés sur le plan de la météo en nous offrant des conditions estivales idéales tandis que de grandes régions du pays vivaient des canicules inhabituelles. Le programme proposait 113 ateliers parallèles et un total de 39 conférenciers. Pour la quatrième année, le programme a été approuvé par le Registry of Approved Continuing Education (RACE). Quelque 310 participants se sont inscrits à l’activité sociale qui s’est déroulée par une splendide soirée d’été à bord du navire de croisière à trois étages de Magic Yacht Charters, le Magic Spirit. L’activité a mis en vedette le splendide littoral de Vancouver et a permis aux collègues et aux amis de se rencontrer et de savourer des plats, de se rafraîchir de boissons et de se divertir.

Congrès de l’ACMV — Lieu de rencontre des vétérinaires du Canada

Chaque année, le congrès de l’ACMV attire des vétérinaires de toutes les régions du Canada ainsi que de nombreux invités internationaux pour se réunir, interagir et apprendre. Beaucoup de réunions d’organisations se tiennent durant le congrès. En voici quelques exemples :

Réunion du NAVL : L’ACMV a été l’hôte de la réunion de cette année du North American Veterinary Leaders (NAVL). Ce groupe se compose des leaders d’organisations provenant des États-Unis, du Mexique et du Canada et il se réunit une fois par année pour discuter de sujets d’intérêt commun.

Boat revelers enjoy themselves.

Des passagers profitent de la croisière.
**NAVL meeting:** The CVMA hosted this year’s North American Veterinary Leaders’ (NAVL) Meeting. This group comprises the leadership of veterinary organizations from the United States, Mexico, and Canada and meets annually to discuss areas of common interest.

**CVMA Summit:** The CVMA’s president-elect, Dr. Terri Chotowetz, organized and chaired the 2018 Summit entitled *The Changing Dynamics of Private Practice.* The Summit drew approximately 175 participants and included presentations and discussions on “Corporate Veterinary Practice — What Does it Mean for The Profession?,” “Experiences in Veterinary Communication Education for Practice Success,” and “How to Form Habits that Foster Resilience in Veterinary Medicine.”

**National Issues Forum:** The CVMA’s 2018 National Issues Forum on the *Therapeutic Use of Cannabinoids in Veterinary Medicine* was moderated by Dr. Joanne Dias, National Issues Committee chair. Three panelists with expertise in companion animal medicine, medical oncology and research, and toxicology presented to about 200 participants using an interactive format employing live polling technology and open discussion. The implementation of new federal legislation to legalize cannabis for human use is scheduled for October 17, 2018.

Use of cannabinoids in animals needs more research and a number of studies are now underway. As yet, there are no

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**Sommet de l’ACMV :** La présidente désignée de l’ACMV, D°e Terri Chotowetz, a organisé et présidé le Sommet 2018 qui s’intitulait *La dynamique changeante de la pratique vétérinaire.* Le sommet a attiré environ 175 participants et incluait des présentations et des discussions sur la «Pratique vétérinaire d’entreprise — son impact sur la profession», des «Expériences en éducation sur la communication vétérinaire pour le succès de la pratique» et «Comment former des habitudes qui favorisent la résilience en médecine vétérinaire».

**Forum sur les enjeux nationaux :** L’édition 2018 du Forum sur les enjeux nationaux de l’ACMV sur l’usage thérapeutique des cannabinoïdes en médecine vétérinaire a été modérée par la D°e Joanne Dias, présidente du Comité sur les enjeux nationaux. Trois panélistes possédant de l’expertise en médecine des animaux de compagnie, en oncologie et en recherche médicale ainsi qu’en toxicologie ont fait des présentations devant environ 200 participants en utilisant un format interactif ayant recours à des sondages en direct et à des discussions libres. L’entrée en vigueur de la nouvelle loi fédérale pour légaliser le cannabis pour consommation humaine est prévue le 17 octobre 2018.

Il est nécessaire d’étudier l’usage des cannabinoïdes chez les animaux de manière plus approfondie et plusieurs projets de recherche sont maintenant en cours. Il n’y a pas encore de produits approuvés par le gouvernement fédéral pour utilisation...
Nchez les animaux. Compte tenu du statut légal du cannabis, les vétérinaires devraient consulter leur organisme de réglementation provincial pour savoir si et comment ils devraient conseiller les propriétaires et répondre à leurs questions. Sur son site Web, l’ACMV a publié «Mise en garde des médecins vétérinaires : L’exposition au cannabis médical chez les animaux de compagnie» (https://www.veterinairesaucanada.net/documents/exposition-au-cannabis-medicinal-chez-les-animaux-de-compagnie), qui aborde les effets de l’usage du cannabis médical chez les animaux de compagnie, les signes d’exposition excessive au cannabis chez les animaux de compagnie et les catégories de cannabis. L’ACMV a exercé des pressions auprès du gouvernement fédéral pour reconnaître les vétérinaires en tant que «praticien de la santé» afin qu’ils puissent donner accès à leurs patients aux produits de cannabis médical et veiller à ce que les produits de cannabis pour consommation humaine soient bien étiquetés afin de protéger les animaux. L’ACMV continue de représenter la profession vétérinaire dans ce dossier et elle maintient le contact avec Santé Canada et d’autres autorités au fur et à mesure que la situation évolue.

**Programme des futurs leaders** : L’ACMV a offert cet atelier, qui est présidé par le Dr Chris Bell et animé par le Dr Rick DeBowes pour la neuvième année consécutive. Le Programme des futurs leaders est conçu afin de préserver ou de réintroduire le plaisir en milieu de travail en enseignant aux diplômés récents et aux professionnels chevronnés comment gérer divers défis vécus en pratique vétérinaire. Il fournit l’occasion aux personnes d’explorer leur approche face aux réalisations personnelles et professionnelles et à leurs relations de travail avec les collègues.

**Assemblée générale annuelle (AGA)** : Il y avait environ 250 personnes présentes à l’AGA 2018 de l’ACMV. La ministre de la Santé du Canada, l’honorable Ginette Petitpas Taylor, a envoyé un message aux membres de l’ACMV, dont les extraits suivants :

«...Je tiens également à vous remercier du soutien que vous avez offert à Santé Canada pendant l’élaboration et la mise en œuvre...»

**2018 Summit speakers: Left to right, Drs. M. Holowaychuk, T. Chotowetz, G. Ravetz and C. Adams.**


federally approved products containing cannabinoids for use in animals. Given the current legal status of cannabis, veterinarians should consult with their provincial licensing bodies regarding if and how they should advise pet owners and answer their questions. On its website, the CVMA has published “Veterinarians Caution: Medical Marijuana Exposure in Pets” (www.canadianveterinarians.net/documents/veterinarians-caution-medical-marijuana-exposure-in-pets), which addresses the effects of using medical cannabis in pets, signs of excessive cannabis exposure in pets, and classes of cannabis. The CVMA has lobbied the federal government to recognize veterinarians as “medical practitioners” so that they can grant their patients access to medical cannabis products and to ensure that human cannabis products are properly labeled to protect animals. The CVMA continues to represent the veterinary profession on this file and maintains ongoing contact with Health Canada and other authorities as the situation evolves.

**Emerging Leaders Program** : The CVMA offered this workshop, chaired by Dr. Chris Bell and facilitated by Dr. Rick DeBowes for the 9th consecutive year. The Emerging Leaders Program is designed to maintain or help bring joy back into the workplace by teaching graduates and experienced professionals alike how to cope with a variety of challenges encountered in veterinary practice. It provides an opportunity for individuals to explore their approach to personal and professional accomplishments and their working relationships with colleagues.

**Annual General Meeting (AGM)** : The CVMA’s 2018 AGM had approximately 250 attendees. Canada’s Minister of Health, The Honorable Ginette Petitpas Taylor, sent a message to CVMA members including the following excerpts: “…I would like to express my appreciation for the support your organization has provided to Health Canada throughout the development and implementation of the regulatory and policy changes introduced to address the issue of antimicrobial resistance in the animal context… We have made significant progress, and much of this is a result of the
leadership and extensive work of the CVMA to encourage responsible antibiotic use…”

International veterinary leaders attending the AGM included Dr. Michael Topper, president, American Veterinary Medical Association (AVMA); Dr. John de Jong, president-elect, AVMA; Dr. Janet Donlin, executive vice-president and chief executive officer, AVMA; Dr. Andrew Maccabe, chief executive officer, Association of American Veterinary Medical Colleges (AAVMC); Dr. Walt Ingwersen, president, World Small Animal Veterinary Association (WSAVA); Dr. Edmundo Villarreal, president, Federación de colegios y asociaciones de médicos veterinarios zootecnistas de México (FedMVZ); Dr. Paula Parker, president, Australian Veterinary Association (AVA); Dr. Rafael Laguens, president, Federation of Veterinarians of Europe (FVE); and, Dr. Francisco Suárez-Güemes, dean, Facultad de Medicina veterinaria y zootecnia, Universidad nacional autónoma de México (UNAM).

The new president and Executive of the CVMA were introduced: Dr. Terri Chotowetz, president; Dr. Melanie Hicks, president-elect; Dr. Enid Stiles, vice-president; Dr. Louis Kwantes, executive member. Dr. Barry Stemshorn remains as treasurer, and Mr. Jost am Rhyn, as CEO. The CVMA would like to extend sincere thanks to Dr. Troye MacPherson, now immediate past-president, for her leadership and many years of dedication to the CVMA and the veterinary profession.

The CVMA and its members honored a number of veterinary professionals at the Awards Ceremony held following to the AGM:

• Small Animal Practitioner Award: Dr. Matt Read (AB)
• Merck Veterinary Award: Dr. Kathleen Parker (AB)

Les leaders vétérinaires internationaux qui assistaient à l’AGA incluaient notamment : D’ Michael Topper, président, American Veterinary Medical Association (AVMA); D’ John de Jong, président désigné, AVMA; D’ Janet Donlin, vice-présidente directrice et présidente-directrice générale, AVMA; D’ Andrew Maccabe, président-directeur général, Association of American Veterinary Medical Colleges (AAVMC); D’ Walt Ingwersen, président, World Small Animal Veterinary Association (WSAVA); D’ Edmundo Villarreal, président, Federación de Colegios y Asociaciones de Médicos Veterinarios Zootecnistas de México (FedMVZ); D’ Paula Parker, présidente, Australian Veterinary Association (AVA); D’ Rafael Laguens, président, Fédération des vétérinaires d’Europe (FVE); et D’ Francisco Suárez-Güemes, doyen, Facultad de Medicina Veterinaria y Zootecnia, Universidad Nacional Autónoma de México (UNAM).

On a présentée la nouvelle présidente et le nouvel exécutif de l’ACMV : D’ Terri Chotowetz, présidente; D’ Melanie Hicks, présidente désignée; D’ Enid Stiles; vice-présidente; D’ Louis Kwantes, membre de l’exécutif. Le D’ Barry Stemshorn occupera de nouveau le poste de trésorier et, M. Jost am Rhyn, celui de PDG. L’ACMV aimerait remercier sincèrement la D’ Troye MacPherson, maintenant présidente sortante, de son leadership et de ses nombreuses années de dévouement envers l’ACMV et la profession vétérinaire.
• CVMA Humane Award: Dr. Helene Van Doninck (NS)
• CVMA Practice of the Year Award: Kannon Animal Hospital (NB)
• CVMA Life Membership: Dr. Carlton Gyles (ON)
• CVMA President's Award: Dr. Barry Stemshorn (ON)
• R.V.L. Walker Award: Ms. Kira Moser (AB)

The CVMA Convention also provided a forum for a broad number of meetings including but not limited to a meeting of the presidents of provincial veterinary medical associations (VMAs); national species groups; provincial veterinary regulatory bodies (hosted by the CVMA); the Provincial Forum including CEOs, executive directors, registrars and communications staff of provincial VMAs (hosted by the CVMA); the annual meeting between CVMA and deans (hosted by the CVMA); the National Examining Board meeting with veterinary regulatory bodies and deans; the CVMA Past-President’s Forum (hosted by the CVMA); Canadian Council of Veterinary Registrars; and alumni receptions of the Atlantic Veterinary College, Ontario Veterinary College, Western College of Veterinary Medicine (WCVM), and a reunion for WCVM’s Class of ’87.

Thank you to the CVMA’s Professional Development Committee (PDC): Dr. Natalie Reid, PDC chair; Dr. Jeanne Lofstedt, scientific coordinator; Dr. Susan McTaggart, member; Dr. Sarah Armstrong, chair 2018; Dr. Jim Berry, chair 2019; Dr. Margaret Brown-Bury, Council liaison; Ex Officio members: Dr. Fran Rotondo, industry representative; Ms. Shannon Brownrigg, RVT; Ms. Nadine Schueller, RVT; and Ms. Sarah Cunningham, manager, Conventions, and to the CVMA staff for their tremendous efforts and success!

A big thank you as well to Dr. Jeanne Lofstedt for having served as CVMA’s continuing education (CE) coordinator for more than a decade. Dr. Lofstedt will remain responsible for the CVMA’s portion of the joint CVMA — WSAVA (World Small Animal Veterinary Association) Conference, July 15—19, 2019, in Toronto. Later this year, Dr. Kathleen MacMillan will start preparing the CVMA’s 2020 CE in conjunction with

L’ACMV et ses membres ont honoré plusieurs professionnels vétérinaires lors de la cérémonie de remise des prix qui s’est tenue après l’AGM :
• Prix du praticien des petits animaux : Dr. Matt Read (Alb.)
• Prix vétérinaire Merck : Dr. Kathleen Parker (Alb.)
• Prix humanitaire de l’ACMV : Dr. Helene Van Doninck (N.—É.)
• Prix de la pratique de l’année de l’ACMV : Kannon Animal Hospital (N.—B.)
• Titre de membre à vie de l’ACMV : Dr. Carlton Gyles (Ont.)
• Prix du président de l’ACMV : Dr. Barry Stemshorn (Ont.)
• Prix R.V.L. Walker : Mme Kira Moser (Alb.)

Le congrès de l’ACMV a aussi servi de forum à un nombre important de réunions, notamment une réunion des présidents des associations provinciales de médecins vétérinaires (AMV), des groupes nationaux d’espèces et des organismes provinciaux de réglementation de la médecine vétérinaire (organisés par l’ACMV); le Forum provincial auquel ont participé les PDG, les directeurs généraux, les registraires et le personnel des communications des AMV provinciales (organisé par l’ACMV); la réunion annuelle entre l’ACMV et les doyens (organisée par l’ACMV), la réunion du Bureau national des examinateurs avec les organismes de réglementation de la médecine vétérinaire et les doyens; le Forum des anciens présidents de l’ACMV (organisé par l’ACMV); le Conseil canadien des registraires vétérinaires; et les réceptions d’anciens de l’Atlantic Veterinary College, de l’Ontario Veterinary College, du Western College of Veterinary Medicine (WCVM) et une réunion de la promotion de 1987 du WCVM.

Merci au Comité du perfectionnement professionnel (CPP) de l’ACMV : Dr. Natalie Reid, présidente du CPP; Dr. Jeanne Lofstedt, coordonnatrice scientifique; Dr. Sarah McTaggart, membre; Dr. Sarah Armstrong, présidente 2018; Dr. Jim Berry, président 2019; Dr. Margaret Brown-Bury, agent de liaison avec le Conseil; membres d’office : Dr. Fran Rotondo, représentante de l’industrie; Mme Shannon Brownrigg, TVA; Mme Nadine Schueller, TVA; et Mme Sarah Cunningham, gestionnaire, Congrès, et aux employés de l’ACMV pour leurs efforts et leurs succès considérables!

Nous remercions aussi sincèrement la Dr. Jeanne Lofstedt qui a servi de coordonnatrice de la formation continue de l’ACMV pendant plus d’une décennie. La Dr. Lofstedt demeurerait responsable du volet de l’ACMV lors de la conférence conjointe ACMV – WSAVA (World Small Animal Veterinary Association) qui se tiendra du 15 au 19 juillet 2019 à Toronto. Plus tard cette année, la Dr. Kathleen MacMillan entamera la planification de la formation continue de l’ACMV pour 2020 en collaboration avec le CPP. La Dr. MacMillan succédera ensuite à la Dr. Lofstedt à titre de coordonnatrice de la formation continue de l’ACMV.

De la table du Conseil
Télémédecine : Le Comité sur les enjeux nationaux de l’ACMV procède à l’examen et à la révision de l’énoncé de position de 2014 de l’ACMV sur la télémédecine et il a tenu des discussions avec divers intervenants durant le processus d’examen et de révision. L’ACMV prévoit provisoirement de faire de la télémédecine, dans le contexte du bien-être animal, le sujet de discussion du Forum sur les enjeux internationaux 2019 durant le congrès conjoint de l’ACMV-WSAVA.
the PDC. Dr. MacMillan will then succeed Dr. Lofstedt as the CVMA’s CE coordinator.

From the Council table

Telemedicine: The CVMA’s National Issues Committee is reviewing and revising the CVMA’s 2014 position statement on Telemedicine and has held discussions with various stakeholders during the process of review and revision. There is a tentative plan in place by the CVMA to have telemedicine, in the context of animal welfare, as the topic of discussion for the 2019 International Issues Forum during the joint CVMA-WSAVA Convention.

Antimicrobial stewardship: Currently, the CVMA’s renewed, web-based Prudent Use Guidelines for Swine, Poultry, Beef, Dairy, Small Ruminants, and Companion Animals are being piloted. All stakeholders will be advised as soon as this new tool, scheduled for the early fall 2018, goes live.

The CVMA’s AMU Surveillance project is designed to provide data based on (electronic) veterinary prescribing and, in the case of food animals, based also on feed mill dispensing data. This project will foster improved antimicrobial use stewardship and public trust, and provide data for international reporting, particularly to the World Organisation for Animal Health (OIE).

Raw meat-based diets for pets: Council approved the following revised position statement:

“The Canadian Veterinary Medical Association (CVMA) accepts the evidence for potential health risks to pets fed raw meat-based diets (RMBDs) and to humans who are in contact with RMBDs or with pets fed RMBDs. The CVMA holds that the documented scientific evidence of potential animal and public health risks in feeding RMBDs outweigh any perceived benefits of this feeding practice.”

Equitable access to veterinary therapeutics for veterinarians globally: As a member of the World Small Animal Veterinary Association (WSAVA), the CVMA engages in the development of WSAVA positions with global reach. Council endorsed the following position:

“Ready access by healthcare professionals to pharmaceuticals (e.g., medicines, anesthetics/analgesics, etc.), biologicals (e.g., vaccines, etc.), parasiticides, and antiseptics is one of the key pillars of appropriate patient care, whether in human or veterinary medicine. Inequities in availability and access exist between various regions of the world for a variety of reasons. We call upon key stakeholders (regulatory authorities, manufacturers, and healthcare professionals) to seek solutions that would broaden access to scientifically proven efficacious therapeutics/diagnostics while maintaining safety and the sanctity of the veterinary-client-patient +/- pharmacist relationship, where warranted.”

Kennel Code: Seven years in the making, the CVMA released its newest edition of the Code of Practice for Canadian Kennel Operations.

Small Mammal Pets Code of Practice: The CVMA established a Working Group to develop such a code.

Antibiorésistance : La version mise à jour des Lignes directrices sur l’administration judicieuse des antimicrobiens pour les porcs, la volaille, les bovins de boucherie, les bovins laitiers, les petits ruminants et les animaux de compagnie fait actuellement l’objet d’un projet pilote. Nous informerons tous les intervenants dès que ce nouvel outil, dont la livraison est prévue pour le début de l’automne 2018, sera affiché en direct.

Le projet de surveillance de l’utilisation des antimicrobiens de l’ACMV est conçu afin de fournir des données basées sur la prescription vétérinaire (électronique) et, dans le cas des animaux destinés à l’alimentation, aussi selon les données de distribution des aliments du bétail. Ce projet favorisera une meilleure antibiogouvernance ainsi que la confiance du public et fournira des données pour les rapports internationaux, particulièrement ceux communiqués à l’Organisation mondiale de la santé animale (OIE).

Diètes à base de viande crue pour les animaux de compagnie : Le Conseil a approuvé l’énoncé de position révisé suivant :

«L’Association canadienne des médecins vétérinaires (ACMV) reconnaît les preuves des risques potentiels pour la santé des animaux de compagnie qui consomment une diète à base de viande crue (DBVC) et pour les humains qui entrent en contact soit avec la DBVC ou les animaux consommant une DBVC. L’ACMV estime que les preuves scientifiques documentées sur les risques potentiels pour la santé animale et la santé publique attribuables à une DBVC l’emportent sur les bienfaits perçus de cette pratique alimentaire.»

Accès équitable aux produits thérapeutiques vétérinaires à l’échelle mondiale : À titre de membre de la World Small Animal Veterinary Association (WSAVA), l’ACMV participe à l’élaboration des positions de la WSAVA ayant une portée internationale. Le Conseil a approuvé la position suivante :

«L’accès facile par les professionnels de la santé aux produits pharmaceutiques (p. ex., les médicaments, les produits anesthésiques et analgésiques, etc.), aux produits biologiques (p. ex., les vaccins, etc.), aux parasiticides et aux antiseptiques représente l’un des principaux piliers de soins aux patients appropriés, qu’il s’agisse de la médecine humaine ou vétérinaire. Il existe des inégalités au niveau de la disponibilité et de l’accès entre les diverses régions du monde pour diverses raisons. Nous exhortons les principaux intervenants (autorités réglementaires, fabricants et professionnels de la santé) à rechercher des solutions qui permettront d’élargir l’accès aux produits thérapeutiques et diagnostiques dont l’efficacité a été scientifiquement prouvée, tout en assurant la sécurité, et l’inviolabilité de la relation vétérinaire-client-patient +/- pharmacien, le cas échéant.»

Code de pratiques recommandées aux chenils du Canada : L’ACMV a publié la nouvelle édition du Code de pratiques recommandées aux chenils du Canada, qui est en préparation depuis sept ans.

Code de pratiques pour les petits mammifères de compagnie : L’ACMV a formé un groupe de travail pour l’élaboration d’un tel code.
Welfare of Cull Dairy Cows: The CVMA Council approved the following new position statement:

“The CVMA opposes prolonged transport of compromised cull dairy cows because they have an increased likelihood of suffering when exposed to transport related stressors. The CVMA supports on-farm animal welfare-based cow culling decisions and the national standardization of dairy cow best management practices.”

Housing Systems for Laying Hens: Council approved the following new position statement:

“The CVMA holds that primary consideration should be given to the welfare of the birds when housing systems for laying hens are adopted. To provide good health and welfare for laying hens, the CVMA supports the evaluation and implementation of both enriched/furnished cage systems and non-cage colony systems that are compatible with good standards of animal welfare.”

Pain Management Framework: The issue of “pain in animals,” including its recognition and management in animals, is fundamental to animal welfare. CVMA Council approved the development of a framework to ensure that there will be consistency in how the CVMA references and discusses pain, including definitions, strategies, priority activities and actions, recognition of new thinking and research in areas such as chronic pain and psychological pain in animals, and new modalities of treatment.

National Tick Awareness Month: The CVMA launched the National Tick Awareness Month in March for the 3rd year in a row. In partnership with its platinum sponsor, Merck Animal Health, the CVMA produced a number of communication tools, including a video series called “What do you really know about ticks?” in which Canadian veterinarian, Dr. Scott Stevenson, provides answers to questions frequently asked by pet owners.

Veterinary Technician Program Accreditation: CVMA Council approved the accreditation of Ottawa’s Algonquin College Veterinary Technician Program.

Council on Education (CoE): Since its inception, the CVMA has been a member of the Council on Education of the American Veterinary Medical Association (AVMA). All 5 Canadian colleges of veterinary medicine are AVMA/ CVMA CoE-accredited. Council newly nominated Dr. David Scammel, a veterinary practitioner from Winnipeg, Manitoba as the CVMA’s representative to the CoE. The CVMA would like to thank Dr. Baljit Singh who held this position for the past 6 years.

Small business tax: The CVMA was an early member of the Coalition for Small Business Tax Fairness, which now includes approximately 70 organizations. Some of the successes achieved by the Coalition were the government’s agreement to decreasing the small business tax rate from 10.5% as of January 2017 to 10% as of January 2018 and 9.5% as of January 2019. Further, the government had planned to restrict the ability to convert income into capital gains. This would have made it more difficult for small business owners to sell or transfer their business at retirement to their children. Following pressure by the Coalition, the government announced that it will not be moving forward.

Bien-être des vaches de réforme: Le Conseil de l'ACMV a approuvé le nouvel énoncé de position suivant:

«L'ACMV s’oppose au transport prolongé des vaches laitières de réforme parce qu’il y a une probabilité accrue de souffrances lors de l’exposition aux éléments de stress liés au transport. L’ACMV appuie les décisions de réforme à la ferme pour des raisons de bien-être des animaux ainsi que la normalisation nationale des meilleures pratiques de gestion des vaches laitières.»

Systèmes de logement pour les poules pondeuses: Le Conseil de l'ACMV a approuvé le nouvel énoncé de position suivant:

«L'Association canadienne des médecins vétérinaires (ACMV) estime que le bien-être des oiseaux devrait être la principale considération prise en compte lors de l’adoption de systèmes de logement pour les poules pondeuses. Afin d’assurer la bonne santé et le bien-être des poules pondeuses, l’ACMV appuie l’évaluation et l’installation de systèmes de cages enrichies et avec aménagements et de systèmes de colonies sans cages qui sont compatibles avec de bonnes normes de bien-être animal.»

Cadre de gestion de la douleur: L’enjeu de la «douleur chez les animaux», y compris sa reconnaissance et sa gestion chez les animaux, est fondamental pour le bien-être animal. Le Conseil de l’ACMV a approuvé l’élaboration d’un cadre de travail afin d’assurer la cohérence dans les mentions et les discussions de l’ACMV sur la douleur, y compris des définitions, des stratégies, des activités et des actions prioritaires, la reconnaissance des nouveaux modes de pensée et de la recherche dans des domaines comme la douleur chronique et la douleur psychologique chez les animaux ainsi que les nouvelles modalités de traitement.

Mois national de la sensibilisation aux tiques: En mars, l’ACMV a organisé, pour la troisième année consécutive, le Mois national de la sensibilisation aux tiques. En partenariat avec son commanditaire platine, Merck Santé animale, l’ACMV a produit plusieurs outils de communication, dont une série de vidéos intitulée «Que savez-vous vraiment au sujet des tiques?», où le vétérinaire canadien D’ Scott Stevenson fournit des réponses aux questions fréquemment posées par les propriétaires d’animaux de compagnie.


Impôt pour les PME: L’ACMV s’est jointe aux premières heures à la Coalition pour l’équité fiscale envers les PME qui regroupe maintenant environ 70 organisations. Parmi les succès de la Coalition, citons l’accord du gouvernement pour la réduction du taux d’imposition des petites entreprises qui passera de 10,5 % en janvier 2017, à 10 % en janvier 2018 puis à 9,5 % à compter de
with these changes. At this time, the Coalition is advocating to amend the new rules related to passive investment income announced in the 2018 federal budget. The government has not kept to its earlier promise to grandfather previous passive investments under the new rules that may increase significantly the 2019 tax bill for some small business owners. The Coalition offered to work with the government to find a more gradual implementation of the new rules and for indexing the exemption limits to inflation. The Coalition is continuing its efforts to achieve the best possible solution to keep small business needs in mind.

Webstore: We are now in the 3rd year of operating the CVMA Webstore. This web solution allows veterinary clinics to sell a broad number of products online to their clients, by direct shipment to the client or for pick-up at the clinic, without the need for onsite inventory and its associated cost (please note that some provincial regulatory restrictions may apply). The pricing of the goods is left to the discretion of the clinic. In order to promote automatic orders for pet food, both Hill’s and Royal Canin have agreed, since last fall, to offer rebates to the Webstore clients averaging approximately $6 per order.

CVMA-WSAVA Convention 2019, July 15–19, Toronto, Ontario: The CVMA’s 2019 Convention will be a joint event with the World Small Animal Veterinary Association Congress, of which the CVMA is a member association. Dr. Jim Berry, who is the member association representative for the CVMA, serves as the CVMA’s host committee chair.

(by Jost am Rhyn, CEO, CVMA)

Ma Vitrine Vétérinaire : Nous en sommes maintenant à la troisième année consécutive de fonctionnement de Ma Vitrine Vétérinaire de l’ACMV. Cette solution Web permet aux cliniques vétérinaires de vendre un grand nombre de produits en ligne à leurs clients, soit en les expédiant directement au client ou pour cueillette à la clinique, sans devoir conserver un inventaire sur les lieux avec tous les coûts qui s’y rattachent (pièce de noter que certaines restrictions réglementaires provinciales peuvent s’appliquer). Le prix des produits est laissé à l’entière discrétion de la clinique. Afin de promouvoir les commandes automatiques d’aliments pour animaux, Hill’s et Royal Canin ont toutes deux consenti, depuis l’automne dernier, à offrir des rabais aux clients de Ma Vitrine Vétérinaire qui s’établissent à environ 6 $ par commande.

CVMA-WSAVA Convention 2019, July 15–19, Toronto, Ontario: The CVMA’s 2019 Convention will be a joint event with the World Small Animal Veterinary Association Congress, of which the CVMA is a member association. Dr. Jim Berry, who is the member association representative for the CVMA, serves as the CVMA’s host committee chair.

(by Jost am Rhyn, CEO, CVMA)

Editor-in-chief of The Canadian Veterinary Journal, Dr. Carlton Gyles accepts the CMVA Life Membership award at the 2018 CVMA Convention. Congratulations! We are proud of our journal leader.

Le rédacteur en chef de La Revue vétérinaire canadienne, le Dr Carlton Gyles, accepte le Titre de membre à vie de l’ACMV lors du congrès 2018 de l’ACMV. Félicitations! Nous sommes fiers du leader de notre revue.
Vaccines Save Lives! Happy Animal Health Week!

This month, we celebrate Animal Health Week from September 30 to October 6, 2018. The Canadian Veterinary Medical Association (CVMA) is highlighting the importance of disease prevention through the campaign slogan, “Vaccines Save Lives!”

This year’s theme is an opportunity to remind animal owners that preventing disease and illness is always preferable to treating an ill animal. Animals can contract communicable diseases through herd exposure, eating contaminated carcasses, casual contact in areas such as dog parks, and environments such as boarding kennels and stables. The safest and easiest way to protect animals against many diseases is through vaccination. A vaccinated animal is a happy, safe, and healthy animal.

We’re reminding animal owners about these Five Reasons to Vaccinate:
1. Vaccinations are safe and effective — they prevent many animal illnesses.
2. Vaccinations protect everyone — they prevent diseases that can be passed not only from animal to animal, but also from animal to human.
3. Vaccinations are an important part of annual health exams.
4. Vaccinations are tailored to each animal based on its breed, age, overall health, and disease exposure risk.
5. Vaccinations can help avoid costly treatments for diseases that can be prevented.

Social media
The CVMA has promoted Animal Health Week for over 30 years. We invite you to share your celebrations on Facebook, Twitter, and Instagram using the hashtag #AnimalHealthWeek.

Our sponsors
Generous support of the 2018 Animal Health Week campaign is provided by Principal Sponsor, Petsecure Pet Health Insurance, Program Plus Sponsor, Merck Animal Health, and Program Sponsor, iFinance Canada (Petcard).

The CVMA would not be able to carry out the important educational campaign that Animal Health Week is without the generous support of our sponsors and the dedication of veterinary teams throughout the country. Thank you.

During this week-long campaign many veterinary clinics and hospitals host open houses, plan dog washes, organize pet poetry or photo contests, and clinic tours. Some veterinarians visit school children or appear on television to talk about animal health care.

Les vaccins sauvent des vies! Joyeuse Semaine de la vie animale!

Ce mois-ci, nous célébrons la Semaine de la vie animale du 30 septembre au 6 octobre 2018. L’Association canadienne des médecins vétérinaires (ACMV) souligne l’importance de la prévention des maladies par le slogan de la campagne, «Les vaccins sauvent des vies!»

Le thème de cette année représente l’occasion de rappeler aux propriétaires d’animaux qu’il est toujours préférable de prévenir la maladie que de traiter un animal malade. Les animaux peuvent contracter des maladies transmissibles par l’exposition dans le troupeau, en mangeant des carcasses contaminées, par le contact occasionnel dans des endroits comme les parc à chiens et dans des environnements comme les chenils et les écuries. La façon la plus sécure et la plus facile de protéger les animaux contre une foule de maladies est la vaccination. Un animal vacciné est un animal heureux, protégé et en santé.

Nous rappelons aux propriétaires d’animaux ces cinq raisons de vacciner :
1. Les vaccins sont sûrs et efficaces — ils préviennent beaucoup de maladies animales.
2. Les vaccins protègent les humains et les animaux — ils préviennent les maladies qui peuvent être transmises non seulement d’un animal à un animal, mais aussi d’un animal à un humain.
3. Les vaccins sont un élément important des examens annuels.
4. Les vaccins sont adaptés à chaque animal en fonction de sa race, de son âge, de son état de santé général et de son risque d’exposition aux maladies.
5. Les vaccins peuvent aider à éviter des traitements coûteux pour des maladies qui peuvent être prévenues.

Médias sociaux
L’ACMV fait la promotion de la Semaine de la vie animale depuis plus de 30 ans. Nous vous invitons à partager vos célébrations sur Facebook, Twitter et Instagram en utilisant le mot-clic #Semainedelavieanimale.

Nos commanditaires
Le commanditaire principal, Petsecure assurance maladie pour animaux, le commanditaire de programme plus, Merck Santé animale et le commanditaire de programme, iFinance Canada (Petcard) ont fourni un généreux soutien à la campagne de la Semaine de la vie animale 2018.

L’ACMV ne pourrait pas mettre en œuvre l’importante campagne d’éducation de la Semaine de la vie animale sans le généreux soutien de nos commanditaires et le dévouement des équipes vétérinaires partout au pays. Merci.

Durant cette campagne d’une semaine, beaucoup d’établissements et de cliniques vétérinaires organisèrent des journées portes ouvertes, planifieront des lave-chien, organiseront des concours de poésie sur les animaux de compagnie ou des concours de photos ainsi que des visites de la clinique. Certains vétérinaires visiteront des enfants dans les écoles ou se présenteront à la télévision pour parler à propos de la santé animale.
Celebrating 2nd Annual National Registered Veterinary Technologist/Technician Month

The Registered Veterinary Technologists and Technicians of Canada (RVTT/TTVAC) is excited to celebrate the 2nd Annual National Registered Veterinary Technologist/Technician Month this October 2018. The Association has been acknowledging registered veterinary technologist/technicians (RVTs) nationally with a week since 1993, but the profession soon discovered one week wasn’t enough!

Once again the Ontario Association of Veterinary Technicians (OAVT) has been instrumental leading the RVT Month Task Force in building both physical and electronic “RVT Month kits,” which are available through your provincial veterinary technician/technologist associations.

The RVT Month kits are for workplaces to highlight their RVT team, educate colleagues and members of the public on the veterinary technologist/technician profession. Each veterinary team is encouraged to utilize the kit materials to launch their own activities and join in on social media with the hashtag #RVTMonth. Check out the website (www.rvttcanada.ca) or social media @RVTTTC to obtain e-kits, for more activities and ideas to share. Join together to celebrate RVT Month!

RVTs contribute greatly to animal health and welfare throughout our nation. National Registered Veterinary Technologist/Technician Month provides an opportunity to recognize and honor the individuals who commit to higher standards of medical care for animals, contribute to the profession, and embody the best of the veterinary profession.

Heather Shannon, RVT, President RVTTTC

Heather Shannon, TVA, présidente TTVAC
and improve client service. Since its inception 29 years ago, the RVTTC has grown to encompass 6 provincial veterinary technician/technologists associations and over 7800 individual RVTs.

The RVTTC would like to thank the British Columbia Veterinary Technologists Association (BCVTA), Alberta Veterinary Technologist Association (ABVTA), Saskatchewan Association of Veterinary Technologists (SAVT), Manitoba Veterinary Technologists Association (MVTA), OAVT and Eastern Veterinary Technicians Association (EVTA) in working together for this truly national campaign in support of our members. It is a testament that great things can be accomplished when we work toward a common goal.

**Veterinary technician oath**

“I solemnly dedicate myself to aiding animals and society by providing excellent care and services for animals, by alleviating animal suffering, and promoting public health. I accept my obligations to practice my profession conscientiously and with sensitivity, adhering to the profession’s Code of Ethics, and furthering my knowledge and competence through a commitment to lifelong learning.”

(by Heather Shannon, RVT, President RVTTC)

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**Thank you from VWB/VSF**

A huge thank you from Veterinarians without Borders/Vétérinaires sans frontières to the Canadian Veterinary Medical Association (CVMA), and all of the individuals who made donations and supported the silent and live auctions during CVMA’s Convention this past July in Vancouver, British Columbia. We look forward to the CVMA Convention each year as an opportunity to connect with supporters from across Canada. This year, as in years past, those enthusiasts offered generous support for our work overseas and across Canada improving the lives of people and animals. We offer a special vote of gratitude to the CVMA for providing us space and time during this busy event, and for the CVMA staff who go out of their way to welcome us and offer help.

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**Merci de VSF/VWB**

Vétérinaires sans frontières/Veterinarians without Borders remercie sincèrement l’Association canadienne des médecins vétérinaires (ACVM) et toutes les personnes qui ont fait des dons et appuyé l’encan silencieux et en direct qui ont eu lieu durant le congrès de l’ACVM qui s’est tenu en juillet dernier à Vancouver, en Colombie-Britannique. Chaque année, nous nous réjouissons à la pensée du congrès de l’ACVM car c’est l’occasion de rencontrer nos partisans provenant de toutes les régions du Canada. Cette année, comme par les années antérieures, ces partisans ont offert un généreux soutien de notre travail outremer et dans diverses régions du pays afin d’améliorer la vie des personnes et des animaux.

Nous remercions sincèrement l’ACVM de nous avoir fourni l’espace et le temps durant cet événement chargé ainsi que le personnel de l’ACVM qui déploie des efforts importants pour nous accueillir et nous offrir de l’aide.
Case Report  
Rapport de cas

Hydronephrosis in a dairy calf: A diagnosis delayed by a clinician’s Bayesian brain reasoning

Hélène Michaux, Sébastien Buczinski, Gilles Fecteau, Jean-Marc Benoit

Abstract — A 3-week-old female dairy calf was presented because of severe weakness and diarrhea. Physical examination and ultrasound findings lead to a tentative diagnosis of intestinal obstruction, although serum biochemistry suggested a primary renal disorder. Reassessment of ultrasound images allowed diagnosis of hydronephrosis that had been misdiagnosed probably because of the clinician’s biased Bayesian reasoning. Pyelonephritis without renal failure was diagnosed 2.5 months later. The calf was euthanized and the diagnoses were confirmed.

Résumé — Une hydronéphrose rénale chez un veau laitier : quand le raisonnement Bayesien du clinicien rend le diagnostic plus difficile.


Can Vet J 2018;59:1062–1066

Case description

A 3-week-old female dairy calf (about 50 kg) was examined at the bovine ambulatory clinic, Université de Montréal for severe weakness. The day before, the owner had observed diarrhea, but had also observed several bloating and diarrheic episodes since birth. Clinical examination revealed abdominal distension, depression, dehydration (7%) with dry and pale mucous membranes, enophtalmia, and cold extremities. Rectal temperature (39.7°C), heart rate (132 beats/min), and respiratory rate (52 breaths/min) were increased. Lung sounds were normal. The umbilicus and the joints were normal. A small amount of dry and pasty feces was present.

Because of depression and diarrhea observed the day before, metabolic acidosis was suspected. A digestive obstruction was suspected because of bloating.

An abdominal ultrasound was performed using a 3.5 MHz probe (LoginBook; General Electric, Wauwatosa, Wisconsin, USA) and revealed small intestinal loops with decreased motility and large distended loops with anechoic content. Intestinal obstruction (empty loops aboral and distended loops oral) was suspected. The video recording is available from the corresponding author upon request.

A blood sample was submitted for a complete blood (cell) count (CBC) and serum biochemistry profile. Supportive treatment was initiated consisting of IV antimicrobial agents (Trimidox; Vétoquinol, Lavaltrie, Quebec), trimethoprim, 120 mg/45 kg body weight (BW), and sulfadoxine, 600 mg/45 kg BW, and ketoprofen (Anafen; Merial, Baie d’Urfé, Quebec), 3 mg/kg BW, IV, intravenous fluids (1 L of sterile water containing 5 g of sodium chloride and 25 g of sodium bicarbonate) to treat the suspected metabolic acidosis.

Results from the CBC and the serum biochemistry profile are presented in Table 1 (1st test results). The white blood cells (WBC) [neutrophils 17.06 × 10^9/L, reference range (RR): 1.1 to 3.6 × 10^9/L; lymphocytes: 2.88 × 10^9/L, RR: 4.0 to 10.0 × 10^9/L] indicated an inflammatory leukogram.
Hyperfibrinogenemia (9 g/L, RR: 2 to 5 g/L) indicated an ongoing inflammatory process. The calf had a non-regenerative anemia (hematocrit 0.19 L/L, RR: 0.26 to 0.4 L/L) with no reticulocytes. Serum or plasma protein concentration was normal.

A severe metabolic acidosis (total CO2: 8.8 mmol/L, RR: 22 to 33 mmol/L; anion gap: 3.9 mmol/L, RR: 7.3 to 17.9 mmol/L) was present (Table 1, 1st test results). Renal insufficiency [blood urea nitrogen (BUN) (59.3 mmol/L, RR: 1.61 to 6.51 mmol/L), creatinine (545 μmol/L, RR: 54 to 132 μmol/L), and hyperphosphatemia (5.36 mmol/L, RR: 1.05 to 2.83 mmol/L)] was also present.

A primary renal problem was suspected because of increased creatinemia and hyperuremia. The initial diagnosis was revised and misinterpretation of the ultrasonogram was suspected. The CBC and the serum biochemical profile did not indicate intestinal obstruction as a differential diagnosis; therefore, renal insufficiency became the most probable diagnosis.

The distended loops with anechoic content were in fact renal lobes filled with anechoic fluid. The renal cortex was not visualized, and the renal pelvis was distended. These findings were compatible with hydronephrosis (1,2).

A second ultrasound examination was performed the following day (Draminski 4Vet mini, convex probe 2–8 MHz, Draminski ultrasound scanner; Draminski, Olsztyn, Poland) (Figure 1). The anechogetic fluid was sampled transabdominally. A watery, colorless, transparent and odorless fluid was obtained. Creatinine and BUN concentrations of this sample were 30.93 mmol/L and 987 μmol/L, respectively, compatible with urine.

Because of the poor prognosis without surgical treatment and the relatively low economic value of the calf, the owner decided not to treat the animal. Euthanasia was discussed, but the owner elected to keep the animal. Antimicrobials were then stopped because of poor prognosis and the possibility that the calf would go to slaughter.

The animal was re-examined during a herd health visit, approximately 2.5 mo later. The heifer was eating and growing adequately according to the owner. Physical examination findings were normal except that spontaneous micturition revealed opaque, yellow urine containing whitish solid fibrin filaments. Urine analysis revealed a density of 1.022 (RR: 1.015 to 1.045), pH of 7 (RR: 7 to 8.5), protein 2+, and blood 4+ (Multistix 10 SG; Siemens Healthcare Diagnostics, Tarrytown, New York, USA). Urinary tract infection was suspected.

The transabdominal ultrasound revealed images that were similar to those observed previously. The affected kidney was identified to be the right one, since the left kidney was clearly identified caudally to the liver and appeared normal (Figure 2).

**Table 1.** Results of hematology and serum biochemistry tests for the initial visit (1st test) and for the subsequent examination (2nd visit).

<table>
<thead>
<tr>
<th>Analysis</th>
<th>1st test</th>
<th>2nd test</th>
<th>Reference range</th>
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<tbody>
<tr>
<td>Hematology</td>
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<tr>
<td>Erythrocytes (× 1012/L)</td>
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<td>9.75</td>
<td>7.4 to 11.6</td>
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<td>Hemoglobin (g/L)</td>
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<td>99</td>
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<td>Hematocrit (L/L)</td>
<td>0.19</td>
<td>0.27</td>
<td>0.26 to 0.4</td>
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<td>925</td>
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<td>Total solids (g/L)</td>
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<td>97</td>
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<td>Fibrinogen (g/L)</td>
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<td>10</td>
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<td>166</td>
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<td>Total CO2 (mmol/L)</td>
<td>8.8</td>
<td>29.0</td>
<td>22 to 33</td>
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</tbody>
</table>

AST — aspartate transaminase; CK — creatine kinase; GGT — gamma-glutamyl transferase; GLDH — glutamate dehydrogenase.
The liquid within the calyx of the right kidney was still anechoic but several hyperechogenic elements were observed (Figure 3). Percutaneous puncture revealed a pink opaque liquid which contrasted with the first sampling. Protein concentration was 48 g/L and microscopic examination after centrifugation (1500 rpm, 5 min) revealed several neutrophils in the background.

Blood samples were collected for a CBC and biochemistry profile. The results revealed hyperglobulinemia (76 g/L, RR: 26.2 to 45 g/L), hypoalbuminemia (16 g/L, RR: 27.7 to 40.4 g/L), hyperfibrinogenemia (10 g/L, RR: 2 to 5 g/L) compatible with a chronic active inflammatory process. The BUN (4.62 mmo/L) and creatinine (108 µmol/L) concentrations (Table 1, 2nd test results) were normal. Considering the grave prognosis, the owner agreed to have the calf euthanized and a complete necropsy was performed at the Faculté de Médecine Vétérinaire.

The necropsy examination revealed an enlarged right kidney (10 kg) with adhesions to the colon and cecum. There was no visible parenchyma macroscopically. Round cavities with a fibrous capsule filled with pus and fibrin mixed with urine were found (Figures 4A and 4B). Distal and middle parts of the right ureter were fibrous and the lumen was reduced; however, the hilum was dilated. The left kidney was slightly enlarged and the calyces were dilated with a loss of parenchyma. The left ureter was dilated. The bladder was empty and adhered to the small intestine.

Conclusions of the necropsy were severe right hydronephrosis with purulent pyelonephritis due to non-hemolytic Escherichia coli and renal atrophy. The same bacteria were also cultured from the liver.

There was a moderate to severe interstitial nephritis (Figure 5) in the left kidney and the ureter was dilated. A slight to moderate subacute peritonitis was also present.

**Discussion**

Hydronephrosis refers to distension and dilation of the renal pelvis and calyx with a loss of renal parenchyma. In small animals, the etiology of hydronephrosis can be genetic or secondary to mechanical obstruction (prostatitis, cystitis, uroliths, nephroliths, pyelonephritis or neoplasia). The most frequent cause in all species is urinary tract obstruction and ureter malformation such as a lack of connection between nephron and collector tubes, which is another possible etiology. Hydronephrosis is frequent in small ruminants and related to mechanical obstruction by uroliths (3). In cattle, some cases of hydronephrosis have been reported with secondary etiologies such as urolithiasis, urinary bladder eversion, or a tumoral mass in the bladder (2,4,5). However, no case of hydronephrosis in young ruminants has been described in the literature. As secondary etiologies of hydronephrosis seem to be excluded in this case, congenital hydronephrosis is a presumptive diagnosis.

After the diagnosis of hydronephrosis, the only treatment that could be proposed to the owner was a nephrectomy of the abnormal kidney combined with supportive therapy (5,6).
During the first visit, no sign of pyelonephritis was observed on ultrasound but plasma fibrinogen concentration was increased and leukocytosis was present. Those changes could have been the early signs of an infection. Unilateral nephrectomy could have been an option after stabilization of the patient (7). The prognosis is guarded to good if surgery is performed and there is appropriate medical treatment (5,6,8). A previous study of 7 cases (8) indicated that severity of the renal insufficiency based on uremia and creatininemia was not a good prognostic indicator. Signs of pyelonephritis are often fever, hyporexia, colic, pyuria. The calf in the present report did not have colic and the rectal temperature was normal, although pyuria was observed. The calf had a normal appetite according to the owner. Surprisingly, normal blood urea and creatinine values were found when there was bilateral pyelonephritis; however, creatininemia was high when the calf was seen the first time. One hypothesis could be that during the first visit, there was renal insufficiency the origin of which was prerenal because of dehydration. This dehydration was addressed with hydrotherapy and the creatininemia was not a good prognostic indicator.

Bayes’ theorem is that the post-test probability of a diagnosis is a function of pre-test probability of the diagnosis (known prevalence or clinician’s belief of this probability) and the likelihood of new diagnostic evidence (ratio of the probability to observe this diagnostic evidence in patients with versus without the suspected disease) (7).

Two types of error are possible: clinician’s beliefs are wrong or the evaluation of the strength of the new diagnostic evidence is overestimated.

Another possibility would be pseudodiagnosticity here, or confirmation bias. New information (ultrasonography results in this case) was not supportive of intestinal obstruction and should lead the clinician toward the correct diagnosis (hydronephrosis). However the clinician interpreted the new information as support for his initial hypothesis based on history and clinical examination. In this case the clinician intuitively thought that small intestine obstruction was more probable than hydronephrosis. The justification of this behavior is that it keeps the problem as simple as possible. It has been observed that when several clinicians agree about clinical findings, they assign them different values (weight) for interpretation and integration for a diagnosis (7).

Bayesian brain is a probabilistic reasoning that deals with probabilities depending on clinician experience. From this experience, the clinician develops a “script” which represents new incoming data with existing knowledge (hypothetico-deductive reasoning). This information influences interpretation of clinical signs and then Bayesian brain influences interpretation of complementary examination towards the more probable diagnosis. This is how Bayesian brain can make the clinician arrive at a mistaken diagnosis.

Finally, another test, the serum biochemistry profile analysis, had a greater weight than ultrasound as a source of new evidence in this case: increased BUN and creatinine concentrations are more specific for a renal problem. That is why the post-test probability of the diagnosis of intestinal obstruction decreased, whereas the probability of a renal problem increased. Then, this last hypothesis had its own pre-test probability (the test was then ultrasound) and considering ultrasound images, it was less likely that those images corresponded to a disease other than hydronephrosis.

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This particular case is interesting because of the “Bayesian brain” of the clinician for medical decision-making. The initial examination lead to a tentative diagnosis of intestinal obstruction because the initial abdominal ultrasound performed at the farm was misinterpreted. Probably biased by history, the veterinarian was oriented towards a digestive problem. The clinical examination made the veterinarian think of a digestive problem (flat calf, history of diarrhea, dehydration). At this stage, a hypothetico-deductive process was initiated. The clinician had a main hypothesis and a few clinical signs were used to confirm this hypothesis. While performing the ultrasound examination, the veterinarian wanted to have confirmation he was dealing with an intestinal obstruction; he thought he had that confirmation by seeing structures which looked like dilated intestinal loops. The diagnosis was revised after biochemistry and hematology results were available.

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Facing difficult cases, it is useful to have results of several complementary examinations whenever possible. Considering results of all examinations will reduce the likelihood of mistakes. Alternatively, one could seek the interpretation of the results from several clinicians, because each one has his/her own Bayesian brain.

This article deals with the first described case of untreated renal hydronephrosis in a calf that was further complicated by pyelonephritis. Performance of a nephrectomy to treat the hydronephrosis may have permitted the calf to survive and possibly avoid pyelonephritis.

References
Case Report  
Rapport de cas

Radiation therapy for the treatment of canine progressive cutaneous angiomatosis: Description of 2 cases

Paola Laganga, Laura Marconato, Simona Cancedda, Vito Ferdinando Leone, Carla Rohrer-Bley, Federica Rossi

Abstract — Two dogs with histologically confirmed progressive cutaneous angiomatosis were presented because of extensive and progressive cutaneous lesions of 1 hind limb causing pain and lameness. Radiation therapy was offered to treat disease recurrence after amputation in the first case and as first treatment in the second case. Metronomic therapy was added in both dogs. Complete and partial regression of the cutaneous lesions was achieved, respectively, with a period of 31 months of disease-free interval (first case) and 12 months of stable disease (second case). Self-limiting grades I and II acute side effects were observed. Radiation therapy can be an alternative to surgery in the treatment of inoperable cutaneous progressive angiomatosis.

Résumé — Radiothérapie pour le traitement de l’angiomatose cutanée progressive canine : description de 2 cas. Deux chiens ayant un diagnostic d’angiomatose cutanée progressive confirmé par histologie ont été présentés en raison de lésions cutanées vastes et progressives d’un membre postérieur qui causaient de la douleur et de la boiterie. La radiothérapie a été offerte pour traiter la récidive de la maladie après l’amputation dans le premier cas et comme premier traitement dans le deuxième cas. La thérapie métronomique a été ajoutée chez les deux chiens. Une régression complète et partielle des lésions cutanées a été obtenue, respectivement, avec un intervalle de 31 mois sans maladie (premier cas) et de 12 mois de maladie stable (deuxième cas). Des effets secondaires aigus spontanément résolutifs de grades I et II acutte e side effects were observed. Radiation therapy can be an alternative to surgery in the treatment of inoperable cutaneous progressive angiomatosis.

Case descriptions

Case 1
A 9-year-old, castrated male, 27.5-kg mixed breed dog was referred to the Centro Oncologico Veterinario for evaluation of treatment options for PCA. The dog had undergone 2 consecutive treatments of laser photocoagulation to treat multiple interdigital nodules attributable to PCA at 8 and 3 mo before referral.

At presentation, the dog showed multiple reddish cutaneous nodules, painful at palpation, involving the right hind limb, extending from the interdigital region to the tarsal region. Additional findings were interdigital dermatitis, marked muscular atrophy of the leg and mild popliteal lymphadenopathy. The skin was otherwise normal, including skin in the scrotal and anal regions. Fine-needle aspiration of the nodules was not conclusive, showing blood contamination and rare stellate cells; however, the popliteal lymph node showed lymphoid hyperplasia and was interpreted as reactive. The dog was initially treated with oral thalidomide as single agent (Thalidomide; Fagron Italia s.r.l., Quarto Inferiore, Bologna, Italy), 2 mg/kg.

lesions can be difficult to treat. In this report, 2 cases of PCA treated with radiation therapy (RT) and metronomic therapy are described.

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In dogs, progressive cutaneous angiomatosis (PCA) is a rare and poorly documented disease (1–3). Clinically, it is characterized by cutaneous reddish-purple plaques or nodules slowly increasing in size or number. Reported localizations are the limbs/digits, and rarely the muzzle (1,3). A single case of skeletal/non-skeletal angiomatosis is described in the literature, in which the cutaneous lesions were associated with bony involvement (4). Bleeding and/or pain are often associated with this condition. In most cases, histology is needed to differentiate this benign tumor-like condition from hemangiosarcoma. Reported treatment options include surgery and laser photocoagulation therapy for localized lesions; however, inoperable
body weight (BW), q24h; however, after 5 mo oral piroxicam (Piroxicam; Pfizer Italia s.r.l., Latina, Italy), 0.3 mg/kg BW, q24h, and oral cyclophosphamide (Endoxan; Baxter s.r.l., Lurago d’Erba, Como, Italy), 7 mg/m2, q24h were added because of progressive disease. This lead to disease stabilization for an additional 12 mo. Eventually, new nodules occurred in the inguinal region. Total body computed tomography (CT) showed multiple contrast-enhancing nodules in the paw, tibial, and femoral region especially along the lateral saphenous vein (Figure 1). Regional lymph nodes, abdominal organs, and thorax were within normal limits. Because of drug-unresponsive pain and low quality of life, right limb amputation followed by RT at the surgical scar and inguinal region was carried out. Histology confirmed the diagnosis of PCA. Radiation therapy was started 10 d after amputation; at that time, multiple red-dish nodules (at least 6) and some hemorrhagic papules were visible in the medial inguinal region adjacent to the caudal margin of the scrotum. The region underwent electron beam radiation treatment delivered using a 6 megavolt (MV) linear accelerator (Clinac DMX System; Varian, Palo Alto, California, USA). Treatment planning was performed by hand calculation, field size was 20 × 20 cm, set to include the entire scar and the right inguinal region and a minimum of 3 cm of lateral tissue. To spare the urethra, the penis was gently stretched and fixed toward the left. Beam energy was 9 MeV, source surface distance was 100 cm. A bolus of tissue equivalent material 1.5 cm thick was used to improve dose distribution uniformity to the surface. The 90% isodose line was chosen to encompass the target volume and for dose normalization (5). Radiation therapy consisted of a finely fractionated protocol with a total dose of 51 Gy, delivered in 17 fractions of 3 Gy over 4 wk (5 consecutive daily fractions the first wk and 4 fractions/wk over 3 wk). Metronomic therapy was continued during and after RT as previously described. Clinical re-check 3 wk after RT and monthly thereafter, showed complete remission of the scrotal lesions. Self-limiting grade II acute RT toxicity was observed, consisting of alopecia, erythema, dry alternated by patchy moist desquamation. Thoracic radiographs and abdominal ultrasound were repeated every 3 mo, and showed no abnormalities. After 9 mo, medical therapy was stopped due to the complete clinical response. The dog did well for an additional 22 mo (31 mo after start of RT) without any further treatment. Forty-six months after the first presentation, a follow-up total body CT scan was repeated, showing thickening of the obturator muscle adjacent to the surgical scar and a second area of soft tissue abnormality lateral to the rectum on the right side, consistent with disease recurrence. A second RT treatment was performed and metronomic therapy was restarted. Photon beam 3-dimensional conformal RT was delivered consisting of 8 fractions of 3.8 Gy applied on a Monday–Wednesday–Friday schedule. No acute side effects were observed. Twelve months after the second RT treatment, the dog was presented because of hematochezia and tenesmus. Colonoscopy revealed a pedunculated rectal mass protruding in the lumen. An excisional biopsy was performed and histopathology revealed a rectal hemangiosarcoma. For staging purposes, a CT-scan was performed, showing partial remission of the obturator muscle lesion, mild right medial iliac lymphadenopathy, and a 3.6 × 2.6 × 3.1 cm rectal mass. Moreover, pulmonary nodules compatible with metastases were observed. A dose-intense chemotherapy protocol consisting of intravenous doxorubicin given at 25 mg/m2 every 21 d in combination with oral toceranib at 2.75 mg/kg BW on a Monday–Wednesday–Friday schedule was initiated. However, the clinical conditions progressively worsened, and the dog was euthanized 66 mo after the initial presentation.

Case 2
A 7-year-old male, 32-kg mixed breed dog was referred for RT because of PCA of the left hind limb, consisting of a nodule at the medial aspect of the right tarsal region associated with...
subcutaneous swelling. On CT, a proliferation of small tortuous subcutaneous vessels involving the metatarsal and tarsal region at 360° and extending proximally in the caudal adipose tissue of the popliteal region was observed (Figure 2). The popliteal lymph node and the bony structures were within normal limits. A biopsy was taken, and histopathology revealed PCA. Conservative surgery was ruled out based on the extensive and circumferential limb involvement and the owner refused amputation.

At presentation, the dog was intermittently lame with mild muscle atrophy and a moderate thickening of the dorsal, medial, and lateral tarsal surface extending proximally to the medial popliteal region. The involved skin had a dark-reddish appearance and was painful on palpation. Positioning CT was carried out with the dog immobilized in an individually shaped vacuum cushion (SecureVac; Bionix, Toledo, Ohio, USA) and with a custom-made byte block (6). The dog was treated with photon 3-dimensional conformal RT providing a total dose of 30 Gy divided in 5 bi-weekly fractions of 6 Gy. Oral metronomic chemotherapy was prescribed as previously described, consisting of thalidomide (Fagron Italia s.r.l., Quarto Inferiore), 2 mg/kg BW, q24h, piroxicam (Pfizer Italia s.r.l.), 0.3 mg/kg BW, q24h, and cyclophosphamide (Baxter s.r.l., Lurago d’Erba), 7 mg/m², q24h. The dog was clinically rechecked after 3 wk and self-limiting grade 1 acute toxicity was observed. Further clinical follow-up was performed after 3, 6, 9, and 12 mo; the dog was free of lameness, the subcutaneous lesion partially regressed and remained stable after 1 y. Alopecia was the only observed late side effect.

**Discussion**

The diagnosis of PCA is based on clinical, imaging, and histological features. The presence of progressively enlarging cutaneous nodules or plaques primarily affecting the digits or distal limbs spreading proximally along the vascular path, painful on palpation, associated with lameness and possible bleeding should suggest this condition (1–3). Skeletal structures are sometimes involved; therefore, radiographic examination of the limb can be useful to evaluate the presence of bony changes; however, CT is required to precisely define the soft tissue involvement (4). Computed tomography findings have not been previously reported in the literature. In these 2 cases, CT showed diffuse soft tissue thickening and a vascular proliferation enhancing in the venous phase, resulting in a thick net of tortuous structures spreading proximally and following the path of the main limb vasculature. Computed tomography was useful in assessing the extent of the disease, showing areas of disease involvement that were not evident on clinical examination. Biopsy is necessary to differentiate PCA from other benign or low-grade malignant vascular tumors. Histologically, this condition is characterized by well-circumscribed dermal and subcutaneous nodules of dilated fully enclosed blood-filled spaces lined by single layers of endothelial cells aligned on thin fibrous walls, with minimal mitotic activity (1,2,7–9).

Wide surgical resection or limb amputation is the preferred treatment option in cases of extensive skin involvement. Wide skin resection may be technically difficult, especially in the case of circumferential involvement and is typically associated with side effects, including suture dehiscence, tissue necrosis, or infection. Coagulation laser has recently been recommended as an alternative to conventional surgery in dogs with the aim of treating the macroscopic disease (1,3). This local treatment, however, is not effective in preventing disease recurrence and monthly re-check and multiple treatments are necessary to control the progression.

Radiation therapy is used for the management of progressive vascular diseases in humans; additionally, vascular disorders are included among the indications provided by the consensus guidelines for RT treatment of benign diseases (10–13). The biologic mechanism of ionizing irradiation in benign diseases is incompletely understood, and it is thought to result from a combination of several biologic mechanisms, including regulation of tissue perfusion, release of cytokine and other inflammatory mediators, impact on the autonomous nervous system and electrochemical milieu, and finally an anti-proliferative effect (13). Vascular endothelial cells are considered a sensitive target and vascular fibrosis that causes an impairment of circulation and reduction of abnormal vessels is suggested to play a key role in the control of vascular proliferation (14–17). Reported RT protocols are variable with respect to delivered total dose (from 7 to 40 Gy) and fractionation (daily fraction of 1.5 to 2.5 Gy). Low total dose (between 4 and 10 Gy) is recommended in children because of the higher risk of growth disturbance and secondary malignancies (11,12).

To the authors’ knowledge, RT has never been reported for the treatment of benign vascular diseases in veterinary medicine. In 2 dogs herein, RT combined with metronomic therapy was effective to locally treat cutaneous angiomatosis. In the first case, complete regression of the cutaneous nodules was obtained after delivering a finely fractionated protocol (total dose of 51 Gy) with a disease-free interval of 31 mo. Because of disease recurrence, a second low-dose treatment (30 Gy administered in 8 fractions of 3.9 Gy) was completed 28 mo after the first treatment, with a further period of clinical control of 12 mo. The second dog received a total dose of 30 Gy with a bi-weekly 6 Gy fraction protocol, and stable disease was achieved for at least 12 mo. Both RT protocols lead to PCA regression and medium/long-term disease control; however, consideration of the best RT strategy to treat this disease is not possible, because only 2 dogs with different dose fractionation were treated. The finely fractionated protocol was associated with acute grade 2 self-limiting toxicity, whereas the low-dose treatments did not cause any acute toxicity. Moreover, the addition of metronomic therapy might have influenced the RT effect.

Hemangiosarcoma developing from hemangioma or other vascular malformation sites has been reported in human medicine as a rare event (18). Most of the reported cases have been considered to arise spontaneously; however, at least 2 cases of recognized radiation-induced hemangiosarcoma are described. The first case occurred in the canthus of the eye of a patient 20 y after radiation for a large face hemangioma and the second occurred from skeletal hemangiomatosis of the pelvis in a Japanese patient exposed to atomic bomb irradiation over 50 y earlier (19,20). Exposure to ionizing radiation is known to...
increase the incidence of cancer, with a latent period of years or decades following exposure (21).

In the first case herein, a rectal hemangiosarcoma was diagnosed 36 mo after the first and 12 mo after the second RT treatment. Since the hemangiosarcoma occurred in the irradiated field, it is possible that it represents a case of malignant transformation of a benign vascular process; however, pre- and post-induction histology would have been necessary to confirm this and it was not available in this dog. Therefore, the hypothesis of a spontaneous occurring hemangiosarcoma cannot be ruled out.

Both cases were treated with metronomic therapy in addition to RT. Metronomic therapy refers to the practice of administering cytotoxic drugs without prolonged drug-free breaks and at doses significantly lower than traditional chemotherapy, with the therapeutic outcome of both anti-angiogenic and immune-modulatory effects (22). Metronomic therapy consisting of piroxicam, cyclophosphamide, etoposide, and/or thalidomide has proven to be efficacious in canine hemangiosarcoma, among other histotypes (23–25). Also, by normalizing tumor blood vessels, thereby resulting in improved tumor perfusion, it may be hypothesized that the addition of radiation therapy to metronomic treatment may lead to a better clinical efficacy, because anti-angiogenic therapy increases oxygenation and radiosensitivity, augmenting radiation efficacy (26,27).

In conclusion, combined RT and metronomic therapy was an effective treatment for PCA in these 2 dogs, leading to long-lasting control of disease and pain. Further cases are required to confirm these preliminary results in a large cohort of dogs and to establish the best protocol.

Acknowledgment
The authors thank Dr. Bux who kindly contributed case material and provided clinical follow-up of the second case.

References
Successful surgical resolution of a ceco-cecal intussusception in a 15-month-old Angus heifer

Gustavo Ferlini Agne, Ricardo M. Stockler, Thomas Passler, Herris Maxwell, Robert Cole

Abstract — A 15-month-old Angus heifer was presented for anorexia and abdominal discomfort. Transabdominal ultrasound was suggestive of a ceco-cecal intussusception. Exploratory laparotomy confirmed the diagnosis and a cecectomy was performed. The heifer recovered well and continued to gain weight after discharge. This is the first report of a heifer with ceco-cecal intussusception in North America.

Rapport de cas — Correction chirurgicale réussie d’une intussusception caeco-cæcale chez une génisse de race Angus âgée de 15 mois. Une génisse de race Angus âgée de 15 mois est présentée pour une anorexie et des signes d’inconfort abdominal. Une échographie transabdominale révèle la présence d’une intussusception caeco-caecale. Le diagnostic est confirmé par laparotomie exploratrice et une typhlectomie est réalisée. La génisse a bien récupéré après l’opération et a continué à prendre du poids après sa sortie de l’hôpital. Ceci est le premier rapport de cas d’une génisse atteinte d’une intussusception caeco-caecale en Amérique du Nord.

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Case description

A 15-month-old, 363-kg Angus replacement heifer was presented to the Auburn University Large Animal Teaching Hospital for evaluation of anorexia and mild abdominal discomfort which had started approximately 24 h earlier. The owner stated that no other animals in the herd were affected.

On admission, the heifer was in good body condition (BCS 6 of 9). Upon physical examination, the heifer was lethargic and febrile [39.8°C, reference range (RR): 37.5°C to 38.5°C]. The heifer had a heart rate of 100 beats/min (RR: 60 to 90 beats/min) with no murmurs or arrhythmias noted upon cardiac auscultation. The respiratory rate was 32 breaths/min (RR: 10 to 30 breaths/min) with normal bronchovesicular sounds and respiratory effort noted during auscultation of the thorax. The mucous membranes were moist and of normal color, with a capillary refill time of 2.5 s, and the heifer was estimated to be 5% dehydrated. The nostrils were free of discharge and there was no coughing. Ruminal sounds were increased with a total of 5 ruminal contractions/min.

Findings from transrectal palpation of the abdomen were unremarkable. Feces were dark and suggestive of sloughed intestinal mucosa. Initial blood analysis revealed a packed cell volume (PCV) of 28% and total solids of 50 g/L. A complete blood (cell) count (CBC) demonstrated a mild leukocytosis (12.22 × 10³/μL, RR: 5.00 to 10.00 × 10³/μL) with a mild neutrophilia (5.62 × 10³/μL, RR: 0.60 to 4.00 × 10³/μL) and normal lymphocyte count (5.13 × 10³/μL, RR: 2.50 to 7.50 × 10³/μL). A mild hypoalbuminemia and mild electrolyte derangements characterized by hyponatremia and hypochloremia were detected on serum biochemistry analysis (Table 1). A fecal egg count performed by a modified McMaster’s method indicated the presence of Trichostrongyle (950 eggs/g) and moderate numbers of coccidia.

Approximately 12 h after admission to the hospital, the heifer developed profuse, fibrino-mucoid, and hemorrhagic diarrhea. A fecal sample was submitted for Salmonella culture, which eventually yielded a negative result 7 d later. Initial medical therapy consisted of pain control with a single dose of the non-steroidal anti-inflammatory drug flunixin meglumine (Banamine; Schering Plough Animal Health, Union, New Jersey, USA), 1.1 mg/kg body weight (BW), IV. Intravenous fluid therapy consisted of 7.2% hypertonic saline (VetOne, Boise, Idaho, USA), 5 mL/kg BW, over 20 min (1) in order to provide rapid plasma volume expansion, along with an electrolyte solution (yeast, magnesium, calcium, and potassium, 500 mg in 20 L of water — YMCP; TechMix, Stewart, Minnesota, USA) via orogastric intubation, administered once.

On day 2, transabdominal ultrasound examination revealed increased peristalsis of the small intestines without luminal distention or increased wall thickness of the small intestines. Transabdominal ultrasound imaging of the abdomen at the right para-lumbar fossa indicated an intussusception with a typical...
target sign lesion consisting of alternating concentric echogenic and hypoechogenic rings of thickened intestinal wall (~10 mm) (Figures 1, 2). Given the anatomic location of the target sign lesion, and the lack of small intestinal distention, a ceco-cecal or ceco-colic intussusception was suspected. No other abnormalities were observed during transabdominal ultrasound examination.

Based on the history, physical examination, and diagnostic procedures performed (i.e., abdominal discomfort and transabdominal ultrasound findings consistent with a cecal intussusception) an exploratory laparotomy was performed. A standing right flank approach was initially selected. After loco-regional anesthesia of the paralumbar fossa using 2% lidocaine hydrochloride in a proximal paravertebral block, a 30-cm vertical skin incision was made in the right paralumbar fossa, midway between the last rib and the tuber coxae. The abdominal wall was incised, the abdomen was manually explored, and the ceco-cecal intussusception was easily palpable but could not be fully exteriorized. The decision to continue the surgery in left lateral recumbency was made. The incision was temporarily closed with the use of Backhaus towel clamps, a high volume caudal epidural (2% lidocaine; Vetone, Boise, Idaho, USA), 1 mL/5 kg BW was administered as previously described (2), and the animal was placed in left lateral recumbency. The abdominal incision was re-opened and the intussusception was exteriorized. A tear in the cecal wall occurred during an attempt to manually correct the intussusception (Figure 3). The affected portion of the cecum was amputated at the base of the cecum and the resulting enterotomy closed with 2-0 PDS (polidioxanone; Ethicon, Johnson and Johnson, Somerville, New Jersey, USA) utilizing an inverting pattern (Cushing pattern).

Post-surgical treatment consisted of anti-inflammatory therapy (flunixin meglumine; Schering Plough Animal Health), 1.1 mg/kg BW, IV, q24h, for 3 d, pain management with butorphanol tartrate (Torbugesic; Zoetis, Parsippany-Troy Hills, New Jersey, USA), 0.04 mg/kg BW, SC, once, and antimicrobial therapy (ampicillin; Polyflex; Boehringer Ingelheim Vetmedica, St. Joseph, Missouri, USA), 11 mg/kg BW, IM, q24h, for 7 d. Recovery from surgery was uneventful, the heifer continued to eat normally and pass normal feces, and was discharged from the hospital 10 d after surgery. At follow-up with the owner 5 mo after discharge, the heifer was doing well and had gained weight.

### Discussion

Abdominal discomfort with lethargy, loss of appetite, and reduction of fecal output are common presenting complaints in ruminant practice. In a retrospective study evaluating the prevalence and prognosis of intussusceptions in calves and adult cattle, all animals were presented with signs of anorexia and changes in fecal quality and output, but only half of the animals presented with signs of pain (3). In the heifer described here evidence of lethargy and decreased appetite were observed but fecal output was not reduced and abdominal discomfort was mild.

The heifer initially had mild tachycardia and pyrexia. Potential causes for the increased heart rate and temperature included: pain related to a gastrointestinal abnormality, peritonitis, cardiac disease, pneumonia, and dehydration. The heifer was not coughing and there was no evidence of nasal discharge, ventral edema, increased jugular pulse or abnormalities noted during auscultation of the thorax; therefore, cardiac disease or a respiratory disease were considered unlikely contributors to the tachycardia and pyrexia noted. The heifer was estimated to be 5% dehydrated, and although there was a mild decrease in the heart rate after fluid therapy and rapid plasma expansion with the use of a hypertonic solution, the heart rate remained elevated, indicating that abdominal pain was likely one of the causes for the tachycardia. Findings of the CBC were consistent with an inflammatory leukogram, likely due to ischemic necrosis of the intussusceptum. Serum biochemistry analysis was consistent with protein loss and electrolyte derangements, which along with an increase in body temperature, were likely secondary to a protein losing enteropathy and focal peritonitis.

### Table 1. Serum blood chemistry analysis of a 15-month-old heifer with a ceco-cecal intussusception.

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Reference range</th>
<th>Result</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total protein</td>
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<td>58.0 to 85.0</td>
</tr>
<tr>
<td>Albumin</td>
<td>18 g/L</td>
<td>30 to 48</td>
</tr>
<tr>
<td>Globulin</td>
<td>29 g/L</td>
<td>34 to 48</td>
</tr>
<tr>
<td>Sodium</td>
<td>135 mmol/L</td>
<td>137 to 151</td>
</tr>
<tr>
<td>Potassium</td>
<td>4.8 mmol/L</td>
<td>2.5 to 5.9</td>
</tr>
<tr>
<td>Chloride</td>
<td>89 mmol/L</td>
<td>98 to 107</td>
</tr>
<tr>
<td>Anion GAP</td>
<td>29.7 mOsm/kg</td>
<td>10.0 to 27.0</td>
</tr>
<tr>
<td>Bicarbonate</td>
<td>21.1 mmol/L</td>
<td>16.0 to 40.0</td>
</tr>
</tbody>
</table>

### Figure 1. Transabdominal ultrasound imaging was performed in the right para-lumbar fossa, showing a sagittal view of the cecum. Concentric rings (arrowhead) representing the target sign or “bulls eye” appearance of the intussusception (asterisk) are present.

### Figure 2. Transabdominal ultrasound imaging was performed in the right para-lumbar fossa to obtain a longitudinal view of the cecal apex (asterisk) with multilayered appearance within the thickened cecal wall (arrowhead).
Transrectal palpation of the abdomen did not confirm the diagnosis of intussusception in this case. In a retrospective study of intussusception in cows, about 50% of the cases had small intestinal distention that was palpable per rectum and only 23% of the intussusceptions were noted during palpation of the abdomen per rectum (4). In our case, dark feces with mucus and sloughing of the mucosa were noted, with an appearance similar to “raspberry jam,” which was consistent with previous reports of intussusception in cattle (5).

As described in other studies (6,7), the presumptive diagnosis in the present case was obtained after transabdominal ultrasound examination findings consistent with intussusception of the intestinal tract. In our case, transabdominal ultrasound examination was only performed on the second day, due to persistence of clinical signs. A transabdominal ultrasound examination at admission could have provided an earlier diagnosis and surgical intervention, which could have lessened the need for complete cecal removal and decreased the chances of possible secondary complications after surgery. Intussusception occurs when an orad segment of the intestinal tract (the intussusceptum) telescopes inside an aborad segment (the intussuscipiens) (8–10). Small intestine distention may occur and is usually seen proximal to the intussusception. Small intestine distention was not observed in our case, which was likely because the ileocecal junction was not obstructed.

The cross-section ultra-sonographic pattern of an intussusception is usually characterized by a multilayered mass with circular rings of varying echogenicity. In a study evaluating the ultrasonographic appearance of intussusceptions in cows, cross-section ultrasound view of the intussusciptum was assumed by echogenic layers combined with hypoechoic portions (likely related to presence of edema), while the cross-section ultrasound pattern of the intussusceptum was often hypoechoic with a hypo to anechoic core (7). In the same study, the longitudinal view was characterized by echogenic parallel lines separated by hypoechoic lines, giving a multilayered appearance to the intussusception. In our case, the cross-section and longitudinal views were similar to those in previous reports, except that in the longitudinal view, the central luminal area was hyperechoic and conical in shape (intussusceptum) and seen within multiple layers of hyperechoic lines, interposed by hypoechoic lines, forming a horse shoe shape (intussuscipiens). These findings were consistent with a similar report in a Simmental heifer (11). Given the anatomical location, ultrasonographic appearance on longitudinal view and lack of small intestinal distention, the intussusception was determined to be involving only the cecum (ceco-cecal).

Cecal intussusceptions are uncommon in cattle and, although previously described in calves, to the authors’ knowledge this is the second report of a ceco-cecal intussusception in a heifer and the first described in North America. In a retrospective study of 336 cases of intussusceptions in cattle, only 12 cases involved the cecum and all were defined as ceco-colic intussusceptions (10). In the same study, calves less than 2 mo of age were the most affected. Our hypothesis is that ceco-cecal intussusceptions are not commonly observed in calves because the size of the cecum in younger animals allows it to telescope completely into the colon as previously described (12). In older animals such as the heifer herein, the cecal diameter is likely too large to telescope into the colon; therefore, if invagination of the cecum occurs, it is limited to a ceco-cecal intussusception due to anatomical proportions.

The diagnosis of a ceco-cecal intussusception was obtained during exploratory laparotomy. The initial surgical approach was performed standing, which allowed palpation of the intussusception but did not permit exteriorization and visualization of the area. This was likely due to excessive tension of the mesentery and therefore, it was decided to place the heifer in left lateral recumbency. Although the incision was temporarily closed with Backhaus towel clamps, altering from a standing to a lateral recumbency increased the time of surgery and the risk of contamination of the abdominal cavity. As previously reported (10), excessive tension of the mesentery while performing standing gastrointestinal surgery might induce the animal to lay down during the procedure. Therefore, it is the authors’ opinion that the surgical approach for the assessment and correction of cecal abnormalities such as a ceco-cecal intussusception should be performed through an incision in the right paralumbar fossa with the animal in left lateral recumbency. Due to edema and tissue friability, an attempt to reverse the intussusception in this case resulted in rupture of the cecal wall. It is our opinion that manual resolution of a ceco-cecal intussusception is difficult and will likely result in tissue damage, increasing the risks of contamination of the abdominal cavity with intestinal contents.
In the present case, the cecum was removed with preservation of the ileoceccolic junction. The effect of complete cecal excision including the ileoceccolic junction on digestibility and weight gain has been reported (13). There was no significant difference in digestibility and mean daily weight gain between cecctomized and sham-operated steers, indicating that the cecum may not be a critical organ for fiber and protein digestion in cattle. In the same study, fecal consistency was loose and, in some cases, diarrhea was noted up to 4 wk after surgery. At 8 wk following cecectomy, the feces of all steers had returned to almost normal consistency, indicating that the colon was likely compensating for the loss of the cecum. It was proposed that initial softening of the manure was related to antimicrobial therapy and to absence of the ileal papilla. The ileal papilla prevents backflow of ingesta from the large intestines to the ileum and if absent, colonic bacteria could colonize the small intestines, leading to diarrhea due to bacterial bile salt deconjugation (13).

In our case, the ileoceccolic junction was preserved; therefore, the soft feces observed while in the hospital were likely related to postsurgical antimicrobial therapy. Fecal consistency following discharge was unknown in our case but the heifer continued to postsurgical antimicrobial therapy. Fecal consistency following discharge was unknown in our case but the heifer continued to gain weight and diarrhea was not evident to the owners. Similarly, diarrhea was not noted after complete cecal removal in a Simmental heifer in Germany (11).

Cecal intussusceptions in cattle are rare, and to the authors’ knowledge this is the first case reported in North America. Transabdominal ultrasound examination is useful in detecting cceco-ccal intussusceptions and its findings should be interpreted in conjunction with additional diagnostic tests, physical examination, and history. Manual reduction of the intussusception may not be possible and might lead to cecal wall rupture; therefore, the surgeon should be prepared for removal of the cecum. This can be performed with sedation and regional analgesia. The authors recommend conducting the procedure in left lateral recumbency. No significant complications were noted after surgical intervention. Cecectomy, when performed early in the disease process, appears to have a good long-term prognosis. Initial weight loss and changes in fecal consistency might be observed but removal of the cecum did not appear to affect weight gain in the heifer described in this report.

References
Occult tonsillar squamous cell carcinoma in 2 dogs presenting for treatment of primary oral squamous cell carcinoma

Nicholas J. Rancilio, Christopher M. Fulkerson

Abstract — Canine non-tonsillar oral squamous cell carcinoma (OSCC) is generally regarded as locally invasive with low rates of metastasis. Two cases of canine non-tonsillar OSCC with occult tonsillar squamous cell carcinoma (TSCC) detected with tonsillar biopsies are reported. Tonsillar biopsies and detection of occult TSCC changed the therapeutic plan and may have contributed to long-term tumor control.

Résumé — Carcinome squameux tonsillaire occulte chez 2 chiens présentés pour le traitement d’un carcinome squameux buccal primaire. Le carcinome squameux buccal (CSB) non tonsillaire canin est généralement considéré comme localement invasif avec de faibles taux de métastase. Deux cas de CSB non tonsillaire canin avec un carcinome squameux tonsillaire (CST) occulte détectés lors de biopsies tonsillaires ont été signalés. Les biopsies tonsillaires et la détection du CST occulte ont modifié le régime thérapeutique et peuvent avoir contribué au contrôle de la tumeur à long terme.

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Squamous cell carcinoma is the second most common oral tumor in the dog (1). The location of oral squamous cell carcinoma (OSCC) is predictive of its biological behavior. In locations other than the tonsil, OSCC is typically locally invasive, and when amenable to wide resection is associated with good long-term clinical outcome. There are infrequent reports of locoregional and distant metastasis at diagnosis or following aggressive local treatment of non-tonsillar OSCC. Regional lymph node metastasis is reported in < 10% of cases, pulmonary metastasis in 3% to 36% of cases, and 1-year survival rates range from 40% to 93.5% (2–10). Complete surgical excision is reported to result in a median disease-free interval of 722 d and low risk of local tumor recurrence (8).

In contrast, tonsillar squamous cell carcinoma (TSCC) has a biologically aggressive behavior both locally and distantly. Regional lymph node metastasis is reported in up to 73% of dogs, pulmonary metastasis in 42% to 63% of cases, and 1-year survival rates range from 10% to 40% (2–5,9–11). Treatment with surgery alone has a median survival time of 137 d (10). Median survival times ranging from 211 to 496 d have been reported with combinations of surgery, radiation, and chemotherapy (3,9–11).

Staging for dogs with OSCC typically consists of computed tomography (CT) of the head, thoracic radiography, abdominal ultrasonography, and cytologic or histopathologic evaluation of locoregional lymph nodes (6). Here we discuss 2 cases presented for treatment of primary OSCC with occult TSCC detected at the time of staging. To the authors’ knowledge, these cases represent the first reported occurrence of occult TSCC concurrently with non-tonsillar OSCC in the dog.

Case descriptions

Case 1
A 9-year-old spayed female 27.1-kg mixed breed dog was presented for evaluation 1 mo after a non-tonsillar OSCC was surgically resected with incomplete margins from the buccal mucosa of the right maxillary lip. A focal erosion was observed that was interpreted as minor surgical dehiscence at the time of presentation (Figure 1A). Complete staging included 3-view thoracic radiographs, abdominal ultrasound, and CT with contrast of the head and neck for radiation treatment planning (Figure 1C). The right mandibular lymph node was enlarged on CT-scan; therefore, a fine-needle aspirate (FNA) was taken. Cytologic evaluation of the right mandibular lymph node revealed a mild to moderate reactive lymph node with no evidence of metastatic carcinoma. Due to the presence of moderate dental calculi, a prophylactic dental cleaning was completed by
a Board-certified veterinary dentist before initiation of radiation therapy. During the dental prophylaxis, maxillary incisor 202 was extracted.

Although the tonsils were grossly normal and cytology from the right mandibular lymph node was consistent with a reactive lymph node likely secondary to dental disease, a biopsy of the right tonsil was performed at the recommendation of the dentist. A pair of 4 mm × 28 mm Jackson Uterine Biopsy Forceps (Jorgensen Labs, Loveland, Colorado, USA) was used to biopsy the grossly normal right tonsil. With the aid of a cotton-tipped applicator, the tonsil was identified within the tonsillar crypt, the forceps were positioned such that the tonsil was located within the open jaws and then closed to obtain multiple tissue samples. Hemorrhage was controlled with direct digital pressure.

Histopathology of the right tonsil revealed multifocal areas of marked cellular atypia within the squamous epithelium, occasional mitotic figures, and invasion into the basement membrane zone, consistent with squamous cell carcinoma (SCC).

Definitive chemoradiotherapy was prescribed consisting of irradiation of the primary mass and tonsils with 19 fractions of 3 Gy, medial retropharyngeal lymph nodes, and mandibular lymph nodes with 19 fractions of 2.52 Gy, and carboplatin. All radiation treatments were delivered by a linear accelerator with 6 MV photons using intensity modulated radiation therapy treatment planning (Varian Clinac 6 Ex Accelerator and Eclipse v.11; Varian Medical Systems, Palo Alto, California, USA) on consecutive weekdays. Carboplatin (Hospira, Lake Forest, Illinois, USA), 300 mg/m², was administered by intravenous injection prior to fraction 8 of radiation therapy. A complete blood (cell) count (CBC) was carried out 14 d after administration of carboplatin. Physical examination and laboratory results were consistent with afebrile and clinically silent Veterinary

Figure 1. A – Case 1. Lesion on buccal mucosa of right maxillary lip surface (arrow) before starting definitive chemoradiotherapy. B – Case 2. Scar on right maxillary lip after 19 fractions of 3 Gy (arrow). C – Case 1. Axial slice CT-scan at the level of the tonsils (stars) demonstrating normal tonsils prior to treatment. D – Case 2. Axial slice CT-scan at the level of the tonsils (stars) demonstrating normal tonsils prior to treatment.
Cooperative Oncology Group common terminology criteria for adverse events (VCOG-CTCAE) grade 3 neutropenia (900 neutrophils/µL), Trimethoprim sulfa (Amneal, Patterson, New Jersey, USA), 37 mg/kg body weight (BW), PO, q12h, was prescribed (12). No delay in radiation delivery occurred and neutropenia resolved without incident as expected. During radiation therapy the patient developed expected acute side effects in the oral cavity and skin including Veterinary Radiation Therapy Oncology Group (VTROG) Acute Morbidity Score grade II–III mucositis, and grade II–III desquamation which resolved without incident (13). Carprofen (Rimadyl; Zoetis, Parsippany-Troy Hill, New Jersey, USA), 1.84 mg/kg BW, PO, q12h, was prescribed when acute radiation side effects were first noted and was continued thereafter.

Due to the unusual presentation of this case, the patient was returned 20 d after completing definitive radiation therapy for diagnostic biopsies of the head and neck lymphocentrums to confirm remission. Bilateral tonsillecctomies, extirpation of the right-sided mandibular lymph node chain, and extirpation of identifiable cervical lymph nodes (bilateral medial retropharyngeal lymph nodes and right deep cervical lymph nodes) were performed. No evidence of SCC was detected in either tonsil or any of the resected lymph nodes. After completing radiation therapy and recovering from surgery, carboplatin chemotherapy was resumed. The second dose of carboplatin (Hospira) was administered 49 d after the first at a 5% dose reduction (285 mg/m²). Clinically silent VCOG-CTCAE grade 4 thrombocytopenia (11 000 platelets/µL) was detected 14 d after the second dose of carboplatin (12). Three subsequent doses of carboplatin were administered at a further 10% dose reduction (257 mg/m²) for a total of 5 doses. The patient was alive, and reportedly well, after consultation with the owner 3 1/2 y after initiating definitive chemoradiotherapy. Based on consultation with the primary veterinarian and review of the patient’s medical record, there was no apparent evidence of SCC at the time of euthanasia.

**Case 2**

A 10-year-old spayed female 26.9-kg mixed breed dog was presented for evaluation 1 mo after a non-tonsillar OSCC was surgically resected with incomplete margins from the right maxillary lip margin (Figure 1B). Following the initial surgery, the primary veterinarian prescribed carprofen (Rimadyl; Zoetis), 3.7 mg/kg BW, PO, q24h. Complete staging was performed including 3-view thoracic radiographs and abdominal ultrasound. Computed tomography of the head and neck with contrast was performed for radiation treatment planning (Figure 1D). Other than an area of focal contrast uptake on the right maxillary lip, no other imaging abnormalities were reported. On oral examination, the left and right tonsils were found to be grossly normal in size and shape. Due to the authors’ experience with the previous case, both tonsils were biopsied using the same technique as in the first case. Histopathology of both tonsils revealed irregular thickening of the mucosal stratified squamous epithelium with abnormal maturation, loss of a distinct basal cell layer or basement membrane, and neoplastic invasion of the underlying lymphoid tissue, consistent with SCC.

Definitive chemoradiotherapy was prescribed consisting of irradiation of the primary mass, tonsils, mandibular lymph nodes, and medial retropharyngeal lymph nodes with 19 fractions of 3 Gy using the same equipment described in the previous case, and carboplatin. Carboplatin (Hospira), 300 mg/m², was administered by intravenous injection before fraction 2 of radiation therapy. A CBC was performed 14 d after administration of carboplatin. Physical examination and laboratory results were consistent with afebrile and clinically silent VCOG-CTCAE grade 4 neutropenia (100 neutrophils/µL) and grade 3 thrombocytopenia (< 50 000 platelets/µL) (12). The patient was started on cefpodoxime (Simplicef; Zoetis), 7.6 mg/kg BW, PO, q24h and the neutropenia and thrombocytopenia resolved as expected without radiation therapy delay. After completing radiation therapy, carprofen was discontinued and piroxicam (Medisca, Plattsburgh, New York, USA), 0.3 mg/kg BW, PO, was started after a 5-day washout period. Four subsequent doses of carboplatin were given at an extended dose interval of once every 28 d and at a 20% dose reduction (240 mg/m²) for a total of 5 doses. VTROG Grade II–III moist desquamation and mucositis also developed on the right muzzle and right maxillary buccal lip (13). All acute radiation side effects resolved as expected. The regional lymph nodes and tonsils were not extirpated following chemoradiotherapy due to owner financial constraints. The patient was euthanized for unknown reasons 1 y and 11 mo after initiating definitive chemoradiotherapy.

Based on consultation with the primary veterinarian and review of the patient’s medical record, there was no apparent evidence of SCC at the time of euthanasia.

**Discussion**

To the authors’ knowledge, these are the first reported cases of occult TSCC concurrent with OSCC in the dog. While primary and occult bilateral TSCC have been documented (2,10), non-tonsillar OSCC uncommonly metastasizes to regional lymph nodes such as the mandibular and medial retropharyngeal lymph nodes, and has not been reported to metastasize to the tonsils (2,3,7,8). Tonsillar metastasis from other oral tumors such as malignant melanoma have been infrequently documented (14). While the authors suspect that the occult tonsillar SCC reported in these cases represent metastasis from the primary non-tonsillar OSCC, concurrent development of TSCC (a second malignancy), or possibly field cancerization due to carcinogen exposure within the oral cavity should also be considered.

The cases herein demonstrate that aggressive management of loco-regionally advanced non-tonsillar OSCC may result in long-term survival. In these cases, radiation therapy would typically have been prescribed to avoid the tonsils in order to diminish the potential for additional acute radiation side effects. If tonsillar biopsies had not been performed before treatment, it is likely that the TSCC would have progressed and been recognized as a treatment failure. Given the low metastatic potential of non-tonsillar OSCC and previously reported successful long-term results with adequate local therapy (2–8,10), the authors may not have incorporated chemotherapy into the treatment protocol if occult TSCC had not been detected (2,4,6–8). Retrospective studies of OSCC and TSCC often suggest that multi-modal therapy including combinations of surgery, radiation therapy, and chemotherapy may provide a
survival benefit, but are confounded by selection bias — owners who elect multi-modal therapy may be more inclined to pursue therapy and less inclined to euthanize (3,9–11). Retrospective studies have demonstrated that chemotherapy protocols including either cisplatin or carboplatin have activity against OSCC and TSCC in the dog, but long-term results remain unsatisfactory (3,5,9–11,15). Due to cisplatin’s nephrotoxicity, carboplatin is often the chemotherapy drug of choice, if chemotherapy is elected. Non-steroidal anti-inflammatory drugs (NSAIDs) also have activity against OSCC and TSCC either alone (16) or in combination with platinum chemotherapy drugs (5,17). While chemotherapy and NSAIDs were used in the treatment of the 2 cases described here, their contribution to the long-term outcome versus treatment with aggressive local therapy alone is unknown. Prospective or randomized studies evaluating the role of chemotherapy in the treatment of OSCC or TSCC following definitive local therapy with either surgery or radiation therapy are lacking.

Tonsillar biopsies can be easily performed using the Jackson Uterine Biopsy Forceps described in this article with minimal additional patient morbidity. This instrument is relatively inexpensive and is reusable after steam sterilization. When used to biopsy the tonsils, the instrument effectively cuts and crushes tissue within the jaws resulting in rapid hemostasis, minimal patient morbidity, and rapid acquisition of tissue samples. Any hemorrhage that occurs can typically be controlled with direct digital pressure (in medium or larger dogs) or use of a cotton-tipped applicator (in small dogs or cats) on the tonsillar crypt. As with any small biopsy, the authors recommend combinations of NSAIDs, tramadol, and/or opioids for post-operative pain management. Given the small size of a grossly normal tonsil, tissue biopsy may be more likely to yield a definitive diagnosis compared with fine-needle aspirate, particularly in cases in which only microscopic foci of neoplasia are present.

Typical staging recommendations for non-tonsillar OSCC in the dog do not include sampling the tonsils (6). Based on these case reports and the relatively low patient morbidity associated with tonsillar biopsies, the authors recommend that veterinarians consider tonsillar biopsies for cases of non-tonsillar OSCC even when the tonsils are not grossly enlarged. The detection of occult TSCC would likely alter the planned course of treatment with regard to local therapy, but further prospective studies are necessary to determine if the addition of chemotherapy or NSAIDs is of any additional therapeutic benefit.

References

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Successful management of doxorubicin overdose and extravasation in a dog with lymphoma

Kristin S. Kicenuik, Nicole C. Northrup, Dawn M. Clarke, Lisa J. Bazzle

Abstract — A dog was hospitalized after accidental overdose and extravasation of doxorubicin. With supportive care and dexrazoxane, systemic toxicity resolved by Day 9 and extravasation injury by Day 36. This case demonstrates that, with treatment, dogs can survive doxorubicin overdose and extravasation. The report also highlights the importance of checking the dose of chemotherapeutic agents and preventing extravasation.

Résumé — Gestion réussie d’une surdose à la doxorubicine et de l’extravasation chez un chien atteint d’un lymphome. Un chien a été hospitalisé après une surdose accidentelle et l’extravasation de doxorubicine. Avec des soins de soutien et de la dexrazoxane, la toxicité systémique s’est résorbée au Jour 9 et la blessure d’extravasation au Jour 36. Ce cas démontre que, avec un traitement, les chiens peuvent survivre à une surdose de doxorubicine et à l’extravasation. Ce rapport souligne aussi l’importance de la vérification de la dose d’agents chimiothérapeutiques et de la prévention de l’extravasation.

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A 13-year-old spayed female mixed breed dog weighing 14.5 kg (body surface area: 0.59 m²) was presented to the University of Georgia Veterinary Teaching Hospital (UGA-VTH) for management of accidental overdose of doxorubicin (Doxorubicin; Pfizer, New York, New York, USA), 30 mg, 51 mg/m², and extravasation of an unknown quantity of doxorubicin.

Twenty-nine days before presentation, the dog was diagnosed with multicentric large cell lymphoma with moderate nonregenerative anemia, thrombocytopenia, and a monoclonal gammopathy. The diagnosis was based on cytological evaluation of a lymph node aspirate and a negative enzyme-linked immunosorbent assay (ELISA) screening test for vector-borne organisms (SNAP 4Dx Plus Test; IDEXX, Westbrook, Maine, USA). Treatment was initiated with prednisone (Prednisone; West-Ward, Eatontown, New Jersey, USA), 1.3 mg/kg body weight (BW), PO, q24h, and L-asparaginase (L-asparaginase; KRS Global Biotechnology, Boca Raton, Florida, USA), 10 000 U/m², SC. Five days later, partial response was observed based on lymph node measurements (1). Chemotherapy was continued with a single agent doxorubicin protocol (30 mg/m², IV, q3wk). The dog was treated with an IV infusion of 18.6 mg of doxorubicin diluted in 35 mL of 0.9% NaCl. Prednisone was decreased to 1 mg/kg BW, PO, q24h. Eight days after doxorubicin administration, the dog was lethargic and inappetent, with febrile neutropenia. Rectal temperature was 39.2°C and grade 2 neutropenia [1080/μL, reference range (RR): 2940 to 12 570/μL] was diagnosed. The dog was treated with IV fluids, amoxicillin trihydrate/clavulanate potassium (Clavamox; Zoetis, Kalamazoo, Michigan, USA) and enrofloxacin (Baytril; Bayer Healthcare, Shawnee, Kansas, USA).

The primary care veterinarian re-examined the dog 23 d after the first treatment with doxorubicin. Stable disease was noted on lymph node palpation. A complete blood (cell) count (CBC) showed that the neutrophil count had returned to the normal range. A reduction in dosage of doxorubicin to 25 mg/m² was planned because of the adverse events with the first dose. The dog weighed 14.5 kg (body surface area: 0.59 m²). Due to a miscalculation of dosage involving conversion of weight to body surface area based on body weight in lb instead of kg, 30 mg of doxorubicin (body surface area: 51 mg/m²) was administered.

Doxorubicin was administered through a 22-gauge IV catheter in the right cephalic vein using an IV fluid pump. The dog received simultaneous infusions of 0.9% NaCl at 20 mL/h and...
Table 1. Neutrophil and platelet counts following doxorubicin overdose (51 mg/m²; intended dose 25 mg/m²) in a dog with lymphoma. The dog was treated with filgrastim (rh-G-CSF) starting 24 h after the overdose.

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<td>10 212</td>
<td>346 000</td>
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* Reference range: 2.9 × 10³ to 12.0 × 10³/µL.

** Reference range: 235 × 10³ to 694 × 10³/µL.

doxorubicin at 5 mL/h (planned administration time 3 h). The administration site was examined every 5 to 10 min. At approximately 1.5 h into the infusion, subcutaneous swelling was noted proximal to the tape at the catheter site. The infusion was discontinued and the catheter was removed. A cold compress was applied to the area and the swelling lessened. The infusion was then completed using a 22-gauge IV catheter in the left cephalic vein. The veterinarian contacted the Oncology Service at UGA-VTH upon recognizing the potential for extravasation of doxorubicin. At that time, the miscalculation was discovered.

After discussion about the potential for life-threatening toxicity, the dog was transferred to UGA-VTH. Due to owner travel to the dog’s location and the distance from the primary hospital to the UGA-VTH, 10 h elapsed between the overdose and extravasation and the time of arrival at UGA-VTH.

On examination, mild erythema and swelling were present on the right antebrachium. A CBC and serum chemistry showed anemia (30.4%, RR: 36.6% to 59.6%), normal platelet count (346 × 10³/µL, RR: 235 to 694 × 10³/µL), normal neutrophil count (10.2 × 10³/µL, RR: 2.9 to 12.0 × 10³/µL), hyperproteinemia (88 g/L, RR: 50 to 73 g/L), hyperglobulinemia (58 g/L, RR: 27 to 44 g/L), and increases in alkaline phosphatase (596 U/L, RR: 11 to 131 U/L) and alanine aminotransferase (269 U/L, RR: 9 to 131 U/L) and alanine aminotransferase (269 U/L, RR: 9 to 131 U/L) and alanine aminotransferase (269 U/L, RR: 9 to 131 U/L) and alanine aminotransferase (269 U/L, RR: 9 to 131 U/L) and alanine aminotransferase (269 U/L, RR: 9 to 131 U/L). The dog was hospitalized for supportive therapy. A 7-French double lumen IV catheter was placed in the right jugular vein to allow IV therapy and repeat blood sampling without repeated venipuncture. Treatment consisted of Lactated Ringer’s solution (Lactated Ringer’s Injection, USP; Baxter Healthcare, Deerfield, Illinois, USA) at 90 mL/kg BW, IV/d, maropitant citrate (Cerenia; Zoetis, Kalamazoo, Michigan, USA), 1 mg/kg BW, IV, q24h, pantoprazole (Protonix; Wyeth Pharmaceuticals, Philadelphia, Pennsylvania, USA), 1 mg/kg BW, IV, q12h, sucralfate (Sucralfate; PLIVA Hrvatska, Teva, North Wales, Pennsylvania, USA), 1 g, PO, q8h, and dexamethasone (Dexamethasone sodium phosphate; Dexaject SP, Bimeda-MTC Animal Health, Cambridge, Ontario) 0.034 mg/kg BW, IV, q24h. The dog was fed a gastroenteric diet (Purina EN; St. Louis, Missouri, USA). Dexrazoxane (Zinecard; Pfizer, New York, New York, USA), 300 mg/m², IV, over 15 min, was administered within 1 h of admission (11 h after extravasation) and repeated 24 and 48 h later. The site was treated with cold compresses for 15 to 20 min every 6 h and topical dimethyl sulfoxide (DMSO) 90% solution (DMSO 90% solution; Neogen, Tulsa, Oklahoma, USA), q8h. Serial monitoring of clinicopathologic data consisted of daily evaluation of the packed cell volume and total solids (PCV/TS) and CBC and serum chemistry every 1 to 3 d (Table 1).

The day after the overdose (Day 1), the dog developed diarrhea and decreased appetite. As significant adverse events were expected, trophic (trickle) feeding through a nasoesophageal (NE) tube was initiated with a continuous rate infusion of a complete and balanced liquid diet (Clinicare; Zoetis) with L-glutamine (L-glutamine; Spectrum Chemical Manufacturing Company, Gardensa, California, USA, compounded to 250 mg/mL) at 12 mL/kg BW per day. Ondansetron hydrochloride (Ondansetron; Aurobindo Pharma, Hyderabad-500 090, India), 0.5 mg/kg BW, IV, q12h and metronidazole (Metronidazole; Unichem, Ghuziabad, India), 15 mg/kg BW, IV, q12h, were administered. Treatment with filgrastim [recombinant human granulocyte colony stimulating factor (rhG-CSF); Neupogen; Amgen, Thousand Oaks, California, USA], 5 µg/kg BW, SC, q24h, was initiated 24 h after the overdose.

On Day 2, the dog’s right forelimb was erythematous (grade 2 infusion site reaction, Figure 1). On Day 3, gastrointestinal (GI) toxicity progressed to grade 3 with anorexia, regurgitation (9 episodes in 13 h), and diarrhea (liquid stool passed...
every 1 to 4 h). A constant rate infusion of metoclopramide hydrochloride (Metoclopramide; PLIVA Hrvatska, Teva, North Wales, Pennsylvania, USA), 1 mg/kg BW per day, was initiated and trophic feeding was discontinued. On day 4, regurgitation stopped. Grade 4 neutropenia (357 neutrophils/µL, RR: 2.9 to 12 × 10³/µL, Table 1) and fever (39.6°C) were identified. Ampicillin sulbactam (Ampicillin sulbactam; Sagent, Schaumburg, Illinois, USA), 22 mg/kg BW, IV, q8h, and enrofloxacin (Bayer Healthcare), 10 mg/kg BW, IV, q24h, were administered. On day 5, the neutrophil count dropped to 15 cells/µL (Table 1).

On Day 6, feces were soft/formed and the dog ate gastrointestinal diet. On Day 7, the dog’s temperature normalized.
Grade 3 thrombocytopenia (46 × 10^3 cells/μL, Table 1) was identified. On day 8, the neutrophil count was normal and filgrastim was discontinued. By day 9, the dog was eating and drinking normally. Consequently, the dog was discharged with 3 days of omeprazole, sucralfate, metronidazole, maropitant, and enrofloxacin. Erythema at the extravasation site had spread proximally (Figure 2).

On Day 13, the dog had no gastrointestinal abnormalities and lymph node measurements indicated a partial response. A CBC was normal. The skin over the right thoracic limb was diffusely erythematous, thick, and corrugated, with dry desquamation (Figure 3). Application of cold compresses and topical DMSO was discontinued. On Day 22, the skin over the right thoracic limb had returned to normal texture with only small areas of scale and erythema (Figure 4). The owner declined further chemotherapy. On Day 62, the dog was euthanized due to progression of lymphoma. At the time of euthanasia, the owner and primary care veterinarian reported that the skin of the right thoracic limb was normal.

**Discussion**

The case described here provides valuable experiential information supporting the survivability of a life-threatening medical error in dosing of doxorubicin compounded by extravasation of doxorubicin, a complication associated with morbidity and even potential mortality. Moreover, this case report highlights 2 important issues facing veterinarians administering cancer chemotherapeutics: the need to ensure correct calculation of the dose and the need to prevent extravasation of chemotherapeutic agents administered by the IV route.

An adverse event is defined as any unfavorable and unintended clinical sign, clinicopathologic finding, or disease temporally associated with the use of a medical treatment (2). The veterinary literature is replete with information focused on GI and cardiac adverse events associated with doxorubicin. Doxorubicin's acute dose-limiting toxicities in the dog include GI toxicity 2 to 5 d after treatment and neutropenia 7 to 10 d after treatment (3,4). Dose-related cumulative cardiotoxicity resulting in arrhythmias, dilated cardiomyopathy, and congestive heart failure, is possible, typically at doses > 180 to 240 mg/m^2 (4,5). However, cardiac toxicity has been reported in dogs receiving as little as 60 mg/m^2 of doxorubicin (5). Following the first cycle of doxorubicin at a standard dose, the dog presented here experienced febrile neutropenia. Worse toxicity was anticipated following the overdose. In humans, overdose of doxorubicin has been associated with severe myelosuppression, mucositis, and GI toxicity (6). Normal dosages for doxorubicin as a single agent in humans are 60 to 75 mg/m^2, IV. In 1991, a letter to the editor from a representative of Adria Labs (Columbus, Ohio) stated that 12 accidental doxorubicin overdoses of 3 to 10 times the planned dosage had been reported to Adria Labs between 1977 and 1991. Five of the 12 patients died. These patients received 150 to 333 mg/m^2 of doxorubicin (7). Another report described a 57-year-old man and a 17-year-old girl who survived doxorubicin doses of 300 mg/m^2 and 436 mg/m^2, respectively (8). In dogs, the reported LD₅₀ for doxorubicin is 2.4 mg/kg BW (9). For a dog the size of the dog in this report that would be 34.8 mg.

Therapy aimed at mitigating GI toxicity was instituted as quickly as possible following recognition that the dog herein had received an overdose of doxorubicin. Treatment consisted of intravenous fluids to prevent hypovolemia and/or dehydration secondary to vomiting and diarrhea. Maropitant citrate, an NK-1 antagonist, was administered to lessen the severity of nausea, vomiting, and diarrhea (10). Pantoprazole, a proton pump inhibitor, was administered to increase gastric pH in an effort to facilitate healing of injured gastric epithelium (11). Trophic feeding via a constant rate infusion through an NE tube was initiated as soon as the dog’s appetite decreased because, in humans, low volume enteral nutrition can prevent atrophy of GI mucosa-associated lymphoid tissues (MALT) and reduce the risk of bacterial translocation and sepsis (12). The commercially available diet was supplemented with L-glutamine. Prophylactic glutamine has trophic effects on GI epithelium, plays a role in support of MALT, and significantly decreases the duration of chemotherapy-induced diarrhea in humans (13).

As the dog reported here experienced grade 2 neutropenia with fever after a standard dosage of doxorubicin, it was anticipated that profound neutropenia would develop following the overdose. The American Society of Clinical Oncology 2013 guidelines recommend prophylactic use of hematopoietic colony-stimulating factors (CSFs) when the risk of febrile neutropenia is ≥ 20% (14). Prophylactic granulocyte-colony-stimulating factor (G-CSF) in humans reduces the risk of febrile neutropenia, duration of antibiotic usage, duration of neutropenia, and number of days of hospitalization (15,16). In dogs, use of G-CSF is limited by the lack of a canine-specific colony stimulating factor and the risk of formation of cross-reactive neutralizing antibodies with recombinant human G-CSF (rh-G-CSF). In this setting of overdose, we believed the risk of short-term use was outweighed by the potential benefit. Consequently, rh-G-CSF (filgrastim) was used starting 24 h after treatment with doxorubicin as per the recommendation in humans. The dog developed febrile neutropenia 4 d after overdose (earlier than expected with standard doses of doxorubicin), with the neutrophil nadir at Day 5. Filgrastim was continued and the neutrophil count returned to normal by Day 8. It is unknown whether the nadir would have been more severe and of longer duration without filgrastim, but rh-G-CSF decreases the severity and duration of neutropenia in dogs treated with myelosuppressive radiation therapy (17) and recombinant canine G-CSF decreases the severity and duration of neutropenia in dogs with parvovirus infection (18).

At the time of extravasation, the veterinarian treating the dog was unsure whether the swelling at the catheter site was related to the tape securing the catheter or due to drug leakage. The infusion site reaction that followed was evidence of extravasation of an unknown amount of doxorubicin. Doxorubicin is a potent vesicant, causing severe tissue ulceration and necrosis. Dexrazoxane is the most effective treatment for anthracycline extravasation (16–26) and should be administered within 3 to 6 h after extravasation, followed by subsequent dosing 24 and 48 h later (19–22). Doxorubicin extravasation was successfully treated in 3 dogs given 1 to 3 doses of dexrazoxane with the initial dose administered within 2 h of extravasation (23). A fourth
dog in that series, treated 48 h after extravasation, developed severe tissue necrosis necessitating limb amputation (23). In the present case, dexrazoxane was not administered until 11 h after extravasation. Despite this delay, tissue injury did not progress to ulceration or necrosis of the skin and underlying tissue. While speculative, it is possible that dexrazoxane administration delayed beyond the current recommended time of 3 to 6 h following extravasation still provided a therapeutic benefit. Dexrazoxane may add to myelosuppression by cancer chemotherapeutic agents (24), however, in dogs, the combination of doxorubicin and dexrazoxane appears to be well-tolerated with signs of GI and hematologic toxicity being similar to those of doxorubicin alone (23,25). The use of DMSO with dexrazoxane is controversial as there may be potential for decreased efficacy of dexrazoxane (26). The current recommendation in humans is to avoid use of DMSO with dexrazoxane for extravasation (27).

Beyond the care of this individual dog, this case highlights the risk for serious medical errors with chemotherapy administration. Medical errors are the third leading cause of death for Americans (28). An important type of medical error in the care of humans is dosing errors. While the incidence of medical errors in veterinary medicine is not reported, it is important to recognize that treatment with cancer chemotherapeutics is associated with potential for serious harm. Veterinarians using these drugs should have standard procedures in place to minimize the risk of errors, including prescribing errors, and to manage complications should they arise. Information on chemotherapy administration is available in veterinary oncology textbooks (4) and guidelines are available in reputable journals (29,30). The American Society of Clinical Oncology (ASCO) and the Oncology Nursing Society (ONS) have defined standards for the safe administration of chemotherapy for humans undergoing cancer treatment (31,32). These comprehensive standards include the prescription, preparation, and administration of cancer chemotherapeutics by qualified personnel. Independent verification of the proposed cancer chemotherapeutic by a second person (either a clinician or other qualified personnel) confirming the correct drug, dosage, calculation used for dosing the patient, route of administration, and rate of administration will minimize medication errors. Guidelines also have been established to lessen the risk of extravasation by emphasizing the importance of appropriate vascular access (adequate vein and proper catheter placement), continuous monitoring of the catheter site at the beginning and throughout the infusion, having protocols in place for management of extravasation, and having antidotes readily accessible (32). While the primary veterinarian involved in this case did not have dexrazoxane available onsite, rapid recognition of the swelling at the catheter site enabled immediate actions that minimized the amount of extravasated drug and initiated transfer to a referral hospital.

In summary, the dog in this report recovered from a life-threatening doxorubicin overdose without suffering potentially severe infusion site reaction secondary to extravasation. With intensive management, survival is possible in cases of overdose and extravasation of doxorubicin. The dog experienced significant adverse effects that negatively impacted her quality of life and resulted in discontinuation of treatment. This serves as a reminder of the importance of careful dose calculation and close monitoring during drug delivery.

Acknowledgments

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References

2. Veterinary Cooperative Oncology Group — Common terminology criteria for adverse events (VCOG-CTCAE) following chemotherapy or biological antineoplastic therapy in dogs and cats v1.1. Vet Comp Oncol 2016;14:417–446.
1. D) The correct answer is D, acantholytic cell. The other cells are not common or numerous findings on cytology or histopathology of pemphigus foliaceus.

2. A) Seizures are caused by abnormal activity in the cerebral cortex.

3. C) Stored whole blood is given along with plasma products to provide coagulation factors.

4. C) The best method of assessing the equine erythroid regenerative response is determination of bone marrow M:E ratio and/or bone marrow reticulocyte count.

5. C) *Haemonchus contortus*, a nematode parasite of sheep, is associated with blood loss anemia and hypoproteinemia. The granular black abomasal contents signify digested blood.

Answers to Quiz Corner
Les réponses du test éclair

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Urinary bladder herniation through inguinal ring in a female cat

Miranda de la Vega, Katy L. Townsend, Jesse Terry, Sarah Nemanic

Abstract — A 7-month-old spayed female domestic shorthair cat was referred for lethargy, stranguria, and a fluctuant mass of varying size in the right inguinal region. Computed tomographic imaging revealed the urinary bladder partially herniated through the right inguinal canal. Primary herniorrhaphy was performed and re-placement of the urinary bladder was confirmed via laparotomy.

Résumé — Herniation de la vessie urinaire par le trou inguinal chez une chatte. Une chatte domestique stérilisée âgée de 7 mois a été recommandée pour de l’abattement, de la strangurie et une masse fluctuante de taille variable dans la région inguinale droite. Une imagerie obtenue par tomodensitométrie a révélé une vessie urinaire partiellement herniée dans le canal inguinal droit. Une herniographie primaire a été réalisée et le placement de la vessie urinaire a été confirmé via laparotomie.

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The inguinal canal is an opening in the abdominal wall extending between internal and external inguinal rings. The internal ring is bounded medially by the rectus abdominis muscle, cranially by the caudal edge of the internal abdominal oblique muscle and laterally by the inguinal ligament. The external ring is a longitudinal slit in the aponeurosis of the external abdominal oblique (1). Structures coursing through the inguinal canal in both sexes include the genitofemoral nerve, artery and vein, and external pudendal vessels. The vaginal process also passes through the opening in dogs; it contains the spermatic cord in males or the round ligament in females (2). In a study involving 10 cats, in contrast with dogs, the vaginal process was not identified within the inguinal canal (3).

Inguinal hernias occur when there is a defect in the inguinal ring through which abdominal contents protrude (4). Indirect inguinal hernias are the most common and are characterized by tissues that herniate into the vaginal tunic in males and vaginal process in females. Indirect hernias in males are called scrotal hernias. Direct inguinal hernias occur when tissues or organs pass through the inguinal rings adjacent to the normal evagination of the vaginal process (5).

Inguinal hernias can be congenital or acquired. Congenital inguinal hernias may occur more often in male dogs because of delayed inguinal canal narrowing from testicular descent and may spontaneously resolve by 12 wk of age when the relative size of the inguinal rings decreases (5,6). In cats, there is a reported 0.02% to 0.025% incidence of congenital inguinal hernias with no breed or gender predilection as described in dogs (7,8). Previous reports of inguinal hernias in cats have had a male predisposition (7–9). This report describes a presumed congenital urinary bladder herniation through the inguinal ring in a female cat.

Case description

A 7-month-old spayed female domestic shorthair cat was referred because of a 4-day history of lethargy, stranguria, and a fluctuant mass in the right inguinal region that varied in size according to reports from the owner and referring veterinarian. The cat had been adopted 1 mo earlier with no history of illness or traumatic injury. On the day before presentation, the referring veterinarian took a single caudal lateral abdominal radiograph. On this image, the urinary bladder was not identified within the inguinal canal (3). Upon presentation to Oregon State University, physical examination revealed the cat was bright, alert, and responsive.
Palpation revealed an 8 cm × 4 cm firm, smooth continuous structure that tapered towards the inguinal canal. Results of a complete blood cell count and biochemical profile were unremarkable.

The cat was placed under general anesthesia for computed tomography (CT) imaging directly followed by surgery. She was premedicated with hydromorphone (West-Ward, Eatontown, New Jersey, USA), 0.1 mg/kg body weight (BW), IM, and acepromazine (VetOne, Boise, Idaho, USA), 0.1 mg/kg BW, IM; anesthesia was induced with propofol (PropoFlo; Zoetis, Parsippany, New Jersey, USA), 6 mg/kg BW, IV. Anesthesia was maintained with isoflurane in 100% oxygen. Fentanyl (West-Ward) continuous rate infusion (CRI) at 0.3 to 0.5 mg/kg BW per minute was given for analgesia. Prophylactic antibiotic administration (cefazolin; Fresnius Kabi USA, Lake Zurich, Illinois, USA), 22 mg/kg BW, IV, was given in the perioperative period.

An abdominal CT-scan was taken on a 64 detector CT scanner (Toshiba Aquilion; Canon Medical Systems, Otawara, Tochigi, Japan) before and after IV injection of iodinated contrast medium (2 mL/kg of Iopamidol — Omipaque; GE Healthcare, Waukesha, Wisconsin, USA). Following contrast medium administration, CT images were acquired in a venous vascular phase and an 8-minute post-contrast medium phase. Images were acquired as a volume and 0.5-mm volume images were reconstructed in bone and soft tissue algorithms with a 0.5-mm reconstruction interval as isotropic voxels with both 3-mm and 1-mm slice thickness in transverse, sagittal, and dorsal planes. For image acquisition, the following settings were used: rotation speed 0.6 s; helical pitch of 0.53, matrix 512 × 512; current 300 mA and voltage peak 120 kV.

On CT images, the urinary bladder was malpositioned with the trigone located cranially at the level of the sacrum and the apex located caudally at the level of the 7th coccygeal vertebra, within the inguinal fat ventral to the gracilis muscle (Figures 2, 3). The urinary bladder neck was positioned to the right of the right rectus abdominus muscle and exited the peritoneal cavity ventral to the external iliac artery and vein, within the right inguinal ring. The right rectus abdominus muscle was decreased in width but increased in height, being approximately the same cross-sectional area as the left. Both ureters entered the trigone of the urinary bladder at a normal position and the urethra exited the cranially directed trigone and turned 180° from cranial to caudal in the abdomen (Figure 4). Caudal to this turn, the location and path of the urethra was normal within the pelvic inlet and perineal tissues. The ureters were not dilated. No fractures were seen, and the fat surrounding the caudal abdomen was normal in attenuation.

A caudal ventral midline incision was used to expose the herniated urinary bladder. The urinary bladder was herniated through the right inguinal canal, confirming a direct inguinal hernia. The urinary bladder was partially emptied by cystocentesis (Figure 5), and gentle digital pressure was used to replace the urinary bladder into the abdomen. The urinary bladder appeared grossly normal, without evidence of thickening, hemorrhage, or bruising. The external inguinal ring was measured to

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**Figure 1.** A lateral abdominal radiograph shows an ovoid soft tissue opaque mass effect silhouetting with the thigh musculature and summing with the ventral abdominal fat, presumed to be the bladder (white arrows). The urinary bladder was not identified in the caudoventral abdomen, instead, fat opacity was seen ventral to the descending colon and dorsal to a moderately thickened ventral body wall (black arrow).

**Figure 2.** Computed tomography scan (5-mm maximum intensity projection image, dorsal plane mid-abdomen, soft tissue algorithm, 8-minute post-contrast; W 320, L 40) showing the bladder partially herniated through the right inguinal ring. The arrows show the ureters entering the bladder at a normal location.
be 2.5 cm at the largest diameter, and it was difficult to identify the internal inguinal ring (Figure 6). The linea alba was incised, and the bladder was retroflexed to visualize the ureters and confirm correct placement. The left external and internal inguinal rings appeared grossly normal. The right external inguinal ring was closed with 2-0 polydioxanone (PDS; Ethicon/Johnson & Johnson, Bridgewater, New Jersey, USA) in a simple interrupted pattern. The linea alba was closed with 2-0 PDS in a simple continuous pattern. The subcutaneous layer was closed with 4-0 poliglecaprone (Monocryl; Ethicon/Johnson & Johnson) in a simple continuous pattern. The skin was apposed with 4-0 nylon (Ethilon; Ethicon/Johnson & Johnson) in a simple continuous pattern.

Post-operative analgesia was maintained with a fentanyl CRI (2 to 5 µg/kg BW per hour) the night of surgery and then transitioned to 0.02 mg/kg BW buprenorphine (Par Pharmaceuticals, Chestnut Ridge, New York, USA) transmucosally every 8 h the following day. One day after surgery, the cat was bright, alert, eating well, and urinating normally without evidence of stranguria or grossly detected hematuria. The cat was presented 2 wk later for suture removal, and physical examination revealed a healed surgical incision with subcutaneous suture reaction and normal urination. She was lost to follow-up after recheck at 2 wk.

Discussion

A non-strangulating, direct, unilateral inguinal herniation of the urinary bladder in a female cat is described. The urinary bladder herniated through the right inguinal canal and varied in size based on voiding of urine, but was never completely reduced. It is unclear if the urinary bladder had previously herniated and reduced prior to adoption as there was no medical history from the shelter. There was also no evidence of trauma, such as hemorrhage, and no gross changes were seen during surgery to suggest chronicity, such as adhesions or bladder wall thickening or hemorrhage. Although the left inguinal canal appeared

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Figure 3. Computed tomography 15-mm maximum intensity projection image (sagittal plane, parasagittal plane, 8-minute post-contrast, soft tissue algorithm, W 400, L 40) showing the right ureter entering the urinary bladder at a normal location. Note the contrast medium in the bladder.

Figure 4. Computed tomography image of the urethra (oblique dorsal plane, 8-minute post-contrast, soft tissue algorithm, W 400, L 40) showing the 180° turn of the urethra (black arrow) from the trigone of the urinary bladder (white arrow) to a midline position in the pelvic inlet, between the left pubic bone and right pubic bone (dark gray arrow) and to the right of the descending colon (light gray arrow).

Figure 5. Intraoperative view of the urinary bladder after caudal ventral midline incision. Cranial is to the right of the photograph. The bladder is herniated through the inguinal ring and cystocentesis is used to empty the bladder.

Figure 6. Intraoperative view of the enlarged inguinal ring after the bladder has been reduced into the peritoneal cavity. Note that the cotton tipped applicator is within the peritoneal cavity, through the inguinal ring.
grossly normal and not enlarged at surgery, due to the young age of the cat and lack of hormonal complications such as estrus, pregnancy, intact status, or metabolic complications such as nutritional disorders or obesity, we believe that a congenital origin of the hernia is most likely.

To the authors’ knowledge, this is the first report of a presumptive congenital inguinal hernia containing the bladder in a female cat. There is a report of urinary bladder herniation through a congenitally enlarged inguinal canal in a male cat and the authors proposed a predisposition in male cats due to testicular descent through the inguinal canal (9). Other reports of cats with inguinal hernias have a male predilection (7–9). This is the first report in which CT was used to diagnose an inguinal hernia in a feline patient; this enabled 3-dimensional imaging of this rare defect in a cat. Ultrasound could also have been used for diagnosis if CT had not been available, but would have given less complete information about the path and size of the ureters, because they were not enlarged, and the pelvic urethra, because of acoustic shadowing from the pelvic bones (10).

Due to anatomical differences, only direct herniation is possible in female cats. A cadaveric study of 10 embalmed female cats failed to identify a vaginal ring or process within the inguinal canal; the only structure identified was the round ligament of the uterus, which entered the inguinal canal and transitioned into fascia just beyond the external inguinal ring (3). The inguinal canal has been measured in 10 cats and was found to be 5 mm in diameter (9). It is unknown whether these cats were male or female. The diameter of the inguinal ring in the cat herein was 5 mm × 17 mm × 22 mm on CT, which is much larger than the reported normal size.

Inguinal herniation in dogs has been described with possible contents including fat and omentum most commonly as well as small intestine, colon, bladder, spleen, uterus, and ovary. The left side is more commonly affected in female dogs (11). Inguinal hernia contents have only recently been reported in cats (9).

Several surgical approaches, termed herniorrhaphy, have been described to correct inguinal hernias. Uncomplicated unilateral inguinal hernias can be approached over the inguinal rings, whereas complicated inguinal hernias, such as those involving strangulation or concurrent abdominal trauma, are approached through ventral midline laparotomy for exploration. Herniorrhaphy can be performed extra- or intra-abdominally, although extra-abdominal herniorrhaphy is more common (12). Based on the presentation in this case, herniorrhaphy was extra-abdominal, and a caudal midline laparotomy confirmed correct placement of the bladder and ensured no torsion or malplacement. In a previous case report with this condition in a male cat, a cystopexy was conducted (9). A cystopexy was not conducted after the bladder was repositioned in the abdominal cavity, as the surgeon did not suspect that the bladder would reherniate after primary repair of the defect. Hernia recurrence is a known complication in inguinal hernia repair in dogs and thought to occur in less than 3% in 1 case series (5).

Congenital inguinal hernias in cats are rare, especially involving herniation of the bladder. This report describes a successful surgical repair of a presumed congenital inguinal hernia involving the bladder in a female cat. A differential diagnosis of an inguinal hernia with bladder involvement should be considered when fluctuant masses are palpated in the inguinal region in young cats. Primary repair of the hernia provided a return to normal urination.

References
Radiotherapy and pasireotide treatment of a growth hormone producing pituitary tumor in a diabetic dog

Francesco Zublena, Alice Tamborini, Carmel T. Mooney, Susan M. North, Monika A. Lobacz, Dan Andrew, Vanessa Woolhead, Heather Covey, Herbert A. Schmid, David B. Church, Stijn J.M. Niessen

Abstract — An 8-year-old castrated male border terrier dog was diagnosed with acromegaly resulting from a growth hormone secreting pituitary tumor. Sixteen daily fractions of radiation therapy were delivered followed, approximately 1 year later, by administration of pasireotide. The aforementioned treatment was considered effective and should be further evaluated in similar cases.

Case description

A 8-year-old castrated male border terrier dog was presented to the primary veterinary surgeon for investigation of polyuria and polydipsia (PU/PD), lethargy, and polyphagia of 8-weeks’ duration. Based on breed, age, and history, tests for both diabetes mellitus (DM) and hyperadrenocorticism were carried out. The former was diagnosed based on persistent hyperglycemia (> 15 mmol/L) and glycosuria. Hyperadrenocorticism was considered unlikely based on adrenocorticotropin hormone (ACTH) stimulation and low dose dexamethasone suppression test results within their reference intervals. Measurement of total thyroxine (TT4) was included in the comprehensive biochemistry panel and hypothyroidism was suspected because of a low TT4 concentration [< 3.0 nmol/L, reference interval (RI): 13.5 to 50 nmol/L]. Treatment with porcine insulin (Caninsulin; MSD Animal Health, Intervet, Milton Keynes, UK), 0.25 IU/kg body weight (BW), SC, q12h, and levothyroxine (Soloxine; Virbac Animal Health, Fort Worth, Texas, USA), 30 μg/kg BW, PO, q24h, was initiated. Eight weeks later, while the DM was apparently adequately controlled (as suggested by a 24-hour blood glucose curve), PU/PD, polyphagia, and lethargy persisted. Serum insulin-like growth factor 1 (IGF-1) concentration was evaluated and found to be 1234 ng/mL (radioimmunoassay employing a human anti-IGF-1 antibody validated for use in the dog; Nationwide Specialist Laboratories, Sawston, UK), which prompted referral.

At the time of referral, the skin around the head and neck was noted to be thick and redundant, and the head appeared proportionally bigger than the rest of the body (Figure 1). There were widened interdental spaces and macroglossia (Figure 1) with obvious intermittent stertor.

Urinalysis revealed isosthenuria (SG, 1.010 with no glycosuria). Measurement of TT4 (45.8 nmol/L), canine thyroid stimulating hormone (cTSH; < 0.03 ng/mL, reference value: < 0.6 ng/mL) 4 h after treatment, and fructosamine (345 μmol/L, RI: 300 to 450 μmol/L) suggested effective treatment for DM and the previously assumed hypothyroidism. Given that there was no evidence of endogenous progesterone production or exogenous progestagen administration, a growth hormone (GH)-secreting pituitary macroadenoma was suspected. The lethargy and polyphagia potentially could be
explained by a pituitary mass and the anabolic state induced by GH excess, respectively. The cause of the persistent PU/PD, despite effectively controlled diabetes mellitus, remained unclear but partial diabetes insipidus could not be ruled out.

A helical computed tomography (CT) scan (SOMATOM Spirit, 2-slice; Siemens AG, Camberley, UK) of the skull was performed under general anesthesia and reconstructed in soft tissue and bone windows. It confirmed the presence of an oval, slightly irregularly shaped, 0.9 cm high × 1.3 cm wide × 0.9 cm long, soft tissue attenuating (61 HU), well-defined mass-like lesion in the region of the pituitary fossa (Figure 2A). Manual administration of intravenous contrast medium 2 mL/kg iohexol (Omnipaque 300 mg I/mL; GE Healthcare, Princeton, New Jersey, USA) demonstrated moderate contrast enhancement (74 HU post-contrast) with visible pituitary flush mildly displaced laterally to the left (Figure 2B).

A definitive radiation protocol (RT) was started using a 6 MV linear accelerator (CLINAC 600c; Varian Medical Systems, Palo Alto, California, USA); a total dose of 48 Gy (4800 cGy) was delivered at 3 Gy (300 cGy)/fraction on a Monday to Friday schedule basis for 16 fractions. The patient was anesthetised and positioned in ventral recumbency with the beam centered on the pituitary gland. The total dose was delivered in 4 field blocks. The radiation protocol was well tolerated and no side effects were noted.

Two and half weeks after RT, mental status and lethargy had improved. TT4 (38.2 nmol/L) and cTSH (< 0.03 ng/mL), 4 h after treatment, were within their reference intervals. A 24-hour blood glucose curve (measurements q2h) showed blood glucose concentrations ranging from 4.1 to 7.9 mmol/L. Urinalysis revealed a specific gravity of 1.031 with no glycosuria. Insulin administration was reduced in a stepwise manner to 0.05 IU/kg BW, q12h over a 10-week period and then stopped in light of persistent euglycemia, absent glycosuria, and fructosamine concentration (292 μmol/L) within the reference interval.

Sixteen weeks after RT, fructosamine concentration remained within reference interval (244 μmol/L), whereas TT4, 4 h after treatment, increased to 68.0 nmol/L. The dose of levothyroxine was decreased to 20 μg/kg BW, PO, q24h and 2 mo later to 10 μg/kg BW, PO, q24h.

Thirty-eight weeks after RT, TT4 (4 h after treatment) and IGF-1 concentrations were 29.7 nmol/L and 1223 ng/mL, respectively. No glycosuria was noticed on dipstick. Levothyroxine administration was discontinued. In light of the reported return of some clinical signs of particular concern to the owner, mainly PU/PD (no SG available) and lethargy despite absence of DM,
As well as the persistent soft tissue changes and elevated IGF-1 concentrations, ongoing clinically relevant hypersomatropism was suspected. Therefore, hypophysectomy or treatment with the novel somatostatin analog pasireotide (Signifor; Novartis Pharmaceuticals, Basel, Switzerland) was offered. The client opted for the latter. The dog was hospitalized and had IGF-1 measured on day 1, received subcutaneous injections q12h with short-acting pasireotide (0.03 mg/kg BW) on days 2 to 4, followed by repeat measurement of IGF-1 on day 5. During this time, the IGF-1 concentration dropped from 1120 ng/mL (day 1) to 536 ng/mL (day 5). The dog was discharged after a subcutaneous injection of long-acting pasireotide (8 mg/kg BW) with a view to repeating the treatment every 4 wk, whilst gradually increasing the injection interval to establish the minimum injection frequency. The results are presented in Table 1. Serum IGF-1 remained markedly decreased compared to initial values. Concurrently, the owner reported a disappearance of the PU/PD, increased activity, gradual disappearance of the soft tissue changes, and complete normalization of the skin of the head and neck. There was also a decrease in weight and size of the abdomen. The disproportionate appearance of the head persisted (Figure 3). No adverse effects were noted.

Five months after the last levothyroxine administration, TT4 (13.1 nmol/L, RI: 13 to 52 nmol/L) and cTSH (0.13 ng/mL, reference value: < 0.41 ng/mL) were within their reference intervals.

**Discussion**

This report describes a GH-secreting pituitary macroadenoma in a dog with concurrent DM, which is thought to be a rare condition. The report also details the first documented use of RT and pasireotide treatment for this condition with consequent remission of DM, decrease in serum IGF-1 concentration, and reversal of some of the acromegaly-associated soft tissue changes.

Acromegaly is an endocrine disorder caused by excessive secretion of GH, resulting in soft tissue, viscera, and bone overgrowth as well as insulin-resistance (1–3). Most affected cats and humans have a functional somatotroph adenoma in the anterior pituitary gland that results in excessive GH production (3–5). In dogs, GH excess is usually associated with prolonged exposure to exogenous or endogenous progesterone that in turn stimulates GH hypersecretion from mammary tissue (3,6–9). To the authors’ knowledge, only 2 cases of suspected and 1 of confirmed acromegaly due to a pituitary adenoma in dogs have been described and it is therefore considered a rare entity (10,11).

In all species, including the dog, clinical signs result from the combined catabolic effects of excess GH and the anabolic effects of GH-induced IGF-1 on soft tissue, viscera, and bone (1–3). Thus unsurprisingly, enlargement of the head, widened

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Table 1. Insulin-like growth factor 1 (IGF-1), total thyroxine (TT4), thyroid stimulating hormone (TSH), blood glucose (BG), glucosuria, fructosamine values, and BW (body weight) before and after treatment of the dog with the growth hormone secreting pituitary tumor.

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<th>T0 + 11 wk</th>
<th>Radiotherapy start</th>
<th>R + 2.5 wk</th>
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<th>R + 38 wk (2015)</th>
<th>R + 50 wk</th>
<th>R + 62 wk</th>
<th>Pasireotide start</th>
<th>P + 4 wk</th>
<th>P + 10 wk</th>
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*The black and white arrows represent withdrawal of the insulin and levothyroxine administration, respectively. n/a — Not available.

*b Reference interval: 13 to 52 nmol/L.

*b Reference value: < 0.41 ng/mL.

Figure 3. The dog after 4 months of pasireotide treatment. The disproportionate appearance of the head persisted.
interdental spaces, excess skin folds, and hypertrophy of the soft tissues of the head and neck (associated with stertor) were observed in the dog of the present case report. Polyuria and polydipsia were also evident and thought to result from the development of DM. In affected cats and humans, excess GH secretion is frequently associated with insulin resistance and development of overt DM (1,3,12,13). Following RT, remission of DM was evident, likely due to improvement of GH-induced insulin resistance, although spontaneous remission enabled by the start of exogenous insulin (and thus reduction of glucotoxicity and endogenous demand) is also possible. The IGF-1 did, however, not normalize and the soft tissue changes progressed in concordance with persistent elevation of IGF-1. Additionally, continued polyphagia (with weight gain), was hypothesized to be directly a result of persistent GH excess (3). In this case, despite remission of DM, the PU/PD recurred and it was speculated to result from mechanisms other than overt DM such as transient diabetes insipidus, as described previously in diestrous-induced acromegaly in dogs (14). Alternatively, possible diabetes insipidus and the ongoing lethargy observed could have been associated with an expanding pituitary tumor. Unfortunately, because of financial constraints, a repeat CT-scan was not performed to investigate such a possibility. The subsequent improvement in demeanor on pasireotide treatment may have been related to a decrease in tumor size, as is reported occasionally in humans treated with this drug (15).

A diagnosis of acromegaly relies on demonstrating excess circulating GH and/or IGF-1 concentrations. The latter is preferred as the assays are more widely available and IGF-1 concentration is much less prone to fluctuations (3,16). In this dog, increased circulating IGF-1 concentration in the absence of progesterone/progestagen stimulation prompted CT imaging of the pituitary gland (1,3,17,18). Hypothyroidism can lead to changes in pituitary gland size, the pulsatile secretion pattern of GH and to increased plasma IGF-1 concentrations; thus elevated IGF-1 concentration in the presence of pituitary enlargement is possible in dogs affected by either acromegaly or hypothyroidism (19–22). In hypothyroidism, the pituitary gland potentially enlarges because of transdifferentiation of somatotrophic pituitary cells to thyrosomatotropic cells (20,22). However, in this dog, the presence of a large oval-shaped soft tissue attenuating lesion in the region of the pituitary fossa despite confirmation of euthyroidism was more suggestive of a GH-secreting pituitary neoplasm rather than hypothyroidism-associated pituitary gland hyperplasia. It was thought that the initial diagnosis of hypothyroidism was incorrect and that the low TT4 value at that time was reflective of the non-thyroidal illness syndrome rather than hypothyroidism per se. Indeed, the persistence of clinical signs and high IGF-1 concentrations whilst on thyroxine supplementation and their reversal whilst on pasireotide treatment and off levothyroxine supplementation supports the diagnosis of a GH-secreting pituitary tumor rather than any association with hypothyroidism.

In dogs, both surgical transsphenoidal hypophysectomy and RT have been reported as treatment options for various pituitary tumors, but there are no reports of the effect of RT on GH-secreting pituitary tumors (23–28). The goal of RT in the case presented here was to achieve tumor size reduction and control the paraneoplastic effects, with minimal injury to surrounding healthy tissues (25). The remission of DM could be suggestive of declining GH concentrations and an effect of RT on tumor size. Previous reports of canine pituitary adenomas treated with RT demonstrated improvement of clinical signs and some control of the disease, as in the dog described here (25–30).

A follow-up IGF-1 concentration remained elevated, 10 mo after the last RT treatment. This is not surprising, as in most RT-treated acromegalic cats and humans, persistently high IGF-1 concentrations are found. It is speculated that RT is capable of only decreasing GH production to a limited extent sufficient to achieve remission of DM but without complete reversal of all clinical signs as in the dog of this report. This has been well-demonstrated in acromegalic diabetic cats in which DM improves or resolves despite persistently high IGF-1 concentrations after RT treatment (31–35). As a consequence, hypophysectomy may be a preferred treatment for most acromegalic humans and cats but was not initially chosen for this case.

Pasireotide is a novel multireceptor-targeted somatostatin (SST) analog with high binding affinity for SST receptor subtypes 1, 2, 3 [SST(1,2,3)] and 5 [SST(5)]. Its use resulted in a significant and rapid decrease in serum IGF-1 concentration within a matter of days together with more long-term reversal of many of the clinical signs of GH excess without any adverse effects. The fact that all clinical signs did not resolve completely in this dog is not unexpected as bony changes (contributing to the disproportionate head size) are known to persist in previously acromegalic dogs (14). Pasireotide has also been shown to be effective in humans with hyperadrenocorticism and hypersomatotropism, dogs with pituitary-dependent hyperadrenocorticism, and cats with hypersomatotropism (36–38). This is the first report of an acromegalic dog being treated with pasireotide.

Finally, this case report suggests that, although pituitary tumor-derived GH excess in male dogs might be rare, the condition should be considered as a possible differential diagnosis in cases with physical examination signs compatible with acromegaly. Optimal treatment in dogs with acromegaly resulting from a GH-secreting pituitary tumor has not been standardized and various options are available subject to accessibility and affordability.

References


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- Buy vs. lease vehicle decisions.
- Oversee tax return preparation and structural tax planning.
- Financial planning for future purchase of a practice or start up of a new practice.
- Cash flow budgeting.

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- Establish RESP for children.
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- Proper creditor proofing of assets to minimize risk of loss in a lawsuit.
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- Cash flow management to assist with children’s education costs.
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- Retirement income design.
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Case Report  Rapport de cas

Fracture-associated osteosarcoma of the femur in a cat
Jared I. Baum, Owen T. Skinner, Sarah E. Boston

Abstract — This report describes a domestic shorthair cat with fracture-associated osteosarcoma 11 years after injury. A left hind limb amputation was performed using coxofemoral disarticulation. No intravenous cytotoxic chemotherapy was used after surgery. Pulmonary metastasis was identified 3 months after amputation. Fracture-associated osteosarcoma may occur in the cat more than 10 years after initial injury.

Résumé — Ostéosarcome du fémur associé à une fracture chez un chat. Ce rapport décrit un chat commun domestique atteint d’un ostéosarcome associé à une fracture 11 ans après la blessure. Une amputation du membre arrière gauche a été réalisée à l’aide de la désarticulation coxofémorale. Aucune chimiothérapie cytotoxique intraveineuse n’a été utilisée après la chirurgie. La métastase pulmonaire a été identifiée 3 mois après l’amputation. Un ostéosarcome associé à une fracture peut se produire chez le chat plus de 10 ans après la blessure initiale.

Introduction

Feline osteosarcoma occurs with almost equal frequency in the axial and appendicular skeleton, and with no gender predilection (1). Osteosarcoma of the appendicular skeleton typically affects the metaphyseal regions of the proximal and distal tibia, distal femur, proximal humerus, and distal radius (1,2). In dogs, metastasis is extremely common and can occur rapidly; however, the metastatic rate for osteosarcoma in cats is much lower and has been reported to be between 8% and 16% (2,3).

Fracture-associated osteosarcoma is rare, but has been reported in both dogs and cats. In dogs, there is typically a lag period of ≥ 5 y before osteosarcoma arises following fracture repair (4,5). In cats, the lag period may be shorter and has been reported to occur within 5 y of the initial surgery, with most reported cases occurring within 6 to 15 mo (2,5–8).

Studies have aimed to identify prognostic characteristics of feline osteosarcoma. One such study found that histologic grade and mitotic index seemed to be the most important histopathologic prognosticators for survival in cats with osteosarcoma (9). Further studies are still needed to help determine whether specific characteristics, such as radiographic, cytologic, or histopathologic features, may help predict the biologic behavior of feline osteosarcoma, and thereby guide clinical recommendations.

The purpose of this case report is to discuss a unique presentation of fracture-associated osteosarcoma with subsequent aggressive biologic behavior in a cat.

Case description

An 11-year-old, neutered male domestic shorthair cat weighing 5.7 kg was presented for evaluation of a left distal femoral mass. The cat had a history of surgical stabilization of a left femoral fracture when he was a kitten. Three days before presentation, the owner noticed a weight-bearing lameness of the left hind limb. At that time, the cat was taken to an emergency clinic, where radiographs were taken, with subsequent referral.

On physical examination, the cat was bright, alert, and responsive. The cat’s heart rate was within normal limits and he was tachypneic (72 breaths/min). Thoracic auscultation was normal. Rectal temperature was normal. The cat had a marked weight-bearing lameness affecting the left hind limb. Signs of pain were elicited during palpation of a 4 × 3 cm, firm, irregular mass at the caudal aspect of the distal portion of the left femur. Physical and orthopedic examination was otherwise normal. The previously obtained radiographs from the referring emergency clinic (Figure 1) were reviewed.

An intramedullary pin was noted in the proximal and mid-thirds of the left femur that had been placed in normograde fashion, extending proximally in the soft tissues lateral to the femoral neck. Five cerclage wires were noted at the femoral diaphysis with overlying cortical bone. Areas of radiolucency were seen between the cortical bone and medullary cavity in the
mid-diaphyseal region. An expansile osseous lesion characterized by areas of moth-eaten to permeative osteolysis and a sunburst to amorphous pattern of periosteal proliferation and associated cortical erosion and ill-defined zone of transition was noted in the mid- and distal-thirds of the femur, with proliferation predominant caudally. The soft tissues surrounding the distal femur were mildly thickened. The body of the left ischium was thickened, with circumferential, mildly irregular osseous proliferation, which may have represented callus due to previous trauma or, less likely, a low-grade aggressive lesion. Superimposition of the left iliac wing to the left sacral wing and asymmetry of the obturator foramina likely represented prior pelvic floor fracture and left sacroiliac subluxation, rather than a positional artifact.

Given the suspicion of a neoplastic lesion of the left femur, staging with 3-view thoracic radiographs was performed. No evidence of pulmonary metastatic disease was seen. Differential diagnoses for the aggressive left femoral lesion included osteosarcoma, other primary bone neoplasms, and, less likely, osteomyelitis or metastatic neoplasia. On cytologic examination, binucleation was frequently seen. Trinucleation, karyomegaly, nuclear molding, and abnormal mitotic figures were occasionally observed. Overall anisokaryosis and anisocytosis were moderate to marked, there were frequent apoptotic cells, and 9 mitoses were detected in 10 400 x fields. Histopathology identified the mass as an osteosarcoma. Chemotherapy was not advised, given the low rate of metastasis reported with feline osteosarcoma (1–3). A 4-week recheck was recommended to repeat a complete blood cell count, serum biochemistry profile, and thoracic radiographs for repeat staging; however, the owner did not return the cat for this appointment.

Approximately 3 mo after surgery, thoracic radiographs taken by the primary veterinarian revealed multiple rounded, variably sized, soft tissue-opaque nodules within the pulmonary parenchyma, consistent with metastasis (Figure 2). Upon presentation to an oncologist, the cat was treated with toceranib phosphate (PALLADIA; Pfizer, New York, New York, USA), 3.0 mg/kg body weight, PO, every Monday, Wednesday, and Friday. Approximately 3 mo after initiating treatment with toceranib phosphate, the cat was presented to an emergency clinic for evaluation of vomiting, diarrhea, and anorexia of 24-hours duration, and was euthanized due to suspected progressive metastatic disease.

Discussion

The radiographic findings in this case were consistent with a primary bone tumor, with osteolytic and osteoproliferative lesions and thickening of the surrounding soft tissue centered on the distal femoral diaphysis at the previous fracture site. The histopathologic findings confirmed osteosarcoma. Though the etiology of fracture-associated osteosarcoma is not fully understood, hypotheses include implant corrosion at the fracture site and inflammation at the fracture site with delayed healing, chronic inflammation, and infection (4,5). Although the cause of osteosarcoma in this case is uncertain, one theory is that stabilization with an intramedullary rod and cerclage wires may have led to continued micro-motion. Associated chronic inflammation and a continued stimulus for proliferation due to relative instability may have predisposed to subsequent tumor formation. Inflammatory mediators contribute to neoplasia by inducing proneoplastic mutations, adaptive responses, resistance to apoptosis, and environmental changes such as stimulation of angiogenesis. All of these changes may confer survival advantages.

Figure 1. Lateral (A) and ventrodorsal (B) radiographic views of the left hind limb. Notice the expansile lesion at the left distal femoral metaphysis, at the distal edge of the implant, characterized by areas of moth-eaten to permeative osteolysis and a sunburst to amorphous pattern of periosteal proliferation (arrows).
to affected cells (10). Given the effects of chronic inflammation, it may be possible in this case that fracture fixation technique may have had significant clinical consequences many years after initial management, even with apparent healing. As there are many reasons why osteosarcoma may have occurred at the fracture site, further studies would be necessary to confirm a relationship between stabilization technique and subsequent tumor development.

This case was unique, given the presentation of late-onset fracture-associated osteosarcoma and the rapid metastasis following amputation of the affected limb. It has been reported that the rate of metastasis of osteosarcoma is low in cats (5% to 10%), with a median survival time of 64 mo (11,12). Serial staging is therefore advisable, but adjuvant chemotherapy is not typically recommended. While the reported metastatic rates and survival times in cats compare favorably to those seen in dogs, these data are based on a limited population of cats reported in studies several decades old (1–3,11,12). Predicting which cats may do well and which may succumb to metastasis with osteosarcoma is not possible with the limited data currently available. One study indicated that histologic grade and mitotic index seem to be the most important prognostic factors for survival (9). Further studies are necessary to help establish prognostic factors for appendicular osteosarcoma in cats. Such factors may be helpful to stratify patients and determine at risk populations that may benefit from adjuvant therapy.

In conclusion, fracture-associated osteosarcoma can occur over 10 y following fracture, and osteosarcoma in felines can occasionally be aggressive, resulting in rapid onset of metastases. Further studies are warranted to assess whether stabilization technique may be associated with tumor development and to identify cats at high risk of metastasis.

References
Antimicrobial resistance in mastitis, respiratory and enteric bacteria isolated from ruminant animals from the Atlantic Provinces of Canada from 1994–2013


Abstract — Diagnostic laboratory antimicrobial susceptibility data for bacteria isolated from clinical samples of cattle, sheep, and goats from 1994 to 2013 were evaluated retrospectively. Among bacteria from bovine mastitis, Staphylococcus aureus and Streptococcus uberis were the most commonly isolated organisms. Pasteurella multocida, Mannheimia haemolytica, and Histophilus somni were commonly isolated from the respiratory tract, while Escherichia coli isolates were frequently recovered from the intestinal tract. Isolates from mastitis were generally highly susceptible to the antimicrobials tested, except neomycin and oxytetracycline. Respiratory tract isolates were highly susceptible to trimethoprim-sulfamethoxazole, penicillin, florfenicol, and ceftiofur, while enteric bacteria were frequently susceptible to ceftiofur. Antimicrobial resistance trends over the study period were generally stable for small ruminant and cattle isolates. Multi-drug resistance was more common among respiratory isolates from small ruminants compared to those from cattle but more common in enteric bacteria from cattle compared to those from small ruminants. This information may guide clinicians when they are choosing empirical therapies for the treatment of ruminant animals in Atlantic Canada.


Introduction

Antimicrobials are used in food animals for treatment and prevention of bacterial diseases (1). However, there is considerable evidence that antimicrobial use in food animal production selects for resistance in commensal and pathogenic bacteria (2). This is a growing concern in veterinary and human health. Development of antimicrobial resistance (AMR), including multi-drug resistance, in bacteria in food-producing species is a particular concern as these organisms may be transferred in food to humans and also may serve as a reservoir for AMR genes. These resistant bacteria may lead to treatment failures in humans and animals and to increased costs of medical care and animal production (3).

For veterinarians, clinical microbiologists, public health officials, and government agencies, knowledge of the common
bacterial causes of infection in food animal species and their antimicrobial resistance patterns is important in selecting optimal empirical and pathogen-specific therapy, guiding treatment protocols, and developing policy (4,5). Antimicrobial susceptibility patterns and bacterial distribution vary from herd to herd and from one region to another (4,5). It is therefore important to acquire regional or local data (6). Additionally, surveillance is important in identifying changes in AMR patterns as well as recognizing new or emerging bacterial diseases among food animals.

There is a lack of published data on the dynamics of antimicrobial resistance in bacteria from food animals, particularly over a long-term period. The objectives of this study were to identify the most commonly isolated bacterial species and their antimicrobial susceptibility from clinical samples from cattle, sheep, and goats submitted to a veterinary diagnostic laboratory in Atlantic Canada and to determine trends in their antimicrobial susceptibilities over a 20-year period.

Materials and methods
Antimicrobial susceptibility data for bacteria isolated from clinical samples from cattle, sheep, and goats from 1994 to 2013 were retrieved from the database of the Atlantic Veterinary College Diagnostic Services Bacteriology Laboratory (AVCDBL) in Charlottetown, Prince Edward Island. For each bacterial isolate, the host animal species was the only information available. Other data, such as antimicrobial treatment, age, gender, and breed were not available. From each clinical sample, the bacteria were isolated using standard clinical microbiological isolation techniques, and antimicrobial susceptibility was determined by the Kirby-Bauer disk diffusion method. Zones of inhibition were interpreted following Clinical and Laboratory Standards Institute standards (7). When CLSI zones of inhibition for bacteria-antimicrobial combinations in a particular host species were not available, the zones of inhibition for other animal species, humans, or different bacterial species were used. For bacteria isolated from mastitic milk samples from dairy cattle, antimicrobial susceptibility was determined to the following antimicrobials: ceftiofur, cephalexin, cloxacillin, oxytetracycline, penicillin-novobiocin, pirlimycin, neomycin, and trimethoprim-sulfamethoxazole. For bacteria isolated from the respiratory and intestinal tracts, susceptibility testing included the following antimicrobials: ceftiofur, erythromycin, oxytetracycline, penicillin, streptomycin, florfenicol, tilmicosin, and trimethoprim-sulfamethoxazole.

Data management and statistical analyses
Bacterial isolates and their antimicrobial susceptibility profiles were selected from the AVCDBL database. Only bacteria that commonly cause clinical disease in ruminant animals were selected. Data were tabulated using a computerized spreadsheet (Microsoft Excel, 2010). Antimicrobial susceptibility was presented as a proportion and only acquired resistance was modeled as a continuous variable, and antimicrobial resistance (yes/no) for each bacterial-antimicrobial combination was the binary outcome. Linear relationship assumption between the year and the log odds of resistance was examined for each bacteria-antimicrobial combination by fitting quadratic polynomial for the year. The antimicrobial resistance trends were presented as odds ratios (OR). An OR > 1 indicated an increased AMR trend over the study period, while an OR < 1 represented a decreased AMR trend over the study period (11). The Wald test was used to determine the statistical significance of each bacterial species-antimicrobial trend. The level of statistical significance was P ≤ 0.05. All statistical analyses were performed using Stata 14 (StataCorp, College Station, Texas, USA).

Results
Antimicrobial resistance in bacteria from mastitis in dairy cattle
Staphylococcus aureus (n = 1532), Streptococcus uberis (n = 1171), and Escherichia coli (n = 716) were the most commonly isolated bacteria from mastitic milk samples. Overall, most of the mastitis isolates were susceptible (90% to 100%) to all the antimicrobials tested (Table 1). Escherichia coli showed reduced susceptibility to cephalexin (43.3%) and neomycin (62.5%); 70% to 90% of all the isolates were susceptible to oxytetracycline, while 96% of S. aureus isolates were susceptible to oxytetracycline. Among Gram-positive bacterial isolates 90% to 98% were susceptible to pirlimycin, except for S. uberis, for which only 82% of isolates were susceptible. Multi-drug resistance was not common among the mastitis bacterial pathogens; it was most observed in E. coli (12.7%) and least observed in both S. dysgalactiae and S. aureus (0.3%).

The trends of antimicrobial resistance over the study period were stable for most bacteria and drug combinations. Significantly increased AMR trends (P < 0.05) were observed for trimethoprim-sulfamethoxazole and E. coli (OR = 1.06, 95% confidence interval (CI): 1.01 to 1.11), oxytetracycline and S. aureus (OR = 1.06, 95% CI: 1.01 to 1.11) and oxytetracycline and S. uberis (OR = 1.10, 95% CI: 1.07 to 1.13). A high proportion of E. coli isolates were resistant to cephalexin and neomycin, but the resistance to cephalexin (OR = 0.97, 95% CI: 0.94 to 0.99) and neomycin (OR = 0.73, 95% CI: 0.70 to 0.77) significantly decreased (P < 0.05) during the 20-year period. Significant decreased resistance trends (P < 0.05) were observed in coagulase-negative staphylococci (OR = 0.76, 95% CI: 0.65 to 0.89) and S. aureus (OR = 0.79, 95% CI: 0.76 to 0.82) to neomycin, and in S. uberis to pirlimycin (OR = 1.04, 95% CI: 1.01 to 1.07) and trimethoprim-sulfamethoxazole (OR = 0.91, 95% CI: 0.86 to 0.96).

Antimicrobial resistance in respiratory bacteria from ruminants
In cattle, 87%, 84%, and 77% of the total Pasteurella multocida (n = 238), Mannheimia haemolytica (n = 187), and Histophilus somni (n = 87) isolates, respectively, were recovered from the respiratory tract over the study period. In small ruminants, 71.4% and 73.8% of M. haemolytica (n = 133), and P. multocida (n = 42), respectively, were isolated from the respiratory tract.
Antimicrobial susceptibilities among these bacteria are presented in Table 2. In both cattle and small ruminants, M. haemolytica and P. multocida were frequently resistant to erythromycin and streptomycin, but were frequently susceptible (susceptibility ranged from 94% to 100%) to ceftiofur, oxytetracycline, penicillin, trimethoprim-sulfamethoxazole, and florfenicol. However, susceptibility was relatively less frequent to tilmicosin (susceptibility ranged from 62% to 85%) in the respiratory isolates from cattle and small ruminants as well as to trimethoprim-sulfamethoxazole in H. somni (86%) from cattle.

Multi-drug resistance was more common among the respiratory isolates from small ruminants compared with those from cattle. The frequency of MDR bacteria was higher in M. haemolytica (17.1%) than in H. somni (14.9%) and P. multocida (11.8%) in cattle. In small ruminants, MDR bacteria were more common in P. multocida (38.1%) than in M. haemolytica (22.6%). The antimicrobial resistance trends in respiratory isolates from ruminants over the study period were stable, with the exception of a significant increased resistance trend (P < 0.05) in P. multocida to erythromycin (OR = 1.15, 95% CI: 1.06 to 1.23).

Antimicrobial resistance in Escherichia coli and Salmonella spp.

In cattle, 85.4% of the total E. coli (n = 489) isolates and 71.4% of the total Salmonella spp. isolates (n = 21) were recovered from the gastrointestinal tract with the remaining isolates recovered from blood, umbilicus, abscess, and respiratory tract. In small ruminants, 83.8% of the E. coli isolates (n = 74) and 5 Salmonella isolates were recovered from the gastrointestinal tract. A low proportion of ruminant isolates was susceptible to streptomycin and oxytetracycline. A high proportion of E. coli and Salmonella spp. isolates was susceptible to ceftiofur (Table 3). Multi-drug resistance was more common in enteric bacteria from cattle compared to enteric bacteria in small ruminants. The antimicrobial resistance trends in the enteric bacteria were stable over the study period, except for significant increased resistance trends (P < 0.05) in E. coli from cattle to ceftriaxone (OR = 1.15, 95% CI: 1.06 to 1.23), trimethoprim-sulfamethoxazole (OR = 1.05, 95% CI: 1.01 to 1.08) and florfenicol (OR = 1.16, 95% CI: 1.10 to 1.23). Significant decreased resistance (P < 0.05) to streptomycin in E. coli was observed in both cattle (OR = 0.94, 95% CI: 0.90 to 0.99) and small ruminants (OR = 0.78, 95% CI: 0.70 to 0.87) over the study period.

**Discussion**

Retrospective antimicrobial susceptibility studies provide helpful information to veterinarians in the selection of empirical antimicrobial therapy (6). This study examined the antimicrobial susceptibility patterns and trends in selected bacteria from clinical samples from cattle and small ruminants using data from a regional veterinary diagnostic laboratory over a 20-year period. Compared to previous studies, this study evaluated AMR data and trends from ruminant bacterial pathogens over a relatively long period (6,11,12).

Staphylococcus aureus was the most frequently isolated agent of bovine mastitis in this study and a high proportion of the
isolates were susceptible to all the antimicrobials tested, including penicillin, which is comparable to other published studies (12–15). Streptococcal isolates were highly susceptible to all antimicrobials except oxytetracycline. β-lactams are the recommended antimicrobials for the treatment of intra-mammary infections caused by *Streptococcus agalactiae* and environmental streptococci (16,17). The proportion of mastitis pathogens that were MDR was low. Most isolates with multi-drug resistance were Gram-negative organisms, especially *E. coli*, which is similar to previous findings from a Canada-wide study (18). Apart from the therapeutic implications of MDR *E. coli*, the bacteria could also play a potential role in the transmission of antimicrobial resistance genes to other udder pathogens (16).

Resistance trends in most antimicrobial and mastitis pathogen combinations were stable. In some instances, resistance decreased over the 20-year period, although most of the antimicrobials have been used to treat mastitis for decades (17). This stable trend is consistent with previous studies in North America (18–21). Increased resistance trends for trimethoprim-sulfamethoxazole and *E. coli* as well as oxytetracycline and *S. aureus* and *S. uberis* were found in this study. This increased resistance trend to both antimicrobials for these bacteria could be because these antimicrobial drugs are commonly used for systemic treatments of dairy cattle on Canadian dairy farms (17). The findings from our study support the evidence presented by the National Mastitis Council’s Expert Group that antimicrobial resistance in mastitis pathogens is uncommon with little evidence of increasing resistant trends (13).

Respiratory isolates from cattle, sheep, and goats and their antimicrobial susceptibility patterns were similar over the study period. However, AMR, as well as MDR bacteria trends over the study period, changed more in cattle compared to small ruminants. This may be because of differences in antimicrobial usage patterns in cattle compared to small ruminants. Dairy and beef cattle are more likely to have bacterial disease challenges, possibly due to management choices, such as increased animal stocking density, and are more frequently exposed to antimicrobial drugs compared to sheep and goats (22).

Respiratory diseases are a major cause of morbidity and mortality in dairy, beef, and small ruminant production systems (23–25). *Mannheimia haemolytica, P. multocida,* and *H. somni* were the most common respiratory pathogens isolated in this study. While *P. multocida* was frequently isolated from cattle, *M. haemolytica* was more common in small ruminants. *Histophilus somni* was the least common respiratory pathogen in cattle and was not isolated in small ruminants. These 3 organisms are commonly isolated from cases of bovine respiratory disease complex (26). A high proportion of these bacteria was susceptible to ceftriaxone, florfenicol, oxytetracycline, trimethoprim-sulfamethoxazole and penicillin in both cattle and small ruminants. Similar antimicrobial susceptibility patterns have been reported in other studies in North America (5,26–28) and in Europe (29). However, ceftriaxone should be reserved for situations in ruminant respiratory diseases in which other antimicrobial options are not available. Third generation cephalosporins are critically important in human medicine (30), but ceftriaxone is a third generation cephalosporin that is approved for both systemic and intramammary treatment in cattle in Canada (17).

While there was variation in proportions of isolates that were susceptible to the antimicrobials tested among both cattle and small ruminant bacteria, most antimicrobial resistance trends over the course of the study were stable. However, an increased antimicrobial resistance trend was observed in *P. multocida* to erythromycin and is in agreement with a similar older study over a 4-year period (1988–1992) in Michigan (26). Conversely, a study from Oklahoma (27) reported a decreased resistance trend to erythromycin in both *M. haemolytica* and *P. multocida* over a 9-year period (1994–2002).

The multi-drug resistance in *M. haemolytica* and *P. multocida* in this study is consistent with the findings of a similar study from Kansas State University, USA (5). The development of multi-drug resistance in both bacteria is reported to be mediated by small plasmid-derived DNA and conjugative and non-conjugative transposons (31). Recently a chromosomal-based mobile genetic element, referred to as an integrative conjugative element, was associated with multi-drug resistance in North American isolates (32). The development of multi-drug resistance in either bacteria would be economically challenging to ruminant animal production systems within this region, as respiratory disease complex is a major disease of both cattle and small ruminants (28).

### Table 2. Antimicrobial susceptibilities in respiratory bacteria isolated from ruminants over a 20-year period.

<table>
<thead>
<tr>
<th>Antimicrobials</th>
<th>Mannheimia haemolytica</th>
<th>Pasteurella multocida</th>
<th>Histophilus somni</th>
<th>Mannheimia haemolytica</th>
<th>Pasteurella multocida</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(n = 187)</td>
<td>(n = 238)</td>
<td>(n = 87)</td>
<td>(n = 133)</td>
<td>(n = 42)</td>
</tr>
<tr>
<td>Ceftriaxone</td>
<td>98.9 (95.8 to 99.7)</td>
<td>98.7 (96.1 to 99.6)</td>
<td>95.4 (88.3 to 98.3)</td>
<td>100.0</td>
<td>97.6 (84.5 to 99.7)</td>
</tr>
<tr>
<td>Erythromycin</td>
<td>47.1 (39.7 to 54.5)</td>
<td>42.0 (34.5 to 50.0)</td>
<td>89.1 (77.2 to 95.1)</td>
<td>18.4 (12.5 to 26.3)</td>
<td>26.8 (15.1 to 43.0)</td>
</tr>
<tr>
<td>Oxytetracycline</td>
<td>90.9 (85.7 to 94.3)</td>
<td>94.5 (90.7 to 96.8)</td>
<td>85.1 (75.7 to 91.2)</td>
<td>91.6 (85.7 to 95.3)</td>
<td>95.2 (81.9 to 98.9)</td>
</tr>
<tr>
<td>Penicillin</td>
<td>94.1 (89.5 to 96.7)</td>
<td>97.9 (95.0 to 99.1)</td>
<td>96.6 (89.6 to 98.9)</td>
<td>97.7 (93.0 to 99.2)</td>
<td>97.6 (83.8 to 99.7)</td>
</tr>
<tr>
<td>Streptomycin</td>
<td>12.0 (7.9 to 17.6)</td>
<td>23.2 (18.2 to 29.1)</td>
<td>48.3 (37.8 to 58.9)</td>
<td>16.2 (10.7 to 23.6)</td>
<td>33.3 (20.4 to 49.4)</td>
</tr>
<tr>
<td>Trimeprprim-sulfamethoxazole</td>
<td>97.3 (93.7 to 98.9)</td>
<td>99.2 (96.7 to 99.8)</td>
<td>86.2 (77.0 to 92.1)</td>
<td>100.0</td>
<td>100.0</td>
</tr>
<tr>
<td>Florfenicol</td>
<td>100.0</td>
<td>100.0</td>
<td>100.0</td>
<td>99.2 (94.4 to 99.9)</td>
<td>100.0</td>
</tr>
<tr>
<td>Tilmicosin</td>
<td>75.3 (68.3 to 81.1)</td>
<td>85.1 (79.7 to 89.2)</td>
<td>74.4 (63.6 to 82.8)</td>
<td>76.1 (67.1 to 83.3)</td>
<td>61.5 (44.8 to 75.9)</td>
</tr>
<tr>
<td>Multi-drug resistant</td>
<td>17.1 (12.4 to 23.2)</td>
<td>11.8 (8.2 to 16.5)</td>
<td>14.9 (8.8 to 24.1)</td>
<td>22.6 (16.2 to 30.5)</td>
<td>38.1 (24.6 to 53.7)</td>
</tr>
</tbody>
</table>

* n = Available CLSI zone diameters.
Table 3. Antimicrobial susceptibilities in enteric bacteria from ruminants over a 20-year period.

<table>
<thead>
<tr>
<th>Antimicrobials</th>
<th>Cattle (Escherichia coli (n = 489))</th>
<th>Salmonella spp. (n = 21)</th>
<th>Small ruminants (Escherichia coli (n = 74))</th>
<th>Salmonella spp. (n = 5)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ceftriaxone</td>
<td>86.4 (82.9 to 89.2)</td>
<td>95.0 (67.7 to 99.4)</td>
<td>95.8 (87.6 to 98.6)</td>
<td>100.0</td>
</tr>
<tr>
<td>Erythromycin</td>
<td>IR</td>
<td>IR</td>
<td>IR</td>
<td>IR</td>
</tr>
<tr>
<td>Oxytetracycline</td>
<td>36.8 (17.3 to 61.9)</td>
<td>36.8 (17.3 to 61.9)</td>
<td>67.1 (55.3 to 77.1)</td>
<td>100.0</td>
</tr>
<tr>
<td>Penicillin</td>
<td>IR</td>
<td>IR</td>
<td>IR</td>
<td>IR</td>
</tr>
<tr>
<td>Streptomycin</td>
<td>10.4 (7.9 to 13.6)</td>
<td>11.1 (2.4 to 38.9)</td>
<td>31.0 (21.1 to 42.9)</td>
<td>0.0</td>
</tr>
<tr>
<td>Trimethoprim-sulfamethoxazole</td>
<td>51.6 (47.2 to 56.1)</td>
<td>95.2 (69.1 to 99.4)</td>
<td>95.9 (87.9 to 98.7)</td>
<td>100.0</td>
</tr>
<tr>
<td>Florfenicol</td>
<td>72.0 (66.5 to 76.8)</td>
<td>53.3 (26.6 to 78.3)</td>
<td>88.1 (76.7 to 94.4)</td>
<td>100.0</td>
</tr>
<tr>
<td>Tilmicosin</td>
<td>IR</td>
<td>IR</td>
<td>IR</td>
<td>IR</td>
</tr>
<tr>
<td>Multi-drug resistant</td>
<td>48.7 (44.3 to 53.1)</td>
<td>33.3 (16.5 to 55.9)</td>
<td>5.4 (2.0 to 15.7)</td>
<td>0.0</td>
</tr>
</tbody>
</table>

IR — intrinsic resistance.

*Escherichia coli* was the most commonly isolated enteric organism from both cattle and small ruminants in this study, which is consistent with other studies (33,34). *Escherichia coli* can be a primary pathogen, a commensal, or a cause of co-infections with other bacteria and viruses. Furthermore, some types of *E. coli* are important food-borne pathogens (35). Enterotoxigenic strains of *E. coli* are a primary bacterial cause of calf scour, while other strains are major causes of extra-intestinal infections in humans and animals (36). In this study, enteric bacteria were frequently resistant to oxytetracycline and streptomycin, which is similar to findings in Europe and North America (6,35,37), and may be due to the prescribing practices and administration of these antimicrobials in ruminant animal production in these regions.

A decreasing trend of resistance to streptomycin in *E. coli* from cattle and small ruminants was found in our study. This may be because streptomycin is unavailable for use in Canada. Since use of streptomycin in dairy production was prohibited in Canada 3 decades ago, the selective pressure exerted by streptomycin is declining (35). Increased AMR trends were seen to ceftriaxone and florfenicol in *E. coli*. This is different from the stable or decreased AMR trends to ceftiofur and florfenicol in Canada 3 decades ago, the selective pressure exerted by streptomycin, which is similar to findings in Europe and North America (6,35,37), and may be due to the prescribing practices and higher susceptibility among specific pathogen and antimicrobials tested over the study period, especially bacteria isolated from bovine mastitis and samples from small ruminants. Generally, AMR trends in isolated bacteria were stable over the study period in both cattle and small ruminants. Stable trends and higher susceptibility among specific pathogen and antimicrobial combinations may indicate predictable susceptibilities that should result in a high probability of therapeutic success when these antimicrobials are used to treat infections without prior antimicrobial susceptibility testing.

**Acknowledgment**

We are grateful to Robert Page of University of Prince Edward Island for the retrieval of the culture and susceptibility data.

**References**


Overlooked sources of *Salmonella* contamination in the pig production network: Slaughterhouse yard pathways and mudguards and carpets from transport trucks

Alexandra Elayiz Henry, Ann Letellier, Jean-Charles Côté, Gabriel Desmarais, Virginie Lachapelle, Nadia Bergeron, Sylvette L. Lewandowsky, Philippe Fravalo

**Abstract** — This report describes various *Salmonella* serovars which were found on often overlooked locations in a pig farm/slaughterhouse interface. These include slaughterhouse yard pathways and mudguards and carpets of transport trucks arriving at and departing from production sites.

**Résumé** — Sources négligées de contamination par *Salmonella* dans un réseau de production de porcs: les voies de circulation de l'abattoir et les garde-boues et les tapis de cabine des camions de transport. Nous montrons ici que *Salmonella*, l’agent causal de la salmonellose, peut être trouvé sur des sites très inhabituels et négligés dans l’interface ferme porcine/abattoir: les voies de circulation de la cour d’abattoir, et les garde-boues et tapis des camions de transport qui arrivent et partent vers les sites de production.

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Salmonellosis is an infection caused by the bacterium *Salmonella*. It is characterized by abdominal cramps, diarrhea, vomiting, and fever (1). Domestically produced pork is an important animal-food source of human salmonellosis (2). Pork can be contaminated by the bacterium at any stage in the farm-to-fork chain, at pre-harvest (pig farming), harvest (slaughter, meat processing), and post-harvest (distribution, cooking). Mitigation measures rely on several factors and specific control measures have been implemented from the farm to the slaughterhouse, including vaccination, changes in pig density, feed additives, and improved hygiene (3,4).

The transport of pigs from the farm to the slaughterhouse is recognized as a source of *Salmonella* contamination (5). Surprisingly, however, little information is available on the presence of *Salmonella* at the interface between the production farm and the slaughterhouse, and more specifically in the slaughterhouse yard, a place of transit for various vehicles, or on the transportation trucks. Our aim was to study the presence and distribution of *Salmonella* on often overlooked locations on a pig slaughterhouse yard; in the dust collected from various pathways taken by transport trucks in the slaughterhouse yard; and on mudguards and carpets of the transport trucks when they arrive and when they leave the slaughterhouse.

A slaughterhouse yard was visited 18 times over a 10-month period, from August 2011 to May 2012. Samples for microbiological testing were collected using cleaned and disinfected dustpans to superficially sweep a 1 m × 1 m surface located on the main gate pathway before the arrival of a pig transportation truck, after its arrival, and upon its departure. Samples were also taken from a 1 m × 1 m surface located on 2 separate pathways: 1 used by the carcass rendering truck and the other used by the non-edible matter truck. A subtotal of 90 (18 × 5) samples was collected. In addition, mudguards from pig transport trucks were sampled 3 times at the slaughterhouse: upon arrival at the entrance of the slaughterhouse yard, during pig delivery at the landing stage, and just upon leaving the slaughterhouse yard at the main gate. Here, a subtotal of 54 samples (18 × 3) was collected. Samples (n = 18) were also collected from cabin carpets of the trucks. Altogether, 162 (18 × 9) samples were collected, carried to the laboratory, and analyzed within 5 h for the presence of *Salmonella*.

*Salmonella* was isolated according to ISO 6579:2002 (6). Briefly, each sample was pre-enriched in buffered peptone water and incubated at 37°C overnight (18 to 20 h). Next, a sample from the pre-enrichment broth culture was inoculated into Rappaport-Vassiliadis medium with soya (RSV broth) and Muller-Kauffmann tetradionate/novobiocin broth (MKTTn broth, pH 8.0). The RSV and MKTTn broths were incubated...
Table 1. Distribution and identification of *Salmonella* serovars on selected slaughterhouse pathways, truck mudguards, and truck cabin carpets.

<table>
<thead>
<tr>
<th>Date YY-MM-DD</th>
<th>Pathway&lt;sup&gt;a&lt;/sup&gt; used by the pig delivery truck</th>
<th>Pathway&lt;sup&gt;b&lt;/sup&gt; used by the non-edible matter truck</th>
<th>Pathway&lt;sup&gt;c&lt;/sup&gt; used by the carcass rendering truck</th>
</tr>
</thead>
<tbody>
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<td>11-08-30</td>
<td>Infantis</td>
<td>Brandenburg, Infantis</td>
<td>Brandenburg</td>
</tr>
<tr>
<td>11-09-07</td>
<td>Infantis, Typhimurium PT U302</td>
<td>Brandenburg, Derby, Typhimurium PT 104b, 1,4,[5],12:i-</td>
<td>Uganda, Typhimurium PT U302</td>
</tr>
<tr>
<td>11-09-28</td>
<td>Derby</td>
<td>Typhimurium PT 208</td>
<td>Brandenburg</td>
</tr>
<tr>
<td>11-10-05</td>
<td>Typhimurium PT 104b</td>
<td>Give, Typhimurium PT UT5</td>
<td>Infantis, Worthington</td>
</tr>
<tr>
<td>11-11-10</td>
<td>Infantis</td>
<td>Typhimurium PT 104b</td>
<td>Infantis, Worthington</td>
</tr>
<tr>
<td>11-11-30</td>
<td>Brandenburg, Typhimurium PT 104</td>
<td>Brandenburg, Infantis, Typhimurium PT 104b</td>
<td>Brandenburg, Infantis, Derby, Schwarzengrund</td>
</tr>
<tr>
<td>11-12-01</td>
<td>Worthington</td>
<td>Worthington</td>
<td>Ohio, Infantis, Typhimurium PT 104</td>
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<td>12-01-19</td>
<td>Typhimurium PT 108</td>
<td>Infantis</td>
<td>Typhi</td>
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<td>12-02-06</td>
<td>Derby</td>
<td>Auto-agglutinating</td>
<td>Alachua</td>
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<td>12-04-18</td>
<td></td>
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*<sup>a</sup> 1 m × 1 m surface located on the main gate pathway.

*<sup>b</sup> 1 m × 1 m surface located on the pathway used by the non-edible matter truck.

*<sup>c</sup> 1 m × 1 m surface located on the pathway used by the carcass rendering truck. Empty areas indicate no *Salmonella* was isolated.
overnight at 42°C and 37°C, respectively. Cultures were plated on xylose lysine deoxycholate agar (XLD agar) and incubated at 37°C, overnight. In some cases, colonies on XLD agar were obtained from both RSV and MKTTn broths. In these cases, colonies from both sources were further identified. Identity of *Salmonella* isolates was confirmed by biochemical reactions including those identified on Triple Sugar Iron (TSI) agar (7). Lysine Iron Agar (LIA) (7), urease medium (7), and API 20E (8). All confirmed *Salmonella* isolates were sent to “Laboratoire d’épidémiossurveillance animale du Québec” (MAPAQ, Saint-Hyacinthe, Quebec) for serotyping (9). *Salmonella Typhimurium* isolates were further characterized by phage typing (10) at the National Microbiology Laboratory (Public Health Agency of Canada, Winnipeg, Manitoba).

Fifty-five of the 90 dust samples collected from locations on the slaughterhouse pathways were *Salmonella*-positive. A total of 72 *Salmonella* isolates were obtained and serotyped. These *Salmonella* isolates encompassed 12 serovars, 1 non-typable and 1 auto-agglutinating (rough variants of *Salmonella* that do not express O antigen) (Table 1). *Salmonella Typhimurium* isolates were subtyped into 5 phage types by phage typing (10) (Table 1). The frequency of recovery of isolates varied according to the different slaughterhouse pathways. *Salmonella* was found on the pathway used by the pig delivery truck before its arrival (10 positive samples/18 samples tested, 56%; 13 isolates/72 total isolates, 18%), after its arrival (7/18, 39%; 8/72, 11%), and after its departure (13/18, 72%; 19/72, 26%). Somehow, this pathway had lost some *Salmonella* serotypes and acquired new ones on the same day between the arrival of the pig delivery truck and after its departure. The location on the pathway used by the non-edible matter truck was also contaminated with *Salmonella* (10/18, 56%; 13/72, 18%). The location on the pathway used by the carcass rendering truck, where leaching water from the slaughterhouse is usually present, was the most contaminated location (15/18, 83%; 19/72, 26%).

Because samples were taken over a 10-month period, it was possible to follow the seasonal distribution of *Salmonella* at these locations on the slaughterhouse pathways. Of the 60 samples taken when the temperature was warmer (from August 30 to December 1, 2011 and from April 18 to May 24, 2012), 44 (73%) contained *Salmonella*. They accounted for 61 (85%) of the total number of isolates. *Salmonella* was also detected in the winter season on pathways covered with snow and ice. Of the 30 samples taken during the winter period (December 20, 2011 to April 6, 2012), 11 (37%) contained *Salmonella*. They accounted for 15% of the total number of isolates. *Salmonella* was detected at a lower frequency in winter (37% versus 73%; Chi-square $P<0.01$).

Thirteen of the 54 samples collected from truck mudguards were *Salmonella*-positive. They yielded 18 isolates that comprised 6 serovars and 4 *Salmonella Typhimurium* phage types (Table 1). Distribution varied according to the time at which mudguards were sampled. *Salmonella* was found on truck mudguards upon arrival (4 positive samples/18 samples tested, 22%; 6 isolates/18 total isolates, 33%); during unloading (5/18, 28%; 5/18, 28%), and upon leaving (7/18, 39%; 7/18, 39%) the slaughterhouse yard. Interestingly, *Salmonella* was not detected on the mudguards during the winter period (December 20, 2011 to April 6, 2012).

Twelve of the 18 samples (67%) collected from the cabin carpet were *Salmonella*-positive. They provided 19 isolates that comprised 3 serotypes and 5 phage types (Table 1). *Salmonella* was detected throughout the period under study.

Several risk factors are associated with pig contamination with *Salmonella* in a farm/slaughterhouse interface: the farm status, pig transport conditions, lairage, which determine pre-existence of *Salmonella* on carcasses followed by cross-contamination, and dirty and “clean” zones of the slaughter line (5,11). It was found that pathways taken by the transportation trucks in the slaughterhouse yard, and the mudguards and truck cabin carpets can all be sources of *Salmonella*, which in turn could be spread elsewhere in the slaughterhouse yard or presumably even be transported back to the pig farms (5).

*Salmonella* was frequently isolated throughout the duration of our study. The isolates showed a great diversity of serotypes and phage types. The presence of common or different *Salmonella* on various pathways from one sampling day to another (Table 1) indicates either the survival of the bacteria or the deposition of new serotypes and phage types, some following the transit of trucks. Interestingly, specific *Salmonella* serotypes and phage types were associated with specific pathways. *Salmonella Typhimurium* and S. Derby were not found on pathways in the slaughterhouse yard used by the non-edible matter collector trucks (0 isolate/13 isolates, 0%; 0 isolate/18 samples, 0%). These pathways were not taken by trucks used in the transport of live swine. These bacteria, however, were found on pathways used by trucks involved in primary production, i.e., the pig delivery trucks (12/40, 30%; 12/54, 22%), and the carcass rendering trucks (9/19, 47%; 9/18, 50%). Not surprisingly, serotypes Typhimurium and Derby are also often found in primary pig production (11–15).

In conclusion, it was shown that *Salmonella* isolates are present on different pathways taken by trucks in the slaughterhouse yard, and on truck mudguards and truck cabin carpets. This work emphasizes the importance of a thorough cleaning and disinfection protocol for transport trucks upon leaving the slaughterhouse to prevent spread of *Salmonella* elsewhere in the network of pig production farms visited by the same trucks.

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**References**


New Products
Nouveaux produits

Interceptor® Plus, Protection Against Five Internal Parasites — Now Available in Canada

Interceptor Plus, a canine parasiticide that provides protection in a monthly chewable tablet with efficacy against five types of internal worms, has received registration in Canada and is now available through all purchasing groups. Interceptor Plus is a prescription product and is available exclusively through the veterinary channel in Canada. “The proven milbemycin oxime/praziquantel formulation of Interceptor Plus provides prevention and treatment against a broad spectrum of parasites in dogs,” says Steve Myette, Head of Sales, Companion Animal Business, Elanco. “But what makes this product unique is the fact that it offers the inclusion of heartworm and tapeworm on its label, meeting the needs of a more complete all-in-one internal parasite solution.”

Interceptor Plus is offered in a tasty chew flavoured with real chicken, is easy to dose, and is safe for use in canines six weeks of age and older. In addition to the product’s unique coverage of both heartworm and tapeworm, Interceptor Plus also provides protection against hookworm, roundworm and whipworm. The product also provides the flexibility to pair with tailored flea and tick control as needed or seasonally.

“Widely accepted throughout the United States for over two years, the launch of Interceptor Plus into Canada has been greatly anticipated, as it allows for the treatment of more worms with one product, helping to strengthen the human animal bond. The product provides cost effective tapeworm treatment in high risk regions; where recent data suggests that tapeworm has been regularly underdiagnosed1,” says Steve Myette.

Veterinary professionals interested in purchasing or learning more about Interceptor Plus are encouraged to talk to their Elanco representative or call 1-800-265-5475.


Contact: Elanco Canada Limited, Research Park Centre, 150 Research Lane, Suite 120, Guelph, ON N1G 4T2; phone: 1-800-265-5475; fax: 519-821-7831; website: elanco.ca
Serological survey of canine vector-borne diseases in Saskatchewan, Canada

M. Casey Gaunt, Anthony P. Carr, Susan M. Taylor

Abstract — Whole blood samples were collected from 515 dogs in the practice region surrounding Saskatoon, Saskatchewan, Canada between 2008 and 2010 and evaluated for seroprevalence of vector-borne diseases. Of 515 samples, 12 (2.3%) were positive, with 7 (1.4%) positive for antibodies to Borrelia burgdorferi. These prevalences are higher than those previously reported for this region.

Résumé — Enquête sérologique des maladies canines à transmission vectorielle en Saskatchewan, au Canada. Des échantillons de sang total ont été prélevés auprès de 515 chiens dans des établissements vétérinaires des environs de Saskatoon, en Saskatchewan, au Canada, entre 2008 et 2010, et ont été évalués pour la séroprévalence des maladies à transmission vectorielle. Parmi les 515 échantillons, 12 (2,3 %) étaient positifs et 7 (1,4 %) étaient positifs pour les anticorps contre Borrelia burgdorferi. Ces prévalences sont supérieures à celles précédemment signalées pour cette région.

V ector-borne diseases are an important and emerging health concern for humans and animals worldwide. A recent special report in the Canadian Veterinary Journal highlighted the increasing risk of Lyme disease in Canada (1). The geographic distribution of vectors, reservoir hosts, and pathogens has been shifting and expanding (2,3), necessitating up-to-date surveillance studies to assess current risk.

Several large seroprevalence studies have provided excellent data on changing pathogen prevalence in North America and the Caribbean; however, these studies lack strong data from the Canadian prairie provinces of Alberta, Saskatchewan, and Manitoba (4–6). One recent short communication described the seroprevalence of vector-borne diseases in a large number of dogs from across Canada; however, less than 2% of the cases came from the provinces of Saskatchewan and Alberta (7). A more recent large survey that reviewed 115 636 SNAP 4DX Plus test results collected in 2013–2014 from eastern Canada west to Saskatchewan found that 2.5% of tests were positive for Borrelia burgdorferi antibodies, while less than 0.5% of samples were positive for antibodies to Ehrlichia canis or Anaplasma phagocytophilum. Despite this large number of samples, only 186 samples came from Saskatchewan, with 0.5% of those testing positive for antibodies to B. burgdorferi (8). While the western Canadian provinces of British Columbia and Manitoba have well-recognized pockets of endemic vector-borne diseases including heartworm and Lyme, Saskatchewan and Alberta continue to be underrepresented in the literature (7–9).

Three dogs with clinical illness due to granulocytic anaplasmosis were identified in Saskatchewan in 2009 and seroprevalence data identifying exposure to West Nile virus in dogs from Saskatchewan were reported in 2015; however, other vector-borne diseases such as ehrlichiosis and Rocky Mountain spotted fever are not usually considered endemic in Saskatchewan (10,11). While there are no known endemic populations of Ixodes scapularis within the province of Saskatchewan, the role of migratory birds in the delivery of competent vectors to the region as well as the projected expansion of vector range due to climate change make further investigation critical to allow for the development of appropriate screening and prevention strategies in this region (12–14).

The aim of this study was to determine prevalence of B. burgdorferi, A. phagocytophilum, E. canis, and Dirofilaria immitis; and to identify potential risk factors for exposure to vector-borne pathogens in dogs from Saskatchewan.

Serum and whole blood samples were collected from 135 clinically healthy client-owned dogs presenting to the Veterinary Medical Centre (VMC) in Saskatoon, Saskatchewan, Canada between 2008 and 2010 for routine health care procedures.
Owners signed a consent form approved by the University of Saskatchewan Animal Use Committee to allow testing of their samples. The seroprevalence of antibodies to West Nile virus in these dogs has previously been reported (11). In addition to those 135 healthy dogs, samples were collected during the same time frame from 14 dogs presenting to the VMC for assessment of clinical illness with differential diagnoses including infectious or vector-borne diseases. The final diagnoses for these patients included endocarditis (1/14), lameness/arthritis (2/14), Shar Pei fever (1/14), gastroenteritis (3/14), polyarthitis (5/14), unspecified immune mediated disease (1/14), fever of unknown origin (2/14), arthritis (1/14), with 1 dog having both fever and lameness. None of the 135 healthy client-owned dogs or the 14 clinically ill dogs had left the province of Saskatchewan in the previous 2 y.

Additionally, 366 whole blood samples submitted for laboratory testing to Prairie Diagnostic Services Laboratory, Saskatoon, Saskatchewan were evaluated for seroprevalence of the 4 previously described pathogens. No historical data, travel, or medical information was available for these samples.

The SNAP 4Dx (IDEXX Laboratories, Markham, Ontario) was used to determine the presence of *D. immitis* antigen, *A. phagocytophilum* antibody, *B. burgdorferi* antibody, and *E. canis* antibody in each sample. There may be cross reactivity with *Anaplasma platys* or *Ehrlichia ewingii*, though no further testing was performed to assess for this possibility. The sensitivity and specificity of each of these tests have been reported by IDEXX Laboratories (package insert) and also reviewed previously (8).

Twelve of the 515 samples that were tested (2.3%) had a positive result on the SNAP 4Dx, for 1 or more pathogens, with 1 dog being positive for both *B. burgdorferi* and *A. phagocytophilum* antibodies. Seven of the dogs (1.4%) were positive for *B. burgdorferi* antibodies, 3 (0.6%) tested positive for *A. phagocytophilum* antibodies and 3 (0.6%) were positive for *E. canis* antibodies. No samples were positive for *D. immitis* antigen. The SNAP 4Dx results are summarized in Table 1.

When dogs with a known clinical history were considered separately, 5/149 (3.4%) were seropositive for 1 or more pathogens on the SNAP 4Dx test. These included 3/149 (2.0%) testing positive for *B. burgdorferi* antibodies and 2/149 (1.3%) testing positive for *A. phagocytophilum* antibodies. Dogs classified as sick were more likely to test positive for *B. burgdorferi* antibodies (2/14; 14.3%, both diagnosed with polyarthritis) than were healthy dogs (1/135; 0.7%). None of the sick dogs were positive for *A. phagocytophilum* antibodies. However, 2/135 (1.5%) and 1/135 (0.7%) samples from healthy dogs were positive for *A. phagocytophilum* and *B. burgdorferi* antibodies, respectively.

Seven of the 366 (1.9%) dogs with unknown historical or clinical data collected from the PDS laboratory were positive for 1 or more pathogens on the SNAP 4Dx test. The positive tests included 4/366 (1.1%) positive for *B. burgdorferi* antibodies, 1/366 (0.3%) positive for *A. phagocytophilum* antibodies and 3/366 (0.8%) positive for *E. canis* antibodies. One dog (0.3%) was positive for both *B. burgdorferi* and *A. phagocytophilum* antibodies.

The overall vector-borne disease seroprevalence of 2.3% is higher than has been previously reported for Saskatchewan, with higher seroprevalence rates for *B. burgdorferi* (1.4%) and *A. phagocytophilum* (0.6%) than those reported for the province in recent surveys. The failure to identify any heartworm antigen is consistent with previous reports for the region (7,8). Bowman et al (6) reported the prevalence of vector-borne diseases in the neighboring states of Montana and North Dakota in 2008. Animals from Montana that were tested did not have antibodies to *B. burgdorferi*, *A. phagocytophilum*, or *E. canis*, but 0.6% had evidence of *D. immitis* antigen, while animals from North Dakota had higher rates for both *B. burgdorferi* (3%) and *A. phagocytophilum* (2.4%) (6).

Interestingly, Herrin et al (8) reported Saskatchewan as having the highest seroprevalence of *E. canis* of any province in Canada with 3/186 (1.6%) samples positive. Our result of 0.6% is lower; however, it is within their reported 95% confidence interval (CI) and is still above the national average reported in that study (0.14%). Herrin et al (8) did not include samples from Alberta or British Colombia in their study, so the true current Canadian national prevalence is unknown.

Although *B. burgdorferi* and *A. phagocytophilum* infections are transmitted by the same tick vector, *Ixodes scapularis*, a much lower seroprevalence was observed for *A. phagocytophilum* antibodies than for *B. burgdorferi* antibodies in this study. This finding is noteworthy given the previous report of clinical anaplasmosis in 3 dogs from Saskatchewan (10). Despite this low value, 0.6% prevalence for *A. phagocytophilum* antibodies is still above what was recently reported to be the national average for Canada (8).

No statistically significant differences were identified between patients with known versus unknown clinical histories or
between sick versus healthy dogs, despite a tendency for dogs with polyarthritis to be B. burgdorferi positive. No risk factors for seropositivity were identified. The association between each evaluated risk factor of interest and serological outcomes was examined using logistic regression (SAS for Windows ver. 9.3; SAS, Cary, North Carolina, USA). The failure to demonstrate a clear difference is likely a reflection of the low positive rate and the small number of patients in the known clinical history and sick patient groups.

There are several important limitations to this study. Only 149/515 dogs had known clinical and travel histories. As such, it is impossible to know the reason for sampling in the 366 dogs tested through the commercial laboratory. These samples may have been submitted as part of routine screening in healthy patients or part of a clinical investigation into underlying disease. Additionally, for the dogs with unknown travel histories, it is possible that they were exposed to pathogens outside of Saskatchewan and not locally exposed. This being said, the seroprevalence rates in this population of dogs are comparable to those found in the 2 recent Canadian studies (7,8) as well as the seroprevalence rates identified in dogs with a known clinical history in the current study, suggesting they may be representative of the population as a whole.

The inclusion of samples from the 14 sick dogs may bias the results towards a higher seroprevalence; however, the authors felt it was appropriate to keep these data in the final analysis in light of the unknown clinical histories of 366 dogs tested through a commercial laboratory. Moreover, when a final analysis was performed after removing data from the 14 sick dogs, the prevalence rate was higher than had been previously reported for Saskatchewan. The small number of sick dogs with clinical signs consistent with vector-borne diseases makes it impossible to draw conclusions about the true prevalence of these diseases in the region. Continued evaluation of the population of sick dogs is necessary to gauge the real impact of vector-borne diseases in the area.

This study used a convenience sample consisting of clinically healthy dogs recruited through the Veterinary Medical Centre. Because it was not a random sample, it is not possible to say how well the results can be generalized to all dogs in the province. It is possible that the independence assumption was violated, because some dogs could have lived in the same household. However, given the average number of dogs per household in the dataset would be substantially less than two, the impact on study estimates of prevalence would be minimal (15).

Given the low prevalence of all of these diseases in Saskatchewan, it must be considered that some of these positive results could represent false positives. The positive predictive value of the SNAP 4Dx test has, however, been suggested to be acceptable in similar serosurveys. Despite this, any asymptomatic dog found to be positive in such a low prevalence environment should be retested prior to clinical intervention (7).

The results from this study serve to expand the information on vector-borne disease in the province of Saskatchewan, and suggest that these diseases must remain in consideration when clinical signs are present, despite lack of travel to a previously documented endemic area.

**Acknowledgment**

The authors gratefully acknowledge the University of Saskatchewan Companion Animal Health Fund which provided financial support for this project.

**References**

Assessing the sharpness of hypodermic needles after repeated use
Kadin Majcher, Dustin Eichorn, Cheryl Waldner, James Johnston, Chris Clark, Murray Jelinski

Abstract — Four gauges (14G, 16G, 18G, 20G) of single use hypodermic needles were evaluated for sharpness by measuring the force required to puncture rehydrated bovine leather. The needles began to dull after 1 use with maximum bluntness occurring within 4 to 5 uses.


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Single use medical devices such as hypodermic needles are routinely used in human and veterinary medicine to mitigate the spread of infectious agents among patients. Within the veterinary community there has been a number of documented cases of iatrogenic transmission of infectious diseases due to the repeated use of needles (1,2). This concern coupled with needle stick injuries, and economic losses resulting from injection site blemishes and broken needles found in meat products, have been the impetus for developing needle-free injection devices (3). This technology, however, has not been widely adopted and hence single use needles remain in common use in veterinary medicine.

Livestock producers routinely reuse the same needle on multiple animals. In fact, Canada’s Verified Beef Program advises producers to change needles after 10 to 15 uses (4). A recent survey of producers in the United Kingdom found that 43% of producers changed needles when the needle broke or became blunt during vaccination procedures (5). Furthermore, a survey of food and mixed animal practitioners found that veterinarians routinely use needles more than once (6). These studies underscore the pragmatic approach that producers and veterinarians apply to using single use needles; balancing strict hygienic practices with the time and cost associated with using a new needle for each injection. Apart from the potential for iatrogenic disease, single use needles dull very quickly thus requiring more penetration force, making them more susceptible to bending and breakage (7). Breakage is of concern because broken needles may become embedded within meat products. In Canada, a survey of beef processors found that 41% received at least 1 complaint annually of broken needles found in retail meat products (8).

The International Organization of Standardization (ISO) provides standards and methods for testing single use hypodermic needles (9), as well as for the stainless steel tubing (needle stem) used in their manufacture (10). There is, however, a paucity of information related to testing of hypodermic needles for use in veterinary medicine. In 1999, Hoff and Sundberg (11) published the results of a study in which 2 lengths of 16 gauge (G) and 18G needles were tested for sharpness using pig cadavers. Using a mechanical spring scale, they assessed the force (pounds) needed to penetrate the pig cadavers at 0, 10, 20, 30, and 40 repetitions or repeat penetrations. From these results it appeared that the 16G and 18G needles became dull after 20 repeated punctures. However, the force measurements were taken after every 10th needle penetration and the method of measuring force was relatively imprecise compared with current technology.

The objective of this study was to indirectly assess the number of times a single use needle could be used before signs of dulling. Dulling was determined by measuring the amount of force required to perforate tanned hide. The greater the change in required force, the greater the degree of dulling.

The testing medium was bovine vegetable tanned side leather (Tandy Leather, Fort Worth, Texas, USA). Prior to testing, the leather was rehydrated by soaking in a warm water bath for a minimum of 30 min. Leather strips, averaging 2.8 mm in thickness, were then cut from a single hide and examined for...
irregularities before testing. Single use, bevel tipped, stainless steel, hypodermic needles (Monoject; Covidien, Mansfield, Maine, USA) of 4 different gauges (G14, G16, G18, and G20) were tested. Each needle was forced to penetrate the leather 10 times, with the leather being repositioned ~10 mm between tests to ensure the needle penetrated intact leather. Testing was conducted intermittently over a 6-week period, beginning with the smallest bore needles (G20). The ten 20G needles were tested on 2 separate days (5/d). All ten 18G needles were tested the same day, while the ten 16G needles were tested over 2 consecutive days (2 and 8 needles/d). Lastly, 4 of the 14G needles were tested the same day, with the remaining 6 the following day.

A servo-hydraulic material testing system (MTS Bionix; MTS System Corporation, Eden Prairie, Minnesota, USA) controlled the axial displacement of the needles during testing. Figure 1. Two rigid aluminum plates fixed the position of the leather and ensured constant surface tension during penetration with an exposed test diameter of 9.52 mm. In preparation for testing, the needle hub was separated from the stem and the tip visually inspected for deformation. A chuck was then used to secure the needle stem in place, preventing any unwanted movement. Each needle penetrated the leather perpendicularly to the surface at a rate of 2 mm/s until puncture occurred. Peak penetration force (puncture force) was recorded at a frequency of 1000 Hz with a data acquisition system (National Instruments Corporation, Austin, Texas, USA) and converted to Newtons (N).

Descriptive statistical analysis of the mean peak penetration force for each needle gauge was completed using commercial software (STATA/SE 14.0 for Windows; StataCorp LP, College Station, Texas, USA). A mixed model with a random intercept for each needle was used to examine the differences in peak penetration force among puncture number (P1 to P10) and the gauge of the needles (14G, 16G, 18G, and 20G). An autoregressive (1) correlation structure was used to account for the order of observations within each needle. The model contained an interaction between puncture number and gauge as well as each main effect. The significance of the interaction term was assessed with a Wald test and planned post hoc comparisons were assessed within each gauge following each puncture and among gauges for each puncture value. Model residuals were checked graphically for normality and homogeneity of variance. Needle dulling was considered to have peaked when the force required to penetrate the leather did not change significantly from one puncture to the next. All levels of statistical significance were P < 0.05.

The mean force (N) required by the 14G, 16G, and 18G needles to penetrate the leather increased significantly between the 1st and 2nd puncture (P1–2) and 2nd and 3rd puncture (P2–3), but was not different between the 3rd and 4th puncture (P3–4) (Figure 2). Specifically, the P-values for the 3 needles at P3–4 were as follows: 14G (P = 0.08); 16G (P = 0.31); 18G (P = 0.20). Apart from 1 exception, P3–4 for the 16G needles (P = 0.001), there were no significant changes in mean force between successive penetration points for the remainder of the study. Since there was no difference in the mean peak penetration force for the P3–4 interval, it can be concluded that the needle reached maximum dullness at the time of the 3rd puncture.

The 20G needles appeared to dull sooner, with no significant change in the mean force (P = 0.07) across the P2–3 interval. Hence, maximum dullness occurred at the time of the 2nd puncture.

The mean increase in total force from the 1st puncture to the puncture in which no further significant increases in force occurred were: P2–3 for 14G [19.5 N; 95% confidence interval (CI): 10.6 to 28.3]; P2–3 for 16G (37.3 N; 95% CI: 28.5 to 46.1); P2–3 for 18G (13.8 N; 95% CI: 5.0 to 22.7); and P1–2 for 20G (13.1 N; 95% CI: 6.7 to 19.5). These represented relative mean increases of 33.1% (14G), 64.7% (16G), 54.8% (18G), and 43.6% (20G) above the force required for the initial puncture.

In addition to differences in mean force between consecutive penetration time-points, the difference in mean forces across the 4 needle gauges at each penetration point were examined. A repeating pattern emerged from this analysis. At each of the 10 puncture points, there were no differences between the mean forces for the 14G and 16G needles (P ≥ 0.13), and the mean forces for the 18G and 20G needles (P ≥ 0.32).
mean puncture forces for all other paired comparisons, at each puncture point, were significantly different (P ≤ 0.03). These relationships are evident in Figure 2, with the lines representing the 14G and 16G needles being very close together, as are the lines for the 18G and 20G needles.

All 4 needle gauges displayed the same general trend throughout the study, with the mean peak penetration forces being lowest at P1 and then steadily increasing at the 2nd and 3rd puncturing events until the penetration force approached to plateau (Figure 2). This plateau can be attributed to the cessation of dulling in which the needle reached maximum bluntness. In the dulled state, the same amount of force was required for each subsequent penetration. Conceivably, had the study been extended, there may have been additional wear and dulling of the needles. Furthermore, to facilitate testing, the needle stem had been detached from the hub. Had the needle remained intact, fatigue at the stem-hub junction may have resulted in needle breakage. It has been reported (11) that lateral forces placed on the needle result in sheering at the stem-hub joint.

Although there was a linear increase in the bore size of the needles, this was not reflected in the amount of force required to penetrate the leather. Presumably, the small bore 20G needles, this was not reflected in the amount of force required for all sequential puncture points (P1 to P10) for the 14G, 16G, and 18G needles. However, mean peak forces tended to drift higher towards the end of the test. This suggests that the needles may have continued to fatigue, making them slightly less sharp and thus requiring greater force to penetrate the leather. For all intents and purposes, single use needles, regardless of gauge, become dull within 2 to 3 uses, and should be considered blunt by the 4th to 5th use. Finally, the results should not be construed as encouraging the repeated use of single use needles. Rather we draw attention to how rapidly these needles become dull, which increases the risk of bending and breaking.

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**References**

Practitioners’ Corner Le coin des praticiens

What is your diagnosis?

Leila Bedos, Ruth Dennis, Adrien Aertsens

A 9-year-old neutered male golden retriever dog was referred for right pelvic limb lameness. The dog had been presented to the referring veterinary surgeon 4 wk previously for acute lameness. He had been rested and given a non-steroidal anti-inflammatory drug (NSAID) and subsequently the clinical signs resolved.

General examination was unremarkable. The orthopedic examination revealed a 1/5 right pelvic limb lameness, muscular atrophy on the right pelvic limb, thickening at the medial aspect of the proximal tibia and distal femur, severe stifle effusion, and pain on stifle extension. The cranial drawer and the tibial thrust signs were negative, and no meniscal click could be felt. The rest of the orthopedic and the appendicular neurologic examinations were within normal limits. Radiographs of the right stifle were taken.

Diagnostic imaging: Findings and interpretation

On the radiographs, there was almost complete obliteration of the infrapatellar fat pad and displacement of fascial planes caudally, caused by soft tissue with opacity (Figures 1A, B). The distribution of the soft tissue cranial to the joint space was not typical for a joint effusion, and raised the suspicion of a soft tissue mass.

Mild changes of osteoarthritis in the form of tiny osteophytes on the patella, proximal end of the trochlear groove, medial fabella, and medial and lateral tibial margins were present but the tibia and femur were aligned normally and there were no visible changes on the tibial plateau at the insertion site of the cranial cruciate ligament (CCL).

The absence of obvious bony changes on the tibial plateau and the pattern of intracapsular soft tissue opacity suggested that CCL disease was not a likely radiographic diagnosis in this case and other causes of severe joint effusion or soft tissue mass in the joint should be considered. Arthrocentesis of the joint was performed, but aspiration was difficult and no effusion could be drawn. Little material was obtained despite multiple attempts; this revealed a low cellularity which was therefore not helpful. Magnetic resonance imaging (MRI) of the stifle joint was carried out using a 1.5 Tesla magnet (GE Signa Echospeed; General Electric, Milwaukee, Wisconsin, USA) with the dog in right lateral recumbency on a spinal radiofrequency (RF) coil. This revealed an extensive, lobulated soft tissue mass in the soft tissues surrounding the distal femur and proximal tibia which extended over a total distance proximodistally of ~20 cm. The mass was predominantly cranial to the femur and probably located in fascial planes rather than invading muscles, but it also extended caudally at the level of the femoral condyles on both lateral and medial aspects. It extended distally between the patella and the femoral trochlear groove into the stifle joint, compressing the fat pad as seen on the radiographs. There was a small, focal area of invasion into the caudal margin of the medial femoral condyle and possibly into the medial margin of the lateral condyle via the intercondylar fossa. The mass extended only lateral to the tibia.

Aside from its lobular aspect, the mass appeared relatively homogeneous, hypointense to fat and hyperintense to muscle on T2W and proton density weighted (PDW) sequences, markedly hyperintense on Short TI Inversion Recovery (STIR), and isointense on T1W sequences. There was heterogeneous contrast enhancement with some poorly enhancing areas, and a marked joint effusion surrounded by inflamed synovium (Figure 2).

What steps would you take to determine a diagnosis?

Additional tests, treatment, and outcome

Biopsies were taken from the affected stifle, and the results were consistent with lipoma. However, the appearance of the lesion on MRI was consistent with a more aggressive process not consisting of adipose tissue. Biopsies of the joint were consequently repeated through a craniocaudal approach, allowing excision of the intra-articular part of the mass together with a portion of the capsule. Soft tissue in the cranial tibial area was also biopsied.

The histopathologic findings were consistent with a malignant spindle cell mesenchymal neoplastic proliferation, most likely compatible with a soft tissue sarcoma. Therefore, amputation of the limb was recommended.

Prior to surgery, the thorax and abdomen were staged using computed tomography, which revealed only mild right inguinal and medial iliac lymphadenopathy. Ultrasound-guided fine-needle aspirates (FNAs) of the enlarged lymph nodes were consistent with non-specific reactive lymphadenopathy with

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no signs of metastatic spread of the tumor. Right pelvic limb amputation with disarticulation of the coxofemoral joint was performed as a potentially curative treatment.

Discussion

Tumors arising around joints in dogs include fibrosarcoma, rhabdomyosarcoma, osteosarcoma, malignant fibrous histiocytoma (MFH), liposarcoma, hemangiosarcoma, myxoma, soft tissue malignant giant cell tumor, and undifferentiated sarcoma. Synovial cell sarcoma (SCS) remains the most common neoplasm affecting joints (1). It is a malignant tumor that arises from synoviocytes of the joint and the capsule of the tendon sheath. Histologically, these tumors are classified as biphasic when both spindle and epithelial cells are present or monophasic when there is a lack of epithelial cells (1). An SCS is graded from 1 to 3 depending on nuclear pleomorphism, mitotic figures, and necrosis (2).

Although SCS has been reported to be the most common joint tumor, a retrospective study including 35 dogs showed that 51.4% were histiocytic in origin (1).

Synovial cell sarcomas are rare in cats and dogs. In dogs, they tend to occur in large breeds, with a predisposition for flat-coated retrievers and golden retrievers (2). These sarcomas typically involve large joints of the extremities, especially the stifle, elbow, and shoulder (2). Clinical signs vary depending on the size and location of the tumor and include lameness, pain, swelling around the affected joint, and enlarged lymph nodes (3).

Although SCSs are locally invasive and aggressive tumors, they have a relatively low metastatic potential (32%) depending on the grade. Metastasis most often occurs in the lungs and occasionally in the regional lymph nodes (2).

A presumptive diagnosis of synovial cell sarcoma is often made based on the presence of compatible clinical signs. Definitive diagnosis is only achieved with biopsies and histologic analysis (4). The surgical biopsies taken from the infiltrated cranial tibial muscle were consistent with a malignant spindle cell mesenchymal neoplastic proliferation, most likely compatible with a soft tissue sarcoma. Immunohistochemistry is often recommended in such cases in order to differentiate SCS from other joint tumors; however, various authors do not always agree with this approach (2). In our case immunohistochemistry proved beneficial in this respect. The results showed the immunophenotype of the neoplastic population compatible with synovial cell sarcoma; this was based on the presence of neoplastic cells positive to vimentin and cytokeratin (CK).

Initial work-up involves imaging of the area to assess the extent of the tumor. Periosteal reactions, remodeling, and osteolysis of the bone can be seen on the radiographs (3,5). Advanced cross-sectional imaging allows more precise visualization of the local invasion.

Figure 1. Radiographic views of the right stifle of a 9-year-old neutered male golden retriever dog, with a history of acute onset of lameness. A – Mediolateral view with arrows pointing at the proximal and distal margins of an intra-articular area of increased opacity mimicking joint effusion. B – Craniocaudal view with arrows pointing at the most medial and lateral margins of increased opacity area. The medial area mimics medial buttress which is seen with chronic cranial cruciate ligament disease. C – Mediolateral view of the contralateral stifle with arrow pointing at the normal fat pad area.
Wide surgical excision, most often consisting in amputation of the whole limb, enables control of the tumor and the best long-term outcome (1,6). Chemotherapy protocols should be considered for the treatment of grade III canine SCS after amputation (6). The effectiveness of adjuvant chemotherapy is unknown in dogs (6), but one study reports some response with the use of doxorubicin HCl and cyclophosphamide (7). In humans, the use of ifosfamide-based chemotherapy was associated with an improved disease-specific survival (8).

Radiation therapy is another optional treatment for large soft tissue sarcomas that cannot be surgically excised or for preoperative treatment (9). However, in the case presented here, considering the invasion of the joint, bone, and musculature surrounding the lesion, amputation was considered the best treatment option. Adjuvant chemotherapy was offered, but was declined by the client.

The long-term prognosis for dogs with synovial cell sarcoma depends on many factors, including the histologic appearance, type of treatment, and evidence of metastatic disease. The median survival time for dogs affected with SCS treated with limb amputation is 850 d; only 455 d are reported with conservative excision (2).

References
Timeless Veterinary Systems® and ClienTrax® Expand Technology Partnership

Timeless Veterinary Systems Inc., a specialized veterinary technology company located in Prince Edward Island, and ClienTrax, a technology solutions company located in Columbus, Ohio have further expanded on their technology partnership and are pleased to announce another major integration. The Timeless Veterinary Cloud PACS is now integrated with the ClienTrax Practice Management Software providing an innovative way for clinics to quickly move images to the radiologist instead of the radiologist to the images. This provides optimum reliability and performance with event-driven workflows that help keep clinics on task, custom-triggering notifications for study interpretation, transcription, report downloads, etc., until the loop is closed. More than just a PACS, it is a comprehensive workflow solution that addresses the challenges of today's reading environments. Advanced DICOM interface tools and HL7 integration make the Timeless Veterinary Cloud PACS a must-have integration that operates seamlessly within the ClienTrax Practice Management System. The Timeless Veterinary Cloud PACS provides advanced imaging tools with an integrated downloadable desktop DICOM viewer and a Zero-Footprint HTML5 DICOM Web Viewer that delivers simple, secure access to imaging results.

The Timeless Veterinary Cloud PACS offers even more advanced features with instant access to the Timeless Veterinary Telemedicine global network of service providers directly from within the ClienTrax Practice Management System. This provides a seamless workflow for DVMs and Specialists to communicate and share patient information. Timeless President, John Rowe is very pleased to be launching this 2nd integration with ClienTrax and further expanding on their technology partnership, noting “with the integration of the Timeless Veterinary Cloud PACS, ClienTrax in partnership with Timeless can now offer clinics a new and innovative approach to telemedicine that is designed to simplify the entire referral process and improve the referral experience saving clinics time by streamlining their workflow”.

Jeff Good, Vice President of ClienTrax, commented that “ClienTrax is proud to launch a new Cloud PACS providing an integrated web-based solution for our clinics’ radiology imaging workflow all from within our practice management software. Our Clinics now can submit a case request without ever having to leave ClienTrax, and to add to the already seamless workflow, the final case report is even automatically sent directly to the patient's medical record in their ClienTrax Practice Management System, keeping all the patients’ information in the medical record and saving the clinic more time.”

The ClienTrax Practice Management software is now fully integrated with the Timeless Veterinary Cloud PACS, and access to the Timeless Veterinary Telemedicine global network of service providers adds to its already powerful list of features to provide clinics with a truly all-in-one Veterinary management solution.

Contact: Timeless Veterinary Systems Inc., 614 North River Road, Suite E, Charlottetown, PE C1A 1K2; phone: 1-855-247-2327; website: TimelessVeterinary.com

Lilly to Separate Elanco Animal Health with Initial Public Offering

Eli Lilly and Company announced that its subsidiary, Elanco Animal Health, has filed a registration statement with the U.S. Securities and Exchange Commission (SEC) for an initial public offering (IPO) of common stock.

The offering is expected to represent an ownership stake of less than 20 percent. The number of shares to be offered and the price range for the offering have not yet been determined. The company expects to complete the IPO process during the second half of 2018.

For Lilly's financial reporting, Lilly will continue to consolidate Elanco in its financial results. Lilly plans to divest its remaining ownership through a tax-efficient transaction. Execution of the IPO is dependent upon — and subject to — a number of factors and uncertainties, including business and market conditions.

“With more than six decades of expertise in animal health, we are prepared to take this step to become an independent company,” said Jeffrey Simmons, president of Elanco Animal Health. “With a sole focus on animal health, we will help our customers address the greatest challenges of keeping animals healthy, and together advance a vision of food and companionship enriching life.”

Contact: Elanco Animal Health, 150 Research Lane, Suite 120, Guelph, ON N1G 4T2; phone: 1-800-265-5475; website: www.elanco.ca
West Nile virus in horses — What do you need to know to diagnose the disease?

Julie Paré, Alison Moore

West Nile virus (WNV) is an emerging arthropod-borne pathogen that causes disease in horses and humans, as well as in a variety of other animals. The virus is maintained within the avian wildlife population that acts as a natural reservoir and amplifier for the virus, which is transmitted mostly by mosquitoes (*Culex* spp.) (1).

In humans, WNV infection is considered a serious zoonotic disease. The infection is asymptomatic in 80% of cases and appears as a flu-like syndrome in 20% of cases. Neurological disease develops in less than 1% of infections. In these, however, case fatality may be as high as 20%, and chronic disease develops in most survivors. In Canada, the number of human cases reported varied, from 21 to 190 in the past 5 years (1).

The first case of WNV in horses was diagnosed in Canada in 2002 (2). West Nile virus is an immediately notifiable disease under the Health of Animals regulations in Canada (3) and is also a notifiable disease in many provinces (British Columbia, Alberta, Saskatchewan, Manitoba, Ontario, and Quebec). From 2013 to 2017, the number of cases reported in horses in Canada via passive surveillance has been 57, 21, 19, 46, and 54 per year respectively, reflecting a continued presence of the virus, and need for horse owner awareness of the risks and preventative measures.

Infection in horses can be asymptomatic; however, approximately 20% of horses infected will develop clinical signs. These signs include ataxia (stumbling, staggering, wobbly gait, or incoordination) combined with circling, hind limb weakness, inability to stand, multiple limb paralysis, muscle fasciculation, proprioceptive deficits, blindness, lip droop/paralysis, teeth grinding, fever, or acute death. Horses that develop neurological disease may have up to 30% case-fatality, and another 10% to 20% recover with residual neurologic deficits. The clinical manifestation of WNV infection may resemble other reportable/notifiable diseases [rabies, eastern equine encephalitis (EEE)], which should be ruled out to confirm disease. Correct identification of WNV cases in horses is important since surveillance indicates the presence of a pathogen and its vector in a geographic area, and the risk of infection to other equines and humans. Cases of WNV infection in horses (and other domestic animals) are reported to the animal health and public health federal-provincial-territorial entities. West Nile virus is also a notifiable disease to the World Organisation for Animal Health (OIE).

A horse is classified as a positive case based on clinical signs AND laboratory testing

The horse must have a clinical presentation of ataxia and at least 2 of the following: circling, hind limb weakness, inability to stand, multiple limb paralysis, muscle fasciculation, proprioceptive deficits, blindness, lip droop/paralysis, teeth grinding, fever, and acute death (4).

Clinical history, location of the horse, as well as vaccination status on the submission form will help confirm the diagnosis and determine the area at risk.

Laboratory testing involves identification of the virus or of a specific immune response to WNV (4). The identification of WNV may involve isolation from tissue [preferred diagnostic tissues are brain or spinal cord; blood or cerebrospinal fluid (CSF)] or by a positive polymerase chain reaction (PCR) to WNV genomic sequences in tissues and appropriate histological changes or, a positive immuno-histochemistry (IHC) for WNV antigen in tissue and appropriate histological changes.

Serological diagnosis is useful for an animal with clinical signs. Detection of IgM antibody to WNV by enzyme-linked immunosorbent assay (ELISA) testing in serum or CSF in a horse that is not known to have been recently vaccinated confirms the diagnosis if associated with compatible clinical signs. Immunoglobulin M (IgM) antibody detection by ELISA is the test of choice since IgM antibodies are short-lived and indicative of a recent infection. There is no need for paired samples to confirm the diagnosis. In some horses, vaccination with specific vaccines has been reported to cause increases in IgM concentration for up to several weeks after vaccination; therefore, the date of the most recent WNV vaccination, if known, should accompany the test request (5,6). Otherwise, confirmation of a case requires an associated 4-fold or greater change in IgG ELISA test or serum neutralization (SN) test antibody titer to WNV in paired sera, in which the first serum
should be drawn as soon as possible after onset of clinical signs and the second drawn at least 7 d after the first. Unless paired serum samples are submitted, the elevated titer to WNV antibody by SN test in serum or positive IgG ELISA test on a single sample will only allow classification as a possible case (4).

Clinical history and appropriate test selection contribute to effective and efficient diagnosis of West Nile virus infection on an individual basis and with a One Health perspective.

References

Book Review

Diagnostic Techniques in Veterinary Dermatology


For those of us who may have, at one time or another, approached their dermatology patient with a little bit of apprehension, this book is a step in the right direction in alleviating those fears. The authors have compiled a step-by-step guide as to how to perform and interpret tests that are essential to every dermatology case workup, as well as detailing other diagnostics which may be required in more complex cases. I believe this book will benefit students, technicians, and practicing veterinarians.

The book is comprised of 15 chapters, the first of which introduces us to the equipment needed for performing a dermatological examination. Included in this chapter are pointers on the use of the microscope and maximizing success in cytology slide preparation and staining. The reader is then guided through a systematic dermatology workup whereby the first half of the book revolves around fundamentals such as looking for parasites, performing hair plucks, trichograms and cytology, while the second half introduces the reader to histopathology, allergy, endocrine, and infectious testing and advanced imaging. There is an abundance of high quality photos depicting various procedures, organisms, and dermatological lesions as well as charts, diagrams, and graphs that are scattered throughout the book. I anticipate the parasite identification guide on pages 39–40 will be visited frequently and I would encourage everyone to read the section on basic histopathological terminology as it is very helpful. The discussion surrounding the interpretation of bacterial culture and sensitivity results in chapter 6 is highly relevant and practical. The schematic representations of tests (e.g., PCR, ELISA, fluorescent antibodies) in the infectious disease chapter were also very useful. The chapter which I think will attract the most attention, however, is chapter 14, “Which Test to Choose When,” of which the figures regarding lesion distribution for pruritic skin conditions in dogs (there is also one for cats) is invaluable and highly needed. The references provided at the end of the book are very useful if more in-depth information is required.

Patients with skin and ear problems are a daily occurrence in practice. This book gives you the tools and confidence in working up these cases as well as knowing when to recommend referral.

Reviewed by Cheryl Vargo, DVM, MVetSc, Dip ACVIM, Western College of Veterinary Medicine, Saskatoon, Saskatchewan.
Commentary Commentaire

Access to veterinary care for low-income Canadians

Martha J. Harding

I read with great interest Dr. Carlton Gyles’ editorial in the April 2018 issue of the Canadian Veterinary Journal, titled “Challenges for the veterinary profession” (1). Dr. Gyles discusses 4 of 7 challenges that are common in both the US and Canada. These areas for concern were originally identified by Dr. Patty Khuly in Veterinary Practice News in her article, “The 7 top challenges facing veterinary medicine in 2017” (2).

I am especially interested in Dr. Khuly’s and Gyles’ comments regarding the challenges of providing veterinary care for low-income pet owners, the so-called “Money Gulf.”

Dr. Khuly writes:

“The yawning divide between rich and poor pet owners shows no signs of abating. Those with the finances and education will manage to redirect their disposable dollars toward their pets. Those with few to speak of will continue to show me their $40 and ask me how much that’ll buy. Heartbreaking. Moreover, as we build this castle ever higher, we’ll continue to face the harsh reality that this glorious standard of care we’re so proud of is leaving the majority of pet owners behind. And, as history shows, an uncomfortable uprising often accompanies economic disparities like this one. Could an antiveterinary backlash be too far behind? This is the biggest issue veterinary medicine faces as it enters 2017. What’s more, it’s not as if we can’t do something about it. Increased compassion toward price sensitivity at the micro level may not be profitable in the short term, but it’s worth millions in goodwill over the long haul.” (2).

As a Canadian veterinary profession, we should ensure that systems are in place to support access to veterinary care for all domesticated animals regardless of owners’ income and geographic circumstance. Dr. Froma Walsh, when Co-Director of the Center for Family Health, University of Chicago, detailed the literature supporting broad evidence that interactions with companion animals contribute to good health, psychosocial well-being, and recovery from serious conditions (3,4). As examples, children living with pets are more empathetic than those living without (5) and seniors with dementia become less anxious and confused when sitting with and stroking a pet (6). Pets have been found to influence the course and optimal functioning of persons with mental health disorders including schizophrenia, depression, anxiety, and attention deficit hyperactivity disorder (ADHD) (7,8). Mental health patients become more involved in their environment in nonthreatening ways with a companion animal (4). Therefore, aiming to support pets, both medically and behaviorally, provides great benefits for society, including citizens of all socioeconomic groups.

Across Canada, many veterinary practices and veterinarians offer reduced rate services and payment plans to impoverished Canadians in times of emergency, especially for their long-term clients. Furthermore, many non-profit animal rescue organizations, community foundations, and veterinary outreach efforts regularly fund veterinary care at hospitals of their choice for pets owned by low-income clients and by women seeking refuge from domestic abuse situations. In Ontario, the Ontario Veterinary Medical Association’s Farley Foundation (9) and Community Veterinary Outreach (10) are notable examples. However, all of the generous goodwill efforts nationally are unable to provide widespread, consistent, and comprehensive assistance to low-income pet owners because of the overwhelming need, notably for working age adults, persons with disabilities, children in single-parent families, seniors, and indigenous people (11).

An exceptional veterinary hospital structure model that aims to ensure access to veterinary care for pets of low-income citizens is the United Kingdom’s Registered Charity “Peoples Dispensary for Sick Animals (PDSA)” (12). Per their website: “Founded in 1917 by animal welfare pioneer, Maria Dickin CBE, PDSA is the UK’s leading veterinary charity. Operating through a UK-wide network of 48 Pet Hospitals and additional mobile services, PDSA provides low cost and free veterinary care to the sick and injured pets of people in need and promotes responsible pet ownership.” Animals are also cared for with the same accessible rates in one of nearly 400 collaborating clinics during weekends, holidays, and after-hour periods. The PSDA network is one of the largest corporate veterinary employers in the UK, with nearly 500 full- and part-time veterinarians. The organization offers free emergency veterinary service for 1 pet per household and low-cost preventative services for all additional pets for eligible pet owners on social assistance. Their outreach programs run active fundraising campaigns and volunteer programs, as well as provision of Pet Insurance and educational resources.

Our East Village Animal Hospitals (EVAH) (13) in London and Kitchener, Ontario, are “beta-testing” the PDSA type of charitable veterinary clinic model in Canada. Both hospitals...
are College of Veterinarians of Ontario “Companion Animal Hospital” facilities devoted exclusively to providing veterinary services of pets cared for by low-income citizens and animal rescue organizations. The hospitals house ASPCA/Humane Alliance-partnered High Volume Spay/Neuter clinics (14), with grant support from Pet Smart Charities of Canada (15) and funding from the Registered Charity Animal Outreach (16), as well as many other charitable organizations and individuals. EVAH-London opened in January 2014 and EVAH-Kitchener became operational in July 2017. Both hospitals also offer comprehensive general medical and surgical care. Since opening, we have worked to derive price-points for all products and services as low as possible to ensure sustainability in the long-term, assuming the hospital is situated amongst a human population of at least 1 million persons within a 100-km radius. EVAH employs approximately 15 full- and part-time staff in each clinic and as well are fortunate to welcome dozens of volunteers, including student veterinary externs, pre-veterinary/technician students, high school co-op seniors, and disadvantaged youth. To help ensure widespread access to veterinary care, notably in more remote regions, EVAH runs mobile clinics on First Nations communities throughout the province. In collaboration with the London-Middlesex Housing Corporation, our staff and volunteers provide veterinary visits in pet owners’ homes in local geared-to-income housing units. EVAH is officially partnered with a Registered Charity [Animal Outreach (16)], which is a mandate for an ASPCA/Humane Alliance Spay/Neuter clinic (14) and unofficially partnered with many animal rescue and community service organizations, including local women’s shelters. Through donations and volunteer efforts of our staff and partner non-profit organization, Progressive Animal Welfare Services (PAWS) (17), a “micro-loan” program is often available, which supports a loan of up to $200 to $300 per client, to cover the costs of emergency veterinary care performed at our EVAH clinics.

A network of charity clinics across Canada, similar to the PDSA or EVAH structure, would help provide comprehensive assistance for low-income pet owners on a national scale. Currently, Registered Charities are not allowed to own and operate veterinary clinics in most Canadian provinces. EVAHs are each their separate Professional Corporations; however, they are unofficially designated and operated as non-profit corporations (Matthew Veterinary Consulting Inc, personal communication, 2016). Concerted efforts to work alongside provincial colleges to update veterinary regulations and with provincial legislatures to expand business corporations acts, which would allow both professional AND non-profit corporations to own and operate veterinary practices accessible to the low-income community would be a giant leap forward. These latter endeavors would ensure the legacy of current non-profit veterinary hospital initiatives, and their associated funding support systems, while addressing “The Money Gulf” issue identified by Dr. Khuly (2).

We welcome the opportunity to continue to work with provincial colleges, veterinarians, veterinary technicians and other interested staff members, animal rescue organizations, volunteers and donors to assist in the creation of additional non-profit veterinary clinics, such as the EVAHs, and collaborating after-hour clinics across the country that would mirror the network of PDSA clinics in the UK. As such, the veterinary profession will become truly invested in the Canadian Veterinary Medical Association’s Canadian Veterinary Oath (18), which in part declares that “I will strive to promote animal health and welfare, prevent and relieve animal suffering, protect the health of the public and the environment…”, for all Canadians, regardless of the pet owner’s socio-economic status.

References
The Art of Private Veterinary Practice
L’art de la pratique vétérinaire privée

Communication: Too compliant client communication

Myrna Milani

Veterinary education often comes across as uncompromising. Problems receive specific names; their symptoms are described, diagnostic protocols defined, and treatments discussed. Students commit this to memory and subsequent quizzes and tests more deeply implant this information. Rarely during this process do the effects of different kinds of client compliance on this process receive much, if any, attention. When it does, lack of compliance, or rather the wrong kind invariably receives all the attention.

Consequently, when Dr. Snyder discovers during her clinical rotations throughout her veterinary education and even more so in private practice that noncompliance is not an alien client response, she begins to dream about how perfect the practice of veterinary medicine would be if only all clients were compliant. When she shared this observation with her employer, Dr. Sagendorf, he smiled and replied, “Be careful what you wish for.” At the time, she could not imagine anything that would make client compliance problematic.

Several months later, Dr. Snyder thought the veterinary compliance gods had answered her prayers when she met with Dr. Wertlieb — a faculty member at a nearby university — and his dog for the first time. The dog had attempted to enlarge a small opening in an old wire fence surrounding an abandoned chicken coop by digging through it. The client suspected that the presence of some wild animal inside the coop had triggered the frenzied digging that resulted in several lacerations to the dog’s front legs and puncture wounds in both front feet. Because of the nature of the injuries and the young dog’s high-spirited temperament, Dr. Snyder recommended that she anesthetize the dog so she could evaluate his injuries and treat them properly. The client readily agreed and told the veterinarian to do whatever was necessary.

After clipping and thoroughly cleaning the injured areas, the veterinarian ascertained that the lacerations were superficial and that no deeper structures were involved. She then sutured those that required it and medicated and bandaged the affected area to keep it clean and control the waning bleeding from the puncture wounds. When Dr. Snyder discharged the dog later that day, she gave the client verbal and written instructions to medicate the dog as directed, keep the bandages clean and dry, and monitor the dog’s activities. The client sincerely thanked the practitioner for giving his dog such good care and promised to follow her instructions to the letter.

When Dr. Wertlieb returned with his dog for suture removal, Dr. Snyder could not believe what she saw. The bandages were clean and dry, but only what little remained of them. Mistaking her look of befuddlement as a request for more information, the client then referred to his copious notes describing all the dog activities since the client picked him up at the clinic. He told Dr. Snyder exactly when and where the dog chewed at the bandages and how he — the client — carefully trimmed any damp edges to ensure the remnants would remain clean and dry as directed. The client also observed carefully as his dog played with his toys in the yard as usual and rough-housed with the neighbor’s dog, also as usual. This resulted in a small amount of blood oozing from one of the puncture wounds on the left foot, but it soon stopped. The dog displayed no signs of discomfort during the recovery period. Nor was there any evidence of bleeding in the house that the client could see.

“His idea of ‘monitoring’ went on and on,” Dr. Snyder later explained to Dr. Sagendorf. “It was maddening because, in a way, he did do everything I told him to do. Literally. But he missed the whole point of it. I just don’t get it. He’s an educated man and this wasn’t rocket science!”

“That was the problem,” replied Dr. Sagendorf with a smile. When his associate gave him a puzzled look, he elaborated. “Dr. Wertlieb is a rocket scientist. He’s a highly regarded aeronautical and space researcher. I’m sure he did his best, but he knows as little about veterinary medicine as you and I combined probably know about rocket science. Consequently, he had no choice but to take everything literally.”

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

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“If he didn’t know, why didn’t he just tell me?” asked his still frustrated associate. “I would have been happy to clarify anything he didn’t understand.”

“But he thought he did understand,” replied her employer. “He interpreted the instructions you gave him the same way he would those related to comparable situations in his area of expertise. Because you didn’t give him specific instructions regarding how to keep the bandages clean and dry or how to replace them if they became wet or dirty, he simply removed any wet and dirty parts. When you told him to monitor the dog, he did the same kind of monitoring he does when he runs an experiment: he observed and made notes.”

Dr. Snyder’s initial thought was to tell Dr. Sagendorf that, if Dr. Wertlieb truly cared about his dog, he would not have behaved in such a ridiculous way. Fortunately, she suppressed the retort when she sensed what her more experienced employer would say.

“I shouldn’t have assumed that, just because Dr. Wertlieb was a professor, he had a lot of knowledge about animal care or even what I consider plain old common sense about dogs,” she admitted instead. “I’ll never make that mistake again.”

Feeling confident that his associate was sincere, Dr. Sagendorf then used the incident as a catalyst for a discussion of other kinds of compliant client communication dilemmas. Like most veterinary practices, theirs also serves several clients with autism spectrum disorder whose limitations are not discernable. However, when confronted by situations outside their experience, these people also may interpret any information — including any veterinary instructions — quite literally. In this regard, though, these clients are no different from Dr. Wertlieb. And, in fact, they are no different from anyone hearing or reading instructions that are outside their areas of expertise.

Other times clients, who do not fully understand any veterinary instructions, may feign compliance because they hesitate to ask the practitioner for clarification for some reason. For example, when Dr. Snyder rushes into the examination room, she immediately apologizes profusely to Ms. Patel for keeping the client waiting. The veterinarian then explains that an emergency case plus on-going viral outbreak at a local shelter has wreaked havoc with her schedule. This causes the ever-gracious and compliant Ms. Patel to decide not to further complicate the busy veterinarian’s life by asking Dr. Snyder to repeat the instructions regarding the proper treatment of her animal. The client tells herself she got the gist of it in spite of Dr. Snyder’s speedy delivery and her own age-related hearing loss. Similarly, when doubts arise about her animal’s condition several days later, Ms. Patel recalls how exhausted and frazzled “that poor Dr. Snyder” looked and decides not to bother the veterinarian.

In this situation, perceiving client compliance where it does not exist may be another side effect of clinician work-related or other sources of exhaustion or stress. When frazzled Dr. Snyder discusses the animal’s problem and how to address it, the veterinarian could miss the fleeting expressions of confusion on her client’s face as she breezes through her instructions. This doesn’t occur because she does not care about Ms. Patel or her animal; the veterinarian does care. But her compromised mental state blinds her to the existence of these subtler forms of client communication. Similarly, Dr. Snyder may miss telltale signs that indicate clients with invisible disabilities such as mild hearing loss or vision impairment, may struggle to comprehend her soft-spoken instructions or read the small print on her written ones.

Comparing faux-compliant client responses to those of clients she expects to understand her instructions because of their education or expertise in other areas, she may not see any signs of confusion in either group because she does not expect them. Same result — diminished animal care — but quite different causes.

“But with all these possibilities, how can I prevent making these mistakes again without hurting their feelings or violating their rights?” asks Dr. Snyder who now is feeling somewhat beleaguered.

Asking, “Do you have any questions about these instructions?” as part of her routine examination or discharge summary for all clients eliminates the possibility of making these mistakes. Reiterating key elements of the treatment process for all clients also facilitates client communication. For example, Dr. Snyder could tell Dr. Wertlieb that, if his dog’s bandage gets wet or soiled, he can change it himself or bring the dog to the clinic for this service. When she feels frazzled and rushed, she could remind her clients that they can contact her or the practice for any questions arise later.

Client compliance may take different forms and, relative to ensuring animal health, some succeed better than others. But by acknowledging this possibility and incorporating preventive communication into their routine, practitioners can avoid the negative fallout that otherwise may occur.
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