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Gastric neuroendocrine carcinoma (carcinoid) in a ferret (*Mustela putorius furo*)

Protothecosis and *Toxoplasma gondii* co-infection in a dog from Nova Scotia, Canada

Reverse sneezing as a clinical manifestation of nasopharyngeal- oropharyngeal fistula in a dog

Inadvertent placement of an esophagostomy tube into the mediastinum of a cat

Breed predilections and prognosis for subungual squamous cell carcinoma in dogs

Comparison of bidirectional barbed *versus* conventional monofilament suture material for closure of feline perineal urethrostomies

Superficial digital flexor tendon luxation repaired with abrasion calcaneoplasty and primary retinaculum repair in dogs

Veterinary student urethral catheterization of small female cats and dogs using 2 urethral catheterization techniques

Massive hepatoma treated with curative-intent liver lobectomy in a standard poodle dog



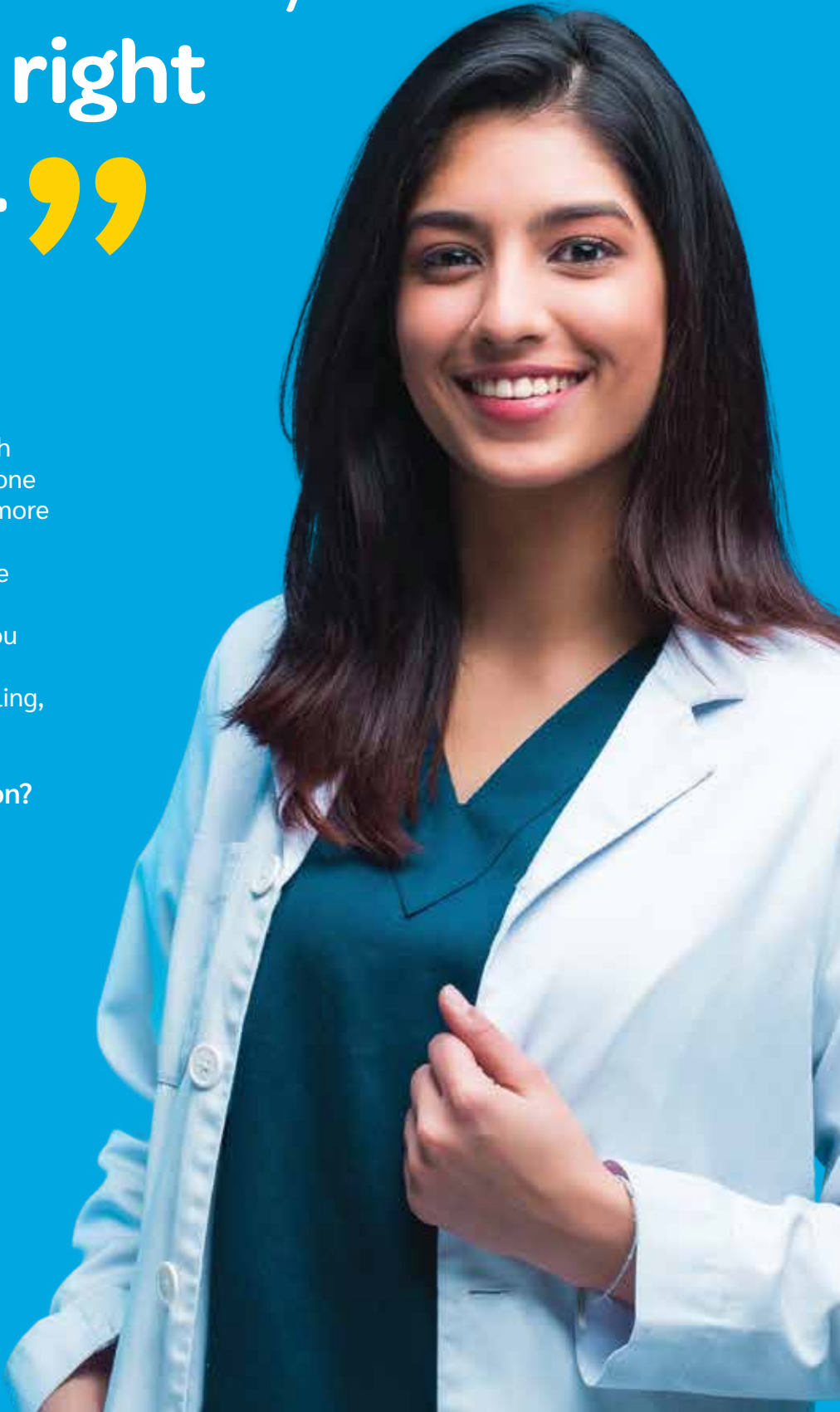
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World Antimicrobial Awareness week is an annual reminder of the increasing impact that antimicrobial resistance has on human health, animal health and the agricultural sector.

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The Canadian veterinary community is committed to doing its part in addressing this critical issue in collaboration with our partners in government, industry and academia.

Learn about how the Stewardship of Antimicrobials by Veterinarians Initiative (SAVI) is engaging veterinarians from coast to coast on ways to use antimicrobials more prudently and judiciously, and look for upcoming events in the CVMA calendar.



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Letters to the Editor *Courrier des lecteurs*

Welfare concerns on production of pregnant mare serum gonadotropin – A comment

Dear Editor,

I read with great concern the ethical question of the month for May 2022 published in the August issue of *The CVJ* (Can Vet J 2022;63:787) regarding the serious welfare concerns around production of Pregnant Mare Serum Gonadotropin (PMSG).

Although I have spent most of my 30+ years as a veterinarian in small animal practice, I remember with great fondness my experience as a student at a pregnant mares' urine (PMU) farm. Those horses were well cared for, at least by the standards of the day. I am glad to learn that there is now a Code of Practice for their care, and that by all accounts the industry in Canada is well-regulated.

So, it was all the more shocking to learn about the egregious welfare violations in the PMSG industry, both in South America and Iceland. How can we, as veterinarians, continue to support this? Surely we have a duty to our patients and our clients to ensure that the medications we prescribe and recommend have been sourced ethically, as much as we are able?

On October 20, 2021, the European Parliament adopted a Resolution on a "farm to fork strategy for a fair, healthy and environmentally friendly food system," (1) which included a call for a ban on PMSG import and production, citing health and welfare concerns.

In March 2022, a complaint was lodged against Iceland to the European Free Trade Association Surveillance Authority

by 17 NGOs (2) regarding the legality of producing PMSG in that country. There is even opposition to the practice in Iceland itself, with the People's party proposing a bill to ban the so called "blood farms." Clearly, there is widespread and growing concern, at least in Europe, about the production of PMSG.

When I was a student, I was taught to withhold pain medication for dogs with pelvic fractures. It now seems shocking, given that we know so much more about pain control and the harm that comes from not providing it, but we didn't know any better at that time. I am sure that most veterinarians, including those who prescribe PMSG, had no idea about the horrors of "blood farms." So, my question for my colleagues is that now that we know, what are we going to do about it?

Submitted by Cecily Grant, B.Sc., DVM

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1. European Parliament. A Farm to Fork Strategy for a fair, healthy and environmentally friendly food system. 2021. Available from: https://www.europarl.europa.eu/doceo/document/TA-9-2021-0425_EN.html Last accessed September 8, 2022.
2. Complaint Form Part 2/2: To the European Free Trade Association Surveillance Authority concerning failure to comply with European Economic Area Law. 2022. Available from: https://www.eurogroupforanimals.org/files/eurogroupforanimals/2022-03/2022_03_28_efta_complaint.pdf Last accessed September 8, 2022.

Ecosystem health and one health at the University of Guelph – A comment

Dear Editor,

Your readers may be interested in a further bit of history on the important contributions the University of Guelph has made to the development of the ecosystem (environmental) dimensions of one health as described by Peter Kelly in *The CVJ* (1).

In 1994 David Rapport, an ecological economist, was appointed to Tri-council Eco-research Chair in 1994 at the University of Guelph, funded by the federal government's "Green Plan" that I had worked to establish. He began initiatives to create an international society devoted to promoting ecosystem health. As Dean of OVC, I actively supported this initiative and when he proposed having the university sponsor an international symposium to further this end, I persuaded Jack MacDonald the acting president to commit the university to host such an event. The university's extension department, led by Virginia Gray, was assigned the huge task of managing

the logistics of organizing such a symposium as well and helping raise the necessary funds.

It was held in June in 1994 in Ottawa, a site chosen to attract visibility and possibly influence public policy in Canada. Rapport assembled a stellar program committee of scientists interested in the subject. They put together a superb program that included many eminent ecologists, economists, and other environmental scientists and health professionals. About 800 persons attended the event and its success created the impetus for rapport to launch the International Society of Ecosystem Health (ISEH) and the journal, *Ecosystem Health*. The university's gamble in bankrolling the symposium was remarkably bold given its subject was in the early stages of development. At the time preregistration closed there had been only about 130 registrants, which created a lot of anxiety for we proponents and organizers since financial commitments totaling over \$500 000 had been made.

Constructive and professional comments made in the spirit of intellectual debate are welcomed by the Editors. Writers are expected to be respectful of others and to ensure that letters are considerate and courteous. The Editors reserve the right to remove comments deemed to be inflammatory or disrespectful.

Fortunately, the excellence of the program wound up drawing a sufficient number to break even.

The ISEH did not flourish as I had hoped, but the ideas it embodied surely have. As a professor emeritus in the Department of Pathobiology, I helped the ISEH organize symposia in Copenhagen (1996) and Sacramento (1999) before terminating my association with the Society. In 2002 the Society became a registered charity in Canada attached to the University of Western Ontario and its journal *Ecosystem Health* was refor-

matted with the name *Ecohealth* under new leadership and is now a very influential publication sponsored by the *Ecohealth Alliance*.

Submitted by Ole Nielsen

Reference

1. Kelly P. One Health programs at Canadian universities with a veterinary college — The University of Guelph. *Can Vet J* 2022;63:863–865.





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Be there!

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Some of the most important aspects of being a veterinarian have nothing to do with medicine. Animal health and well-being is the focus of our jobs as veterinarians whether in clinical practice, industry, regulatory or academic medicine, but there are other intangible important attributes to the profession. To have a successful, fulfilling career, learn to incorporate mentorship into your daily routines.

Mentorship suggests an image of student and teacher. A mentee is often considered a young, inexperienced person, and the mentor, the wise elder. However, that is not always the case, and we must challenge ourselves to look at mentorship not as a hierarchical structure, but as a collaborative experience between 2 or more individuals with common goals. A mentor can be a confidant that you choose to share your experiences with, or someone from whom to learn new knowledge, or a person who acts as a sounding board for your ideas. Sometimes these mentors are veterinary colleagues but not always.

Some of the issues our profession struggles with surrounding mental health and wellness can be addressed by having mentors in our lives. It doesn't need to be a formal process or relationship — although those can work well, too. Some of us are introverted, perfectionists, and suffer from imposter syndrome. Although it's hard to break down those barriers, look around in your life for people you can talk to and engage in conversation. We all probably have that one friend from vet school, veterinary professor, or colleague whom we can run a case by but also look for friends, allies, and family with whom you can talk to about other aspects of life. Mentorship doesn't have to be all about medicine, and you can be both the mentee and mentor at the same time, depending on the situation.

If you need to formally find mentorship or support, there are many programs available. The CVMA offers support through the **Togetherall** program, colleges have mentorship and support programs, veterinary medical associations and professional colleague associations such as the American Association of Equine Practitioners, and the American Animal Hospital Association have programs as well. There are dozens of veterinary related social media-based mentoring groups. Try signing up for a

Certains des aspects les plus importants de la profession vétérinaire n'ont rien à voir avec la médecine. La santé et le bien-être des animaux sont au cœur de notre travail de vétérinaire, que ce soit en pratique clinique, dans l'industrie, en médecine réglementaire ou en milieu universitaire, mais il existe d'autres attributs intangibles importants de la profession. Pour une carrière réussie et épanouissante, envisagez d'intégrer le mentorat à vos routines quotidiennes.

Le modèle classique du mentorat est celui d'un élève et d'un enseignant. Un mentoré est souvent considéré comme une personne jeune et inexpérimentée, tandis que le mentor est un sage plus âgé. Or ce n'est pas toujours le cas, et nous devons nous mettre au défi de considérer le mentorat non pas comme une structure hiérarchique, mais comme une expérience de collaboration entre des personnes qui ont des objectifs communs. Un mentor peut être un confident avec qui vous choisissez de partager vos expériences, quelqu'un avec qui vous pouvez acquérir de nouvelles connaissances, ou une personne que vous consultez pour avoir son avis sur vos idées. Ces mentors sont parfois des collègues vétérinaires, mais pas toujours.

Certains des problèmes auxquels notre profession est confrontée en matière de mieux-être et de santé mentale peuvent être résolus en ayant des mentors dans nos vies. Il ne s'agit pas nécessairement d'établir une relation formelle ou de suivre un processus officiel – bien que cela puisse bien fonctionner aussi. Certains d'entre nous sont introvertis, perfectionnistes, et souffrent du syndrome de l'imposteur. Même s'il est difficile de surmonter ces barrières, regardez autour de vous et trouvez des gens avec qui vous pouvez parler et amorcer une conversation. Nous avons probablement tous des camarades de classe, des anciens professeurs ou des collègues que nous pouvons consulter pour un cas, mais on peut aussi se constituer un réseau d'amis, d'alliés et de membres de la famille avec qui on peut discuter d'autres facettes de notre vie. Le mentorat n'a pas à se limiter à la médecine, et vous pouvez être à la fois mentoré et mentor selon la situation.

Si vous souhaitez trouver du mentorat ou du soutien, de nombreux programmes sont disponibles. L'ACMV offre du soutien

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vet-2-vet type group on Facebook and follow the threads of other vets who are posting about cases, concerns, issues in practice and/or issues in life. You will find their concerns are similar to your own; this can be an effective way to feel connected with your colleagues and the profession.

If you have the opportunity to provide mentorship to a colleague, student, friend, or another person with aspirations to improve their life through their connection with you, it can be extremely rewarding. Some of the fondest parts of my career have been working with pre-vet students, vet students, aspiring veterinary specialists, and veterinary colleagues in a collaborative learning and sharing experience. Seize those opportunities. They exist in all facets of veterinary medicine and life! Mentorship doesn't have to fit into a specific box of ideas, lists or techniques.

I would like to share some of the important mentors in my life. **Mr. Dave Crooks** was my high school science teacher. His class expanded my interest in science and medicine leading me to follow my path to veterinary medicine. **Mr. Jay Stark**, a trusted advisor in business and life. **Dr. Greg Andrews** and **Dr. Mike Scott** were my first mentors that exposed me to the world of equine surgery and veterinary business during my high school years. They helped me develop a love for surgery. **Dr. Chris Mody**, a thoracic medicine physician and researcher at the University of Calgary, mentored me as a MSc student

prior to my acceptance to vet school and his lab instilled a keen interest in research and the scientific method. **Dr. Dan French** and **Dr. Shawn Mattson**, both mentored me while working at summer positions during veterinary school. **Dr. Scott Taylor** and **Dr. Rick Howard** at Arizona Equine Medical and Surgical Centre helped develop my clinical judgement through my internship year. The first year out of veterinary school is very formative and important for young veterinarians. **Dr. Peter Fretz** guided many important aspects of my surgical training and provided an example of how to conduct oneself as an equine surgeon. **Drs. Dane Tatarniuk, Joe Bracamonte, and Sarah Graham** are amazing surgeons who act as important sounding boards for me.

There are so many people that help us achieve our goals. I encourage you to not only become a mentor or influencer to someone but, to recognize the people who guided you on your path. I challenge my colleagues to start a recognition of the mentors and influencers in your life. Use the social media **#CVMAmentorofinfluence** and tag CVMA so all can see and recognize the contributions that so many important people have had in our lives and, therefore, the lives of the animals we are able to care for and treat.

Be present for each other. ■

Chris Bell

par l'entremise de la plateforme **Togetherall**, les écoles vétérinaires ont des programmes de mentorat et de soutien, les associations de médecins vétérinaires et les associations professionnelles comme l'American Association of Equine Practitioners et l'American Animal Hospital Association proposent également divers programmes. Il existe des dizaines de groupes de mentorat en lien avec la médecine vétérinaire accessibles par les médias sociaux. Joignez-vous à un groupe vétérinaire sur Facebook et suivez les fils de discussion d'autres médecins vétérinaires qui publient des messages sur leurs cas, leurs préoccupations, ou des problèmes dans leur pratique ou leur vie. Vous constaterez que leurs préoccupations sont similaires aux vôtres, et cela peut être un moyen efficace de sentir une connexion avec vos collègues et la profession.

Si vous avez l'occasion d'offrir du mentorat à un collègue, à un étudiant, à un ami ou à une autre personne qui aspire à améliorer sa vie grâce à son lien avec vous, cela peut être extrêmement gratifiant. Un des aspects les plus valorisants de ma carrière est la possibilité de travailler avec des étudiants, des résidents et des pairs dans le cadre d'une expérience collaborative d'apprentissage et de partage. Saisissez ces opportunités. Elles existent dans toutes les facettes de la médecine vétérinaire et de la vie! Le mentorat n'a pas à prendre une forme prédéterminée ni à se conformer à des idées, à des listes ou à des techniques particulières.

J'aimerais souligner l'apport important de quelques-uns des mentors que j'ai eus dans ma vie. **M. Dave Crooks** a été mon professeur de sciences au secondaire. Son cours a éveillé mon intérêt pour la science et la médecine, ce qui m'a mené sur la voie de la médecine vétérinaire. **M. Jay Stark** a été pour moi un conseiller de confiance pour les affaires et la vie en général. **Le D^r Greg Andrews** et **le D^r Mike Scott** ont été mes premiers mentors qui m'ont exposé au monde de la chirurgie équine et des affaires vétérinaires pendant mes années d'études secondaires.

C'est grâce à eux que j'ai développé un amour pour la chirurgie. **Le D^r Chris Mody**, pneumologue et chercheur à l'Université de Calgary, a été mon mentor durant ma maîtrise avant mon admission à l'école vétérinaire, et j'ai découvert dans son laboratoire mon grand intérêt pour la recherche et la méthode scientifique. **Le D^r Dan French** et **le D^r Shawn Mattson** ont été des mentors alors que j'occupais des emplois d'été pendant mes études en médecine vétérinaire. **Le D^r Scott Taylor** et **le D^r Rick Howard** de l'Arizona Equine Medical and Surgical Centre m'ont aidé à aiguïser mon jugement clinique tout au long de mon année d'internat. La première année après l'obtention du diplôme de médecine vétérinaire est très formatrice et cruciale pour les jeunes vétérinaires. **Le D^r Peter Fretz** a guidé de nombreux aspects importants de ma formation chirurgicale et a été un excellent exemple de la façon de se conduire en tant que chirurgien équin. **Le D^r Dane Tatarniuk**, **le D^r Joe Bracamonte** et **la D^{re} Sarah Graham** sont d'extraordinaires spécialistes en chirurgie et de précieux collègues pour moi.

Il y a tellement de gens qui nous aident à atteindre nos objectifs. Je vous encourage non seulement à devenir un mentor ou une source d'inspiration pour quelqu'un, mais aussi à remercier les personnes qui ont influencé votre parcours ou été des guides sur votre chemin. Je vous mets au défi de rendre hommage aux mentors de votre vie. Sur les médias sociaux, utilisez le mot-clic **#mentorACMV** et mentionnez l'ACMV pour que nous puissions tous célébrer les contributions de ces personnes importantes qui ont eu un impact dans nos vies et, par ricochet, dans celle des animaux que nous sommes en mesure de soigner et de traiter.

Soyez là les uns pour les autres. ■

Chris Bell

Veterinary Medical Ethics

Déontologie vétérinaire

Ethical question of the month – August 2022

Your client purchases a young large-breed stallion that must be castrated on short notice. You are unable to do the surgery, so ask the client to find another veterinarian that can accommodate their needs. The surgery is performed on-farm with injectable general anesthesia. Within an hour, the client calls in a panic. The horse is down, groaning, and flank watching. You advise that the client call the veterinarian who performed the surgery. She refuses, saying that she asked 3 times about pain control and was told that “it is better to have them sober so we can see how they are doing.” You advise giving an NSAID and an hour later the horse is up and grazing.

You contact the veterinarian to tactfully discuss interoperative, regional, and post-surgical pain control. The response is along the lines of “I’ve been doing it this way for decades...” You hope that there will be an exploration of some of the suggested options.

Recently you are contacted by a client that had the same veterinarian repair an eyelid laceration with an accompanying corneal ulcer. She is satisfied with the repair but asks you about pain control, as none was administered or dispensed beyond the local aesthetic. **What do you do?**

Question de déontologie du mois – Août 2022

Une de vos clientes a acheté un jeune étalon qu’elle veut faire castrer rapidement. Comme vous n’êtes pas en mesure de faire la chirurgie, vous dites à la cliente de trouver un autre médecin vétérinaire qui peut répondre à ses besoins. La chirurgie est réalisée à l’écurie alors que le cheval est sous anesthésie générale injectable. Dans l’heure qui suit, la cliente vous appelle en panique. Le cheval est couché, il gémit, et il se regarde le flanc. Vous lui suggérez de communiquer avec le vétérinaire qui a fait la castration. Elle refuse en expliquant qu’elle a demandé trois fois à ce vétérinaire s’il allait administrer un analgésique à son cheval et qu’il lui a répondu qu’il était préférable de ne rien donner pour que l’état du cheval puisse être évalué correctement. Vous lui conseillez d’administrer un AINS et, une heure plus tard, le cheval est debout et il broute.

Vous contactez le vétérinaire qui a fait la chirurgie pour discuter avec tact de l’analgésie régionale, périopératoire et postopératoire. Il se justifie en répondant qu’il procède ainsi depuis des décennies. Vous espérez tout de même qu’il explorera certaines des options dont vous avez parlé.

Plus tard, une autre cliente vous appelle; son cheval, qui avait une laceration de la paupière et un ulcère cornéen, a été vu par ce même vétérinaire. Elle est satisfaite de la réparation de la laceration mais elle vous questionne sur le soulagement de la douleur, car aucun analgésique n’a été administré ni prescrit à son cheval à part l’anesthésique local lors de l’intervention.

Que faites-vous?

Ethicists’ commentary on post-surgical pain control

There is now widespread agreement in the veterinary community that post-surgical pain control for animals is important, for at least 3 reasons: i) it prevents animal suffering, which is part of the core commitment of a veterinarian; ii) it helps to produce better outcomes from the surgery for the animal concerned; and iii) it is better for the relationship between the client and the animal.

Consistent with this view, the guidelines for Pain Management in Animals from the Canadian Veterinary Medical Association (CVMA), (February 2022) make the need for pain management explicit and note that “veterinarians must stay current in the recognition and management of pain in the species they treat.”

This case features an ‘old school’ veterinarian who does not appear to see the need for management of post-surgical pain.

Indeed, the veterinarian was unresponsive when the issue of pain control was previously raised, which suggests that aiming to argue the veterinarian into changing his or her behavior is unlikely to succeed.

The specific questions at hand, then, are: i) how to respond to questions from a client who has asked about this veterinarian’s approach to pain control, and more generally; ii) how to address the veterinarian’s behavior.

In responding to the client, it is reasonable to explain what would normally be considered best practice in terms of post-surgical pain control for the specific case of repairing an eyelid laceration. It would also be reasonable to encourage the client to discuss post-operative care with their veterinarian in any future case, pointing out that they can choose another veterinarian if they are uncomfortable with treatment plans offered to their

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animal. As a matter of professionalism, directly criticizing the colleague's treatment plan should be avoided, especially without knowledge of the details of injury, treatment, or other factors relating to the case history that may have affected the treatment plan.

In response to the second question, a first step would be to once again speak directly to the colleague. The veterinarian should be reminded that the CVMA has guidelines on post-operative pain control, and that in this case at least it seems that he or she is not following recommended practice. He or she should also be told that this is the second report received from a client about a lack of appropriate post-operative pain control, and that if another report is received, these cases will be reported to the provincial regulatory body.

In addition to confronting the veterinarian in question, the case also speaks to the larger issue of how best to maintain a strong shared culture around pain control in the veterinary profession. To help address this goal, we suggest that this case, suitably anonymized, be brought for discussion at professional meetings in Canada and internationally; this will allow consideration of both the technical aspects of how best to treat specific cases, and the ethical issues around how best to develop and enforce professional standards around pain management.

Drs. Clare Palmer, Peter Sandoe, and Dan Weary

Ethical question of the month – November 2022

Veterinary pathologists encounter numerous cases on a regular basis in which a diagnosis cannot be determined. In one such case, a healthy, indoor-only, 12-year-old, neutered male, Maine coon-mix cat is suddenly found deceased. The owner cannot think of any toxin exposure and routinely brought her cat for annual veterinary visits. The cat has no prior history of disease, is up to date on vaccinations, and eats exclusively veterinary prescription diet. The body is submitted for necropsy and the cat is in good body condition; there are no significant findings on external nor internal examination, including evaluation of the cardiovascular system. Pathologist A believes that the owner's grieving should be remedied and reports that the cat died of hypertrophic cardiomyopathy. This disease is not uncommon in middle-aged cats and may present with sudden death. She goes on to tell the owner that nothing could have been done to detect it sooner and the owner is somewhat relieved and none the wiser. **Was the pathologist's decision to address the owner's grief over providing an accurate diagnosis ethical?**

Question de déontologie du mois – Novembre 2022

Les pathologistes vétérinaires voient régulièrement des cas pour lesquels aucun diagnostic ne peut être établi. Dans un de ces cas, un maine coon croisé castré de 12 ans, apparemment en bonne santé, a été retrouvé mort. La propriétaire ne pense pas qu'il pourrait avoir été exposé à des produits toxiques. Elle emmenait son chat tous les ans chez le médecin vétérinaire pour son examen annuel, et le chat n'avait aucun antécédent de maladie, sa vaccination était à jour, et il mangeait exclusivement une diète vétérinaire sur ordonnance. Le corps est soumis pour une nécropsie. Le chat a un bon état de chair, et l'examen externe et interne, y compris l'évaluation du système cardiovasculaire, ne révèle rien de particulier. La pathologiste estime qu'il faut tenter d'apaiser la peine de la propriétaire et statue que le chat est mort d'une cardiomyopathie hypertrophique. Cette maladie n'est pas rare chez les chats d'âge moyen et peut se manifester par une mort subite. La pathologiste dit également à la propriétaire que rien n'aurait pu être fait pour détecter le problème plus tôt, et la propriétaire, qui ignore la vérité, s'en trouve quelque peu réconfortée. **La décision de la pathologiste de consoler la propriétaire au lieu de donner les véritables résultats de son examen est-elle éthique?**

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. Bettina Bobsien, 4353 Yellowpoint Road, Ladysmith, British Columbia V9G 1G5; email: bettinadv@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 avec vos nom et adresse à l'adresse suivante : **Choix déontologiques, a/s de la Dr^e Bettina Bobsien, 4353 rue Yellowpoint, Ladysmith (Colombie-Britannique) V9G 1G5; courriel : bettinadv@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.

Quiz Corner

Test éclair

1. A ten-year-old neutered male Cavalier King Charles spaniel is presented for a recent cough, lethargy, and decreased exercise tolerance. A grade 3/6 heart murmur was noted on routine evaluation 6 months ago.

On examination, the dog is stable and cardiac auscultation reveals a grade 4/6 left-sided heart murmur at the heart base. Mucous membranes are pink with a prolonged capillary refill time. Pulse quality is fair. Thoracic auscultation reveals diffuse crackles, particularly in the caudodorsal lung fields.

What is the most appropriate long-term treatment plan based on the top differential?

- A. Diltiazem, atenolol
- B. Supplemental oxygen to stabilize then spironolactone
- C. Furosemide, pimobendan
- D. Digoxin, enalapril
- E. Inhaled fluticasone, albuterol

1. Un épagneul Cavalier King Charles castré de dix ans est présenté pour une toux récente, de la léthargie et une tolérance réduite à l'exercice. Un souffle cardiaque de grade 3/6 a été noté lors d'une évaluation de routine il y a 6 mois.

À l'examen, le chien est stable et l'auscultation cardiaque révèle un souffle cardiaque de grade 4/6 à gauche à la base du cœur. Les muqueuses sont roses et le temps de remplissage capillaire est prolongé. La qualité du pouls est moyenne. L'auscultation thoracique révèle des crépitements diffus, en particulier dans les champs pulmonaires caudodorsaux.

Quel est le plan de traitement à long terme le plus approprié d'après le diagnostic différentiel le plus probable?

- A. Diltiazem, aténolol
- B. Oxygène pour stabiliser le patient, puis spironolactone
- C. Furosémide, pimobendane
- D. Digoxine, énalapril
- E. Fluticasone par inhalation, albutérol

	Patient's value/ Résultat de l'animal	Reference range/ Valeurs de référence
Temperature/Température	100.1°F (37.8°C)	99.5–102.5°F (37.2–39.2°C)
Heart rate/Fréquence cardiaque	160 bpm	60–120 bpm
Respiratory rate/Fréquence respiratoire	38 brpm/rpm	15–34 brpm/rpm

2. A 12-year-old spayed female domestic shorthair cat is presented for severe lethargy and weakness. The owner reports that the cat has been vomiting and anorexic for 3 days with increased drinking and urination for 2 months.

On physical examination, the cat is dull, with a body condition score of 2/9 and marked dehydration. Thoracic auscultation is unremarkable, but pulse quality is poor. Abdominal palpation reveals a large, soft urinary bladder and bilaterally decreased renal size.

2. Une chatte domestique à poil court stérilisée de 12 ans est présentée pour une léthargie et une faiblesse sévères. La propriétaire rapporte que la chatte vomit et ne mange pas depuis 3 jours, et qu'elle boit plus et urine plus depuis 2 mois.

À l'examen, la chatte est abattue et elle présente un indice de condition corporelle de 2/9 et une déshydratation marquée. L'auscultation thoracique ne révèle rien de particulier, mais la qualité du pouls est mauvaise. La palpation abdominale révèle une vessie volumineuse souple et la taille des deux reins semble réduite.



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What is the most appropriate next step based on the top differential for this patient?

- Transition to a low-carbohydrate high-protein diet and prescribe lente insulin.
- Pass a urinary catheter and start rehydration therapy.
- Administer SQ fluids and dispense glargine insulin.
- Give maropitant citrate (Cerenia) and fluids subcutaneously and start glipizide.
- Admit to hospital for IV fluids and regular insulin.

Quelle est la prochaine étape la plus appropriée en fonction du diagnostic différentiel le plus probable?

- Donner une diète à faible teneur en glucides et à forte teneur en protéines et prescrire de l'insuline lente.
- Installer un cathéter urinaire et commencer un traitement de réhydratation.
- Donner une fluidothérapie sous-cutanée et prescrire de l'insuline glargine.
- Administer du citrate de maropitant (Cerenia) et une fluidothérapie sous-cutanée, et commencer un traitement par du glipizide.
- Hospitaliser l'animal pour lui donner une fluidothérapie intraveineuse et de l'insuline régulière.

	Cat's value/ Résultat de l'animal	Reference range/ Valeurs de référence
Temperature/ Température	98.2°F (36.8°C)	100–103.1°F (37.8–39.5°C)
Heart rate/ Fréquence cardiaque	234 bpm	180–220 bpm
Respiratory rate/ Fréquence respiratoire	34 brpm/rpm	16–40 brpm/rpm

Hematology/Hématologie

Test/Paramètre	Value/ Résultat	Normal/ Valeurs de référence
RBC/Érythrocytes	10.5	7.12–11.46 M/ μ L
Hematocrit/Hématocrite	52	28.2–52.7%
Hemoglobin/Hémoglobine	16	10.3–16.2 g/dL
MCV/VGM	48	39–56 fL
MCH/TCMH	15.2	12.6–16.5 pg
MCHC/CCMH	35.2	28.5–37.8 g/dL
Reticulocytes/Réticulocytes	15	3–50 K/ μ L
WBC/Leucocytes	30	3.9–19.0 K/ μ L
Neutrophils/Neutrophiles	25.6	2.62–15.17 K/ μ L
Lymphocytes	0.9	1.06–4.95 K/ μ L
Monocytes	3.5	0.04–0.53 K/ μ L
Eosinophils/Éosinophiles	0	0.09–2.18 K/ μ L
Basophils/Basophiles	0.0	0–0.1 K/ μ L
Platelets/Plaquettes	482	155–641 K/ μ L

Chemistry/Biochimie

Test/Paramètre	Value/ Résultat	Normal/ Valeurs de référence
Glucose	659	72–175 mg/dL
Creatinine/Créatinine	2.5	0.9–2.3 mg/dL
BUN/Urée	52	16–37 mg/dL
Phosphorus/Phosphore	2.8	2.9–6.3 mg/dL
Calcium	10.7	8.2–11.2 mg/dL
Sodium	145	147–157 mmol/L
Potassium	3.5	3.7–5.2 mmol/L
Chloride/Chlorure	114	114–126 mmol/L
TCO ₂ (Bicarbonate)	8	12–22 mmol/L
Anion Gap/Trou anionique	23	12–25 mmol/L
Total Protein/Protéines totales	8.6	6.3–8.8 g/dL
Albumin/Albumine	4.6	2.6–3.9 g/dL
Globulin/Globulines	4.0	3.0–5.9 g/dL
ALT	150	27–158 U/L
AST	66	16–67 U/L
ALP	52	12–59 U/L
GGT	4	0–6 U/L
Bilirubin — Total/Bilirubine totale	0.2	0.0–0.3 mg/dL
Cholesterol/Cholestérol	300	91–305 mg/dL
Amylase	3800	623–2239 U/L
Lipase	100	0–45 U/L
Creatine kinase/Créatine kinase	760	64–440 U/L
Hemolysis index/Indice d'hémolyse	N/A/ ND	
Lipemia index/Indice de lipémie	N/A/ ND	

Feline Urinalysis/Analyse d'urine

Test/Paramètre	Value/Résultat
Collection/Prélèvement	Cystocentesis/Cystocentèse
Color/Couleur	Dark yellow/jaune foncé
Clarity/Limpidité	Clear/Limpide
Specific gravity (N = 1.020–1.040)/ Densité (1,020–1,040)	1.055
pH	6.5
Urine protein/Protéines	1+
Glucose	3+
Ketones/Corps cétoniques	3+
Blood/Hemoglobin/Sang/hémoglobine	1+
Bilirubin/Bilirubine	Negative/Négatif
Urobilinogen/Urobilinogène	Normal
Mucus	None seen/Non
Casts/Cylindres	1+
Crystals/Cristaux	None seen/Non

Test/Paramètre	Value/ Résultat	Normal/ Valeurs de référence
White blood cells Leucocytes	2–5	0–5 per HPF/ 0–5 par champ à fort grossissement
Red blood cells Érythrocytes	2–5	0–5 per HPF/ 0–5 par champ à fort grossissement
Bacteria/Bactéries	None/Aucune	None/Aucune
Epithelial cells/ Cellules épithéliales	Rare (0–1) Rares (0–1)	1–2 per HPF/ 1–2 par champ à fort grossissement

(See p. 1157 for answers./Voir les réponses à la page 1157.)

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Pet Insurance Growth – Why Practices Are Being Urged to Adopt Technology

Essor de l'assurance pour animaux de compagnie – l'une des raisons pour lesquelles les pratiques devraient prendre le virage technologique

As veterinary teams across North America continue to struggle with often-daunting appointment schedules, burnout, and staffing challenges, pet insurance growth forecasts underscore *why* the American Veterinary Medical Association (AVMA) recently recommended practices adopt technology to “support workflow and practice efficiency.”

According to a 2022 report by Research and Markets, the global pet insurance market is projected to top \$84 billion U.S. by 2027 (up from \$57 billion U.S. in 2020). Similar forecasts from Zion Market Research and Graphical Research all point in the same general upward direction for pet insurance.

Against the current state of our industry, this upward forecast effectively represents a double-edged sword for veterinary teams.

On one hand, pet insurance empowers pet owners to make health care decisions based on what's best for their pet *versus* being constrained by finances. This naturally enables practice teams to perform better veterinary medicine, improves patient outcomes, and helps address mental and emotional impacts of

Alors que les équipes vétérinaires partout en Amérique du Nord continuent de faire face à des horaires qui débordent, à l'épuisement professionnel et à la pénurie de main-d'œuvre, les prévisions de croissance de l'assurance pour animaux de compagnie soulignent *pourquoi* l'American Veterinary Medical Association (AVMA) a récemment recommandé le virage technologique pour soutenir l'efficacité et la productivité.

Selon un rapport publié en 2022 par Research and Markets, le marché mondial de l'assurance pour animaux de compagnie devrait atteindre 84 milliards de dollars américains d'ici 2027 (comparativement à 57 milliards de dollars américains en 2020). Des prévisions similaires de Zion Market Research et de Graphical Research pointent aussi vers une croissance importante dans le secteur de l'assurance pour animaux de compagnie.

Avec la situation actuelle de notre industrie, cet essor représente une épée à double tranchant pour les équipes vétérinaires.

D'une part, l'assurance pour animaux de compagnie permet aux propriétaires de prendre des décisions en fonction de ce qui est le



economic euthanasia. Indeed, according to a joint 2020 study published by *Frontiers in Veterinary Science*, “Insurance was associated with a marked decrease in risk of pre-surgical euthanasia” because pet owners could afford life-saving surgery for their pets.

On the other hand, when pet owners *have* pet insurance, they tend to visit practices more often. According to Nationwide, insured dog owners visit practices 73% more often per year, and insured cat owners visit 43% more often.

When you compare the above against the current reality at many (or most) practices, there are clear indications of the potential for an untenable future situation as the *current* situation at many practices is barely manageable. Yet there are solutions to help practices now and prepare them for a better future.

According to a recent survey of 80+ practices by CVMA's Affinity Partner, LifeLearn Animal Health, lack of time is a big contributor to the unmanageability. To help practices save time, increase efficiency, and more easily manage appointments, a recent AVMA report pointed the way forward. Urging practices to adopt technology to streamline management and administrative processes, the report added that technology saves practice teams time by supporting “workflow and practice efficiency.”

Dr. Brendon Laing echoed this message at the 2022 Ontario Veterinary Medical Association Conference & Trade Show symposium *A Road Better Travelled: The Client Journey Through a Technology-Forward Practice*. Acknowledging the crossroads at which practices now find themselves, Dr. Laing believes that technology will be the cornerstone of future veterinary practices by enabling better practice efficiency and patient care, increased team well-being, and stronger relationships with pet owners.

The good news: The kind of technology that the AVMA, Dr. Laing, and other veterinarians and veterinary medical organizations recommend exists right now, well in advance of what pet insurance projections are pointing toward. The technology is easy to find, and there are people waiting to help practices implement it.

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mieux pour leur animal au lieu d'être contraints par les finances. Cela permet au personnel vétérinaire de pratiquer une meilleure médecine vétérinaire, améliore les résultats pour les patients, et aide à éviter les impacts mentaux et émotionnels de l'euthanasie effectuée pour des raisons économiques. En effet, selon une étude publiée en 2020 par *Frontiers in Veterinary Science*, l'assurance était associée à une diminution marquée du risque d'euthanasie préchirurgicale car, grâce à elle, les propriétaires pouvaient se permettre une intervention chirurgicale vitale pour leur animal.

D'autre part, les propriétaires qui *ont* une assurance pour animaux de compagnie ont tendance à consulter plus souvent. Selon Nationwide, les chiens et les chats assurés sont vus en clinique 73 % et 43 % plus souvent chaque année, respectivement, que les chiens et les chats non assurés.

Comme beaucoup de pratiques fonctionnent déjà au maximum de leur capacité, cette augmentation pourrait engendrer une situation intenable. Or, il existe des solutions pour aider les pratiques dès maintenant et les préparer pour l'avenir.

D'après un récent sondage mené auprès de plus de 80 pratiques par le partenaire de l'ACMV LifeLearn Animal Health, le manque de temps contribue grandement à la surcharge. Un récent rapport de l'AVMA a indiqué la voie à suivre pour aider les praticiens à gagner du temps, à être plus efficaces et à gérer plus facilement les rendez-vous. Il encourage les pratiques à faire appel à la technologie pour rationaliser les processus de gestion et d'administration, et précise que la technologie permet aux équipes vétérinaires de gagner du temps en favorisant l'efficacité et la productivité.

Le **D^r Brendon Laing** a fait écho à ce message lors du Congrès de l'Ontario Veterinary Medical Association de 2022 dans son exposé intitulé *A Road Better Travelled: The Client Journey Through a Technology-Forward Practice*. Expliquant qu'on est maintenant à la croisée des chemins, le D^r Laing croit que la technologie sera la pierre angulaire des pratiques vétérinaires futures en permettant une productivité accrue, la prestation de meilleurs soins, une amélioration du bien-être des membres de l'équipe et des relations plus solides avec les propriétaires d'animaux.

Heureusement, la technologie que l'AVMA, le D^r Laing et d'autres associations vétérinaires recommandent existe déjà, et peut être adoptée avant que les prévisions concernant l'assurance pour animaux de compagnie se concrétisent. La technologie est facile à trouver, et il y a des gens qui sont prêts à aider les pratiques à la mettre en œuvre.

Les membres de l'ACMV ont droit à un rabais de 10 % sur les produits de LifeLearn (WebDVM, ALLYDVM, ClientEd, Petriage et Sofie). Pour en savoir plus sur ces produits, visitez le site de LifeLearn (www.lifelearn.com).

2023 CVMA Awards Nominate a Deserving Colleague Nominations Due January 31, 2023

Prix de l'ACMV de 2023

Soumettez la candidature d'un collègue méritant!

Les candidatures sont acceptées jusqu'au 31 janvier 2023.

Each year, through its awards program, the Canadian Veterinary Medical Association (CVMA) proudly recognizes individuals who have demonstrated significant accomplishments, exemplary leadership, and tireless commitment to Canada's veterinary community.

Nominations for the 2023 CVMA Awards are accepted until **January 31, 2023**.

Award recipients receive **complimentary registration** to the 2023 CVMA Convention in Québec City.

AWARD ELIGIBILITY

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

- **CVMA Humane Award** — recognizes leadership in the care and well-being of animals
- **CVMA Industry Award** — recognizes contributions to the advancement of veterinary medicine in industry roles
- **Merck Veterinary Award** — recognizes work in food animal production practice, clinical research, or basic sciences that contributes to the advancement of food animal medicine and surgery, including herd health management

Chaque année, dans le cadre de son programme de remise de prix, l'Association canadienne des médecins vétérinaires (ACMV) récompense fièrement des personnes qui ont accompli des réalisations remarquables, fait preuve d'un leadership exemplaire ou démontré un engagement indéfectible envers la communauté vétérinaire canadienne.

Les candidatures pour les prix de l'ACMV de 2023 sont acceptées jusqu'au **31 janvier 2023**.

Les lauréats recevront une **inscription gratuite** au Congrès de l'ACMV de 2023 qui aura lieu à Québec.

ADMISSIBILITÉ

Les candidats proposés pour les prix de l'ACMV (à l'exception de ceux qui sont nommés pour le titre de membre honoraire) doivent être des membres en règle de l'ACMV, mais leur candidature peut être soumise par des personnes qui ne sont pas membres de l'ACMV. Nous vous invitons à soumettre la candidature d'un collègue méritant pour l'un des prestigieux prix de l'ACMV ci-dessous!

- **Prix humanitaire de l'ACMV** – Ce prix reconnaît le leadership dans le domaine des soins et du bien-être des animaux.
- **Prix de l'industrie de l'ACMV** – Ce prix reconnaît le rôle des médecins vétérinaires de l'industrie dans l'avancement de la médecine vétérinaire.



- **CVMA Small Animal Practitioner Award** — recognizes work in small animal practice, clinical research or basic sciences that contributes to the advancement of small animal medicine, surgery, or small animal practice management
- **CVMA Practice of the Year Award** — recognizes a veterinary practice team for outstanding achievement within their local community
- **CVMA Distinguished Member Award** — recognizes a CVMA member for long and outstanding service on CVMA Council, Executive, Boards, and Committees or for outstanding contributions to the veterinary profession
- **CVMA Honorary Membership** — recognizes an individual who has rendered distinguished service to the profession, whether residing in Canada or elsewhere.

More information about CVMA Awards can be found under the *Awards* page of the *About CVMA* section of the website (www.canadianveterinarians.net).

NOMINATIONS

Award recipient selection is based solely on the information provided in the nomination package.

Please submit nominations directly through the CVMA website: (www.canadianveterinarians.net/about-cvma/cvma-awards/nomination-process).

Include the following **supporting documents** as part of the nomination submission:

- Outline of nominee's key professional accomplishments (maximum of 1000 words)
- Letters of support (maximum of 5 letters, 500 words each)
- Newspaper articles (maximum of 2 articles written within the last 2 years)
- Articles written by nominee (maximum of 3 web links to articles).

Nomination forms are due by **January 31, 2023**.

- **Prix vétérinaire Merck** – Ce prix honore un membre dont le travail en productions animales, en recherche clinique ou en sciences fondamentales contribue à l'avancement de la médecine ou de la chirurgie des animaux destinés à la production d'aliments, y compris la régie de la santé des troupeaux.
- **Prix du praticien des petits animaux de l'ACMV** – Ce prix salue un membre dont le travail en pratique des animaux de compagnie, en recherche clinique ou en sciences fondamentales contribue à l'avancement de la médecine ou de la chirurgie des petits animaux ou à la gestion d'une pratique pour petits animaux.
- **Prix de la pratique de l'année de l'ACMV** – Ce prix récompense l'équipe d'une pratique vétérinaire pour ses réalisations exceptionnelles au sein de sa communauté locale.
- **Membre émérite de l'ACMV** – Ce titre est conféré à un membre de l'ACMV pour des services exceptionnels et de longue date au sein du Conseil, de l'exécutif ou des comités de l'ACMV ou pour des contributions remarquables à la profession vétérinaire.
- **Membre honoraire de l'ACMV** – Ce titre est décerné à une personne qui a rendu des services distingués à la profession, qu'elle réside au Canada ou ailleurs.

Pour obtenir plus d'information sur les prix de l'ACMV, consultez la page des *Prix de l'ACMV* de la section *À propos de l'ACMV* de notre site Web (www.veterinairesauCanada.net).

MISE EN CANDIDATURE

La sélection des lauréats est fondée uniquement sur les renseignements fournis dans le dossier de candidature.

Veuillez soumettre les candidatures directement sur le site de l'ACMV (<https://www.veterinairesauCanada.net/a-propos-de-l-acmv/prix-de-l-acmv/processus-de-mise-en-candidature/>).

Il faut inclure les **pièces justificatives** suivantes dans le dossier de candidature :

- Description des principales réalisations professionnelles du candidat (maximum de 1000 mots)
- Lettres d'appui (maximum de 5 lettres de 500 mots ou moins chacune)
- Articles de journaux (maximum de 2 articles écrits au cours des deux dernières années)
- Articles rédigés par le candidat (maximum de 3 liens Web vers des articles).

Les dossiers de mise en candidature doivent être soumis au plus tard le **31 janvier 2023**.

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

La Journée « Une seule santé » et la Semaine mondiale pour un bon usage des antimicrobiens soulignent l'importance d'une approche « Une seule santé » pour lutter contre la résistance aux antimicrobiens

One Health Day: November 3, 2022

World Antimicrobial Awareness Week:
November 18 to 24, 2022

Journée « Une seule santé » : 3 novembre 2022

Semaine mondiale pour un bon usage des antimicrobiens :
18 au 24 novembre 2022

One Health Day answers the urgent need for a One Health trans-disciplinary approach toward solving today's critical global health challenges. It is a timely initiative that gives scientists and advocates a powerful voice for moving beyond current provincial approaches to emerging infectious diseases, antimicrobial resistance, climate change, environmental pollution, and many other problems, to a holistic default way of working together. One Health Day celebrations have been especially poignant for the past 3 years. In the face of the COVID-19 pandemic, One Health is being recognized and embraced as needed now more than ever.

The goal of One Health Day is to build the cultural will necessary for change in how planetary health challenges are assessed and addressed, and how professionals exchange information across disciplines. One Health Day brings global attention to the need for One Health. The One Health Day campaign is designed to engage as many individuals as possible from as many arenas as possible in One Health education and awareness events, and to generate an inspiring array of projects worldwide.

Celebrated annually, World Antimicrobial Awareness Week (WAAW) aims to increase awareness of global antimicrobial resistance and to encourage best practices among the general public, health workers, and policymakers to avoid the further emergence and spread of drug-resistant infections.

The Quadripartite organizations, the Food and Agriculture Organization of the United Nations (FAO), the United Nations Environment Programme (UNEP), the World Health Organization (WHO), and the World Organisation for Animal Health (WOAH, founded as the OIE), are pleased to announce

La Journée « Une seule santé » répond au besoin urgent d'une approche transdisciplinaire pour résoudre les problèmes de santé mondiaux critiques d'aujourd'hui. C'est une initiative opportune qui donne aux scientifiques et aux parties prenantes une voix puissante pour aller au-delà des méthodes provinciales actuelles de lutte contre les maladies infectieuses émergentes, la résistance aux antimicrobiens, les changements climatiques, la pollution de l'environnement, et divers autres problèmes afin de tendre vers une approche collective globale. Les célébrations de la Journée « Une seule santé » ont été particulièrement significatives au cours des trois dernières années. Avec la pandémie de COVID-19, la nécessité d'adhérer au concept « Une seule santé » est reconnue et acceptée plus que jamais auparavant.

L'objectif de la Journée « Une seule santé » est de créer la volonté culturelle nécessaire pour opérer un changement radical dans la façon dont les questions de santé sont évaluées et abordées à l'échelle planétaire et dont les professionnels de diverses disciplines échangent de l'information. Elle attire l'attention sur la valeur d'adopter une approche « Une seule santé ». La campagne est conçue pour impliquer autant de personnes que possible dans autant de domaines que possible dans des événements d'information et de sensibilisation en lien avec le concept « Une seule santé » et pour générer un éventail inspirant de projets dans le monde entier.

Célébrée annuellement, la Semaine mondiale pour un bon usage des antimicrobiens vise à accroître la sensibilisation à la résistance aux antimicrobiens dans le monde et à encourager les meilleures pratiques parmi le grand public, les travailleurs de la santé et les décideurs afin d'éviter l'émergence et la propagation d'infections résistantes aux médicaments.

Les quatre partenaires organisateurs, soit l'Organisation des Nations Unies pour l'alimentation et l'agriculture (FAO), le Programme des Nations Unies pour l'environnement (PNUE), l'Organisation mondiale de la santé (OMS) et l'Organisation mondiale de la santé animale (OMSA, anciennement OIE), ont annoncé que le thème de la Semaine mondiale pour un bon usage des antimicrobiens de 2022 serait *Prévenir ensemble la résistance aux antimicrobiens*.



**Antibiotics
Antivirals
Antifungals
Antiparasitics**



the theme of World Antimicrobial Awareness Week (WAAW) 2022: *Preventing Antimicrobial Resistance Together*.

Antimicrobial resistance (AMR) is a threat to humans, animals, plants, and the environment. It affects us all. This year's theme calls for collaboration across sectors to preserve the efficacy of these critical medicines. Fighting AMR is a truly global endeavor and must be addressed through a One Health approach.

All sectors must join forces and encourage the prudent use of antimicrobials, as well as preventive measures, to curb it effectively. Strengthening infection prevention and control in healthcare facilities, farms, and food industry premises, ensuring access to vaccines, clean water, sanitation, and hygiene, implementing best practices in food and agriculture production, and guaranteeing the sound management of waste and wastewater from relevant industries are critical to reducing the need for antimicrobials, and minimizing emergence and transmission of AMR.

The slogan of World Antimicrobial Awareness Week remains **Antimicrobials: Handle with Care.**

The Canadian Veterinary Medical Association (CVMA) strongly supports veterinarian involvement in One Health as veterinarians have a vital role in improving the health and welfare of the animals in their care in a manner that also protects and supports human health, and a healthy environment.

The One Health approach is particularly relevant to development of collaborative strategies for responsible antimicrobial use that support control of antimicrobial resistance (AMR).

"The CVMA has recognized antimicrobial resistance as a growing global threat and has advocated for the responsible use of antimicrobials for over 3 decades," says **Dr. Chris Bell**, CVMA President. "We have put those concerns into action and have directed tangible initiatives aimed at reducing AMR over the last several years."

The CVMA continues to spearhead a multi-stakeholder antimicrobial stewardship initiative. **SAVI, the Stewardship of Antimicrobials by Veterinarians Initiative**, is conceived, driven, and managed by Canadian veterinarians. It aims to provide veterinary professionals with the knowledge and tools necessary to make informed decisions on antimicrobial use in a wide range of species.



La résistance aux antimicrobiens est une menace pour les humains, les animaux, les végétaux et l'environnement. Elle nous affecte tous. Le thème de cette année encourage la collaboration intersectorielle pour préserver l'efficacité de ces médicaments essentiels. La lutte contre la résistance aux antimicrobiens est une entreprise véritablement mondiale et doit être abordée dans le cadre d'une approche « Une seule santé ».

Tous les secteurs doivent unir leurs efforts et promouvoir l'utilisation responsable des antimicrobiens et des mesures préventives afin de freiner efficacement la résistance aux antimicrobiens. Il est essentiel de renforcer la prévention et la maîtrise des infections dans les établissements de soins de santé, les fermes et les entreprises alimentaires, d'assurer l'accès aux vaccins, à l'eau potable et à des mesures d'hygiène personnelle et publique, de mettre en œuvre les meilleures pratiques en production alimentaire et agricole, et de garantir la gestion saine des déchets et des eaux usées provenant des industries concernées afin de diminuer le besoin de recourir aux antimicrobiens et de réduire l'émergence et la transmission de la résistance aux antimicrobiens.

Le slogan de la Semaine mondiale pour un bon usage des antimicrobiens reste « **Antimicrobiens : À manipuler avec précaution** ».

L'Association canadienne des médecins vétérinaires (ACMV) encourage vivement l'adhésion des médecins vétérinaires à l'approche « Une seule santé » étant donné que les médecins vétérinaires jouent un rôle essentiel dans l'amélioration de la santé et du bien-être des animaux dont ils s'occupent, et ce, d'une façon qui protège et soutient également la santé des humains et de l'environnement.

L'approche « Une seule santé » est particulièrement pertinente pour l'élaboration de stratégies collaboratives visant l'utilisation prudente des antimicrobiens afin d'appuyer la maîtrise de la résistance aux antimicrobiens.

« L'ACMV reconnaît que la résistance aux antimicrobiens est une menace mondiale croissante et préconise l'utilisation responsable des antimicrobiens depuis plus de trois décennies », a déclaré le **Dr Chris Bell**, président de l'ACMV. « Nous avons d'ailleurs mis en œuvre des initiatives concrètes visant à réduire la résistance aux antimicrobiens au cours des dernières années. »

L'ACMV continue de diriger un projet sur l'usage responsable des antimicrobiens auquel participent de multiples intervenants. **L'IVUJA (Initiative vétérinaire pour l'usage judicieux des antimicrobiens)** a été conçue et est menée et gérée par des médecins vétérinaires canadiens. Elle vise à fournir aux professionnels vétérinaires les connaissances et les outils nécessaires pour prendre des décisions éclairées concernant l'utilisation des antimicrobiens chez un large éventail d'espèces.

Les antimicrobiens ont révolutionné la médecine humaine et vétérinaire et jouent un rôle crucial dans l'obtention de résultats positifs pour la santé. Des animaux en santé fournissent de la viande, du lait et des œufs sécuritaires pour la consommation humaine et assurent la réussite continue des agriculteurs, des producteurs, et de l'industrie agricole et agroalimentaire du Canada. Cependant, la recherche scientifique a montré que l'usage de ces médicaments peut entraîner le développement d'une résistance aux antimicrobiens, et que les antimicrobiens doivent être utilisés de

Antimicrobials have revolutionized veterinary and human medicine, with important roles in achieving positive health outcomes. Healthy animals provide safe meat, milk and eggs for human consumption and ensure the continued success of Canada's farmers, producers and the agriculture and agri-food industry. However, scientific research has shown that use of these medications leads to antimicrobial resistance (AMR) and must be used judiciously in the treatment of humans, livestock, and companion animals.

The CVMA has recognized the growing importance of this issue over the past 30 years but has most recently focused on improving antimicrobial stewardship within the veterinary community through the generation of antimicrobial use (AMU) data. The CVMA Guidelines are found in an online platform intended to support Canada's veterinarians in making sound decisions on the appropriate and responsible use of antimicrobials in animals. The initiative currently covers 6 species groups. These data can be used by veterinarians to establish benchmarks for use, target stewardship efforts within the veterinary community, and support credibility of the state of animal health management with Canadian citizens, and with trading partners given the increasing international attention on AMR/AMU.

Access the CVMA Veterinary Guidelines for AMU on the Firstline App. The CVMA, the University of Calgary, and Firstline Clinical (TM) have launched the CVMA Guidelines for Veterinary Antimicrobial Use (AMU) on Firstline, an innovative tool designed to assist Canadian veterinarians in making sound, evidence-based prescribing decisions. Firstline delivers the current CVMA guidelines to veterinarians at point of care. Using their mobile device, any Canadian veterinarian can access species-specific options for AMU that incorporate the latest antimicrobial stewardship guidance. The Firstline initiative is part of the Antimicrobial Resistance (AMR)-One Health Consortium, funded by the Major Innovation Fund program of the Ministry of Jobs, Economy and Innovation, Government of Alberta.

The Stewardship of Antimicrobials for Veterinarians Initiative (SAVI), led by the CVMA, has provided subject matter expertise in support of the Firstline initiative and is funded in part by the Canadian Agricultural Partnership (CAP) initiative of the Government of Canada.

SAVI is intended to both generate and share knowledge on prudent antimicrobial stewardship, as well as pilot data collection of prescription and dispensing-based AMU information for the beef, poultry, and swine sectors. The project was also designed to align with the multi-jurisdictional Pan-Canadian Framework on Antimicrobial Resistance and associated Action Plan.

Visit the website (www.SAVI.vet) for more information and to access our current guidelines.

façon judicieuse pour traiter les humains, le bétail et les animaux de compagnie.

L'Association canadienne des médecins vétérinaires (ACMV) a reconnu l'importance croissante de cette question au cours des trente dernières années, mais s'est plus récemment concentrée sur l'amélioration de la gestion des antimicrobiens au sein de la communauté vétérinaire par la production de données sur l'utilisation des antimicrobiens. Les lignes directrices de l'ACMV se trouvent sur une plateforme en ligne destinée à aider les médecins vétérinaires du Canada à prendre des décisions éclairées sur l'utilisation appropriée et responsable des antimicrobiens chez les animaux. L'initiative couvre actuellement six groupes d'espèces. Ces données peuvent servir aux médecins vétérinaires pour établir des références concernant l'usage des antimicrobiens, pour cibler les efforts visant l'utilisation responsable des antimicrobiens en médecine vétérinaire, et pour soutenir la crédibilité de l'état de la gestion de la santé animale auprès des citoyens canadiens et des partenaires commerciaux étant donné l'attention internationale grandissante accordée à l'usage des antimicrobiens et à la résistance aux antimicrobiens.

Les lignes directrices de l'ACMV concernant l'utilisation des antimicrobiens en médecine vétérinaire peuvent être consultées au moyen de l'application Firstline. L'ACMV, l'Université de Calgary et Firstline Clinical^{MC} ont publié les lignes directrices sur Firstline, un outil novateur conçu pour aider les médecins vétérinaires canadiens à prendre des décisions judicieuses et éclairées relativement à la prescription d'antimicrobiens. Firstline rend les lignes directrices à jour de l'ACMV accessibles au point de service. Ainsi, les médecins vétérinaires canadiens peuvent consulter, directement sur leur appareil mobile, de l'information spécifique à l'espèce à traiter qui tiendra compte des plus récentes recommandations en lien avec l'utilisation prudente et responsable des antimicrobiens. L'initiative Firstline est un projet de l'Antimicrobial Resistance (AMR) – One Health Consortium financé par le programme Major Innovation Fund du ministère de l'Emploi, de l'Économie et de l'Innovation du gouvernement de l'Alberta.

L'IVUJA, menée par l'ACMV et financée en partie par le Partenariat canadien pour l'agriculture (PCA) du gouvernement fédéral, a apporté son expertise pour appuyer l'initiative Firstline.

L'IVUJA vise à la fois à générer et à partager des connaissances sur l'utilisation prudente des antimicrobiens et à piloter la collecte de données sur l'usage des antimicrobiens d'après les données de prescription et de distribution des antimicrobiens pour les bovins de boucherie, les volailles et les porcs. Le projet a également été conçu pour s'aligner avec le cadre pancanadien sur la résistance aux antimicrobiens et son plan d'action.

Visitez le site IVUJA.vet pour en savoir plus et pour accéder aux lignes directrices actuelles.

Special Report Rapport spécial

Together again – Kenyans and Canadians work together to improve sustainable livelihoods of Kenyan smallholder dairy farmers

Alanna Dudych (WCVM 2024), Kaitlyn Lawson (OVC 2024), Vanessa Oliver (OVC 2024), Elyse Perrault (OVC 2024)

For over a decade, Veterinarians without Borders/Vétérinaires sans Frontières (VWB/VSF) Canada has sent volunteers to rural Kenya to work with smallholder dairy farmers. Past volunteers have assisted on a variety of projects, with topics ranging from cow comfort to biosecurity and One Health. As a result of the COVID-19 pandemic, Canadian volunteers have not been able to travel to Kenya to take part in VWB projects since 2019. However, many of these initiatives were able to continue in Kenya throughout the pandemic due to a small group of dedicated Kenyans who took up volunteer roles with VWB when international travel was not possible. Since then, the number of national volunteers has doubled, and there are now 9 volunteers across 2 sites in Kenya! This success is due in part to the partnership between VWB and Global Affairs Canada (GAC). The VWB-GAC partnership has also supported 4 Canadian veterinary students who travelled to Kenya from May to August 2022 as part of their Young Volunteers Program.

The 4 young volunteers that were selected to travel to Kenya this year were incoming third year veterinary students, Alanna Dudych, Kaitlyn Lawson, Vanessa Oliver, and Elyse Perrault; supervised by Canadian veterinarians Drs. Shauna Richards and Julia Stewart. To maximize resources and make the most of the short time in Kenya, the group split up soon after their arrival in mid-May. Alanna, Vanessa, and Dr. Stewart travelled to Mukurwe-ini, Kenya to partner with the Mukurwe-ini Wakulima Dairy Ltd (MWDL). Kaitlyn, Elyse, and Dr. Richards travelled to Meru, Kenya to work with the Meru Central Dairy Co-operative Union Ltd. Both teams quickly settled in, meeting the national volunteers and partner organization members throughout the first week. The role of the Canadian volunteers was to assist in training local smallholder dairy farmers on several relevant topics, including cow comfort, mastitis, reproduction, and dry cow management. National volunteers also provided training on additional topics such as calf rearing strategies, dry cow nutrition, and gender equality.

The MWDL is one of the partner organizations with VWB, which was established over 30 y ago to provide farmers in the surrounding areas a place to sell their milk, and have it processed and distributed. They process approximately 60 000 L of milk a day from approximately 9000 farmers, with a goal of soon

processing about 100 000 L. The positive relationships established between Canadian volunteers in the past and the MWDL made for a worthwhile experience for Vanessa and Alanna. The Meru Dairy Union is much larger in scale, opening in 1967, with the goal of helping farmers from the Katheri, Naari, and Buuri societies market their milk. Since this time, the dairy has grown substantially, and now processes 500 000 L of milk per day from over 50 000 farmers across more than 50 dairy societies. Both dairy partners produce various processed milk products including yogurt, fermented milk, and pasteurized and ultra-high temperature (UHT) milk.

Dairy farming in the Kenyan highlands differs greatly from dairy farming in Canada and other high-income countries in terms of numbers and management; however, breeds of cattle are similar as Kenya has imported genetics of dairy breeds typically seen in North America and Europe. Although the average Canadian dairy farmer has a milking herd of 92 cows (1), the average dairy farmer in the Kenyan highlands will have between 1 and 3 milking cows (2). Most milking cows in the highland region of Kenya are managed in a zero-grazing unit, as land is a very limited resource in this region due to it being a densely populated area with good farmland. Zero-grazing also reduces risk of tick-borne diseases which are prevalent across Kenya. Milking and harvesting of crops are done almost exclusively by hand, although farmers are quite skilled and fast at both! Dairy farmers are encouraged to plant drought resistant forages which are high in protein and energy, such as napier grass, super napier grass, brachiaria, panicum, calliandra, and desmodium. With the support of dairy extension workers, some farmers have done an excellent job of making silage from maize or napier grass. This allows farmers to have access to a good quality food source year-round for their cattle, which is an important way to avoid feed shortages during dry seasons.

Issues associated with mastitis and reproduction were identified as 2 prominent areas of concern for farmers both in Mukurwe-ini and Meru. Canadian and Kenyan volunteers worked together to develop a training session on these topics. Based on prior research, it is known that subclinical mastitis is very common in these areas, but most farmers are unaware of this condition, given it shows no clinical symptoms. Therefore, California Mastitis Testing (CMT) was promoted through demonstrations on-farm, and ongoing use of this diagnostic test through local veterinary and animal health services offered by both dairy partners. This helped farmers visualize subclinical mastitis, allowing them to better understand the important role

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(from left to right) VWB young volunteers Alanna Dudych (WCVm 2024), Kaitlyn Lawson (OVC 2024), Elyse Perrault (OVC 2024), and Vanessa Oliver (OVC 2024) pose for a picture at a training for Meru County Community One Health Champions in Mukurwe-ini.



(from left to right) VWB Canada young volunteers Kaitlyn Lawson (OVC 2024) and Elyse Perrault (OVC 2024), local farmers Martha and Stephen Kaaria from Wega Society, and VWB national volunteer and gender specialist Patricia Kanyiri pose for a picture after harvesting sweet potatoes from the Kaaria's farm in Wega.

it plays in reducing milk production, risk for chronic infection, and having their milk rejected by the dairy partners. Since milking is done by hand in both regions, the volunteers discussed the importance of thoroughly cleaning hands and teats prior to milking, as well as using appropriate techniques for milking, and using a teat dip. The reproduction training focused on the major causes associated with delayed or irregular cycling, and pregnancy failure. In both Meru and Mukurwe-ini, poor nutrition is a major culprit for reproduction related issues. This is further exacerbated by drought, which is becoming more pronounced with ongoing climate change. As a result, cows are often in poor body condition, and thus struggle to reach reproductive age in a timely manner, cycle, get pregnant, or maintain a pregnancy. The training included information about drought resistant forages which were high in protein and energy, and farmers were encouraged to grow and feed these forages instead of common lower quality forages. This can help support sustainable and economic use of the limited landscape available to grow forages in this region.



(from left to right) VWB national volunteer Naftari Wanjiku, VWB young volunteers Vanessa Oliver (OVC 2024), Alanna Dudych (WCVm 2024), and VWB national volunteers Maureen Tanyai and Daisy Jerop in a recently constructed calf shed in the Mukurwe-ini region of Kenya.

Following group training sessions, the team of national and Canadian volunteers made visits to farms to provide individualized advice to farmers on priority topics relevant to their farm needs. One example commonly addressed on farm visits was cow comfort by recommending low-cost changes such as the addition of locally available bedding material and altering stall design. Farmers were also taught how to recognize signs associated with both good and poor cow comfort and stall design, as well as general guidelines for stall designs, and small improvements farmers could make to improve cow comfort. Previous research in this region has shown that making these simple low-cost changes can not only increase cow welfare and cleanliness, but also increases milk production.

When the volunteers were not training farmers, they worked with veterinarians, to visit farmers and discuss management and nutrition of cattle or to see clinical cases. On other occasions, the volunteers would accompany the VWB national volunteers and gender specialists, Patricia and Maureen, to listen to their presentations on topics related to gender empowerment, abuse, and inequality. These presentations provided the volunteers with an excellent opportunity to better understand the intersection between culture and gender and learn more about Kenyan perspectives on gender empowerment and equality. Throughout the summer the volunteers were also able to collaborate with extension staff at the dairies to assist them in providing training and information to farmers. Veterinarians without Borders and the Meru Dairy Union collaborated to provide the Meru extension staff with a CMT kit and weigh tape. These tools are of importance to the extension staff, and after receiving the CMT kits, volunteers observed the extension staff assessing subclinical mastitis at every farm they visited. Having these kits available also provided an opportunity for the extension staff



(from left to right) VWB Canada young volunteers Vanessa Oliver (OVC 2024) and Alanna Dudych (WCVN 2024) with a dairy cow in the Mukurwe-ini region, Kenya.

to educate the farmers on the risks associated with subclinical mastitis. Together with the extension staff, the volunteers could visit 6 to 8 farms per day. These farms often differed greatly from one another in terms of management of cattle and forage, and subsequently differed in terms of milk production. This provided a valuable opportunity for the Canadian volunteers to provide individualized advice to farmers to help improve animal welfare and milk production. Sustainability is a major goal of this project, and the involvement of extension staff helps to ensure the project remains sustainable, by increasing knowledge transfer and access to information between VWB, the partner organizations, and the farmers.

We are grateful to have had this amazing opportunity to live and volunteer in Kenya over the last 3 months. From seeing the joy on the faces of farmers during our training sessions, to seeing farmers making changes in the management of their cows, it was clear that we had made a meaningful impact in the lives of many individuals. This project is aimed at improving

the livelihoods of farmers and reducing poverty in these areas, while empowering farmers, especially women. Some of the farmers we worked with acknowledged that their milk production had more than doubled after receiving training from either the national or Canadian volunteers. Other farmers discussed in detail the changes they made to stalls, and subsequently the impact of these trainings on the welfare of their cows. Farmers also remarked how beneficial these trainings were in empowering them to make decisions for the present and future of their farm. In collaboration with the national volunteers, each training group of farmers in Meru will have received a total of 4 training sessions covering several topics; including, cow comfort, mastitis, reproduction, gender empowerment, dry cow nutrition and management, and calf rearing. From May to August, the Meru team was able to provide training to 284 farmers, more than half of whom were women. The Wakulima team hosted 42 seminars, each with an attendance ranging anywhere from 5 to 50 farmers!

We would like to acknowledge both VWB Canada and GAC for providing funding and resources to make this experience possible. The Young Volunteer Program is part of the Volunteers Engaged in Gender-Responsive Technical Solutions Project. This project is a 7-year program aimed at improving economic and social well-being in 6 countries across Africa and southeast Asia, with a focus on empowering women and girls. We would like to thank our partner organizations, the Mukurwe-ini Wakulima Dairy and the Meru Central Dairy Co-operative Union, for hosting us and allowing us the wonderful opportunity to learn from many of their staff. We would also like to acknowledge the hard work, dedication, and expertise of the national volunteers. We could not have completed our trainings and accomplished many of our goals without their help. We are also thankful for the members of the local communities, which welcomed us with open arms. Finally, we would like to thank Drs. Shauna Richards and Julia Stewart for supervising and mentoring us during our time in Kenya. We will not soon forget this amazing journey!

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Case Report **Rapport de cas**

Gastric neuroendocrine carcinoma (carcinoid) in a ferret (*Mustela putorius furo*)

Teresa Bousquet, Maria Bravo-Araya, Jennifer L. Davies

Abstract — A well-differentiated neuroendocrine carcinoma of the stomach (gastric carcinoid) with transcoelomic and lymph node metastasis was confirmed on post-mortem examination of a 3-year-old, spayed female, domestic ferret (*Mustela putorius furo*). The animal was initially presented with a history of persistent vomiting which progressed to weight loss, a palpable abdominal mass, and melena. The ferret received palliative treatment and was euthanized 9 mo after initial presentation. The clinical, ultrasonographical, cytological, gross pathological, histopathological, and immunohistochemical findings are described. Gastric neuroendocrine carcinomas are rarely reported in animals; this is the first description in a ferret.

Key clinical message:

Veterinary practitioners and diagnosticians should include neuroendocrine carcinoma as a differential diagnosis when encountering gastric neoplasms in ferrets and be aware of the potential for aggressive behavior and widely spread metastasis.

Résumé — **Carcinome neuroendocrine gastrique (carcinoïde) chez un furet (*Mustela putorius furo*).** Un carcinome neuroendocrinien bien différencié de l'estomac (carcinoïde gastrique) avec des métastases transcoelomiques et ganglionnaires a été confirmé lors de l'autopsie d'une femelle furet domestique (*Mustela putorius furo*) stérilisée de 3 ans. L'animal a été initialement présenté avec des antécédents de vomissements persistants qui ont évolué vers une perte de poids, une masse abdominale palpable et un méléna. Le furet a reçu un traitement palliatif et a été euthanasié 9 mois après la présentation initiale. Les résultats cliniques, échographiques, cytologiques, de pathologie macroscopique, histopathologiques et immunohistochimiques sont décrits. Les carcinomes neuroendocriniens gastriques sont rarement rapportés chez les animaux; c'est la première description chez un furet.

Message clinique clé :

Les praticiens vétérinaires et les diagnosticiens doivent inclure le carcinome neuroendocrinien comme diagnostic différentiel lorsqu'ils rencontrent des néoplasmes gastriques chez les furets et être conscients du potentiel de comportement agressif et de métastases largement disséminées.

(Traduit par Dr Serge Messier)

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Neoplasia is a common condition affecting domestic ferrets after 3 years-of-age (1). Ferrets can develop the same types of tumors as those seen in other species, but neoplasms of the endocrine, hemolymphatic, and integumentary systems are most common (1–4). Although tumor type incidence varies globally with differing husbandry practices (5), the 3 most-recognized neoplasms in ferrets are insulinomas, adrenocortical tumors, and

lymphoma (1–5). It is common for ferrets to present with more than 1 type of tumor simultaneously (1,2,5–7). Of all neoplasms reported in this species, 1.75 to 8.4% originated from the digestive system (2,3,5). Lymphoma is the most common gastric neoplasm and gastric adenocarcinomas are also described (4,5,7).

We report the clinical, ultrasonographical, cytological, gross pathological, histopathological, and immunohistochemical

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Figure 1. Ultrasonographic image of gastric mass in sagittal section; ferret. In this view, the hypoechoic gastric mass measures 1.77 cm in diameter.

features of a gastric neuroendocrine carcinoma in a ferret. Gastric neuroendocrine carcinomas are rarely reported in animals, and this is first description of this tumor in a ferret.

Case description

A 3-year-old, spayed female, domestic ferret (*Mustela putorius furo*) was brought to Park Veterinary Centre with a history of increased frequency of vomiting; the ferret had been vomiting daily over the previous week. The ferret was housed indoors with another ferret of similar age and was fed Hill's Prescription Diet t/d dry cat food. The ferret had been evaluated 3 mo earlier for diarrhea and was treated with oral (PO) metronidazole (Metronidazole; Summit Veterinary Pharmacy, Aurora, Ontario), 10 mg/kg body weight (BW), q12h for 5 d. On inspection, the ferret was bright, alert, and responsive, and weighed 1160 g. Physical examination revealed very mild dental tartar and mild splenomegaly. The ferret was sedated with intramuscular (IM) butorphanol (Torbugesic; Zoetis Canada, Kirkland, Quebec), 0.2 mg/kg BW for blood collection from the jugular vein. The complete blood (cell) count (CBC) and a serum biochemistry panel were unremarkable. Thoracic and abdominal radiographs were declined. An abdominal ultrasound examination was recommended if the vomiting persisted.

Approximately 1 mo later, the owner reported that the ferret continued to vomit, albeit less frequently, and abdominal ultrasound was pursued. The ferret was sedated with subcutaneous (SQ) butorphanol (Torbugesic, Zoetis), 0.2 mg/kg BW. Ultrasonography revealed a well-circumscribed, ovoid, mildly heterogeneous, hypoechoic mass in the cranial abdomen measuring approximately 1.5 to 2 cm in diameter (Figure 1). The margins of the mass appeared confluent with the greater curvature of the stomach. Several enlarged gastric lymph nodes were noted, measuring ~7.8 mm in diameter and 9 mm in diameter (Figure 2). The spleen was mildly enlarged, with a small, poorly defined convex region, measuring 6 to 7 mm; possibly a nodule. Otherwise, the spleen was homogeneous.

Approximately 2 mo after the initial examination, the ferret returned for ultrasound-guided fine-needle aspiration of the gastric mass. The ferret was sedated with butorphanol,



Figure 2. Ultrasonographic image of a gastric lymph node in sagittal section; ferret. In this view, the enlarged lymph node measures 0.9 cm in diameter.

0.3 mg/kg BW, SC and midazolam (Midazolam USP; Fresenius Kabi Canada, Toronto, Ontario), 0.5 mg/kg BW SC, and then maintained on isoflurane inhalant gas (Isoflurane USP; Fresenius Kabi Canada) *via* a face mask for the sampling.

Aspirate samples were submitted to ANTECH Diagnostics Canada for cytological examination. The smears were moderately to markedly cellular and markedly hemodiluted with several variably sized platelet clumps. The background was pale and amphophilic to basophilic with varying numbers of ruptured cells and frequent bare nuclei admixed amongst larger numbers of erythrocytes. Low numbers of small, mature lymphocytes with scattered plasma cells were seen. There were also numerous variably sized aggregates of epithelial cells that sometimes formed small secretory acinar-like structures. The epithelial cells had moderate amounts of basophilic cytoplasm, indistinct cell borders, and a single round to slightly ovoid nucleus with a clumped immature chromatin pattern and indistinct nucleoli. Anisocytosis and anisokaryosis were mild. Mitotic figures were not seen. This was interpreted as epithelial neoplasia with neuroendocrine-type appearance, and lymphoid inflammation.

Surgical resection of the gastric mass with submission for histopathology was discussed with the owner but was declined. The rationale for this decision was the suspicion of metastasis due to enlarged gastric lymph nodes noted on ultrasound, as well as the lack of information regarding prognosis for this condition in ferrets. The owner opted for palliative management and the ferret was started on oral (PO) prednisolone (Pediapred; Sanofi-Aventis Canada, Laval, Quebec,) 1 mg/kg BW, PO, q24h.

Eight months after initial presentation, the ferret was examined at another veterinary clinic. The owner reported that the ferret was lethargic, losing weight, uncomfortable in her abdomen, and had black stool. The ferret was thin and weighed 860 g. The mass had grown considerably and was readily palpable, as a large, bilobed firm mass, estimated to be 6 to 7 cm × 2 to 3 cm. Additional options for palliative management were discussed and the ferret was started on oral ondansetron (Ondansetron; Strathcona Compounding Pharmacy, Edmonton, Alberta), 1 mg/kg BW, PO, q24h (8).

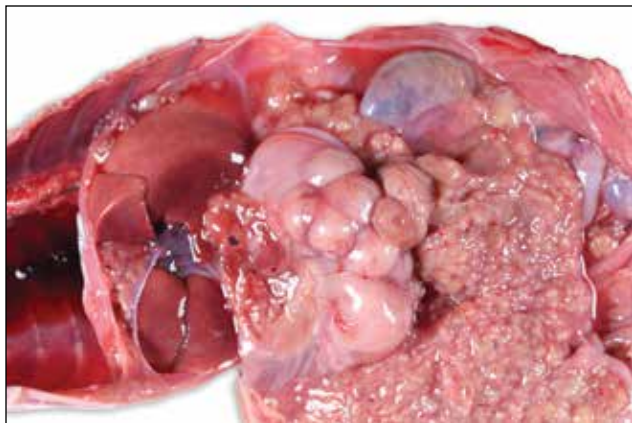


Figure 3. Abdominal cavity; ferret. A large, multilobular, tan mass effaces approximately 75% of the greater curvature of the stomach. The mesentery is studded with innumerable, multifocal to coalescing, 2 to 8 mm, slightly raised, tan nodules consistent with transcoelomic metastasis.

Approximately 1 wk after the visit to the other clinic, the ferret returned for a recheck examination. The ferret was confirmed to be underweight at 856 g, and the size of the gastric mass was confirmed as described above. The ferret had a prolonged skin tent and was estimated to be 6 to 8% dehydrated. The ferret was sedated with butorphanol, 0.2 mg/kg BW, IM for blood collection from the jugular vein. The CBC showed a neutrophilia ($3.62 \times 10^9/L$; reference range (RR): 0.62 to $3.30 \times 10^9/L$), lymphopenia ($0.8 \times 10^9/L$; RR: 1 to $8 \times 10^9/L$), and eosinopenia ($0.09 \times 10^9/L$; RR: 0.1 to $0.6 \times 10^9/L$). A serum biochemistry panel showed an elevation in blood urea nitrogen (BUN), (21.1 mmol/L; RR: 3.6 to 16.1 mmol/L), hyperglobulinemia (35 g/L; RR: 18 to 31 g/L), and an elevation in alkaline phosphatase (Alk Phos) (240 U/L; RR 9 to 84 U/L). Creatinine was within the normal range ($54 \mu\text{mol/L}$; RR 35 to $80 \mu\text{mol/L}$). The ferret was started on oral sucralfate (Sulcrate Suspension Plus; Aptalis Pharma Canada ULC, Markham, Ontario), 50 mg/kg BW, PO, q12h and a probiotic (FortiFlora Feline; Nestlé Purina PetCare Canada, Mississauga, Ontario), 1/2 sachet, PO on food, q24h.

Nine days later, the ferret was examined at an emergency clinic in evident pain and with new lesions on the skin. Small collarettes were noted on the perianal region and on the ventral abdomen. The ferret was treated with oral trans-mucosal (OTM) buprenorphine (Buprenorphine; Summit Veterinary Pharmacy, Aurora, Ontario), 0.02 mg/kg BW, OTM, q8h, and topical silver sulfadiazine cream (Flamazine; Smith&Nephew, Mississauga, Ontario) thin layer, topically, q8 to 12h.

Ten days later and 9 mo after the initial presentation for vomiting, the ferret was brought to the emergency clinic again in declining condition. On physical examination, the ferret was dull, with muffled heart and lung sounds, bilateral hind-limb paresis, and a distended abdomen with a large abdominal mass. Abdominal and thoracic point-of-care ultrasound revealed severe ascites, free abdominal gas, and severe pleural effusion. The owner elected to euthanize the ferret.

The body was submitted to the Diagnostic Services Unit at the University of Calgary, Faculty of Veterinary Medicine for

post-mortem examination. The carcass was dehydrated and cachectic weighing 907 g. The abdomen was pendulous with a fluid wave and the peritoneal cavity contained approximately 20 mL of red, watery, slightly turbid fluid consistent with ascites. The omentum was adherent to a $6 \text{ cm} \times 4 \text{ cm} \times 3 \text{ cm}$, soft, tan, multilobular mass involving approximately 75% of the greater curvature of the stomach (Figure 3). On section, the mass was tan, homogenous, soft, and transmural, causing marked thickening of the gastric wall and effacing normal layers. The mass protruded into the gastric lumen and was ulcerated. The omentum and the mesentery were thickened by innumerable, multifocal to coalescing, 2–8 mm, slightly raised, soft, tan to pink nodules consistent with transcoelomic metastasis (Figure 3). Similar lesions studded the peritoneal surface of the diaphragm and body wall. Lying in the mesentery at the level of the ileocecolic junction, there was a 1 cm, tan, nodular mass suspected to represent ileocolic lymph node metastasis. The thorax contained approximately 25 mL of red, clear fluid (hydrothorax) and the lungs were partially atelectatic. The spleen was diffusely and mildly enlarged with a meaty texture. The skin lesions noted at the first emergency clinic visit were not observed at the time of post-mortem examination.

Sections of the gastric mass, diaphragm, ileocolic lymph node, spleen, liver, lung, kidney, omentum, thyroid glands, heart, adrenal glands, bladder, tongue, skeletal muscle, spinal cord, brain, and pancreas were fixed in 10% buffered formalin for 48 h, processed routinely for histological examination and slides were stained with hematoxylin and eosin (H&E). Selected sections of the mass were subjected to Grimelius stain. Immunohistochemistry (IHC) using rabbit anti-chromogranin A (Immunostar, Hudson, Wisconsin, USA; 1 in 1000 dilution) and mouse anti-synaptophysin [clone27G12; Leica Microsystems (Canada), Richmond Hill, Ontario; 1 in 50 dilution) was conducted at Prairie Diagnostic Services, Saskatoon, Saskatchewan, using an automated slide stainer (Autostainer Plus; Dako Canada, Mississauga, Ontario). Heat-induced epitope retrieval was performed in a Tris/EDTA pH 9.0 buffer and binding of the primary antibodies was detected using a horse-radish peroxidase (HRP)-labelled polymer detection reagent (EnVision+System-HRP Labelled Polymer; Dako).

Microscopically, the normal gastric architecture was replaced by a highly cellular, infiltrative, unencapsulated, poorly defined, and full thickness neoplasm extending from the ulcerated mucosa to the serosa. The neoplasm demonstrated histopathologic features typical of well-differentiated neuroendocrine tumors including neoplastic cells arranged in nests, trabeculae, and pseudorosettes separated by delicate fibrovascular septa (Figure 4). The neoplastic cells were cuboidal with distinct cell margins, a moderate amount of lightly eosinophilic and finely granular cytoplasm, and central, oval nuclei. The cells were uniform, and no mitotic figures were seen in 10 high-power fields ($\times 400$). Multiple lymphoid nodules were scattered within the mass. Infrequent tumor cells contained argyrophilic intracytoplasmic granules on Grimelius stain. Immunohistochemistry was positive for strong to moderate granular cytoplasmic expression of chromogranin (Figure 5) and labelling for synaptophysin was negative. The same tumor cells

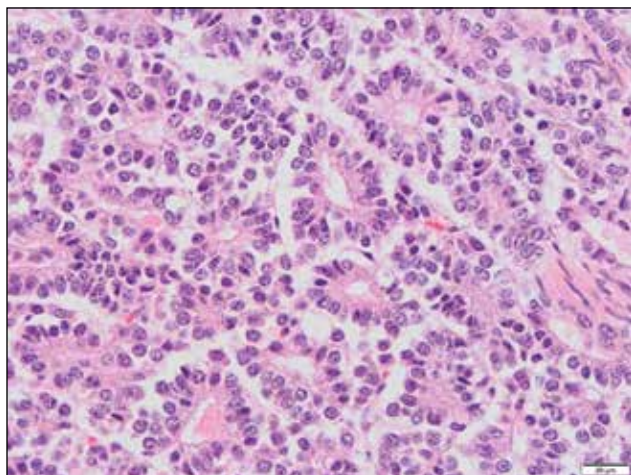


Figure 4. Gastric neuroendocrine carcinoma; ferret. Photomicrograph demonstrating a relatively uniform population of neoplastic epithelial cells arranged in nests and pseudorosettes separated by delicate fibrovascular septa, typical of neuroendocrine tumors. Hematoxylin and eosin. Bar = 20 μ m.

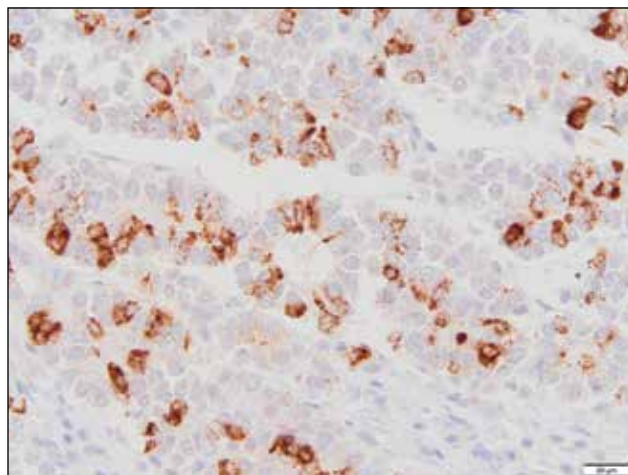


Figure 5. Gastric neuroendocrine carcinoma; ferret. Photomicrograph showing strong to moderate granular cytoplasmic expression of chromogranin, confirming neuroendocrine origin. IHC. Bar = 20 μ m.

lined the peritoneal surface of the diaphragm and omentum and effaced the architecture of the ileocolic lymph node. Metastases were not observed in any of the other tissues examined. The cytological, histopathological, histochemical and immunohistochemical features of this neoplasm supported the diagnosis of a well-differentiated gastric neuroendocrine carcinoma with lymph node and transcoelomic metastasis.

Discussion

In animals, endocrine cells are arranged in discrete endocrine glands or distributed throughout many organ systems in small clusters or individually as part of the diffuse neuroendocrine system. The dispersed neuroendocrine system is concentrated in the gastrointestinal tract, lung, and reproductive systems. Neuroendocrine tumors of nonendocrine organs, previously known as carcinoids, arise from this diffuse neuroendocrine system (9). In the gastrointestinal tract, these tumors arise from the enteroendocrine cells. Neuroendocrine tumors occur in the gastrointestinal tract of humans, but gastric neuroendocrine carcinomas are rarely reported in the veterinary literature (10).

Spontaneous neoplasms arising from the discrete endocrine glands are extremely common in ferrets and the incidence of endocrine tumors is much higher in ferrets than in other domestic species (11). Retrospective studies indicate that 40 to 53% of all tumors in ferrets are of endocrine origin with pancreatic islet tumors and adrenocortical tumors being the most common (2,3,6). The reasons for this increased prevalence are not fully understood but genetics, diet, and gonadectomy may predispose ferrets to increased incidence of these tumors (11,14). The intake of a carbohydrate-rich diet has been implicated in the pathogenesis of insulinoma (4,11). Altered photoperiods and gonadectomy leading to disruption of the negative feedback mechanism of gonadotropin-releasing hormone (GnRH) and luteinizing hormone (LH) release from the hypothalamus are implicated in the pathogenesis of proliferative adrenocortical

lesions (4,11). Interestingly, although neoplasms arising from the discrete endocrine glands are common in ferrets, there are no reports of tumors arising from the diffuse neuroendocrine system. Gastric neuroendocrine tumors are reported in humans (12,13) and rarely in veterinary species including dogs (14–16), 1 cat (17), and bearded dragons (18,19). In bearded dragons these tumors have been further subclassified as somatostatinomas *via* immunohistochemistry (18,19). In dogs with gastric neuroendocrine carcinomas, the most reported clinical signs include vomiting, anorexia, weight loss, and lethargy with diarrhea and abdominal pain reported infrequently (15). The 1 feline case was associated with chronic vomiting (17). Anorexia, vomiting, weight loss, lethargy, and melena have been reported in bearded dragons with gastric neuroendocrine carcinomas (18,19). Like reported clinical signs in other species, in this ferret the initial presenting sign was chronic vomiting progressing to weight loss, melena, abdominal pain, and diarrhea over the course of the disease. In addition to the nonspecific clinical signs, no specific changes were observed on CBC or serum biochemistry. An elevated BUN without an accompanying elevation in creatinine was noted and attributed to gastrointestinal blood loss from ulceration of the gastric mass. In the absence of liver metastases, the elevation in alkaline phosphatase was attributed to prednisolone treatment.

The pathogenesis of gastric neuroendocrine tumors is largely unknown in veterinary species. In humans there is a well-documented association between chronic atrophic gastritis and the development of gastric neuroendocrine tumors (12,13). Impairment of gastric acid secretion in atrophic gastritis leads to increased gastric pH and compensatory hypergastrinemia. Excessive levels of gastrin result in proliferation of enterochromaffin-like cells in the fundic mucosa with eventual neoplastic transformation. A similar association has been made between the development of gastric neuroendocrine carcinoma in Norwegian lundehund dogs, a breed predisposed to the

development of chronic atrophic gastritis (15). There was no evidence of chronic atrophic gastritis in this ferret and the pathogenesis of this tumor remains unknown.

With infrequent reports in the veterinary literature, the biological behavior of gastric neuroendocrine carcinomas is largely unknown (10). All reported neuroendocrine carcinomas in dogs had evidence of distant metastasis with reported sites including the regional lymph nodes, liver, lungs, spleen, kidney, and brain (14–16). In bearded dragons, gastric neuroendocrine tumors, specifically somatostatinomas, are regarded as high-grade malignancies with all tumors metastasizing to the liver and less consistently to other organs (18,19). In contrast, surgical resection of a feline gastric neuroendocrine carcinoma appeared curative, although the cat died of unrelated causes 4 mo after surgery (17). In the current case, the ferret was euthanized 9 mo after the initial presentation with extensive lymph node and transcoelomic metastasis indicating potential aggressive behavior of these tumors in this species such as is observed in dogs and bearded dragons. The initial management of this case was based on a palliative approach for the ferret; however, after consideration of the potential tumor type, earlier intervention with gastro-protectants might have been a more appropriate course and may have improved quality of life.

In conclusion, this is the first report of gastric neuroendocrine carcinoma in a ferret. Clinicians and diagnosticians should be aware of this condition and include gastric neuroendocrine carcinoma as a differential diagnosis in ferrets with clinical signs including vomiting, weight loss, abdominal pain, diarrhea, melena, and/or with gastric masses. This case also highlights the potentially aggressive biological behavior of these neoplasms in ferrets informing discussions on treatment options.

Acknowledgments

Thank you, Dr. Marissa Rodriguez, for assistance in performing the abdominal ultrasound and ultrasound-guided fine-needle aspirations in this ferret. Thanks also to Dr. Alice Liboiron, for taking care of this case when our schedule was unable to accommodate the ferret as quickly as we would ideally have liked. CVJ

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Case Report **Rapport de cas**

Protothecosis and *Toxoplasma gondii* co-infection in a dog from Nova Scotia, Canada

Anne C. Arsenault, Susan V. Carr, Russell S. Fraser, Shelley A. Burton

Abstract — A 2-year-old, neutered male mixed-breed dog from Nova Scotia, Canada was evaluated for panuveitis, polyuria, polydipsia, and hind limb ataxia. Toxoplasmosis was diagnosed ante-mortem based on markedly increased *Toxoplasma gondii* titers. The post-mortem examination confirmed systemic toxoplasmosis and demonstrated disseminated protothecosis. This article documents the first reported case of canine protothecosis in Atlantic Canada.

Key clinical message:

This case report demonstrates that protothecosis should be a clinical consideration for dogs in Canada. Co-infection with other organisms may occur, which may mask clinical signs and potentially delay diagnosis.

Résumé — **Protothécose et co-infection à *Toxoplasma gondii* chez un chien de la Nouvelle-Écosse, Canada.**

Un chien de race mixte mâle castré de 2 ans de la Nouvelle-Écosse, au Canada, a été évalué pour une panuvéite, une polyurie, une polydipsie et une ataxie des membres postérieurs. La toxoplasmose a été diagnostiquée ante-mortem sur la base d'une augmentation marquée des titres de *Toxoplasma gondii*. L'autopsie a confirmé la toxoplasmose systémique et mis en évidence une protothécose disséminée. Cet article documente le premier cas signalé de protothécose canine en Atlantique.

Message clinique clé :

Ce rapport de cas démontre que la protothécose devrait être une considération clinique pour les chiens au Canada. Une co-infection avec d'autres organismes peut survenir, ce qui peut masquer les signes cliniques et potentiellement retarder le diagnostic.

(Traduit par D^r Serge Messier)

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Prototheca spp. are algal organisms closely related to green algae (*Chlorella* spp.). They are present in organic waste material, such as sewage, fecal material, soil, and free-standing water (1). *Prototheca* spp. have a global presence, with organisms reported on all continents, except for Antarctica (2). A recent molecular taxonomic study from 2019 has expanded the classification of *Prototheca*; 14 species are currently recognized (3). Of particular interest to the veterinary community are *Prototheca wickerhamii*, *P. bovis* (formerly known as *P. zopfii* genotype-2), *P. ciferri* (formerly *P. zopfii* genotype 1), *P. blaschkeae*, and *P. cutis*, all of which have been implicated in infections in animals (3–6).

Protothecosis has been described in humans, cattle, cats, and dogs (7). Protothecosis in humans is rare, with only 211 cases reported globally as of mid-2017 (7). Transmission is suspected to occur through direct contact with the organism or traumatic inoculation and occurs more frequently in immunocompromised individuals (7,8). Feline protothecosis is reported very

rarely, with low numbers of case reports documenting cutaneous infections and a single report of gastrointestinal infection (9,10). Bovine protothecosis is not uncommon, as *Prototheca* spp. are a well-described causative agent for mastitis (11).

Canine protothecosis is rare, with only 59 cases reported (4). *Prototheca zopfii* and *P. wickerhamii* have been the most frequently isolated species in canine infections, with *P. zopfii* described as causing more aggressive clinical disease (4,12). Given the recent changes in nomenclature, those previously speciated cases of *Prototheca zopfii* likely represent cases of *Prototheca bovis* (formerly *Prototheca zopfii* genotype-2) infections. Disseminated disease is most common in dogs, with a gradual and ultimately fatal course described. Gastrointestinal, ocular, and central nervous systems are frequently involved. Colonic and rectal involvement is the most common feature, with hemorrhagic colitis often reported prior to the onset of other signs (12). Uveitis, retinal detachment, and vision loss

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are frequently reported signs of ocular disease (13). Neurologic involvement is a frequently described manifestation of canine protothecosis, with dissemination to the brain and/or spinal cord leading to neurologic signs of varying severity (12,14). Other organ involvement can include the heart, kidney, liver, and skeletal muscle; cutaneous infections are documented rarely (1,15). The pathogenesis of canine protothecosis is uncertain; however, given the frequency of colitis in infected dogs, translocation across the gastrointestinal tract is hypothesized, with subsequent dissemination to other organs (1,12). Increased risk of infection in immunocompromised dogs has been suggested, as well as potential breed predispositions of collie and boxer dogs (4,16,17).

Diagnosis of protothecosis can be made by visualizing the organism in cytologic specimens such as rectal scrapings, aspirates of lymph nodes, impressions from cutaneous lesions, and in urine sediment. As organism numbers can be small, more invasive sampling methods for diagnosis may be necessary, including tissue biopsy samples, cerebrospinal fluid sampling, and vitreous fluid collection (18).

The prognosis for canine protothecosis is grave. A 2007 literature review noted one survivor at the time of publication (12). An ultimately fatal course of disease is reported otherwise, with outcomes of death or euthanasia (1,12,13). Given the scarcity of canine reports detailing treatments and outcomes, therapeutic recommendations are often extrapolated from management of human infections. Antifungal therapy with amphotericin B, fluconazole, itraconazole, and voriconazole is described for systemic infections; topical antifungal therapy and surgical intervention are reported with cutaneous lesions (1,8,12). Unfortunately, successful treatment of disseminated disease in dogs has not been demonstrated to date.

This report describes a case of concurrent protothecosis and toxoplasmosis in a dog from Atlantic Canada, the first confirmed case of canine protothecosis in this region. Co-infection with 2 organisms supports previous hypotheses regarding the role of immunosuppression in canine protothecosis. This report aims to increase awareness of this rare disease not previously described in this geographic region.

Case description

A 2-year-old, neutered male Rhodesian ridgeback mixed-breed dog from Nova Scotia, Canada, was referred to the Atlantic Veterinary College (AVC), with a history of an acute development of panuveitis, polyuria, polydipsia, and hind-limb ataxia. The dog had been obtained as a puppy from a breeder in New Brunswick and had no history of travel outside Atlantic Canada. It had free-roaming access to extensive land in rural Nova Scotia. Core vaccinations were current, and the dog had received monthly ectoparasite prevention. Several months before presentation, mild waxing and waning hind-limb lameness and ataxia were observed. This progressed to more noticeable episodes of hind-limb ataxia and paresis, including a bunny-hopping gait and difficulties rising. Several days before referral, acute onset of blepharospasm, ocular opacity, polydipsia, polyuria, and urine dribbling developed. A veterinary ophthalmologist diagnosed bilateral panuveitis with secondary glaucoma affecting the left eye. There was complete

left-sided retinal detachment and significant retinal detachment of the right eye. The dog was referred to the AVC Internal Medicine Service for further evaluation.

Upon presentation to the AVC, the dog was quiet, alert, and responsive and weighed 35 kg. Non-invasive blood pressure measurement was within normal limits. Mandibular, prescapular, and popliteal lymph nodes were mildly enlarged and firm. Passive urine dribbling was noted. The dog had bilateral blepharospasm and the left eye was blind, with complete retinal detachment, scleral injection, corneal edema, buphthalmia, and severe aqueous flare. The right eye had a large area of retinal detachment and hemorrhage but was still visual. A mild right-sided head tilt was present. Remaining cranial nerve assessment was normal. Marked hind-limb ataxia was present and abnormal nail wear was evident on both hind limbs. Lumbosacral pain was elicited with tail-jacking and firm palpation of the lumbosacral region. The dog had mildly delayed conscious proprioceptive placement of both hind limbs. The remainder of the physical examination was unremarkable.

Evaluation of a complete blood (cell) count revealed a normal white blood cell concentration with a mild eosinophilia ($2.0 \times 10^9/L$, reference interval (RI): 0.0 to $1.5 \times 10^9/L$). Red blood cell and platelet concentrations were within reference intervals. Evaluation of a serum biochemical panel revealed a mild elevation in total protein (89 U/L, RI: 56 to 71 U/L) with a moderate hyperglobulinemia (60 g/L, RI: 25 to 38 g/L) and a mild hypoalbuminemia (29 g/L, RI: 30 to 36 g/L). Serum protein electrophoresis indicated an increase in positive acute phase proteins and a mild polyclonal gammopathy. Symmetric dimethylarginine (SDMA) (IDEXX Laboratories, Westbrook, Maine, USA), thyroxine, and thyroid-stimulating hormone concentrations were within reference intervals. A WITNESS Lepto Canine Leptospira Antibody Test Kit (Zoetis Canada, Kirkland, Quebec) was negative for antibodies against *Leptospira canicola*, *L. grippityphosa*, *L. icterohaemorrhagiae*, and *L. pomona*. A Snap4Dx test (IDEXX Laboratories) was negative for antigens to *Dirofilaria immitis* and antibodies to *Borrelia burgdorferi*, *Anaplasma phagocytophilum/platys*, and *Ehrlichia canis/ewingii*. A canine vector-borne disease serology and polymerase chain reaction (PCR) panel submitted to the North Carolina College of Veterinary Medicine Vector Borne Diagnostic Laboratory (Raleigh, North Carolina, USA) was negative for all organisms tested. *Toxoplasma gondii* and *Neospora caninum* indirect fluorescent antibody (IFA) titers reported by the Michigan State University Veterinary Diagnostic Laboratory (Michigan, USA) were both elevated. The dog had a *T. gondii* IgG titer of $> 20\,480$ (reference value < 20). The *T. gondii* IgM titer was negative. The *N. caninum* IgG titer was 800 (reference value < 100). A fecal flotation sample was negative. A urinalysis performed on a free-catch urine sample was unremarkable aside from a urine specific gravity of 1.014. Thoracic radiographs were unremarkable. Abdominal ultrasonography revealed mild enlargement of the medial iliac lymph node, mild thickening of the duodenum, and a single loop of jejunum, with preservation of wall layering of both. Fine-needle aspirates taken from the prescapular and popliteal lymph nodes had a marked increase in plasma cells consistent with strong antigenic stimulation.

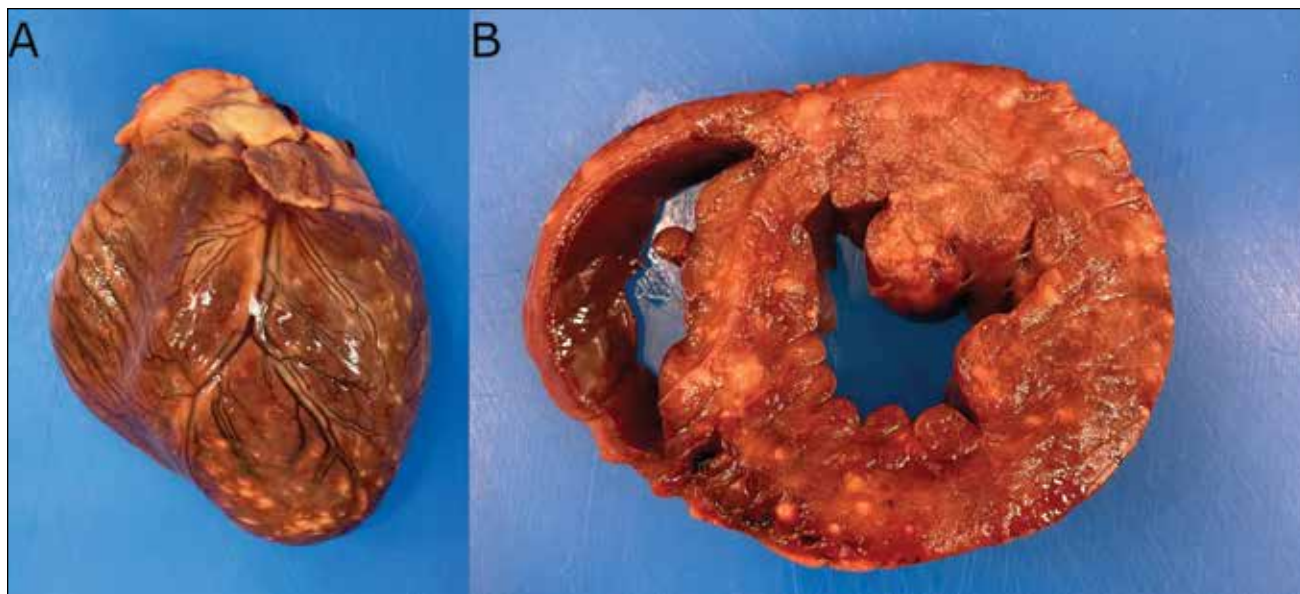


Figure 1. Cardiac protothecosis. A – The epicardial surface of the left ventricle contains multifocal to coalescing, slightly raised white nodules. B – Cross section of the heart demonstrating nodules of a similar description throughout the myocardium.

Computed tomography (CT) of the head and cervical region revealed mild enlargement of the medial retropharyngeal lymph nodes and deep cervical lymph nodes with mild enlargement of the left thyroid gland. Mildly enlarged tracheobronchial lymph nodes were visualized within the portion of the partially included thorax, with multifocal renal infarcts and moderate medial iliac lymph node enlargement noted in the visible portion of the abdomen. Several incidental cervical and thoracolumbar skeletal abnormalities were noted and deemed unlikely to be of clinical relevance. Cerebrospinal fluid collected from the cerebromedullary cistern had a mild mixed pleocytosis (nucleated cells = $13 \times 10^6/\text{L}$, reference value: $< 5 \times 10^6/\text{L}$; protein = 0.49 g/L, reference value: $< 0.30 \text{ g/L}$) with mild blood contamination (red blood cell concentration = $614 \times 10^6/\text{L}$). No infectious organisms or neoplastic cells were observed.

Therapy with doxycycline (Apotex, Toronto, Ontario), 4.3 mg/kg BW, PO, q12h, clindamycin (Sandoz Canada, Boucherville, Quebec), 10 mg/kg, IV, q12h, and enrofloxacin (Bayer Canada, Mississauga, Ontario), 5 mg/kg, IV, q24h was initiated while awaiting the *T. gondii* and *N. caninum* titers and vector-borne disease panel results. Prednisolone acetate ophthalmic (TEVA Pharmaceuticals Industries, Toronto, Ontario), trehalose ophthalmic 3% (Théa Pharmaceuticals, Keele, England), and tobramycin ophthalmic 0.3% (Sandoz Canada, Boucherville, Quebec) were administered bilaterally, with dorzolamide 2% and timolol maleate 0.5% ophthalmic (Apotex, Toronto, Ontario) administered to the left eye. Despite ongoing treatment for panuveitis, progressive retinal detachment of the right eye was noted 3 d after referral; the dog became blind. The right-sided head tilt became more severe and ventrolateral strabismus developed. Due to worsening neurologic deficits raising concern about possible increased intracranial pressure, dexamethasone sodium phosphate (Vétoquinol N.-A.,

Lavaltrie Quebec), 0.25 mg/kg, IV, q24h was administered. Upon receipt of the *T. gondii* and *N. caninum* titers 9 d later, enrofloxacin was discontinued. The dog continued to deteriorate over the following week with worsening polyuria, polydipsia, and progressive pelvic-limb ataxia. Humane euthanasia was elected 2 wk after initial presentation.

On gross post-mortem examination, numerous irregular, white, 5 to 10-mm nodules were widespread in multiple organs, including the heart, aorta, kidneys, and left thyroid gland. Fifteen to 20% of the ventricular and interventricular myocardium contained nodules (Figure 1), which were also present along the adventitial surface of the descending aorta. Nodules were present within the cortex and medulla of both kidneys. Multiple acute renal infarcts were present bilaterally. Histopathology of heart, aorta, kidney, thyroid glands, and thoracic lymph node revealed severe lymphoplasmacytic inflammation with intralesional organisms ranging in size from 5 to 20 μm with a thick outer capsule and variably containing 2 to 4 endospores, some of which had a “Maltese cross” (consistent with *Prototheca*). Numerous *Prototheca* organisms were present within the bone marrow, which had marked myelofibrosis with lymphoplasmacytic and pyogranulomatous myelitis. Sections of liver and lung both contained rare *Prototheca* organisms. Sections from the gastrointestinal tract were markedly autolyzed and not suitable for interpretation. Glaucoma secondary to severe lymphoplasmacytic endophthalmitis, severe retinitis, and exudative retinal detachment was confirmed in the left eye, with intralesional *Prototheca* organisms and protozoal cysts observed. Severe lymphoplasmacytic and granulomatous optic neuritis was also present, with *Prototheca* organisms invading the optic nerve (Figure 2). The right eye had similar but less severe changes, with no evidence of glaucoma. Rare protozoal cysts were detected within both adrenal glands. Evaluation of the

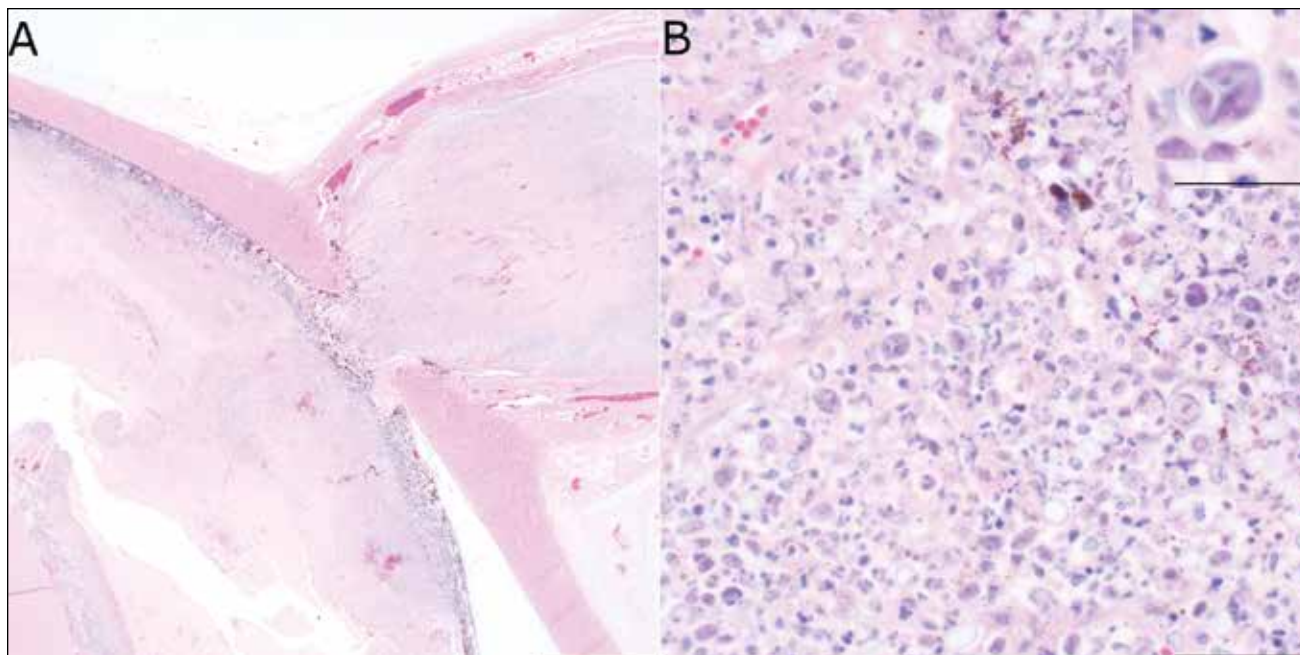


Figure 2. Photomicrographs of ocular protothecosis. A – There is marked chorioretinitis and severe optic neuritis. Abundant exudate in the posterior chamber has led to retinal detachment (retina is present in the lower left corner). H&E. Scale bar: 2 mm. B – Higher magnification of the exudate confirms the presence of numerous *Prototheca*, some showing clear evidence of endosporulation (middle of the image and top-right inset). H&E. Scale bar: 50 μ m (scale bar of inset image is 20 μ m).

brain revealed lymphoplasmacytic encephalitis with the presence of *Prototheca* organisms and protozoal cysts. The cervical and lumbar spinal cord both contained protozoal cysts.

Additional diagnostic investigations followed the post-mortem examination. Brain tissue submitted to the University of Guelph Animal Health Laboratory (Guelph, Ontario) for PCR and immunohistochemical testing was positive for *T. gondii* and negative for *N. caninum*. Culture of affected kidney yielded smooth and white yeast-like colonies on blood agar plates after 24 h of incubation at 35°C. Subsequent wet mount and staining with lactophenol cotton blue demonstrated the characteristic internal septations and thick walls of sporangia. A focused review of urine sediment was performed with rare *Prototheca* organisms visualized. Rigorous re-examination of the previously submitted lymph node aspirates revealed rare structures consistent with *Prototheca* organisms. Repeated attempts at DNA isolation were unsuccessful, precluding speciation. The dog was ultimately diagnosed with systemic protothecosis and toxoplasmosis.

Discussion

Protothecosis in this dog was not diagnosed ante-mortem due to several factors. These included the diagnosis of toxoplasmosis believed to be responsible for clinical signs, the low index of suspicion for protothecosis based on the rarity of this disease and lack of gastrointestinal signs, and the absence of organisms identified on initial cytologic examination. To the authors' knowledge, the only previous case of canine protothecosis reported in Canada occurred in a dog in Ontario that had travelled to Thailand (17). The current case emphasizes that although rare, protothecosis should remain a consideration in Canadian dogs

with comparable clinical signs. Canine protothecosis remains a diagnostic challenge, as emphasized by the delayed diagnosis in this case. This dog had many features consistent with reported cases of canine protothecosis, including ocular, neurologic, and renal involvement (1,4,13). Despite gastrointestinal system involvement being frequently described, gastrointestinal signs were not observed in this dog. This is an unusual and interesting aspect of this case. Mild ultrasonographic thickening of the gastrointestinal tract was present ante-mortem. However, evaluation of the gastrointestinal tract was unsuccessful at post-mortem due to severe autolysis limiting conclusions.

Tissue samples are often necessary for diagnosis given the sparsity of *Prototheca* organisms in cytological samples. This was demonstrated in this case in which despite disseminated disease, no organisms were visualized in cerebrospinal fluid or lymph node aspirates evaluated ante-mortem. Cytological detection by less invasive methods may be feasible and potentially rewarding. Urine sediment evaluation, especially if larger volumes of urine are centrifuged to result in a large amount of sediment for microscopic examination, may allow diagnosis. This is supported by a study in which the presence of *Prototheca* organisms in urine sediment was confirmed in 4 of 8 dogs (18). That study also documented urine culture as a viable method for diagnosis of protothecosis. The potential diagnostic utility of urine sediment evaluation is also highlighted in the current case, with rare *Prototheca* organisms identified on a focused urine sediment review performed post-mortem. Although not available in the current case due to autolysis, histologic examination of colon and rectum tissue samples have shown reasonable rates of organism detection and thus appears to be

a useful diagnostic test (12). With continued disease awareness and organism recognition, ante-mortem diagnosis of canine protothecosis may increase.

Co-infection with *T. gondii* clouded the clinical picture in this case as both organisms can cause disseminated disease with overlapping clinical signs. Canine disseminated toxoplasmosis often has neurologic and ocular involvement (19), like that of protothecosis. Dogs and cats with toxoplasmosis have been reported to have concurrent multipathogen infections, with neosporosis, leishmaniasis, rickettsial infections, canine distemper virus, and canine parvovirus described (19). Infection with one opportunistic organism such as toxoplasmosis should raise clinical suspicion for additional infectious agents.

Co-infection with these 2 opportunistic organisms is suggestive of immunosuppression. In humans, immunosuppressed individuals are at a higher risk of developing *Prototheca* infections compared to non-immunocompromised patients (7,8). Given the ubiquitous presence of *Prototheca* organisms in the environment and the low infection rate, clinical canine protothecosis is also likely associated with an immunocompromised state (1,13). Immune system dysfunction at a cellular level, or localized to the intestinal tract, has been suggested as a contributing factor to the overrepresentation of collie and boxer dogs with protothecosis (12,16,17). Concurrent protothecosis and toxoplasmosis in the dog described herein supports a potential role of immunosuppression in *Prototheca* infections and highlights the importance of screening for concurrent diseases.

Canine protothecosis remains a poorly characterized disease, with topics such as risk factors and treatments requiring further research. Increased awareness of this rare but potentially fatal disease will help facilitate the prompt recognition and intervention as well as generating data to understand this serious disease more completely.

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Case Report **Rapport de cas**

Reverse sneezing as a clinical manifestation of nasopharyngeal-oropharyngeal fistula in a dog

Marianthi Gelatos, Sara A. Colopy, Kenneth Waller, Jessica C. Pritchard

Abstract — A 6-year-old spayed female Labrador retriever was evaluated for a 3-month history of intermittent reverse sneezing and gagging episodes. Pertinent findings at evaluation included frequent reverse sneezing and non-productive retching. No pathology was visible on sedated oral examination. Contrast-enhanced computed tomography of the skull revealed a gas-filled defect within the left ventral aspect of the soft palate. A non-eroded defect was present in the left caudoventral nasopharyngeal wall on nasopharyngoscopy. Surgical exploration revealed a nasopharyngeal-oropharyngeal fistula within the left palatine tonsillar fossa. The dog had a witnessed oropharyngeal stick injury (OSI) 3 months previous in the location of the fistula. The OSI had been allowed to heal by secondary intention and was treated with an oral antibiotic and NSAID. However, the dog lacked characteristic signs of a chronic OSI such as nasal discharge or abscess formation. The defect in the soft palate was surgically debrided and closed, and the left palatine tonsil was excised. The dog recovered completely with cessation of reverse sneezing and retching episodes.

Résumé — Éternuements inversés comme manifestation clinique d'une fistule oropharyngée-nasopharyngée chez un chien. Une femelle Labrador stérilisée âgée de 6 ans a été évaluée pour une histoire de 3 mois d'épisodes intermittents d'éternuements inversés et d'étouffements. Les résultats pertinents lors de l'évaluation comprenaient des éternuements inversés fréquents et des haut-le-cœur non productifs. Aucune pathologie n'était visible à l'examen oral sous sédation. La tomodensitométrie à contraste améliorée du crâne a révélé une imperfection remplie de gaz dans la face ventrale gauche du palais mou. Une imperfection non érodée était présente dans la paroi nasopharyngée caudo-ventrale gauche à la nasopharyngoscopie. L'exploration chirurgicale a révélé une fistule nasopharyngée-oropharyngée au sein de la fosse amygdalienne palatine gauche. Le chien a eu une blessure oropharyngée par une branche (OSI) il y a 3 mois à l'emplacement de la fistule. L'OSI avait été laissée à guérir par seconde intention et a été traitée avec un antibiotique oral et un AINS. Cependant, le chien ne présentait pas de signes caractéristiques d'une OSI chronique comme un écoulement nasal ou la formation d'abcès. Le défaut du palais mou a été chirurgicalement débridé et fermé, et l'amygdale palatine gauche a été excisée. Le chien s'est complètement rétabli avec l'arrêt des épisodes d'éternuements inversés et de haut-le-cœur.

(Traduit par D^r Serge Messier)

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Reverse sneezing occurs when irritation to the nasopharyngeal mucosa triggers spasms of the pharyngeal muscles preventing air passage to the larynx. Instead, secretions and foreign material are transferred to the oropharynx for swallowing. Reverse sneezing also promotes mucociliary clearance of secretions and foreign material by triggering a coughing episode following a reverse sneezing episode.

In many small breed dogs, reverse sneezing paroxysms are idiopathic, nonpathological, and do not progress. Pathologic

causes of reverse sneezing are commonly associated with space-occupying lesions within the nasopharynx including benign or malignant space-occupying masses, foreign bodies, and fungal mats/granulomas (*e.g.*, sinonasal aspergillosis). Other nasopharyngeal irritants leading to increased secretions and reverse sneezing include viral infection, allergic rhinitis, or parasitic disease such as the nasal mite *Pneumonyssoides caninum* (1–4). Diagnosis of the underlying cause of pathologic reverse sneezing requires a thorough review of the history, as well as findings

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from a general physical examination, computed tomography (CT), rhinoscopy, and nasopharyngoscopy.

This case report is unique because it describes a dog in which chronic reverse sneezing was the primary clinical sign occurring secondary to a nasopharyngeal-opharyngeal fistula. The goal for this case report is to describe the clinical presentation, diagnosis, management, and outcome of a nasopharyngeal-opharyngeal fistula that formed secondary to an oropharyngeal stick injury (OSI) in a dog.

Case description

A 6-year-old spayed female Labrador retriever was presented to the University of Wisconsin Veterinary Care for evaluation following an ~3-month history of persistent reverse sneezing, intermittent gagging, and recent onset halitosis. Three months before referral, the dog had been observed running with a stick, during which time she vocalized and began to extend her head and neck unable to further vocalize or bark. The dog was taken to a veterinarian that day for evaluation, where she was discovered to be febrile (39.6°C). The remainder of the physical examination was reportedly unremarkable. Radiographs of the cervical and thoracic regions were performed in addition to a sedated oral examination. Radiographic evaluation revealed a scant amount of gas striating the retropharyngeal space, dorsal to the larynx, spanning the level of the stylohyoid bones to the plane of the larynx. Sedated oral examination revealed trauma to the left caudal soft palate, with no foreign material observed. She was discharged with 5 d of carprofen (Rimadyl; Zoetis, New Jersey, USA), 2 mg/kg body weight (BW), PO, q12h, 2 d of maropitant (Cerenia; Zoetis, New Jersey, USA), 2.4 mg/kg, BW, PO, q24h, and 5 d of doxycycline (Wedgewood Pharmaceuticals, New Jersey, USA), 8 mg/kg, BW, PO, q12h as treatment for oropharyngeal trauma.

Three days after initial presentation, the dog was able to eat and drink normally, but she began to experience intermittent episodes of reverse sneezing and gagging. Four weeks after initial presentation, the dog returned to the primary veterinarian with the chief complaint of intermittent hacking and reverse sneezing. She had an inducible cough on tracheal palpation during physical examination. Sedated oral examination was repeated and an ~2 cm area of swelling along the left caudal soft palate, as well as an associated draining tract adjacent to the left palatine tonsil were noted. A small volume of fluid was aspirated from the draining tract, and cytology revealed neutrophilic inflammation and the presence of rod bacteria. Aerobic culture and susceptibility testing was submitted on the fluid obtained, and the dog was discharged with a 2-week course of clindamycin (Midwest Pharmaceuticals, Michigan, USA), 12 mg/kg, BW, PO, q24h. Culture results revealed significant growth of *Enterobacter cloacae*. Based on the bacterial antibiotic susceptibility profile, ciprofloxacin (Rising Pharmaceuticals, New Jersey, USA), 20 mg/kg, BW, PO, q24h was prescribed 7 d later and subsequently the owner reported some improvement in both reverse sneezing and gagging. Consideration of referral for additional diagnostics to address the reverse sneezing was recommended at that time.

Three months after the initial date of injury the dog was presented to the University of Wisconsin Veterinary Care.

During the physical examination, the dog experienced frequent episodes of reverse sneezing, gagging, and non-productive retching when excited. Additional examination findings included marked halitosis and a mild left submandibular lymph node enlargement. The dog was non-painful upon opening the mouth and during palpation of the laryngeal region and temporomandibular joint. The remainder of the dog's physical examination was unremarkable. Routine laboratory testing [complete blood (cell) count, chemistry profile] was unremarkable. Sedation for an oral examination was achieved using intramuscular methadone (Akorn Pharmaceuticals, Illinois, USA), 0.5 mg/kg, BW, IM and dexmedetomidine (Dexdomitor, Zoetis, New Jersey, USA), 0.005 mg/kg, BW, IM followed by intravenous propofol administered to effect through a 20-gauge IV catheter placed in the left cephalic vein. The sedated oral examination revealed no marked abnormalities. A contrast enhanced CT scan of the head was then taken under general anesthesia. The imaging revealed a cone-shaped gas-containing defect in the left dorsolateral soft palate with mild peripheral contrast enhancement, tapering at the apex of the defect approaching the tonsillar region (Figure 1) and incidental right otitis media.

Following review of the dog's CT images, retroflexed nasopharyngoscopy revealed a non-eroded defect within the wall of the left caudoventral nasopharynx (Figure 2). On further oral examination, an area of mild erythema was noted within the left palatine tonsillar crypt. Probing of the tonsillar crypt with a 20-gauge peripheral intravenous catheter documented a small, healed fistula without obvious abscessation between the oral cavity and the left caudal nasopharynx. This region of this lesion corresponded to the defect noted on nasopharyngoscopy (Figure 3 A). The fistula was flushed with sterile saline using a curved tip dental oral irrigation syringe. The decision was made to conduct a left tonsillectomy with resection of the fistulous tract. An elliptical incision was made around the left tonsil with a scalpel blade. The left tonsil and tonsillar crypt were then sharply excised along with the fistulous tract and associated scar tissue (Figure 3 B). The defect in the soft palate was closed with 3-0 glycomer 631 in a simple continuous pattern (Figure 3 C). The palate was inspected to ensure there was no longer communication between the nasopharynx and oral cavity after surgical repair. The excised tissue was submitted for histopathology, which revealed lymphoid hyperplasia as well as abundant granulation tissue formation. No foreign material was identified grossly, during flushing, or histologically.

The dog had an uneventful recovery from general anesthesia with cessation of reverse sneezing and gagging episodes, and was later discharged with 10 d of fluconazole (Glenmark Pharmaceuticals, Mumbai, India), 5 mg/kg, BW, PO, q12h and 14 d of mometasone (Perrigo pharmaceuticals, Dublin, Ireland), in the right ear, q24h as treatment to address fungal otitis suspected to be un-related to the chronic nasopharyngeal-opharyngeal fistula. No additional antimicrobials were prescribed, and the dog was given 3 d carprofen (Rimadyl; Zoetis, New Jersey, USA), 2 mg/kg BW, PO, q12h. Five months following surgical repair of the nasopharyngeal-opharyngeal fistula, the dog's owners reported continued complete resolution of her reverse sneezing and gagging episodes.

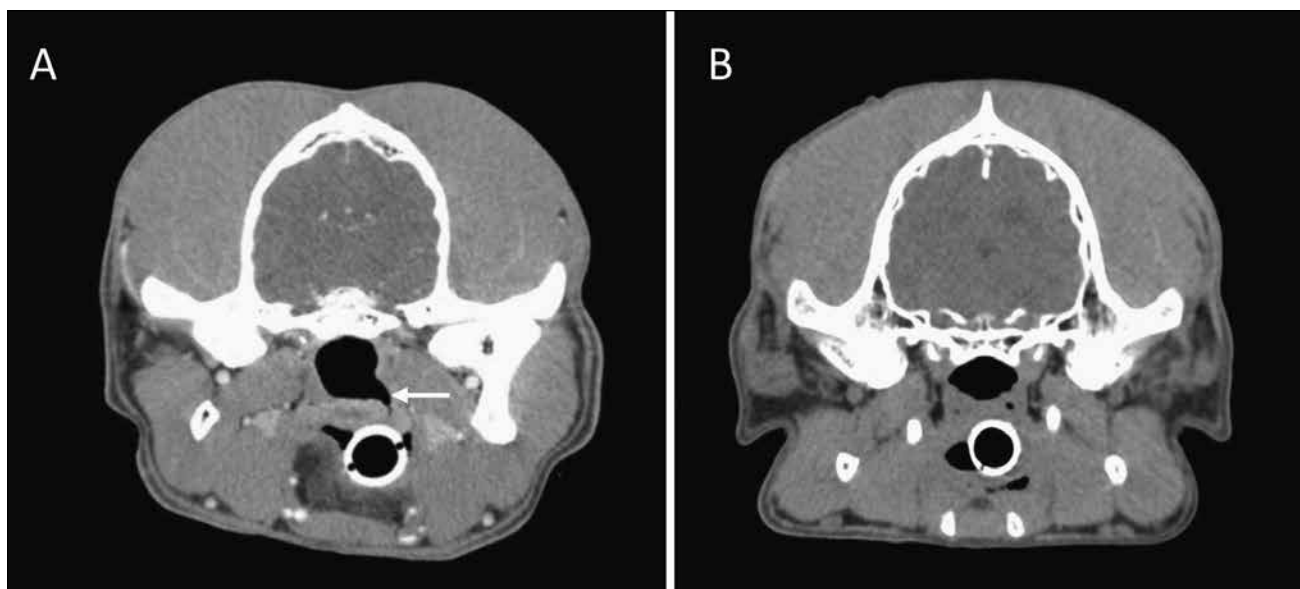


Figure 1. Contrast-enhanced and plain computed tomography (CT), transverse plane; right to left. A – At the level of the cone-shaped gas containing defect in the left dorsolateral soft palate (white arrow). B – A clinically normal patient at approximately the same anatomic location, with a smooth typical ovoid shape to the nasopharynx.



Figure 2. Retroflexed nasopharyngoscopy image of the reported dog's nasopharynx (*) and defect in the left ventrolateral nasopharyngeal wall (^).

Discussion

A diagnosis of nasopharyngeal-oro-pharyngeal fistula secondary to a chronic oropharyngeal stick injury (OSI) was made in this dog based on a combination of history, advanced imaging findings, and thorough oral examination. This dog's predominant presenting complaint was frequent episodes of reverse sneezing, which has not been a previously reported clinical sign in dogs with chronic OSI or oronasal fistulae.

Oropharyngeal stick injury is a relatively common cause of oropharyngeal trauma, and is typically the result of impalement during stick chasing or stick chewing in medium to large

breed dogs (5). Common breeds presenting with OSI include border collies, collies, German shepherds, mixed breeds, English springer spaniels, and Labrador retrievers (6,7). Oropharyngeal stick injuries are generally categorized as acute (< 7 d) or chronic (> 7 d), with differences in both clinical presentation, treatment, and prognosis based on type (6,8).

Acute OSIs are usually diagnosed based on eyewitness accounts of the accident. The most common clinical signs associated with acute OSI are oropharyngeal or cervical pain, oral bleeding, ptyalism, swelling, or the presence of subcutaneous emphysema, although some dogs may present with more subtle symptoms such as inappetence, pyrexia, dyspnea, lethargy, dysphagia, gagging, and halitosis (5–8). Chronic OSI is often more difficult to diagnose due to lack of an eyewitness account and has been associated with signs including abscess formation secondary to the presence of foreign material, draining tracts, chronic nonhealing wounds, nasal discharge, swelling, and halitosis (5,6). Importantly, the presence of draining tracts may or may not be reported by owners, as 69% failed to note them in one study evaluating chronic OSI (6).

Diagnosis of OSI is based on history, physical examination findings, and imaging findings. Routine laboratory testing (CBC, blood chemistry profile, urinalysis) is typically unremarkable. Plain and contrast radiography, ultrasonography, CT, and magnetic resonance imaging (MRI) are diagnostic imaging modalities that have been described in the diagnosis of OSI (5,8–11). Cervical emphysema seen on plain radiographs is a frequent clinical finding in acute OSI and in one study was associated with the presence of blunt trauma tracts in all dogs, making it a useful initial diagnostic test in dogs suspected of acute OSI (7). In contrast, plain radiography is unlikely to be helpful in dogs with chronic OSI as emphysema has likely resolved and wooden foreign material has absorbed fluids leaving it a similar radiopacity to the surrounding tissues (6).



Figure 3. Images of the dog's oral cavity with the patient in dorsal recumbency under general anesthesia. A – A 20-gauge IV catheter is passed through nasopharyngeal-opharyngeal fistula noted in left palatine tonsillar fossa. B – The nasopharyngeal-opharyngeal fistula, as well as adjacent left palatine tonsil after surgical debridement. C – Sutures in the place of the previous nasopharyngeal-opharyngeal fistula following surgical repair.

The goals of treatment differ between acute and chronic OSI. With acute OSI, stabilization may be necessary depending on the location of the penetration and degree of swelling present. For acute OSI, definitive treatment is aimed at removal of any residual foreign material, repair of damaged soft tissue structures, and lavage of the affected tissues, often with surgical exploration under general anesthesia (7). Early surgical exploration is the best course of action to optimize outcome. Suggested antimicrobial prophylaxis with amoxicillin-clavulanate and metronidazole is aimed at organisms commonly seen in the dog oropharynx or with wounds contaminated with bacteria that have been recovered; such as, *Staphylococcus aureus*, *Streptococcus* spp., *Escherichia coli*, and *Clostridium* spp. (7). The prognosis following appropriate treatment of dogs with acute, non-life threatening OSI is favorable (5–7). In one study, all dogs with acute OSI ($n = 6$) survived; in another study, all 24 dogs with pharyngeal penetration survived, whereas 64% with esophageal penetration survived (6,7).

When chronic OSI is diagnosed, treatment is focused on removal of any residual foreign material, aggressive surgical debridement of abscesses and chronic inflammatory tissue, and exploration of all draining tracts (6). In the largest case series of chronic OSI to date, the initial injury site was identified in fewer than half of dogs, necessitating thorough evaluation. Historically, the prognosis associated with chronic OSI is poorer, with a previous case series describing an approximate 60% success rate for resolution of clinical signs within a 6-week follow-up period (6). Patients in that case series were considered to have failed therapy if clinical signs of dysphagia, ptyalism, abscess formation, or oral bleeding recurred within the follow-up period. The poor prognosis associated with chronic oropharyngeal stick injuries is related to the risk of aberrant migration of any remaining foreign material, thus making it more difficult to locate and successfully remove, recurrent abscessation, and granulation tissue formation (5,6).

Aside from a newly noted halitosis, the dog reported here lacked classic clinical signs of chronic OSI, with the primary presenting complaint of reverse sneezing. On initial sedated oral examination, no draining tracts or swelling were observed. Computed tomography was used to evaluate this dog for the

presence of nasopharyngeal foreign material or masses as causes of its reverse sneezing. No foreign material was observed on CT examination of this dog's head, or upon oral examination. Only the small nasopharyngeal-opharyngeal fistula was noted. In this dog, small fragments of wood or other soft tissue attenuating foreign material may have been overlooked as this is a known limitation of advanced imaging modalities including CT and MRI (5). Despite these drawbacks, CT and MRI are the preferred imaging modalities as they allow for better inspection of the entire pharyngeal area and surrounding soft tissue and bony structures, thus allowing for more accurate lesion localization (1,8,10). In this dog, the combination of CT scan and nasopharyngoscopy provided the necessary direction to diagnose the nasopharyngeal-opharyngeal fistula by probing of the left palatine tonsillar fossa.

Given the location of the fistula and the previously reported OSI, it seems likely that fistula formation was secondary to a healed OSI tract and the dog's reverse sneezing was the result of oral material traversing the fistula and irritating the nasopharynx. This dog completely recovered without complication following surgical debridement and closure of the fistula noted on examination, despite poorer reported prognoses for chronic OSI, potentially due to the unique manifestation reported here (6).

This is the first report describing intermittent periods of reverse sneezing as a clinical manifestation of chronic OSI. Reverse sneezing is not a previously reported clinical sign in acute or chronic cases of OSI or nasopharyngeal-opharyngeal fistula. This report highlights the importance of considering oropharyngeal penetrating injury or nasopharyngeal-opharyngeal fistulae as a differential when acute onset reverse sneezing is reported.

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Case Report **Rapport de cas**

Inadvertent placement of an esophagostomy tube into the mediastinum of a cat

Shannon Kelly, Carsten Bandt

Abstract — An 8-year-old neutered male Siberian forest cat was presented for respiratory distress. Endoscopy, exploratory surgery of the neck, and sternotomy confirmed initial placement of the esophagostomy tube (e-tube) into the mediastinum. The patient recovered from surgery, developed laryngeal paralysis, and then arrested and died within 48 h after surgery.

Key clinical message:

To the authors' knowledge, there are no other case reports documenting inadvertent placement of an e-tube into the mediastinum of a cat. This case report highlights the complications that can be associated with incorrect placement of an e-tube.

Résumé — Placement par inadvertance d'un tube d'œsophagostomie dans le médiastin d'un chat. Un chat des Forêts sibériennes mâle castré âgé de 8 ans a été présenté pour détresse respiratoire. L'endoscopie, la chirurgie exploratoire du cou et la sternotomie ont confirmé le placement initial du tube d'œsophagostomie (e-tube) dans le médiastin. Le patient s'est remis de la chirurgie, a développé une paralysie laryngée, puis a fait un arrêt cardiaque et est décédé dans les 48 heures suivant la chirurgie.

Message clinique clé :

À la connaissance des auteurs, il n'y a pas d'autres rapports de cas documentant le placement par inadvertance d'un e-tube dans le médiastin d'un chat. Ce rapport de cas met en évidence les complications qui peuvent être associées au placement incorrect d'un e-tube.

(Traduit par D^r Serge Messier)

Can Vet J 2022;63:1124–1128

Anorexia is one of the most common clinical signs in ill cats that require hospitalization. Institution of early enteral nutrition is important in promoting recovery of critically ill patients, as malnutrition can lead to immunosuppression, impaired metabolic function, and compromised wound healing (1,2).

E-tubes have been used widely in veterinary medicine to provide enteral nutrition to dogs and cats. They are placed at the mid-cervical region allowing animals to still be able to intake orally on their own (3,4). However, several complications have been associated with e-tube placement in cats and dogs including patient removal of the tube, vomiting, difficulties with the tube itself (obstruction), inflammation around the stoma site, infection, and abscess formation (5). In a retrospective study of complications associated with e-tube placement

in cats, 19/52 (36.5%) of cats experienced a complication. Complications varied and included inflammation at the tube site and vomiting (6).

To the authors' knowledge, there are no published reports of incidental placement of an e-tube into the mediastinum of cats.

Case description

An 8-year-old neutered male Siberian forest cat weighing 4.69 kg was presented to the emergency service for respiratory distress. Prior to transfer, the patient had been initially seen at the primary care veterinarian who documented that the patient had been presented to their clinic with a several-day history of vomiting, diarrhea, and inappetence. Upon examination, he was quiet and alert. He was euhydrated, his respiratory rate was 36 bpm, heart rate 200 bpm, temperature 40.7°C, his mucous membranes were pink and moist, and abdominal discomfort was appreciated. Routine in-clinic blood work (CBC and chemistry) demonstrated suspected bands, mild eosinopenia at $0.12 \times 10^9/L$ [reference range (RR): 0.17 to $1.57 \times 10^9/L$], mild thrombocytopenia at 144 K/ μL (RR: 151 to 500 K/ μL), low urea at 4.3 mmol/L (RR: 5.7 to 12.9 mmol/L), and mild hypophosphatemia at 0.81 mmol/L (RR: 1.00 to 2.43 mmol/L). A rapid test for pancreatitis (spec fPL) was normal. Urinalysis revealed a USG of 1.024.

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Figure 1. Left lateral thoracic radiograph showing the endotracheal tube and e-tube.

Abdominal radiographs demonstrated concern for functional ileus, gastric content, and splenomegaly. Chest radiographs indicated equivocal mild cardiomegaly. An abdominal ultrasound revealed thickened small intestines due to thickening of the muscularis layer with preservation of wall layering, reactive lymphadenopathy, splenomegaly, and questionable gastric content concerning foreign material. Fine-needle aspirations of the liver revealed lymphocytic inflammation, those of the spleen demonstrated possible reactive lymphoid hyperplasia, and those of the mesenteric lymph node revealed reactive lymphoid hyperplasia with mild neutrophilic inflammation. A fever of unknown origin panel was negative and cardiac ultrasound was normal. Diarrhea panel was positive for coronavirus. Based on these findings, inflammatory bowel disease or lymphoma was suspected.

The cat was supported with intravenous fluids, maropitant, ampicillin, metronidazole, and buprenorphine. After 48 h of hospitalization, he was sedated with butorphanol (10 mg/mL), 0.2 mg/kg IV, 0.2 mg/kg, midazolam (5 mg/mL), IV, and alfaxalone (10 mg/mL), 2 mg/kg, IV. Endoscopy was performed and a large tricobezoar was removed from the stomach. Due to continued anorexia in clinic, the referring veterinarian placed an e-tube into the left lateral neck using a standard technique and fastened with a purse string suture (specific details of the procedure were not provided). No complications were noted with anesthesia. A single left lateral thoracic radiograph (with radiologist interpretation) showed an endotracheal tube in place and another radiopaque tube superimposed over the neck and thorax with the exact location of this tube difficult to determine. This tube was suspected to be the e-tube (Figure 1). E-tube feedings were initiated several hours after placement and the cat was discharged the next day. The cat was returned to the primary care veterinarian the following day for respiratory distress and then transferred to the emergency service the same day. The e-tube was removed by the referring veterinarian prior to presentation to the emergency service.

On presentation, the cat was quiet and alert, normothermic (38.3°C), normotensive at 120 mmHg (Doppler Flow Detector; Parks Medical Mechanics, Aloha, Oregon, USA), mucous membranes were pink, with a SpO₂ of 100% on room air. His respiratory rate was normal (28 breaths/min) with dull lungs sounds ventrally bilaterally. His mouth was held slightly open with marked ptyalism. There was an open wound on the left lateral neck where the e-tube had been initially placed (the e-tube was not present at this time). A 22-gauge intravenous catheter was present in the left forelimb and patent.

Abdominal focused assessment with sonography for trauma (AFAST) demonstrated bilateral pleural effusion. A series of diagnostics were performed. Initial blood gas revealed a mild respiratory acidosis (ABL 800 Flex; Radiometer, London, Ontario). Three-view thoracic radiographs (with radiologist interpretation) demonstrated a mass effect dorsal to the trachea causing marked widening of the cranial mediastinum, a moderate volume of bilateral pleural effusion, and possible mild cardiomegaly (Figure 2 a–c). A thoracic ultrasound demonstrated moderate to marked echogenic cranial mediastinal sediment with moderate bilateral pleural effusion.

The patient was sedated with midazolam (0.1 mg/kg, IV), fentanyl (3 µg/kg, IV), and alfaxalone (1.9 mg/kg, IV), and a right-sided thoracocentesis was performed. Approximately 63 mL of serosanguinous fluid was removed. Cytology of the pleural effusion demonstrated septic exudate/pyothorax with a WBC count of $25 \times 10^9/L$ without bands. A complete blood (cell) count and chemistry revealed a leukocytosis characterized by neutrophilia of $16.47 \times 10^9/L$ (RR: 2.1 to $8 \times 10^9/L$), lymphopenia at $0.72 \times 10^9/L$ (RR: 1 to $5.6 \times 10^9/L$), a mild decrease in BUN at 5.4 mmol/L (RR: 6 to 14 mmol/L), creatinine of 84.2 µmol/L (RR: 89 to 189 µmol/L), mild hypocalcaemia at 1.99 mmol/L (RR: 2.26 to 2.8 mmol/L), mild hyponatremia at 143 mmol/L (RR: 146 to 155 mmol/L), hypoalbuminemia at 19 g/L (RR: 28 to 26 g/L), mild decrease in globulins 32 g/L (RR: 35 to 58 g/L) mild elevation in bilirubin

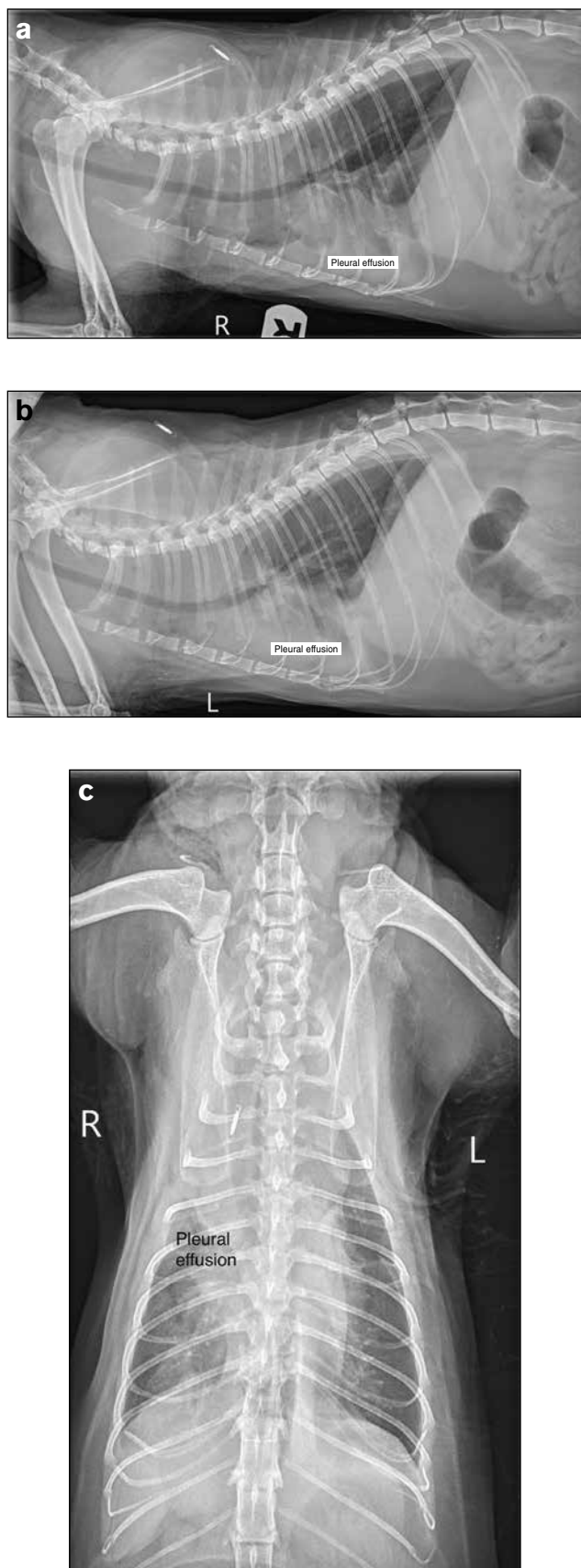


Figure 2. Thoracic radiographs showing a mass effect dorsal to the trachea causing marked widening of the cranial mediastinum and a moderate volume of bilateral pleural effusion. a – right lateral view; b – left lateral view; c – ventrodorsal view.

at 9.5 $\mu\text{mol/L}$ (RR: 0 to 8 $\mu\text{mol/L}$), and a moderate increase in creatine phosphokinase at 1104 U/L (RR: 0 to 55 U/L) (True North Veterinary Diagnostics, Langley, British Columbia).

Endoscopy was used to evaluate the pharynx and esophagus. The cat was sedated with fentanyl (5 $\mu\text{g/kg}$, IV) and alfaxalone (2 mg/kg, IV), and maintained with isoflurane. An 8-mm gastroscope was used for the endoscopy and bruising was seen in the ventral and left side of the pharynx. Furthermore, the esophagus was easy to inflate and was normal with no mucosal lesion/opening in the neck area indicating no evidence that an e-tube was ever placed into the esophagus. The cat then underwent neck exploratory surgery and sternotomy. Surgery revealed that the area dorsal and left of the trachea was impacted with cat food and blood, an entry wound from the left lateral neck was contiguous with the skin, retropharyngeal hemorrhage and food impaction, extension of food into the cranial mediastinum, and no evidence of any incision ever being made into the esophagus. The food was manually removed from this area, suction was performed, and the area was closed. A ventral sternotomy was then performed that revealed food material within the mediastinum and pleural cavity. The area was lavaged and closed. An e-tube (14 French Small Animal Esophagostomy Tube; Jorgensen Laboratories, Loveland, Colorado, USA) was then placed and confirmed by palpation and radiographs. A left 14 g MILA thoracostomy tube (Mila International, Florence, Kentucky, USA) and a right 10 French Jackson-Pratt channel drain (Cardinal Health, McGaw Park, Illinois, USA) that extended through the thoracic inlet was placed.

The cat recovered from surgery uneventfully and was noted to be eupneic and comfortable. He continued to receive isolyte and the following continuous rate infusions: fentanyl (4 $\mu\text{g/kg}$ per hour), ketamine (0.18 mg/kg per hour), midazolam (0.1 mg/kg per hour), alfaxalone (0.05 mg/kg per minute) (to help limit stress of handling), and metoclopramide (0.08 mg/kg per hour). In addition, he was given amoxicillin-clavulanic acid (22 mg/kg, IV, q8h), pantoprazole (1 mg/kg, IV, q12h), maropitant (1 mg/kg, IV, q24h), and dexamethasone (0.12 mg/kg, IV) once to help reduce any swelling around the larynx.

Two hours after surgery, intermittent open mouth breathing, stridor, and left-sided Horner's syndrome were noted. His SpO_2 on room air was 100%. Oropharyngeal examination revealed laryngeal paralysis, and neuropraxia was suspected. A nasal tracheal tube was placed to initiate oxygen therapy at 0.25 L/min, which immediately improved his breathing.

Within the next 24 h, an oral examination was performed with the surgeon confirming laryngeal paralysis and laryngeal swelling. The cat then had a right-sided laryngeal tieback performed for the laryngeal paralysis. It was elected to proceed with this to limit complications that could develop from a temporary tracheostomy (e.g., occlusion, dislodgement, or death). Repeat thoracic radiographs (with radiologist interpretation) revealed aspiration pneumonia in the right caudal lung lobe (Figures 3 a–c).

Despite these interventions, the cat became cyanotic and required intubation with flow by oxygen. Several episodes of desaturation were noted in which intermittent suctioning of the endotracheal tube was required (due to mucus and serosanguinous fluid accumulation). His SpO_2 would return to normal after

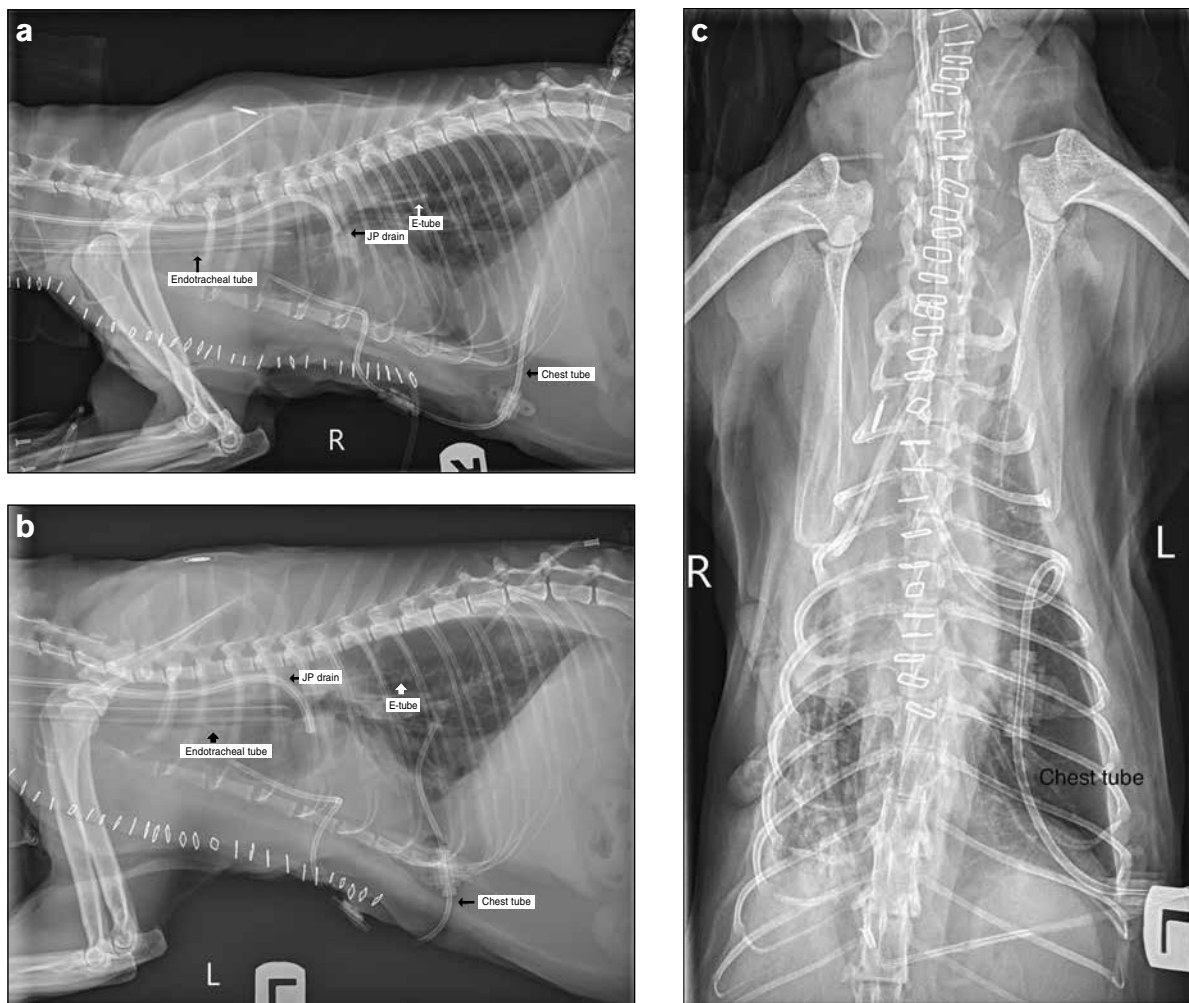


Figure 3. Thoracic radiographs showing aspiration pneumonia characterized by a mild to moderate patchy interstitial pattern in the right caudal lung lobe. a – the right lateral view; b – left lateral view; c – ventrodorsal view.

suction. The cat also had an episode during one of the suctions in which his heart rate dropped to 100 bpm. Once suction was removed and oxygen provided, his heart rate normalized. The cat received intermittent manual positive pressure ventilation. Mechanical ventilation was discussed; however, before this could be initiated, the cat was noted to be bradycardic with dilated pupils, an absent pupillary light reflex, bilaterally, and an absent palpebral and corneal reflex. His breathing became shallow. The cat arrested, and cardiopulmonary resuscitation (CPR) was commenced, but owners elected to cease CPR.

Discussion

Esophagostomy tube (e-tube) placement is beneficial for providing enteral nutrition in critically ill animals. E-tubes can be left in place for several weeks and easily managed by the owner (7). One study stated the average duration of e-tube placement was 23 d (6). E-tubes have been used to introduce nutrition in a variety of patients with various conditions, including chronic kidney disease, several dental disease, maxillofacial trauma, or pharyngeal masses (8,9). The main disadvantage is the short-duration general anesthesia needed in an already critically ill patient (3).

Several studies have evaluated complications associated with e-tube placement in cats. In a retrospective study that evaluated complications in 103 dogs and 123 cats, complication rates were 43.1 and 45.5%, respectively (5). Complications included erythema around the stoma site, loose sutures, and vomiting of the tube. One cat and 7 dogs had evidence of food coming through the stoma, which had not been previously reported (5). One cat in the study was euthanized due to septic shock secondary to infection at the stoma site, and 1 dog was euthanized due to severe regurgitation and aspiration pneumonia (5). E-tubes have also been known to cause peristomal cellulitis. This can be prevented by ensuring that the sutures are not too tight and keeping the site clean and dry (10). In another recent study that evaluated complications associated with esophageal feeding in cats, complications occurred in 35.8% of cats. The most common complication was tube dislodgement and then stoma site infections (11). Other less common complications included temporary laryngeal paralysis to focal esophageal rupture. None of the cats in that study died (11).

There are apparently no case reports published documenting mediastinal placement of an e-tube. The mediastinum is the space between the 2 pleural sacs; it can be divided into the

cranial, middle, and caudal areas, and sub-divided into dorsal and ventral areas. The dorsal mediastinum contains the trachea, esophagus, as well as veins and nerves (12). A lateral thoracic radiograph should always be performed to confirm e-tube placement. If placement is uncertain, a small amount of a nonionic contrast material can be placed through the e-tube to confirm esophageal placement (7,13).

The cat in this case had the e-tube initially placed by the primary care veterinarian. It was placed routinely through the left side of the neck, but endoscopy and surgical intervention performed at the time of referral confirmed that the e-tube was never placed in the esophagus. The proposed mechanism for mediastinal placement was for the e-tube to have been placed through the left lateral neck, enter the soft tissue structures adjacent to the esophagus and pharynx and then directly into the mediastinum. The radiographs done before presentation to the emergency clinic were not specific as to whether the e-tube was confirmed to be within the esophagus. Additional methods to confirm placement of the e-tube could include the use of contrast and additional radiographic views with radiologist interpretation. Prevention of erroneous mediastinal e-tube placement can be accomplished by ensuring that the forceps placed into the esophagus are exposed through the skin incision on the left lateral neck when introducing the e-tube. This guarantees that the e-tube enters the esophagus. If, at the time of placement, it is known that the e-tube enters the mediastinum, the tube should be immediately removed, and the patient monitored for signs of respiratory distress.

Laryngeal paralysis is uncommon in cats and the causes are often undetermined (14). Congenital and acquired forms have been documented. Causes reported include thyroidectomy, infiltration of the vagus nerve by lymphoma, and part of a presumptive generalized neuromuscular disorder (15). Acquired laryngeal paralysis usually involves damage to the recurrent laryngeal nerve. This is a branch of the vagus nerve that courses through the neck to innervate the cricoarytenoideus dorsalis muscle that abducts the arytenoid cartilage (15,16). In this case, it is suspected that there was trauma/inflammation to the region of the neck where the nerve courses through, causing laryngeal paralysis.

Left Horner's syndrome also developed in this cat. The vagosympathetic trunk courses through the cervical region, in close to the esophagus and innervates the muscles of the eye (16). Damage or inflammation to the cervical region from attempted e-tube placement is the proposed mechanism of Horner's syndrome development in this cat. The degree of damage to the vasosympathetic trunk is unknown. A previous case report documented development of Horner's syndrome after e-tube placement; however, the patient was euthanized, precluding the opportunity to determine if the Horner's syndrome resolved (17).

The cat herein was critically ill and sustained a cardiac arrest ~48 h after neck surgery and sternotomy. His initial recovery from surgery was uneventful but he then required oxygen therapy and intubation. At this time, there was effort to his breathing; however, he remained normothermic, normotensive, and had a normal heart rate and rhythm. Several episodes of desaturation of hemoglobin were noted, which resolved with

suctioning of the endotracheal tube. There were no specific changes to his treatment plan or his clinical presentation immediately prior to his sudden arrest. Just prior to arrest, his SpO₂ with oxygen supplementation was 100%. A blood gas was not performed at the time for acid/base analysis. It is well-known that septic patients are at risk for a thrombotic event (18). It would be important to consider a vascular event as the cause of death in this cat. It would also be important to consider that a large mucus plug causing an acute airway obstruction leading to hypoxemia may have been the cause for his arrest. Regardless, the cause of death remains unknown.

In conclusion, e-tubes are important in critically ill patients to provide enteral nutrition and medications, and they are relatively easy to place. Regardless, care must be taken when placing an esophagostomy tube to avoid deadly complications. Placement should always be confirmed with thoracic radiographs. If the position of the tube is uncertain, additional radiographic views, with or without contrast, should be performed. This report highlighted a fatal complication secondary to incorrect e-tube placement.

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Article

Breed predilections and prognosis for subungual squamous cell carcinoma in dogs

Olivia Chiu, Brian P. Wilcock, Anne E. Wilcock, A. Michelle Edwards

Abstract

Objective

To better document the prevalence, breed predilections, and clinical behavior of subungual squamous cell carcinomas in dogs.

Procedure

Retrospective analysis of records from 278 812 canine biopsy submissions including 1518 subungual squamous cell carcinomas from dogs in Canada between the years 2003 and 2021.

Results

In agreement with previous studies, giant schnauzers [odds ratio (OR): 56.7], standard schnauzers (OR: 20.3), Gordon setters (OR: 18.3), black standard poodles (OR: 11.1), Kerry blue terriers (OR: 9.4), Rottweilers (OR: 7.0), and several other breeds of large black dogs had a strong predilection for development of subungual squamous cell carcinomas. In giant schnauzers and standard poodles specifically, the risk of developing additional tumors on additional digits was 56%. There were no local postoperative recurrences, and the risk of detecting metastatic disease within 5 y after initial diagnosis was very low at 4%.

Conclusion

Moderately large black, or black and tan, dogs have a marked increase in the prevalence of subungual squamous cell carcinomas. At least in giant schnauzers and black standard poodles, the risk of developing additional similar tumors on additional digits is high, but the metastatic risk is very low.

Clinical relevance

Veterinarians receiving a histologic diagnosis of subungual squamous cell carcinoma in a large black (or predominantly black) dog should advise the owners of a substantial risk that the dog will develop similar tumors on other digits in 2 or 3 y following initial diagnosis, but that the risk of local recurrence or metastatic spread is extremely low.

Résumé

Prédilections de race et pronostic du carcinome épidermoïde sous-unguéal chez le chien

Objectif

Mieux documenter la prévalence, les préférences de race et le comportement clinique des carcinomes épidermoïdes sous-unguéaux chez les chiens.

Procédure

Analyse rétrospective des dossiers de 278 812 soumissions de biopsies canines, y compris 1518 carcinomes épidermoïdes sous-unguéaux de chiens au Canada entre 2003 et 2021.

Résultats

En accord avec les études précédentes, les schnauzers géants [rapport de cotes (OR) : 56,7], les schnauzers standards (OR : 20,3), les setters Gordon (OR : 18,3), les caniches standards noirs (OR : 11,1), les Kerry blue terriers (OR : 9,4), Rottweilers (OR : 7,0) et plusieurs autres races de grands chiens noirs avaient une forte prédilection pour le développement de carcinomes épidermoïdes sous-unguéaux. Chez les schnauzers géants et les caniches

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standards en particulier, le risque de développer des tumeurs supplémentaires sur des doigts additionnels était de 56 %. Il n'y a pas eu de récurrence postopératoire locale et le risque de détecter une maladie métastatique dans les 5 ans suivant le diagnostic initial était très faible à 4 %.

Conclusion

Les chiens noirs ou noirs et brun-roux de taille moyenne présentent une augmentation marquée de la prévalence des carcinomes épidermoïdes sous-unguéaux. Au moins chez les schnauzers géants et les caniches standards noirs, le risque de développer des tumeurs similaires supplémentaires sur des doigts additionnels est élevé, mais le risque métastatique est très faible.

Pertinence clinique

Les vétérinaires qui reçoivent un diagnostic histologique de carcinome épidermoïde sous-unguéal chez un gros chien noir (ou à prédominance noire) doivent informer les propriétaires d'un risque substantiel que le chien développe des tumeurs similaires sur d'autres doigts dans les 2 ou 3 ans suivant le diagnostic initial, mais que le risque de récurrence locale ou de propagation métastatique est extrêmement faible.

(Traduit par D^r Serge Messier)

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Introduction

Osteolytic invasive squamous cell carcinomas arising from the nail bed epithelium of dogs are the most prevalent digital neoplasms in dogs, representing a mean of 36% of all digital neoplasms in 3 studies totaling 459 dogs. In those same studies, squamous cell carcinoma represented 54, 65, and 70% of those tumors specifically arising at or near the nail bed (1–3). In a larger recent study, squamous cell carcinoma accounted for 758 of 1528 (49.6%) of all digital neoplasms in dogs (4). They occur primarily in medium- and large-breed dogs with a black or predominantly black haircoat, with a mean and median age of 10 y at the time of first diagnosis. Breeds identified in multiple studies as having a particularly high risk include giant schnauzers, standard schnauzers, black standard poodles, Rottweilers, Gordon setters, briards, and Kerry blue terriers. In these multiple studies, the prevalence in giant schnauzers has consistently been substantially higher than in any other breed (4–7). In data from the records of the Laboratory of Pathology and Toxicology, University of Pennsylvania, the probability for development of subungual squamous cell carcinoma in giant schnauzers was 14.6 times that of dogs in general (6). In a more recent study based upon submissions from veterinarians in 24 European countries, the predilection for giant schnauzers was 13.6 times that of dogs in general (4). The other studies did not adjust their data to account for wide variation in the overall prevalence of these breeds within their sample population, so true breed predilections cannot be determined from those data (5–8).

In these predisposed breeds, there are several reports of dogs developing multiple subungual squamous cell carcinomas on multiple digits, but only 2 of those studies involve enough dogs to allow estimates of the actual risk of having multiple digits involved at the time of presentation or in the 2-year postoperative interval. In 1 study, 11 of 49 dogs (22%) had multiple digit involvement (5). In the second study, 7 of 79 dogs (9%) had multiple digit involvement (8).

Estimates of the metastatic risk of subungual squamous cell carcinoma have varied from 0 to 24% (Table 1), with those estimates based on follow-up information from relatively limited numbers (19 to 79 dogs) (1–3,5,7). Some of the varia-

tion may be related to the duration of the follow-up interval, intermingling of data from subungual tumors with those arising elsewhere on the digit, imprecise discrimination of benign subungual keratoacanthomas from true subungual squamous cell carcinomas, and failure to define whether “metastatic disease” included just spread to the regional lymph node or whether it required compelling evidence of more distant metastasis. In virtually all cases, the diagnosis of metastatic disease was based on evidence derived from radiography or more advanced imaging but without histopathology. Additional variation might stem from the source of the cases (diagnostic laboratories serving primary care practices *versus* cancer referral centers). The latter probably see more advanced or more aggressive disease, and probably use more sophisticated techniques to detect metastatic spread.

The primary goals of this study were to determine the magnitude of the predilection (odds ratios) for subungual squamous cell carcinomas in black giant schnauzers, standard poodles, and other predisposed dog breeds in Canada, and to determine (in giant schnauzers and black standard poodles) the risk of affected dogs developing multiple such tumors, the rapidity of such development, and the metastatic risk.

Materials and methods

Case selection

The records of Histovet Surgical Pathology were searched for the years 2003 to 2021 to identify all cases of canine digital squamous cell carcinomas confirmed by histologic assessment of amputated digits. This laboratory receives cases from primary care veterinary practices across Canada with a small proportion (3%) from the United States, Bermuda, and Asia.

All submissions were formalin-fixed amputated digits. Slides were prepared by routine histology techniques from sagittal sections taken specifically to capture the nail bed. All diagnoses were made by the same pathologist (BW) based upon standard diagnostic criteria: destruction of nail bed architecture by branching invasive cords of disorganized stratum spinosum-like squamous epithelium accompanied by substantial reactive fibrosis and mixed inflammation (9,10). Osteolysis was

Table 1. Postoperative behavior of subungual squamous cell carcinomas in dogs.

Reference	Location	Number of dogs with follow-up	Local recurrence postoperatively	Initial or eventual involvement of additional digits Number (%)	Metastasis Number (%)
(7)	Italy	79	3	18 (23%)	14 (18%)
(5)	France	49	0	11 (22%)	4 (8%)
(3)	USA/Canada	42	1	7 (6%)	10 (24%)
(1)	USA	33	0	3 (9%)	0
(2)	USA	19	0	NG	1 (5%)
(8)	USA	21	0	0	0

NG = Not given.

Table 2. Prevalence of subungual squamous cell carcinomas as a proportion of all skin and digital masses in predisposed dog breeds.

Breed	Skin tumors (including digital tumors)	Number of digital tumors	Number of subungual squamous cell carcinomas	Squamous cell carcinomas as a percentage of all skin masses, including digital
Giant schnauzer	228	114	100	29.2
Standard schnauzer ^a	144	40	37	20.1
Standard poodle ^a	1036	202	174	14.1
Gordon setter	57	15	13	13.1
Rottweiler	1087	206	133	10.3
Kerry blue terrier	168	24	16	8.3
Briard ^a	53	9	5	8.1
Scottish terrier	246	37	21	7.4
Bouvier	397	55	33	7.3
Flat-coated retriever	218	24	9	3.7
Dachshund ^{a,b}	675	42	23	3.2
Labrador retriever ^a	9930	431	164	1.7

^a Coat color not specified.^b Coat type not specified.

apparent in most cases but was not an absolute requirement for the diagnosis.

Prevalence data

For the 19-year interval from 2003 to 2021 inclusive, we determined the total number of canine biopsy submissions, the number specified as skin or subcutaneous masses, and the number specified as digital masses arising from nailbed or bone rather than skin or subcutaneous tissue. We then determined the number of masses subsequently identified *via* histopathology as subungual squamous cell carcinomas.

Using a list of predisposed breeds adapted from the 5 most relevant previous studies (1,3–6), we determined the prevalence of subungual squamous cell carcinomas in those breeds as contrasted to the prevalence in all dogs within our study population. True breed predilections rather than just overall prevalence were determined by calculating odds ratios (OR) and confidence intervals (CI). We also determined the prevalence in 3 additional breeds not previously documented to be at increased risk to serve as relevant negative controls. Newfoundland dogs were selected as negative controls for “large black dogs” and German shepherd dogs and Bernese Mountain dogs as negative controls for “large black and tan dogs.”

Odds ratios and confidence intervals were calculated for each breed by building contingency tables in the GLIMMIX

Procedure in the SAS Software System. Statistical significance was set to $P \leq 0.05$.

Assessment of postoperative tumor behavior

We sent 158 surveys to veterinarians who had submitted samples subsequently confirmed as subungual squamous cell carcinomas in giant schnauzers and standard poodles. We limited the surveys to just those 2 breeds because they were the 2 breeds repeatedly mentioned in previous studies as being strongly predisposed and for which we had larger numbers than for any other predisposed breeds. The survey questions were about the color of the dog, the location and timing of the development of any similar tumors on the same or additional digits, the development of metastases, how those metastases were confirmed, and duration of postoperative survival.

The surveys were done at 2 times (in 2012 for cases originally diagnosed for the years 2003 to 2011, and in 2021 for cases diagnosed in the interval 2017 to 2020, inclusive). The questions were identical. In the 2021 survey, we did not attempt to gather information about cases that had been diagnosed more than 4 y before the survey date, and so the survey included only those cases diagnosed during 2017 to 2020. Based on our experience with the 2011 survey, the response rate related to patients last seen > 4 y before the survey date was extremely poor. For both surveys, we followed up with telephone calls to

Table 3. Breed predilection for subungual squamous cell carcinomas in dogs.

Breed	Number of overall biopsy submissions	Subungual squamous cell carcinomas Number (%)	P-value	Odds ratio	95% confidence interval
Giant schnauzer	422	100 (23.7%)	< 0.0001	56.7	45.0 to 71.4
Standard schnauzer ^a	370	37 (10%)	< 0.0001	20.3	14.4 to 28.6
Gordon setter	143	13 (9.1%)	< 0.0001	18.3	10.3 to 32.4
Standard poodle ^a	3032	174 (5.7%)	< 0.0001	11.1	9.5 to 13.1
Kerry blue terrier	327	16 (4.9%)	< 0.0001	9.4	5.7 to 15.6
Rottweiler	3619	133 (3.7%)	< 0.0001	7.0	5.8 to 8.3
Briard ^a	135	5 (3.7%)	< 0.0001	7.0	2.9 to 17.2
Bouvier	962	33 (3.4%)	< 0.0001	6.5	4.6 to 9.2
Scottish terrier	758	21 (2.8%)	< 0.0001	5.2	3.4 to 8.0
Flat-coated retriever	513	9 (1.8%)	0.0005	3.3	1.7 to 6.3
Dachshund ^{a,b}	2372	23 (1.0%)	0.0059	1.8	1.2 to 2.7
Labrador retriever ^a	26 094	164 (0.6%)	0.0813	1.2	1.0 to 1.4
Newfoundland	692	4 (0.6%)	0.9056	1.1	0.4 to 2.8
Bernese Mountain dog	3059	16 (0.5%)	0.8914	1.0	0.6 to 1.6
German shepherd	7226	20 (0.3%)	0.0026	0.5	0.3 to 0.8
All dogs	278 630	1518 (0.5%)			

^a Coat color not specified.^b Coat type not specified.**Table 4.** Comparison of dog breed predilection data for subungual squamous cell carcinomas in the 3 largest studies.

Breed Reference	Number of dogs (current study)	(6)	(4)	Probability (current study)	(6)	(4)	Odds ratio (current study)	(6)	(4)	95% CI ^a (current study)	(6)
Giant schnauzer	100	5	298 ^b	< 0.0001	< 0.00001	≤ 0.001	56.7	14.6	13.6	45.0 to 71.4	5.8 to 36.3
Standard poodle	174	19 ^c	22 ^{c,d}	< 0.0001	< 0.00001	≤ 0.001	11.1	5.6	4.1	9.5 to 13.1	3.5 to 8.9
Rottweiler	133	7	40	< 0.0001	0.03	≤ 0.001	7.0	2.2	4.7	5.8 to 8.3	0.1 to 4.8
Kerry blue terrier	16	5	3	< 0.0001	< 0.00001	NG	9.4	9.0	NG	5.7 to 15.6	3.6 to 22.2
Gordon setter	13	8	≤ 2	< 0.0001	< 0.00001	NG	18.3	12.5	NG	10.3 to 32.4	6.1 to 25.7
Briard ^c	5	3	28	< 0.0001	< 0.00001	≤ 0.001	7.0	9.2	5.9	2.9 to 17.2	2.9 to 29.5
Scottish terrier	21	7	≤ 2	< 0.0001	0.01	NG	5.2	2.5	NG	3.4 to 8.0	0.2 to 5.4
Standard schnauzer ^c	37	10	?	< 0.0001	< 0.00001	NG	20.3	5.3	NG	14.4 to 28.6	2.6 to 10.3
Dachshund ^{c,d,e}	23	13	28	0.0059	0.0005	NG	1.8	2.6	3.7	1.2 to 2.7	1.5 to 4.6
Labrador retriever ^c	164	28	33	0.0813	0.004	NG	1.2	1.8	1.1	1.0 to 1.4	0.3 to 2.6

^a For reference (4) 95% CI data were not given.^b Not specified as giant or standard.^c Coat color not specified.^d Not specified as standard, miniature, or toy.^e Coat type not specified.

NG = Not given.

encourage a response from those clinics that had not responded to the written request.

Results

Prevalence data

There were 278 630 canine biopsy submissions over the 19-year study interval. Of these, 1518 (0.5%) were identified as subungual squamous cell carcinomas. The number of submissions that represented skin and subcutaneous masses in general, the number representing digital masses arising from nailbed rather than skin, and those identified specifically as squamous cell carcinomas in those breeds previously identified as being predisposed to subungual squamous cell carcinomas are presented in Tables 2 and 3.

Breeds confirmed as having a genuine predilection resemble those in the previously published lists. We specifically compared (Table 4) our results to those published in 1998 by Goldschmidt and Shofer (6) from the diagnostic laboratory at the University

of Pennsylvania and in 2021 by Grassinger *et al* (4) from a diagnostic laboratory in Germany (the only studies that reported odds ratios).

Survey results

We received responses to 106 of the 158 surveys (67.1%). For giant schnauzers, all dogs were confirmed as being black. In standard poodles, all dogs were black except for 1 described as “coffee-colored.”

In postoperative intervals varying from 12 mo to 5 y, there were no local recurrences following digital amputation. Seventeen dogs had had a previous subungual squamous cell carcinoma removed prior to entry into this study or had more than 1 tumor present at the time of first evaluation. Twenty-two dogs developed squamous cell carcinomas on additional digits within the first year following excision of the first tumor. In 13 additional dogs, there were additional tumors on additional digits first identified between 1 and 2 y after initial surgery. Seven dogs

Table 5. Behavior of subungual squamous cell carcinomas in giant schnauzers and standard poodles.

Breed	Number of responses	At initial presentation	Number with additional digits affected				Number with suspected metastasis
			≤ 1 y	1 to 2 y	2 to 5 y	Total (%)	
Giant schnauzer	41	7	14	6	0	27 (66%)	4 ^a
Standard poodle	65	10	8	7	7	32 (49%)	0
Total	106	17 (16%)	22 (21%)	13 (12%)	7 (7%)	59 (56%)	4 (4%)

^a In these 4 dogs, metastasis occurred at 3 mo, 6 mo, 2 y, and 5 y, respectively, after first amputation.

(all standard poodles) developed additional tumors only between 2 and 5 y after removal of the first tumor. Metastatic spread was suspected in 4 dogs (all giant schnauzers; Table 5) based on radiographic evidence of metastatic foci in lung, although none was confirmed by cytology or histology.

Discussion

This study confirmed, with much larger numbers and therefore with more statistical reliability, virtually all conclusions reported in the most credible of the previous studies on this disease. Those studies reported epidemiologic and clinical information based upon 758, 154, and 79 dogs, respectively (4,5,7). In this study, we had 1518 dogs with histologically confirmed subungual squamous cell carcinoma.

We confirmed the very strong predilection for larger black or black and tan dogs, and yet that predilection was not absolute. Some of the common large breeds that fit this profile such as Newfoundland dogs, Bernese Mountain dogs, and German shepherd dogs have a very low risk of developing subungual squamous cell carcinoma, equal to or less than the risk for dogs in general. Clearly, being moderately large and black is not, by itself, enough to explain the breed predilections.

Data for breed predilections in our study, as well as in all the other published studies, suffer from imprecise information about breed, coat color, and type that can be extracted from submission forms for most diagnostic laboratories. Several of the previous studies, for example, listed data for “schnauzers” without defining whether those data were from giant schnauzers specifically or whether they included data from standard and miniature schnauzers that are separate breeds with distinctive genomes. The same shortcoming applied to data listed only as being derived from “poodles” without specifying whether those dogs were standard, miniature, or toy. In our study, we reported data specifically from giant schnauzers and standard poodles. Even in our study, however, we were unable to determine the coat color for those breeds in which colors other than black are common: Labrador retrievers, briards, standard schnauzers, and dachshunds. Therefore, the relative prevalence of subungual squamous cell carcinomas specifically in black dogs of those breeds is likely to be higher than what we have reported here. This same shortcoming applies to all published reports to date.

We compared (Table 4) our results to those of Goldschmidt and Shofer (6), and Grassinger *et al* (4). The list of predisposed breeds was similar in all 3 studies, although it was inexplicably shorter in the study from Europe. In 2 of the 3, giant schnauzers had the greatest predilection (consistent with virtually all other published studies, despite not reporting odds ratios). In

Grassinger *et al* (4), schnauzers were not specified as being giant or standard, although these are separate breeds with distinct genomes. In our study, standard poodles had the largest overall number of cases, and were the fourth highest in terms of odds ratio. Based on our survey responses, all affected giant schnauzers and all but 1 of the standard poodles were black.

The most pragmatic and useful information from this study was related to clarification of the risk of seeing additional subungual squamous cell carcinomas on additional digits, how quickly that was likely to occur, and the risk of metastatic spread. These are questions we are asked frequently by primary care practitioners because they are the questions of greatest concern to the owners. Published estimates for the risk of developing tumors on additional digits at between 6% (7/109) and 23% (18/79), and the metastatic risk at anywhere from 0% (0/33) to almost 25% (10/42) are too broad to be useful. Our data, admittedly derived only from the behavior in giant schnauzers and standard poodles, indicated the risk of developing squamous cell carcinomas on additional digits at 56% (59/106) within 2 y after first diagnosis. The metastatic risk was 4% (4/106), with metastases first observed anywhere from 3 mo to 5 y after the first diagnosis. Most dogs destined to develop additional tumors on additional digits did so within 2 y after initial diagnosis (Table 5).

This study, like all previous ones, had limitations intrinsic to retrospective studies based on submissions to diagnostic laboratories. We have already discussed our inability to determine the coat characteristics for several of the breeds on our list of predisposed breeds, which means that the genuine prevalence in black dogs of those breeds is likely to be much higher than what is reported here and elsewhere. Our information about metastatic risk was limited by detection methods used in primary care practice, and there was no clear distinction between radiographic observation of presumed metastases and the presence of actual clinical signs related to metastatic spread. Even in cases in which pulmonary radiographs revealed suspected metastatic spread, in none of these was the tumor confirmed as squamous cell carcinoma by histopathology. CVJ

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Article

Comparison of bidirectional barbed *versus* conventional monofilament suture material for closure of feline perineal urethrostomies

Sean R. Schubmehl, Lauren Deahl, Nicole M. Salas

Abstract

Objective

A retrospective comparison of bidirectional barbed absorbable suture material to conventional absorbable monofilament suture for closure of feline perineal urethrostomies.

Animals

Client-owned cats (N = 26) that underwent perineal urethrostomy.

Procedure

Medical records for cats that underwent perineal urethrostomy surgery at BluePearl Veterinary Specialty and Emergency Center Conshohocken between 2018 and 2021 were reviewed. Information regarding signalment, perioperative conditions, surgical procedures, treatments, and postoperative complications were identified. Long-term follow-up information was obtained using owner questionnaires and referring veterinarian records.

Results

Mucocutaneous apposition in 15 cats was accomplished using bidirectional barbed suture material followed by 11 consecutive cats sutured using conventional suture material. The mean ($\pm$ SD) surgery time in the bidirectional barbed group was 31.6 ($\pm$ 5.8) minutes and in the conventional group was 34.5 ($\pm$ 7.1) minutes. Short-term complications included urine extravasation, licking, hemorrhage, stranguria, bruising/erythema, diarrhea, and hemorrhage. The short-term complication rate in the bidirectional barbed group was 80% (12/15) compared to 55% (6/11) in the conventional group. Long-term complications included recurrent urinary tract infections, suture migration, recurrent feline lower urinary tract disease signs, excessive licking, and stricture. The long-term complication rate in the bidirectional barbed group was 47% (7/15) compared to 36% (4/11) in the conventional group.

Conclusion

The use of bidirectional barbed suture was comparable to the conventional absorbable suture technique with no significant differences in surgical time or complication rates.

Clinical relevance

The use of bidirectional barbed suture is an acceptable option for closure of perineal urethrostomies.

Résumé

Comparaison des sutures barbelées bidirectionnelles par rapport au matériel de suture monofilament conventionnel pour la fermeture des uréthroscopies périnéales félines

Objectif

Comparaison rétrospective du matériau de suture résorbable barbelée bidirectionnelle à la suture monofilament résorbable conventionnelle pour la fermeture des uréthroscopies périnéales félines.

Animaux

Chats de clients (N = 26) ayant subi une uréthroscopie périnéale.

Procédure

Les dossiers médicaux des chats ayant subi une chirurgie d'uréthroscopie périnéale au *BluePearl Veterinary Specialty and Emergency Center Conshohocken* entre 2018 et 2021 ont été examinés. Des informations concernant la signalisation,

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les conditions périopératoires, les procédures chirurgicales, les traitements et les complications postopératoires ont été identifiées. Les informations de suivi à long terme ont été obtenues à l'aide des questionnaires des propriétaires et des dossiers des vétérinaires référents.

Résultats

L'apposition cutanéomuqueuse chez 15 chats a été réalisée à l'aide d'un matériau de suture barbelé bidirectionnel suivi de 11 chats consécutifs suturés à l'aide d'un matériau de suture conventionnel. La durée moyenne ($\pm$ ET) de la chirurgie dans le groupe barbelé bidirectionnel était de 31,6 ($\pm$ 5,8) minutes et dans le groupe conventionnel de 34,5 ($\pm$ 7,1) minutes. Les complications à court terme comprenaient l'extravasation d'urine, le léchage, l'hémorragie, la strangurie, les ecchymoses/érythèmes, la diarrhée et l'hémorragie. Le taux de complications à court terme dans le groupe barbelé bidirectionnel était de 80 % (12/15) contre 55 % (6/11) dans le groupe conventionnel. Les complications à long terme comprenaient des infections récurrentes des voies urinaires, la migration des sutures, des signes récurrents de maladie des voies urinaires inférieures félines, un léchage excessif et une sténose. Le taux de complications à long terme dans le groupe barbelé bidirectionnel était de 47 % (7/15) contre 36 % (4/11) dans le groupe conventionnel.

Conclusion

L'utilisation de la suture barbelée bidirectionnelle était comparable à la technique de suture résorbable conventionnelle sans différences significatives dans le temps chirurgical ou les taux de complications.

Pertinence clinique

L'utilisation d'une suture barbelée bidirectionnelle est une option acceptable pour la fermeture des uréthroscopies périnéales.

(Traduit par D^r Serge Messier)

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Introduction

Urethral obstruction is a common cause of morbidity in male cats (1,2). Of male cats with feline lower urinary tract disease (FLUTD) 18 to 58% progress to urethral obstruction. The incidence of feline urethral obstruction has decreased significantly over the last 20 y (3). Recurrent urethral obstructions caused by FLUTD in cats is the most common indication for perineal urethrostomies (PU) but may also be considered in cases of anatomic abnormalities and trauma. The technique initially described by Wilson and Harrison in 1971 is still the most common procedure for perineal urethrostomies (4). This technique has been modified to minimize intrapelvic dissection preserving urethralis muscle function and increase visualization *via* sharp transection of the ischiourethralis and ischiocavernosus muscles for pudendal nerve preservation (5–7). Initially, a nonabsorbable simple interrupted pattern was used to suture the urethral mucosa to the skin. The nonabsorbable sutures would remain in place to achieve primary wound healing and then were removed after 2 wk (8). Facilitation of suture removal often required repeat general anesthesia or sedation. A simple continuous suture pattern using absorbable suture material described and evaluated in 2004 proved to be a viable alternative to the use of nonabsorbable suture material (9).

Advances in suture technology have provided veterinary medicine with knotless and bidirectional barbed suture material, which are characterized by protruding barbs in various geometrical positions along a monofilament suture to provide self-anchoring. Barbed suturing devices have been described for skin, enterotomy, and gastrotomy closures (10–12). Barbed suture can be either monodirectional with a loop or tag to prevent the need for a knot at initiation or bi-directional with double swaged needles (13). Key benefits to barbed suture

include the ability to eliminate knots which may cause irritation, decrease in surgery time, subjective improvement in cosmesis, and minimization of tissue entrapment which may lead to local ischemia (14). Conventional suture knots create high tension in focal areas as opposed to the purported even dispersal of tensile forces through the entire closure as seen with barbed suture (15). Smooth and barbed sutures are distinctly different biomechanically. When comparing the breaking strength of various sizes of conventional smooth polypropylene suture to 2-0 barbed polypropylene suture, the breaking strength was not significantly different from the conventional smooth 3-0 polypropylene suture. Barbed suture had less elongation and was significantly stiffer than any other conventional smooth suture (14,16). A disadvantage of using a bidirectional barbed suture is the opportunity for the barbs to cause persistent migration upon patient movement. This has been documented in human plastic surgery causing pain and irritation to the patient thereby requiring suture removal (17).

Our objective was to evaluate the use of bidirectional barbed suture as an alternative to conventional suture material for mucosa to skin closure of feline perineal urethrostomies and to compare postoperative complication rates. We hypothesized that the use of a bidirectional barbed suture would reduce urethrostomy closure times with minimal to no significant difference in short- or long-term complications.

Materials and methods

Electronic medical records were searched for all cats admitted to BluePearl Veterinary Specialty and Emergency Center at Conshohocken, Pennsylvania, USA that underwent perineal urethrostomy surgery between 2018 to 2021. All cats brought in for urethral obstructions secondary to feline lower urinary tract

disease were unblocked and stabilized before surgery. Methods of unblocking were not reported and remained at the discretion of the emergency veterinarian. Cats were considered eligible for inclusion provided appropriate records were maintained, a 2-week recheck examination was performed, and long-term follow-up were recorded. Long-term follow-up was defined as a minimum of 1 y following surgery. Long-term follow-up consisted of a telephone interview with owners and/or through using referring veterinarian records. All cats had signalment, weight, history, baseline laboratory tests, concurrent infections, radiographic evaluation of the bladder/urethra, and duration of hospital stay recorded. All surgeries were completed in entirety by the same Board-certified veterinary surgeon. Cats were divided into 2 groups for consecutive surgeries: 15 bidirectional barbed suture and 11 conventional monofilament suture. Exclusion criteria included concurrent surgical procedures required at the time of perineal urethrostomy and/or cats undergoing revision of a previous PU.

Surgical procedure

All cats had perineal urethrostomy surgical procedures based on the technique described by Wilson and Harrison (4). All surgical procedures were carried out in entirety by the same ACVS Board-certified surgeon (N.S.). All cats were placed in sternal recumbency with perineal elevation. The ischiocavernosus muscle attachments to the pelvis were transected. Once the urethra was mobilized, dissection was made proximal to the level of the bulbourethral glands for landmark visualization. A #11 blade was used for incision of the urethra using a semi-rigid polypropylene urinary catheter for guidance. Adequate urethral diameter was determined if passage of a closed Halsted mosquito hemostat to the level of the box locks could be achieved (17). Tension free, accurate tissue apposition of the urethral mucosa to the skin was performed. The subcutaneous tissues were not closed. For the bidirectional barbed suture group, the spatulated urethral mucosa was sutured to the skin using bidirectional barbed 3-0 poliglecaprone (Quill Monoderm, Surgical Specialties Corporation, Westwood, Massachusetts, USA) starting at dorsal midline. The first needle was passed through the urethral mucosa on dorsal midline and through the skin along the median raphe. The suture was passed through until the suture barbs were noted to engage, as evidenced by tension on the suture. The second needle was passed similarly ~1 mm lateral to the first suture passage. Each suture end was continued ventrally along its respective edge of the lateral urethral mucosa and skin in a simple continuous horizontal suture pattern. This was continued until the urethral mucosa was apposed 1.5 cm in length where the distal penis was transected and a circumferential ligature was placed using 4-0 poliglecaprone 25 (Monocryl Ethicon, Somerville, New Jersey, USA). Both barbed suture ends were cut flush to the skin. The remaining skin apposition ventral to the urethral mucosa was apposed with 4-0 poliglecaprone 25 in a simple interrupted pattern. For the conventional suture group, the spatulated urethra was initially tacked to the skin on dorsal midline with two simple interrupted sutures using 4-0 poliglecaprone 25 to ensure proper dorsal apposition of the mucosa to the skin. The 4-0 poligle-

caprone 25 was continued distally until all mucosa was sutured in a simple interrupted suture pattern. The remaining skin ventral to the urethral mucosa was apposed with 4-0 poliglecaprone 25 in a simple interrupted pattern. All cats recovered routinely from anesthesia and were monitored closely in hospital. Postoperative urinary catheters were not placed. Records were noted to be complete if appropriate documentation of urination, incision evaluation, and use of Elizabethan collar were maintained during the entirety of the postoperative hospitalization period. Postoperative treatment for all cats included intravenous fluid therapy, a partial *mu* opioid, non-steroidal anti-inflammatory medication, and a cephalosporin antibiotic. Cats were discharged with a partial *mu* opioid, non-steroidal anti-inflammatory medication, and an antibiotic when indicated by the culture and sensitivity obtained on admission. Cats were discharged with the recommendation to be placed on a prescription diet to minimize recurrent FLUTD signs.

Follow-up evaluation

Information from the immediate post-operative hospitalization was obtained *via* electronic medical record. A 2-week recheck examination (range: 10 to 16 d after surgery) was carried out in person by the surgeon of record to ensure adequate healing, evaluate for dehiscence, and appropriate stoma size. In person questionnaires were completed at that time for review of the recovery period. The immediate post-operative period was defined as the time from surgery to the 2-week recheck examination. All owners were contacted for long-term follow-up and medical records from referring veterinarians were requested. Long-term follow-up was performed at > 1 y following surgery. Owners were asked about complications related to perineal urethrostomy surgery including stricture formation, recurrence of FLUTD signs, bacterial urinary tract infections, behavioral changes, hemorrhage, and suture migration. A review of referring veterinarian records was performed if records were obtained.

Data analysis

All analyses were performed using SAS 9.4 (Cary, North Carolina, USA). A significance threshold of 0.05 was used. Binomial proportions with two-sided exact 95% confidence intervals (CI) were calculated for short-term and long-term complication rates for each group. Logistic regressions were used to compare odds of complications between groups. Log-likelihood ratio test *P*-values were recorded. Risk differences between groups were calculated along with 95% CI. A Student's *t*-test was used to compare surgical times between groups. Q-Q plots and histograms of surgical times by group were examined and supported the assumption of normality.

Results

Thirty cats were admitted to the hospital throughout the study period for evaluation of urethral obstruction secondary to FLUTD signs. Four cats were excluded due the presence of cystoliths noted on radiographs necessitating cystotomy in addition PU. Fifteen cats in the bidirectional barbed absorbable suture group and 11 cats in the conventional monofilament absorbable suture group met inclusion criteria. All cats survived

Table 1. Number of cats with short-term complications.

Complications	Conventional	Bidirectional barbed
Urine extravasation	1	0
Licking	0	4
Hemorrhage	2	6
Stranguria	2	7
Bruising/erythema	2	2
Diarrhea	0	3
Hemorrhage requiring transfusion	0	1

to follow-up. None of the cats in either group was noted to have incisional dehiscence. Six cats were noted to have urinary tract infections when brought to the hospital; diagnosed by the emergency department upon unblocking based on positive urine culture or bacteriuria discovered on urinalysis. Pathogens were identified as *Escherichia coli* ($n = 2$), *Pasturella multocida* ($n = 1$), *Serratia plymuthica* ($n = 1$), *alpha* hemolytic *Streptococcus* ($n = 1$), and cocci (culture and sensitivity declined). A urethral tear was noted in 1 cat in the bidirectional barbed suture group at the time of surgery due to the unblocking procedure performed on admission to the emergency department. This cat experienced self-limiting urine extravasation with excessive peri-incisional bruising in the immediate post-operative period. No further complications were identified in this cat following the 2 wk recheck examination. The mean ($\pm$ SD) overall surgery time in the bidirectional barbed group was 31.6 ($\pm$ 5.8) min and in the conventional group was 34.5 (7.1) min ($P = 0.27$). Mean duration of hospitalization after surgery was 1.7 d (range: 1 to 3 d with an outlier of 9 d for the cat with urine extravasation).

Minor complications noted during the immediate post-operative period included urine extravasation ($n = 1$), licking at the surgical site ($n = 4$), hemorrhage ($n = 8$), stranguria ($n = 9$), persistent bruising/erythema ($n = 4$), and diarrhea suspected secondary to concurrent antibiotic therapy (1). Major complications noted during the immediate post-operative period included hemorrhage requiring transfusion ($n = 1$) (Tables 1, 2). The short-term complication rate in the bidirectional barbed group was 80% (12/15; 95% CI: 52 to 96%) compared to 55% (6/11; 95% CI: 23 to 83%) in the conventional group ($P = 0.17$; odds ratio (95% CI) 3.3 (0.6 to 19). The difference in short-term complication rates (bidirectional barbed *versus* conventional) was 25% (95% CI: -10 to 61%). Incidence of short-term complications in the presence of urinary tract infections at the time of diagnosis was 50% (3/6 cats). All complications in these cats were minor and were not significantly associated with identification of preoperative urinary tract infection.

Minor complications identified between the immediate post-operative period and the 1-year follow-up included recurrent urinary tract infections confirmed *via* urine cultures ($n = 2$), suture migration ($n = 1$), recurrent FLUTD signs ($n = 5$), and excessive licking of the surgical site (10). Major complications between the immediate post-operative period and at the 1-year follow-up included stricture with secondary obstruction ($n = 1$) (Tables 2, 3). The cat with a stricture was evaluated 5 mo after surgery for excessive licking and recurrent FLUTD signs. This cat was diagnosed with a urinary tract infection on urinalysis

(culture declined). One month after treatment for the urinary tract infection, the cat was presented again for recurrence of FLUTD signs. A stricture was diagnosed, and revision surgery was recommended; however, euthanasia was elected. The long-term complication rate in the bidirectional barbed group was 47% (7/15; 95% CI: 21 to 73%) compared to 36% (4/11; 95% CI: 11 to 69%) in the conventional group ($P = 0.60$; odds ratio: 1.5; 95% CI: 0.3 to 8). The difference in long-term complication rates (bidirectional barbed *versus* conventional) was 10% (95% CI: -28 to 48%).

Discussion

The results of this study suggest that closure of feline perineal urethrostomies using bidirectional barbed absorbable suture material reveal no statistically significant increases in complication rates compared with using conventional absorbable monofilament suture material. The use of bidirectional barbed absorbable suture material, therefore, can be considered an appropriate closure material for PU surgeries. The complication rates, both short-term and long-term, for the bidirectional barbed suture group in this retrospective evaluation of cats with mucocutaneous closure were comparable to those of conventional absorbable suture. The potential for the presence of minor increases in complication rates amongst the bidirectional barbed suture group may be identified in larger studies with greater power. The overall results of this study were uncertain as evidenced by the large 95% CI. Variables were minimized by conducting all surgeries by the same Board-certified veterinary surgeon in one hospital. All surgeries were carried out at a newly established specialty hospital; this attributed to the small case numbers presented. The findings of this study resulted in similar long-term complication rates but considerably higher short-term complication rates when compared to previous studies. Short-term complication rates of 20 to 25% and long-term complication rates of 28 to 57% have been previously reported (2,8,9,18–23). This is in contrast to the short-term complication rate of 55% for the conventional group and 80% for the bidirectional barbed group, and the long-term complication rate of 36% for the conventional group and 47% for the bidirectional barbed group reported in this study. Previous studies report dysuria and incisional inflammation but not hemorrhage, excessive licking of the surgery site, and stranguria (17). Inclusion of post-operative hemorrhage, excessive licking of the surgery site, and stranguria as short-term minor complications may be the cause of this disparity.

One cat in the bidirectional barbed suture group had excessive postoperative hemorrhage requiring a packed red blood cell transfusion. Excessive bleeding may occur from the ischiocavernosus muscle transection or accidental laceration to deeper vessels. Hemorrhage from these structures should be identified and rectified before mucocutaneous closure. The authors consider this cat's complication potentially related to the horizontal suture pattern used in this study compared with a vertical simple continuous suture pattern. Consideration of a simple continuous vertical suture pattern in the future is recommended as this may assist with improved blood vessel tamponade. Another potential cause of excessive hemorrhage requiring transfusion may be the

Table 2. Postoperative complications.

	Conventional		Bidirectional barbed	
	Number of cats	Percentage of complications	Number of cats	Percentage of complications
Short-term (< 2 weeks)	6/11	55%	12/15	80%
Long-term (> 2 weeks)	4/11	36%	7/15	47%
Hemorrhage requiring transfusion	0/11	0%	1/15	7%
Urethral stricture/reobstruction	1/11	9%	0/15	0%

Table 3. Number of cats with long-term complications.

Complications	Conventional	Bidirectional barbed
Urinary tract infection	2	0
Suture migration	0	1
Recurrent FLUTD signs	2	3
Excessive licking	4	6
Stricture	1	0

use of reverse cutting PS-2 needles present on the bidirectional barbed absorbable suture as opposed to a tapered SH needle of the conventional monofilament 4-0 poliglecaprone 25 as no excessive hemorrhage from either the ischiocavernosus muscle or surrounding area was noted prior to mucocutaneous closure (13,17).

The absorbable suture material poliglecaprone, a copolymer of epsilon-caprolactone and glycolide, was used in both groups. Each has similar degradation and absorption periods. This absorbable material is rapidly degraded *via* hydrolysis. After 14 d, the suture material loses approximately 2/3 of its tensile strength and is completely absorbed by 120 d (13,17). A 1-year follow-up period was chosen to ensure complete absorption of suture material along with ample time for the possible development of complications related to the surgical procedure. A 3-0 sized bidirectional barbed suture has an outer diameter of 3-0; however, with consideration of the barbs, the suture is similar to a 4-0 diameter conventional suture (13,14). A 4-0 sized conventional monofilament was chosen for comparison with the 3-0 sized bidirectional barbed suture for this reason. Overall surgical times were comparable with a statistically insignificant decrease in time for the novel approach closing with bidirectional barbed suture material. Decreases in surgical times may be achieved with further experience using the bidirectional barbed suture material. Start to finish surgical times were recorded in the medical record in each case included in this study. Mucocutaneous suture closure time was not documented. Further studies evaluating the mucocutaneous closure times in relation to the suture material used are warranted to delineate the protentional for decreases in duration of surgical time.

Urinary tract infection may be related to early suture degradation and incisional dehiscence with use of poliglecaprone suture for closure of PU surgeries (17). Poliglecaprone has rapid degradation when continuously immersed in urine; this may also lead to incisional dehiscence when used for PU surgeries (24,25). All cats herein with urinary tract infections diagnosed at the time of presentation to the hospital by the

emergency department (6/26 cats) recovered from surgery with only minor complications. None of the cats with urinary tract infections developed dehiscence or stricture. Two of 26 (7.7%) cats were diagnosed with urinary tract infections during the long-term period. One cat which was initially diagnosed with an *Escherichia coli* infection after surgery was brought to the clinic for recurrent urinary tract signs 9 mo after PU surgery. A methicillin-resistant *Staphylococcus* urinary tract infection was diagnosed and treated with complete resolution. No further complications were noted in this cat. The other cat had a urinary tract infection diagnosed on urinalysis (culture declined by owner) 5 mo after surgery. This cat was initially urinary culture negative at the hospital before surgery. One month after treatment for a urinary tract infection, the cat was again evaluated for licking and recurrent FLUTD signs. A stricture was diagnosed, and euthanasia was elected. The cause of stricture formation is unknown; however, the urinary tract infection in this case may have been a contributing factor. Urinary tract infection alone is considered less likely the cause in the presence of self-mutilation.

In the study by Frem *et al* (17), only 2/61 cats had incisional dehiscence and both cats were noted to have self-trauma. Other studies have also shown self-mutilation as a complication after PU surgery and may be a cause of urethral dehiscence and/or stricture formation (17). Excessive licking to the point of self-trauma (self-mutilation) after surgery was recorded in this study as a complication to monitor for potential causes of dehiscence and stricture. In the authors' experience, use of bidirectional barbed suture material in cutaneous closures for abdominal and stifle incisions has the potential for suture migration. To the authors' knowledge, cutaneous barbed suture migration has not been previously documented as a complication in the postoperative period for cats. Human patients with suture migration were noted to have marked pain requiring suture removal (18). Clinically, cats with cutaneous barbed suture migration may experience similar irritation and/or pain which may lead to excessive licking. No cats in either group of this study were noted to have incisional dehiscence. Only 1 cat (1/26 cats, 3.8%) was noted to form a stricture in the long-term. This cat, in the conventional absorbable monofilament group, was also noted to have excessive licking at the time of and following treatment for a urinary tract infection. It is difficult to attribute the stricture in this cat solely to the self-mutilation; however, it may be considered a contributing factor. This finding is similar to previously reported rates of stricture formation ranging from 0 to 18.1% of cases after PU surgery (2,8,17,22). No cats in the present study had urethral catheters placed after surgery. This was based on surgeon preference as this has been

suggested as a potential cause for stricture formation and ascending urinary tract infection (17,23).

Limitations of this study include the small sample size, comparison of bidirectional barbed horizontal suture pattern to a simple interrupted suture pattern, comparison of a tapered needle with a reverse cutting needle, the retrospective nature, and reliance on long-term follow-up *via* owner questionnaire and referring veterinarian records. The overall results of this study may be inconclusive as type II error is likely. Further studies with larger inclusion groups are recommended for evaluation of the bidirectional barbed absorbable suture. Consideration of use of a taper needle instead of the reverse cutting needle is recommended along with use of a simple continuous suture pattern for both groups.

In conclusion, the use of bidirectional barbed absorbable suture for closure of feline perineal urethrostomies may be an acceptable and viable alternative to the use of conventional suture material; however, further studies are required to elucidate the significant benefits and complications. The bidirectional barbed suture did not prove to significantly decrease surgical time; this did not support our original hypothesis. Postoperative complications of the conventional monofilament to bidirectional barbed suture, both short- and long-term, within this study are comparable, which supports our original hypothesis.

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Article

Superficial digital flexor tendon luxation repaired with abrasion calcaneoplasty and primary retinaculum repair in dogs

Kaitlyn Johnson, Garrett Davis

Abstract — Surgical treatment of a superficial digital flexor tendon luxation is the treatment of choice, since nonsurgical treatment has been shown to be unsuccessful in dogs in which it has been attempted. The objectives of this study were to report complications and short- to long-term outcomes in dogs with superficial digital flexor tendon luxation treated with abrasion calcaneoplasty, an adjunctive surgical technique, in addition to traditional repair. In total, 12 client-owned dogs with superficial digital flexor tendon luxations were examined in this retrospective case series (from 2010 to 2020) of a novel surgical technique using abrasion calcaneoplasty, in addition to retinaculum imbrication. Records were reviewed for signalment, chronicity of clinical signs, preoperative diagnostics tests, surgical techniques, postoperative complications, and outcomes. Abrasion calcaneoplasty, in addition to traditional primary retinaculum repair, was successfully performed in 12 dogs, with ultimate resolution of clinical lameness in all patients, despite short-term relaxation in 1 patient. Based on the findings of this case series, we inferred that abrasion calcaneoplasty can be considered in addition to traditional repair as an option to treat luxation of the superficial digital flexor, with a 58% short-term complication rate, and no evidence of long-term complications.

Résumé — Luxation du tendon fléchisseur superficiel réparée par calcanéoplastie par abrasion et réparation primaire du rétinaculum chez le chien. Le traitement chirurgical d'une luxation du tendon fléchisseur superficiel est le traitement de choix, car le traitement non chirurgical s'est avéré infructueux chez les chiens chez lesquels il a été tenté. Les objectifs de cette étude étaient de rapporter les complications et les résultats à court et à long terme chez les chiens présentant une luxation du tendon fléchisseur superficiel traitée par calcanéoplastie par abrasion, une technique chirurgicale complémentaire, en plus de la réparation traditionnelle. Au total, 12 chiens de propriétaires présentant des luxations des tendons fléchisseurs superficiels ont été examinés dans cette série de cas rétrospective (de 2010 à 2020) d'une nouvelle technique chirurgicale utilisant la calcanéoplastie par abrasion, en plus de l'imbrication du rétinaculum. Les dossiers ont été examinés pour le signalement, la chronicité des signes cliniques, les tests de diagnostic préopératoires, les techniques chirurgicales, les complications postopératoires et les résultats. La calcanéoplastie par abrasion, en plus de la réparation primaire traditionnelle du rétinaculum, a été réalisée avec succès chez 12 chiens, avec une résolution ultime de la boiterie clinique chez tous les patients, malgré une relaxation à court terme chez un patient. Sur la base des résultats de cette série de cas, nous avons conclu que la calcanéoplastie par abrasion peut être considérée en plus de la réparation traditionnelle comme une option pour traiter la luxation du fléchisseur superficiel, avec un taux de complications à court terme de 58 % et aucune preuve de complications à long terme.

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Introduction

Luxation of the superficial digital flexor tendon is a relatively uncommon orthopedic condition in active dogs with possible breed predisposition in herding breeds such as Shetland sheepdogs, collies, and giant breeds (1). It has been previously reported that lateral displacement of the superficial digital flexor tendon results from tearing of the weaker medial attachment on the tuber calcanei. Also, anatomical factors that increase medial or lateral stresses on the tendon as it passes over the calcaneus may contribute to a luxation (2,3).

Dogs with a superficial digital flexor luxation will typically present with a mild to severe lameness that may be episodic. There is consistently effusion noted at the level of the tuber calcis, which can be mild to marked (1,4). The superficial digital flexor muscle's lateral and medial heads originate on the caudal aspect of lateral and medial femoral condyles, respectively and course distally before fanning to form a cap structure and sliding along the calcaneus, serving as an extensor of the hock. The tendon continues distally to its final insertion on the middle phalanges of the second to fifth digit (2,5).

Diagnosis of a luxated superficial digital flexor tendon is made at the orthopedic examination by direct palpation of the tendon as it displaces over the calcaneus. Displacement often occurs when the hock is flexed with the stifle extended, resulting in the tendon leaving the calcaneal groove. As the tendon displaces, a popping sensation may be appreciated (1,2). Patients with chronic luxations may develop a fixed luxation of the tendon with pain and swelling appreciated, but no obvious tendon movement. Lateral displacement of the superficial digital flexor is more common than medial displacement (1–4).

Surgical treatment of luxation is the treatment of choice since nonsurgical treatment has been shown to be unsuccessful in dogs in which it has been attempted (6). Surgery involves relocating the tendon to the central position of the groove between medial and lateral processes of the tuber calcanei with imbrication of the bursal wall on the side opposite the luxation. Immobilization of the tarsal joint for a minimum of 4 wk has been recommended to support the repair (1–4). Methods described recently by Gatineau *et al* (2) for lateral luxation include a release incision on the medial aspect of the bursa calcanei and retinacular structures allowing reduction, followed by excision of the redundant medial bursa calcanei and retinaculum. If soft tissue available for attachment *via* sutures is scant, 1 or 2 screws (1.5 to 2.0 mm) can be inserted into the calcaneus near the tendon edge and can be used for suture anchorage (7). Alternatively, with the aid of 2 small holes drilled through the tuber calcanei, sutures can be placed through the bone and tendon. The use of suture anchors and restraining pin to negate immobilization has also been reported. Polypropylene mesh has also been used for revision of failed repair of superficial digital flexor tendon luxation in dogs (8). Historically, surgical treatment has a good outcome (1), but complications include repeat luxation, microfiber injury of the tendon, and continued lameness.

Materials and methods

The medical record database of a specialty practice were reviewed for cases of superficial digital flexor tendon luxa-

tion that were treated surgically from November 2010 to September 2020. The diagnosis of a singular lateral or medial or bilateral superficial digital tendon luxation was determined based on orthopedic examination in conjunction with owner-reported clinical signs and confirmed at surgery. All patients underwent a single anesthetic event, including the patient with bilateral luxation which underwent correction with 1 surgery in place of a staged repair.

Information was collected from medical records included sex, age, weight, pertinent medical history, initial orthopedic consultation, physical examination findings, pre-operative diagnostic tests (specifically tarsal radiographs), surgically treated limb, type of luxation, surgical technique, perioperative complications, and post-operative lameness and stabilization.

The surgical procedure was similar in all instances. A total of 12 dogs were placed in sternal recumbency with the limb hung caudally and the region of tarsal joint aseptically prepared. A caudal lateral approach for lateral luxations and a medial approach for medial luxations was made *via* a curvilinear incision through the skin. The bursa was identified by manual palpation and displacement of the tendon. The surgical incision was extended to the level of the fibrocartilaginous cap within the tendon of the superficial digital flexor muscle. The adhesions to the cap were excised and the cap was mobilized to allow access to the tuber calcanei. The bursa was incised adjacent to and parallel to the tendon.

In each of the 12 cases, at time of surgical intervention, the tendon continued to have increased tendency to dislocate following positioning between the medial and lateral processes. Based on increased mobility, a calcaneoplasty was performed (Figure 1). The groove of the calcaneus between the medial and lateral processes of the tuber calcanei was deepened using a #2 burr and a Hall Drill. Intraoperatively, care was taken to start the calcaneoplasty distal to the attachment of the common calcaneal tendon to ensure the tendon was not disrupted. The groove was deepened to the point that there was at least 2 mm of bony tissue on either side of the calcaneal groove allowing the tendon to remain seated between the processes (Figure 2). In all instances, following calcaneoplasty the tendon was replaced in the groove. The redundant retinaculum was trimmed or imbricated, and the retinaculum was closed using a non-absorbable suture in a horizontal mattress pattern. In 2 cases of laterally luxating superficial digital flexor tendons, the lateral retinaculum was released to minimize pull on the superficial digital flexor tendon once reduced into the newly formed groove, although this was not needed in all cases after deepening the groove. Following placement, digital pressure was applied to the tendon in the direction of luxation with the tarsus in flexion and extension to ensure that the tendon could not be luxated. The deep fascia and skin were closed in a routine fashion in all cases.

All 12 patients had external coaptation consisting of a custom-moulded fiberglass splint in a modified Robert Jones bandage applied postoperatively for a minimum of 2 wk, followed by strict activity restriction for a total of 12 wk after surgery. Out of the 12 patients, duration of external coaptation varied, with 3 patients remaining splinted for 2 wk, 7 patients



Figure 1. Intraoperative determination of shallow calcaneal groove in a dog.



Figure 2. Burr used to deepen the groove of the calcaneus between the medial and lateral processes of the tuber calcanei in a dog.

remaining splinted for 4 wk, and 2 patients remaining splinted for 6 wk. Variation was dependent on individual surgeon preference but was also influenced by secondary bandage complications of individual dogs. Bandage changes were performed every 1 to 2 wk to evaluate range of motion, as well as incisional healing and bandage complications.

All patients had a full orthopedic examination performed at several points during their recovery. Initially, all 12 patients had all joints evaluated using a validated numeric lameness scoring system (9) and validated pain score using the Colorado State University (CSU) acute pain scale for the dog (10) by the primary surgeon at 1 d after surgery, then again at each bandage change during the perioperative period (every 7 to 10 d for the duration of external coaptation placement, from 2 to 6 wk depending on patient splinting interval). Each patient received an in-person evaluation with the primary surgeon including lameness score within the short- to mid-term complication period (3 to 6 mo). Long-term orthopedic examinations including lameness scores (> 12 mo) were included and evaluated through a combination of the primary surgeon and primary care veterinarian patient records. The mean long-term follow-up was obtained 53.8 wk postoperatively with the primary surgeon. For patients that lacked > 52 wk postoperative in-person examinations with the primary surgeon (4 of the 12 patients), client telephone interviews were conducted, and primary-care veterinarian wellness records were evaluated (to include lameness scoring and noted orthopedic examination findings).

Complications were classified as perioperative or postoperative. Perioperative complications include those arising from surgical intervention to 3 mo after surgery. Postoperative complications were classified as short-term when they occurred between 3 and 6 mo postoperatively; for all patients, this included time following external coaptation removal. Long-term complications occurred 1 y after surgery.

For the follow-up, records were reviewed from recheck examinations scheduled with the primary surgeon, in addition to the review of the primary-care veterinarian's long-term medical

records. Information collected primarily focused on prospectively recorded post-operative orthopedic examination findings (degree of lameness determined by numeric rating scale, joint range of motion and joint effusion subjectively determined by evaluating surgeon, and pain score determined based on validated scoring system) as well as evidence of reported degree of observational lameness by owners at home. The single patient that had persistent lameness following external coaptation removal, had further diagnostics performed postoperatively. These diagnostics consisted of repeat tarsal radiographs and stifle radiographs during the short-term follow-up period.

In total, 12 dogs with a total of 13 superficial digital tendon luxations met the criteria for inclusion into the retrospective study. One dog had a luxation in both right and left superficial digital flexor tendons. Of the patients, 8 dogs were spayed females, 2 were castrated males, 1 was an intact male, and 1 an intact female. The dogs ranged in body weights and breeds, with an average weight of 20 kg (range: 5.3 to 53 kg), 6 were large breed (> 20 kg), and 6 were considered small breeds (< 20 kg) at the time of surgery (Table 1). Of the 13 tarsi, 10 tarsi had lateral luxation of the superficial digital flexor tendon, whereas 3 tarsi had medial luxation of the superficial digital flexor. Patient No. 3 had medial luxation of the superficial digital flexor tendon in the left tarsus and lateral luxation of the superficial digital flexor tendon in the right tarsus. This patient underwent repair of both tendons during 1 surgical event.

Three dogs had concurrent medial luxating patella, with grades ranging from a 2 to 3 out of 4 (scale of 1 to 4), in the same limb affected by luxation of the superficial digital flexor tendon, noted prior to surgical repair. The patient with concurrent Grade 3/4 medial luxating patella required surgical intervention for correction following superficial digital flexor tendon repair, due to persistent lameness.

Abrasion calcaneoplasty was performed with an open surgical technique as an adjunct to retinaculum imbrication in 13 tarsi; 3 had a medially luxating superficial digital flexor, whereas 10 had a laterally luxating superficial digital flexor. All surgeries

Table 1. Complications related to abrasion calcaneoplasty.

Signalment	Luxation	Duration of external coaptation (wk)	Complications	Time after surgery (wk)
2 y MN Labrador retriever mix, 37 kg	Lateral	2	Reluxation, managed with repeat splint	6
4 y FS Whippet mix, 23 kg	Lateral	4	Decreased range of motion	2
6 y MN Australian shepherd, 19 kg	Lateral (R), Medial (L)	2	Bandage sores	2
6 y FS Terrier mix, 7 kg	Medial	4	None	—
1 y FS Labrador retriever, 29 kg	Lateral	4	Decreased range of motion	4
8 y FS Italian greyhound, 5.3 kg	Lateral	4	Incisional dehiscence	2
1 y MI Estrela Mountain dog, 53 kg	Lateral	4	Bandage sores	3
4 y FS Shiba inu, 10.4 kg	Lateral	4	None	—
1 y FS Shiba inu, 13 kg	Lateral	4	None	—
7 y FS Pomeranian mix, 6.6 kg	Lateral	2	Decreased weight-bearing	6
1 y FS Leonberger, 42 kg	Medial	6	Incisional infection	2
4 y FS Terrier mix, 12.5 kg	Lateral	4	None	—

MN — Male neutered; FS — Female spayed; MI — Male intact.

were stabilized postoperatively with a fiberglass splint encased in a soft padded bandage for 2 to 6 wk.

Results

Out of the 12 surgeries, 7 dogs were partially weight-bearing (noted to have Grade 3-4/5 lameness based on numerical rating scale) 1 d after surgery and 4 patients were weight-bearing on the affected limb 1 wk after surgery. Patient No. 3 was ambulatory on all 4 limbs 1 d after surgery. One patient started reliably placing weight on the limb 2 wk postoperatively. Of the 12 patients, 11 patients were fully weight-bearing by the time of their external coaptation removal recheck examination. One patient was persistently partially weight-bearing following removal with acute worsening of perceived lameness by owner 2 wk following splint removal (4 wk after surgery). This patient did ultimately require Grade 3/4 medial luxating patella repair 6 mo after superficial digital flexor tendon luxation correction.

Perioperative complications (< 3 mo after surgery) included incisional infection, incisional dehiscence, suture reactions, bandage complications including bandage sores, and increased pain perceived *via* validating scoring systems postoperatively. Of the 12 procedures, 7 surgeries (58%) developed perioperative complications that did not require intervention other than splint remodelling or removal, and each resolved shortly after external coaptation removal. Of the 12 patients that underwent abrasion calcaneoplasty, in addition to retinacular imbrication, 11 patients, approximately 92%, had no pain or luxation noted at the time of splint removal (ranging from 2 to 6 wk postoperatively). Furthermore, 1 of the 12 patients was noted to have persistent lameness following bandage removal at 2 wk. Of the 12 patients, 1 patient had reluxation of the superficial digital flexor tendon after surgery. Patient No. 1 was non-painful with appropriate range of motion at time of external coaptation removal (2 wk); however, acute swelling of the tarsus with intermittent non-weight-bearing lameness was appreciated 6 wk postoperatively, necessitating removal and replacement of the splint.

Short- to mid-term complications (3 to 12 mo after surgery) included a decreased range of motion in the tarsus and

thickening/scar tissue formation at the level of the tarsal joint. A decreased range of motion was noted in the 13 tarsi of 4 dogs (31%) after splint removal. In each of these cases, the range of motion returned to normal after several weeks of physical therapy and the dogs returned to normal activity with no signs of lameness noted long term. Out of the 12 dogs, 4 dogs (33%) had concurrent medial patella luxations noted at time of initial surgery examination. In 1 of these cases, the clinical signs of luxation required surgical correction 6 mo following superficial digital flexor tendon repair due to persistent lameness and discomfort appreciated based on validated scoring systems. In 1 dog, digital palpation was able to elicit laxity and reluxation of the superficial digital flexor tendon 6 wk postoperatively, 4 wk following external coaptation removal. The superficial digital flexor tendon was manually reduced and replaced into correct anatomic position. This dog was then treated with a fiberglass splint for an additional 7 wk. Following external coaptation removal, no repeat luxation was noted, and the dog regained full range of motion.

Significant long-term complications (> 12 mo after surgery) in relation to the superficial digital flexor tendon repair were not reported in any of the 12 patients. All dogs were reported to be using the limb reliably with a non-appreciable lameness using a validating numerical lameness scoring system and were reported to be comfortable (0/4 pain score based on the Colorado State University acute pain scale for the dog) on joint range of motion based on evaluation of in-hospital and referral veterinarian records. No tendon was noted to reluxate during the long-term follow-up period.

Discussion

Abrasion calcaneoplasty combined with retinacular repair was successfully performed in 12 patients resulting in resolution of clinical lameness in all patients. Intraoperative abrasion calcaneoplasty *via* a burr and Hall Drill was simple to achieve and re-established a groove on the calcaneus in patients which were noted to have persistent tendency for the superficial digital flexor tendon to dislocate following positioning at the time of surgery. All patients had ultimate resolution of their clinical

lameness. In 1 of the 12 dogs, the superficial digital tendon relaxed 6 wk after, but additional splinting for 7 wk achieved stabilization with no additional surgery required. No tendon was noted to relaxate in the long-term (> 12 mo interval).

The demographics of our population did not reveal any breed or body weight predisposition as previously reported for canine patients with luxated superficial digital flexor tendons (1–6,11). Furthermore, there was no predisposition for limb involvement (right *versus* left). As in previous reports, lateral displacements were more common among our patient pool than medial displacements (1–4). Of the 12 patients, 1 patient had bilateral displacement with 1 limb affected with a medial displacement and the contralateral limb affected with a lateral displacement.

Follow-up *via* in-hospital recheck examination and referral veterinarian records did not reveal any complications related directly to the proposed sulcoplasty. Although intraoperative reports did not mention a significant morphological abnormality of the calcaneus, it was a logical surgical approach to attempt to deepen the groove using a calcaneoplasty procedure between the medial and lateral processes of the calcaneal tuberosity. Further preoperative planning *via* CT may help to evaluate morphological defects more accurately prior to surgical correction (12). Complications such as weakness of the calcaneus, excessive inflammation, degenerative changes following removal of the cartilage or need for repeat surgical procedure for persistent repeat relaxation was not noted in our population within our current long-term follow-up period. All patients returned to full functional outcomes.

As in previous reports, postoperative external coaptation was performed in all patients. In prior studies, exact recommended duration of immobilization of the tarsal joint, following superficial digital flexor tendon repair, is unknown but 4 to 8 wk has been recommended (12). As a retrospective study, the variety in length of external coaptation was not equally distributed among our patient population and ultimately was a limitation due to the study type. Of the 12 patients, 3 were splinted for 2 wk, the majority (66%) were splinted for 4 wk, and 1 patient was splinted for as long as 6 wk immediately after surgery. Following the concepts of wound healing, if external coaptation remains in place for 2 wk, it will provide the necessary support during the weakest phases of healing. A fiberglass splint encased within a soft padded bandage limiting mobility during the proliferative phase helps to add necessary stability while the extracellular matrix is replaced by Type I collagen. By applying external coaptation during the first 2 phases of wound healing, the bandage can reduce weight-bearing and shear stress on the repair when it is at its weakest point of healing (13). In a recent study, postoperative SDF tendon luxation repair patients were bandaged for a maximum of 12 d, but data revealed that even this duration of external coaptation was not thought to provide significant support to the repair of the superficial digital flexor tendon retinaculum. In this same study, the external coaptation was omitted in more recent patients due to the increased risk of minor complications of skin irritation, pressure necrosis, and superficial infection (12). Based on our patient population and perioperative complications, 58% of our patients had complications

directly related to postoperative splinting. In future studies, it may prove beneficial to explore patient outcomes in the absence of external coaptation in patients which underwent this adjunct repair method to further evaluate if postoperative splinting may be contraindicated. Reviewing short-term postoperative complications, in the absence of external coaptation, may also stand as a truer test of stability when using this adjunct repair method. Utilizing more abbreviated external coaptation periods (2 wk), following surgical repair in conjunction with abrasion calcaneoplasty, may be adequate to protect the superficial digital tendon luxation repair and decrease the rate of bandage-associated complications. Further research is needed to prove this hypothesis, including the use of a control group and larger patient populations.

Postoperative rehabilitation following a shorter splinting interval may improve earlier return to function. The demographics of our population reported a 25% decreased range of motion at the time of external coaptation removal. It is suggested that all patients undergoing repair of a superficial digital tendon luxation would benefit from a minimal external coaptation interval followed by physical rehabilitation. By applying studies for rehabilitation recommendations following cranial cruciate ligament tears and other pelvic limb tendon/ligamentous injuries (13,14), rehabilitation for superficial digital flexor tendon luxation should be focused on improving muscle mass, range of motion, and weight-bearing. The goals of rehabilitation for the postoperative superficial digital flexor tendon patient should focus on relieving pain, enhancement of tissue healing, and return to full activity. Rehabilitation should ideally begin immediately after surgery and continue until the patient has returned to full activity.

Limitations of this study include limited case numbers, attributed to the uncommon nature of disease condition. In addition, this study did not include a control group. Further research is needed to evaluate required length and necessity of external coaptation. Additional limitations of this study include the nature of a retrospective study design, utilizing multiple surgeons with preferred intraoperative techniques and inherent subjectivity of the original depth and new depth of the sulcus so results should be evaluated cautiously.

In conclusion, abrasion calcaneoplasty, in conjunction with retinacular imbrication, resulted in full functional outcomes for patients with superficial digital flexor tendon luxation, regardless of the duration of external coaptation placement. Traditional repair methods require immobilization of the hock in extension to alleviate pressure on the repair, especially during early phases of healing. Periods of immobilization are recommended starting at 3 to 4 wk but can be used up to 6 to 8 wk in some patients. In patients which underwent traditional repair, postoperative outcomes may be poor secondary to complications involving poor patient/owner compliance with splint or brace management and secondary to bandage-related skin injury (pressure sores, pododermatitis). The abrasion calcaneoplasty repair may allow for decreased or omission of external coaptation during that early phase. By focusing on a shorter duration of splinting (2 wk) with postoperative rehabilitation, a decrease in bandage complication rates and earlier return to function in patients

which underwent the abrasion calcaneoplasty surgical repair technique may be possible, compared to traditional repair methods.

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Article

Veterinary student urethral catheterization of small female cats and dogs using 2 urethral catheterization techniques

Josephine A. Dornbusch, Laura E. Selmic, Peter M. Sadowitz, Mary Coleman, Linda Bednarski, Brian Skock, Mary McLoughlin, James Howard, Vincent A. Wavreille

Abstract

Objective

Compare veterinary student success at urethral catheterization of small female cats and dogs using traditional and novel 2-catheter techniques.

Animal

Healthy anesthetized female cats ($n = 23$) and dogs ($n = 6$) weighing < 10 kg undergoing elective ovariohysterectomy.

Procedure

Two junior (Year 3) veterinary students with no previous urethral catheterization experience participated. Each pet was catheterized by 1 student using both the traditional blind technique and the novel 2-catheter method (placement of a large red rubber catheter into the vaginal canal prior to insertion of the conventional catheter). Technique order was randomized and attempts for each technique was allowed for up to 3 min. Time to successful catheterization and catheterization success within the allotted time were recorded.

Results

Successful urethral catheterization was performed using the traditional blind and novel 2-catheter techniques in 56.3 and 87.5% of cases, respectively.

Conclusion

Students had a higher rate of successful catheterization with the 2-catheter catheterization technique in this report.

Clinical relevance

Urethral catheterization in small female cats and dogs is technically challenging, which is compounded by the inability to consistently and reliably palpate loco-regional anatomic landmarks due to the small sized vestibules. Data from this report will be used to design future studies to assess the utility of this novel urethral catheterization technique for teaching inexperienced students this challenging clinical skill.

Résumé

Cathétérisme urétral de petites chattes et chiennes à l'aide de deux techniques de cathétérisme urétral par des étudiants en médecine vétérinaire

Objectif

Comparez le succès des étudiants vétérinaires lors du cathétérisme urétral de petites chattes et chiennes en utilisant des techniques traditionnelles et nouvelles à deux cathéters.

Animal

Chattes ($n = 23$) et chiennes ($n = 6$) en bonne santé et anesthésiées pesant < 10 kg subissant une ovariohystérectomie élective.

Procédure

Deux étudiants vétérinaires juniors (3^e année) sans expérience préalable en cathétérisme urétral ont participé. Chaque animal a été cathétérisé par un étudiant en utilisant à la fois la technique traditionnelle à l'aveugle et

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la nouvelle méthode à deux cathéters (placement d'un gros cathéter en caoutchouc rouge dans le canal vaginal avant l'insertion du cathéter conventionnel). L'ordre des techniques a été randomisé et les tentatives pour chaque technique ont été autorisées jusqu'à 3 minutes. Le temps de cathétérisme réussi et le succès du cathétérisme dans le temps accordé ont été enregistrés.

Résultats

Un cathétérisme urétral réussi a été réalisé en utilisant les techniques traditionnelles à l'aveugle et les nouvelles techniques à deux cathéters dans 56,3 et 87,5 % des cas, respectivement.

Conclusion

Les étudiants avaient un taux plus élevé de cathétérisme réussi avec la technique de cathétérisme à deux cathéters dans ce rapport.

Pertinence clinique

Le cathétérisme urétral chez les petites chattes et chiennes est techniquement difficile, ce qui est aggravé par l'incapacité de palper de manière cohérente et fiable les repères anatomiques loco-régionaux en raison des vestibules de petite taille. Les données de ce rapport seront utilisées pour concevoir de futures études afin d'évaluer l'utilité de cette nouvelle technique de cathétérisme urétral pour enseigner aux étudiants inexpérimentés cette habileté clinique difficile.

(Traduit par D^r Serge Messier)

Can Vet J 2022;63:1147–1152

Introduction

Previously reported traditional techniques for urethral catheterization in female cats and dogs includes viewing the urethral papilla with an otoscope or speculum, concurrent digital palpation within the vaginal canal to guide catheter placement, and blind catheterization (1,2). In female cats or small dogs, concurrent digital palpation is precluded by a small vestibule and the vaginal canal, forcing most clinicians to resort to blind catheterization techniques (1,2). Urethral catheterization in the female cat or dog is an inherently challenging clinical skill that takes practice and a basic knowledge of anatomical landmarks to be performed successfully (1,2). The inherent challenge of learning this clinical skill is compounded in veterinary students who are more likely to be unfamiliar with regional anatomy, clinical procedures, or aseptic technique compared to practicing clinicians. Improving new students' clinical skillsets and confidence can be maximized with development of novel instructional guidelines and techniques. This remains critical for "day-one-ready" veterinarian success (3).

In a previous report (4), the authors described a simple, novel technique for urethral catheterization in small female cats and dogs. This study assessed the success rates and time to successful catheterization for 3 clinicians having varied experience with the novel technique (4). This involved placing a large red rubber catheter into the vaginal canal to occlude the vagina during catheterization, thereby mimicking the action of finger-guiding urethral catheter placement during digital palpation (4). This 2-catheter technique had higher rates of successful catheterization than the traditional blind method (4). The aim of this current study was to obtain preliminary data evaluating veterinary student success and time to successful urethral catheterization in small female cats and dogs. Both a traditional and 2-catheter technique were used in preparation for larger clinical studies assessing both techniques in cadaveric models and clinical settings. The authors hypothesized that veterinary students have higher rates of successful catheterization with the 2-catheter technique than with the traditional blind method.

Materials and methods

Animals

Any female cat or dog weighing < 10 kg that was undergoing elective ovariohysterectomy with the Ohio State University Veterinary Medical Center (OSU VMC) student surgery spay lab was enrolled in this study. Informed and written owner consent was obtained before enrollment. This study and its procedures were approved by the OSU Institutional Animal Care and Use Committee. The animal information collected at the time of surgery included signalment, body weight, and body condition score.

An *a priori* sample size calculation was performed to estimate the number of animals required per student to evaluate the difference between urethral catheterization success rates and time to successful catheterization using both techniques. An independent 2-sample Student's *t*-test with a type I α error of 0.05 and power of 0.9, assuming for a mean difference of 15 s between the techniques and a standard deviation of 10 s, resulted in a sample size of 10 animals per catheter placer. We had planned a sample size of 13 animals for each student to account for up to a 25% drop out.

Personnel

Two third-year veterinary students (PS and MC) without any previous urethral catheterization experience participated as catheter placers in this study. A veterinary intern (JD) with urethral catheterization experience using standard techniques in 7 female dogs participated as a control for comparison. All 3 catheter placers were provided with an illustrated handout (Figures 1, 2) demonstrating both urethral catheterization techniques, then the catheter placers observed a senior author (LS) with experience in both techniques while they performed both techniques on a live animal. Each catheter placer successfully catheterized 1 animal using both techniques before data collection initiation to ensure that all catheter placers understood the concept of both techniques.

Instructions for Indirect Urethral Catheter Placement Technique**Supply List:**

- Sterile gloves
- Red rubber catheter:
10-Fr for cats or 18-Fr for dogs
- Urethral red rubber catheter:
5-Fr for cats, 8-Fr for dogs
- Sterile lube
- Towel
- Sterile syringe
- Assistant with stopwatch

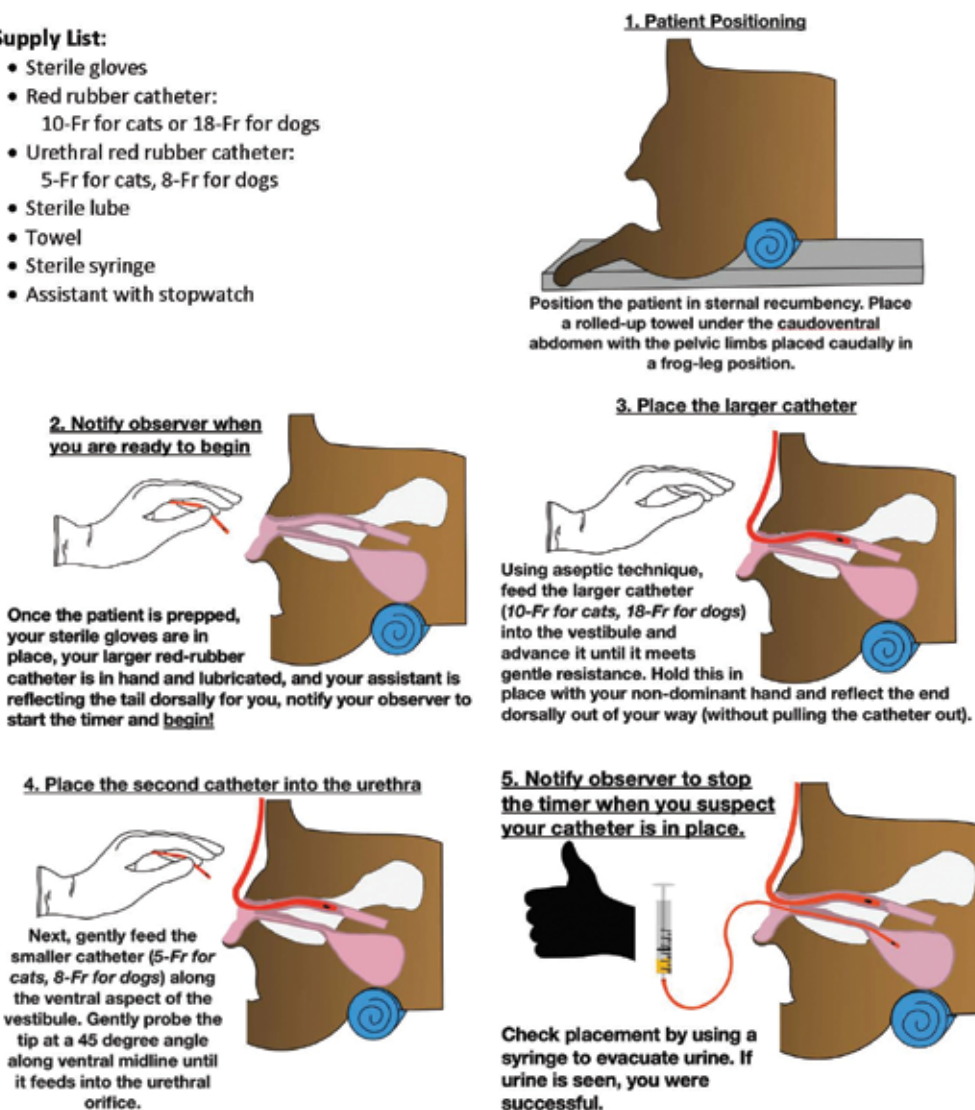


Figure 1. Instructional, 2-page illustrated handout provided to the catheter placers demonstrating both of the urethral catheterization techniques used in this report. Note that the 2-catheter technique used in this report is included on Page 1.

Urethral catheterization procedure

All animals were anesthetized using the same protocol. Cats were pre-medicated with dexmedetomidine, ketamine, and buprenorphine (0.01 mg/kg, 5 mg/kg, and 0.02 mg/kg, respectively) intramuscularly and induced with propofol to effect (approximately 2 mg/kg) intravenously. Dogs were pre-medicated with acepromazine and buprenorphine (0.03 mg/kg and 0.02 mg/kg, respectively) intramuscularly and induced with propofol to effect (approximately 4 mg/kg) intravenously. All animals were maintained under general anesthesia with a mixture of inhalant isoflurane and oxygen. Just before aseptic preparation of the spay site, anesthetized animals were placed in sternal recumbency with a rolled-up towel under the caudal

abdomen just in front of the pelvic limbs, and the limbs were placed in a frog-leg position (Figure 3). The tails were dorsally reflected and held by an assistant and 2% chlorhexidine scrub was used to prepare the vulva and surrounding skin.

The catheter placer donned sterile gloves and moved the glove wrapping to be used as a sterile field over the pelvic limbs just below the vulva. Sterile lubricant was decanted onto the glove wrapping, and the appropriate sterile red rubber catheter(s) (Sovereign feeding tubes; MWI Animal Health, Boise, Idaho, USA) were passed to the catheter placer.

Each animal was catheterized by 1 catheter placer using both techniques. A coin toss was used to determine which urethral catheterization technique was performed first. When the

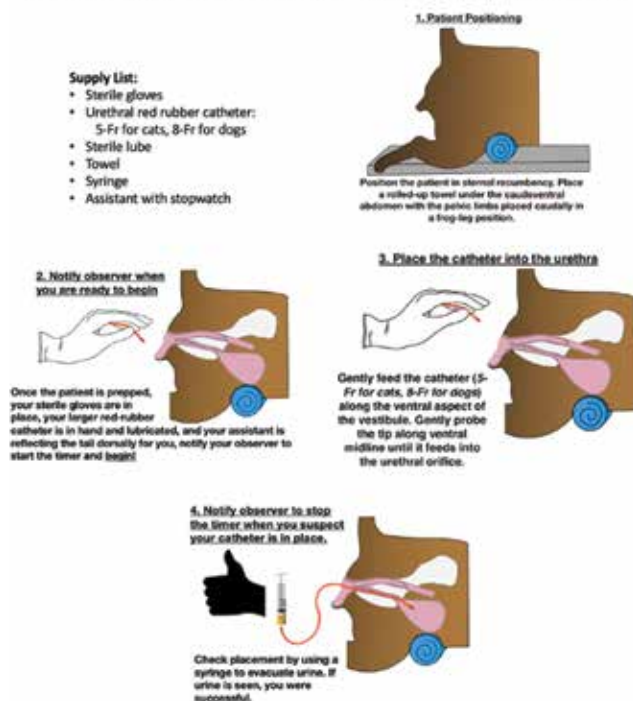
Instructions for Traditional Urethral Catheter Placement Technique

Figure 2. Page 2 of the illustrated handout demonstrating the traditional urethral catheterization method used in this report.

catheter placer had donned sterile gloves and stood ready with catheter in hand, an assistant was notified to start a timer and catheterization was initiated. The catheter placer was allowed up to 3 min to perform each technique. Once the catheter placer believed successful catheterization had occurred, the assistant stopped the timer and placement was checked by applying suction to the urethral red rubber catheter with a syringe. If urine was evacuated with the syringe, the attempt was considered successful and the time was recorded and the catheter placer converted to the second technique. If no urine was noted, the timer was restarted, and the catheter placer resumed their attempt at catheterization. If 3 min passed without successful catheterization, the attempt was considered unsuccessful and the catheter placer converted to the second technique. The above protocol was then repeated with the alternate technique.

Two-catheter technique

Two sizes of red rubber catheters are used when performing the 2-catheter technique. The first red rubber catheter (10-Fr in cats and 18-Fr in dogs) was introduced into the vestibule and gently advanced cranially until resistance was met when it encountered the cervix to obstruct the vaginal canal during placement. The catheter was left in place and reflected dorsally by the catheter placer's non-dominant hand. Then, the smaller red rubber catheter (5-Fr for cats and 8-Fr in dogs) was retrieved and gently advanced into the vestibule while being directed along ventral midline at approximately a 45° angle, probing gently along the ventral surface of the vestibule until it could be advanced into the urinary bladder through the urethral orifice.



Figure 3. Patient positioning in sternal recumbency with the tail reflected dorsally by an assistant. A rolled towel was placed in front of the pelvic limbs and the sterile glove packaging was used to create a small sterile field for the procedure. Successful placement of a urethral catheter using the 2-catheter technique is shown, with the larger red rubber catheter reflected dorsally and the smaller red rubber catheter placed in the urethra ventrally.

Traditional catheterization

An appropriately sized red rubber catheter (5-Fr catheters for cats, and 8-Fr catheters in dogs) was selected. The catheter was gently advanced into the vestibule while being directed along ventral midline at approximately a 45° angle, probing gently along the ventral surface until it could be advanced into the urinary bladder through the urethral orifice. No digital palpation or visualization with other instruments was allowed.

Statistical analyses

Continuous variables were assessed for normal distribution using the Shapiro-Wilk test. A McNemar test was used to evaluate for a difference in success rates between the student traditional and 2-catheter urethral catheterization techniques. The Mann Whitney *U*-test was used to calculate time to successful student catheterization for each technique. All results were calculated with statistical software (SAS Version 9.4 for Windows; SAS Institute, Cary, North Carolina, USA; SPSS Version 26 for Mac, IBM Corporation, Armonk, New York, USA).

Results

Due to the COVID-19 pandemic in 2020, data collection for this report was abruptly halted, resulting in a premature completion of this study. At the time of the study's completion, 23 cats and 6 dogs had been enrolled, with 1 cat being excluded due to inadvertent placement of the larger, 10-Fr catheter into the urethra during the 2-catheter technique. This cat was noted to be pregnant on physical examination with mucoid vaginal discharge and an apparently distended urethra that made catheterization easy, leaving 22 cats in the study. Cats enrolled in this report ranged from 2 and 72 mo of age (median: 6.5 mo) and weighed between 2.1 and 6.5 kg (median: 3.2 kg). Dogs in this study ranged from 2.5 to 18 mo of age (median: 3.5 mo) and weighed between 4.6 and 9.8 kg (median: 5.2 kg). All cats were recorded as either domestic shorthair or domestic longhair

Table 1. Success rates for placement of urinary catheters in cats and dogs, using 2 approaches. Students 1 and 2 lacked urethral catheterization experience, whereas the Control was a person with urethral catheterization experience.

	Student 1		Student 2		Both students		Control	
	Traditional	2-Catheter	Traditional	2-Catheter	Traditional	2-Catheter	Traditional	2-Catheter
Cats	5/8 (62.5%)	6/8 (75%)	4/5 (80%)	5/5 (100%)	9/13 (69.2%)	11/13 (84.6%)	9/9 (100%)	9/9 (100%)
Dogs	0/3 (0%)	3/3 (100%)	N/A N/A	N/A N/A	0/3 (0%)	3/3 (100%)	3/3 (100%)	2/3 (66.7%)
Overall	5/11 (45.5%)	9/11 (81.8%)	4/5 (80%)	5/5 (100%)	9/16 (56.2%)	14/16 (87.5%)	12/12 (100%)	11/12 (91.7%)

Table 2. Median time (in seconds) for placement of urinary catheters in cats and dogs, using 2 approaches. Students 1 and 2 lacked urethral catheterization experience, whereas the Control was a person with urethral catheterization experience.

	Student 1		Student 2		Both students		Control	
	Traditional	2-Catheter	Traditional	2-Catheter	Traditional	2-Catheter	Traditional	2-Catheter
Cats	22.58	92.73	43.69	42	30.39	47.46	8.52	19.7
Dogs	N/A	22.3	N/A	N/A	N/A	22.3	52.19	150
Overall	22.58	47.46	43.69	42	30.39	44.73	28.1	38

cats, whereas dog breeds consisted of 4 mixed breed dogs, 1 beagle, and 1 chihuahua.

Students performed the traditional catheterization technique first in 62.5% (10/16) of animals, and the 2-catheter technique first in 37.5% (6/16) of animals. Overall student success rates for catheterization using the traditional and 2-catheter techniques were 56.2 and 87.5%, respectively (Tables 1, 2). The control catheter placer performed the traditional and 2-catheter technique first in 66.7 and 33.3% (8 and 4 of 12) animals. The overall control catheter-placer success rate for catheterization was 100 and 91.7% for traditional and 2-catheter techniques, respectively (Tables 1, 2).

Both students were able to successfully place urethral catheters in most of the small female patients enrolled in this study using traditional and 2-catheter techniques (56.3 and 87.5% of cases, respectively). No significant difference was identified in overall success rates between urethral catheterization techniques used by student catheter placers ($P = 0.063$). Time to successful catheterization by students with each technique was not different ($P = 0.305$).

Discussion

This study confirmed that veterinary students with no previous female urethral catheterization experience can successfully catheterize small female cats and dogs with moderate to high success rates (56.2 and 87.5%) using the traditional and 2-catheter techniques, respectively. Although no significant difference among the rates of success between each technique were identified, these findings were comparable to both published results assessing catheterization techniques and to the control clinician that participated in this current report (4). The lack of significant findings shown here may be attributable to a Type 2 error as a result of the reduced sample size experi-

enced due to COVID-19, especially since these findings were similar to the previous study in which a larger sample size was obtained (4). Results from this report confirmed that novice veterinary students could successfully perform both urethral catheterization techniques. The success rates and time to successful catheterization from this report will be used to plan subsequent studies evaluating both techniques in larger populations of students and in the clinical setting to objectively measure if 1 technique is more successful than the other.

The time to successful urethral catheterization between student catheter placers and clinicians (from this report and the previous) were not considerably different, with successful catheterization being performed in < 3 min for all parties (4). Time to successful catheterization using the 2-catheter technique herein was longer than the time to catheterization using the direct technique, which intuitively makes sense, since time is required to place a second catheter to accomplish the same task. Regardless, no significant difference in time was identified on statistical analysis.

During this study the authors noted that dogs with larger diameter vaginal canals, allowing digital palpation of the urethral papilla, were more technically challenging to catheterize using the 2-catheter technique. In these instances, the vaginal canal diameter was larger than the 18 French red rubber catheters used to obstruct the vaginal canal, allowing the smaller urethral catheter to pass. Although outside the scope of this report, the authors suspect that dogs approaching the 10-kg limit or those having had previous litters may require larger diameter red rubber catheters (*e.g.*, 24- or 26-gauge) to effectively obstruct the vaginal canal. Alternatively, these dogs may simply not be candidates for the 2-catheter catheterization technique since concurrent digital palpation is possible.

The 2-catheter technique detailed in this report used affordable, readily available supplies, and requires minimal training.

This technique can provide veterinary students, nurses, and clinicians of all experience levels an additional method for urethral catheterization in the small female cat and dog that may aid in the clinical setting, either as a firstline technique or when standard methods are unsuccessful. Although further studies are needed to evaluate this technique with traditional methods in clinical patients to truly assess its efficacy, sharing information on an additional method that may have higher success rates for some catheter placers in this challenging population of patients is important to help the veterinary team become proficient at this essential clinical skill.

Providing clinical skills instruction to students with live animals best mimics the experience that students will have in the clinical setting. However, cadaveric practice and model simulations are more technically feasible and lack the ethical dilemmas that come with live animal clinical skills training (3,5). The authors believe that acquiring data regarding the estimated rates of successful catheterization and the time required to perform this technique in a novice population of catheter placers can provide valuable information about the true aptitude of students' abilities and be used to more accurately plan future investigations.

Due to the COVID-19 pandemic, data collection for this report was abruptly discontinued. The incomplete data collection may have contributed to the lack of a significant difference in success rates for catheterization with each technique. The information gained from this study will still help guide further study design for future investigations. During the practice catheterizations, the authors anecdotally noted that small adult female dogs were more technically challenging than female puppies. With a larger canine population, success rates of both techniques may be significantly different. Furthermore, it is unclear how general anesthesia may have altered the success rates compared to clinical scenarios when patients may only be sedated, with less relaxation of the regional anatomy. In a clinical

setting, it is unlikely that practitioners or students will place multiple urethral catheters close in time. During this study, the authors suspect the catheter placers quickly learned the appropriate angle and direction of the urethral papilla and could simply repeat a similar action between each animal to achieve successful catheterization, which may have altered the results of this study.

In conclusion, the 2-catheter technique was successfully used by 2 veterinary students without prior urethral catheterization experience in clinically healthy female cats and dogs. The authors plan to further assess the success of the 2-catheter technique with follow-up investigations built on the results of this report. Larger groups of pre-clinical veterinary students working on cadavers and other members of the veterinary team using a population of clinical patients requiring catheterization in the hospital setting will be studied.

Acknowledgments

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Student Paper Communication étudiante

Massive hepatoma treated with curative-intent liver lobectomy in a standard poodle dog

Andrew C. Poon

Abstract — A 12-year-old neutered male standard poodle was seen at a veterinary clinic for a complete oral health assessment and treatment. A routine blood biochemistry revealed a marked hepatic enzymopathy, with gamma-glutamyltransferase being the most severely elevated enzyme. Liver lobectomy was performed to remove a hepatic tumor visualized on abdominal ultrasound examination. Despite concerns for a cholestatic disorder or biliary neoplasia, histopathology of the resected mass confirmed a massive hepatoma from the left lateral liver lobe.

Résumé — Hépatome massif traité par lobectomie hépatique à visée curative chez un chien caniche standard.

Un caniche standard mâle castré de 12 ans a été vu dans une clinique vétérinaire pour une évaluation et un traitement complets de la santé bucco-dentaire. Une biochimie sanguine de routine a révélé une enzymopathie hépatique marquée, la gamma-glutamyltransférase étant l'enzyme la plus élevée. Une lobectomie hépatique a été réalisée pour enlever une tumeur hépatique visualisée à l'échographie abdominale. Malgré les inquiétudes concernant un trouble cholestatique ou une néoplasie biliaire, l'histopathologie de la masse réséquée a confirmé un hépatome massif du lobe latéral gauche du foie.

(Traduit par D^r Serge Messier)

Can Vet J 2022;63:1153–1156

Case description

In May 2022, a 12-year-old neutered male standard poodle was seen by a referring veterinarian for a complete oral health assessment and treatment with concerns for an underlying hepatopathy. The dog was bright, alert, and responsive, with bilateral lenticular sclerosis, diffuse calculus, gingivitis, and a 2.5-cm mobile subcutaneous mass in the left flank. The family reported that the dog was in good condition at home despite occasional bilious vomiting, and that he was on a tapering dose of oclacitinib 8 mg, PO, q24h (Apoquel; Zoetis, New Jersey, USA) for ongoing atopic dermatitis. A complete blood (cell) count (CBC) and biochemical profile on May 17 revealed decreased reticulocyte-hemoglobin [23.6 pg; RI (reference interval): 24.5 to 31.8 pg], increased alanine aminotransferase (ALT) (279 IU/L; RI: 18 to 121 IU/L), alkaline phosphatase (ALP) (512 IU/L; RI: 5 to 160 IU/L) and gamma-glutamyltransferase (GGT) (355 IU/L; RI: 0 to 13 IU/L). Lipemia (315 IU/L; RI: 0 to 250 IU/L), with hypercholesterolemia (10.9 mmol/L; RI: 3.4 to 8.9 mmol/L) and

hypertriglyceridemia (6.15 mmol/L; RI: 0.23 to 1.71 mmol/L) was also evident. Given the concern for hepatobiliary disease, an abdominal ultrasound examination was performed.

Using ultrasonography at a depth of 11 cm and a frequency of 7 megahertz (MHz), a hyperechoic, cavitated 6.5 to 7.5 cm mass was seen arising from the left side of the liver (Figure 1 a, b). Apart from prominent and mildly enlarged adrenal glands, the remainder of the abdominal ultrasound was unremarkable. Treatment options were discussed, and the dog was referred to a veterinary surgical oncologist.

At the time of surgery, the dog was sedated with methadone (Comfortan; Dechra Pharmaceuticals, Northwich, UK), 0.25 mg/kg, IV and dexmedetomidine (Dexdomitor; Zoetis, New Jersey, USA), 1 µg/kg, IV then induced with ketamine (Anesketin; Dechra Pharmaceuticals, Northwich, UK) and Propofol, 1 mg/kg, IV and 4 mg/kg IV (PropoFlo) to effect. An ultrasound-guided locoregional block of the intercostal and quadratus lumborum planes with ropivacaine hydrochloride (Naropin; AstraZeneca, Cambridge, UK), 2 mg/mL, IM was conducted by a veterinary anesthesiologist, and a 20-gauge arterial catheter was placed in the right dorsal pedal artery. Peri-operative cefazolin (Kefzol; Teva Canada, Toronto, Ontario), 22 mg/kg, IV was given 40 min before surgery. The dog was transferred to surgery and maintained on isoflurane with a fentanyl citrate (Dechra Pharmaceuticals), 20 µg/kg per hour, IV and ketamine (Dechra Pharmaceuticals), 3 µg/kg per hour, IV constant rate infusion for the entire surgical procedure. Meloxicam (Metacam; Boehringer Ingelheim, Ingelheim am Rhein, Germany), 0.1 mg/kg, SQ was given 5 min into anesthetic recovery.

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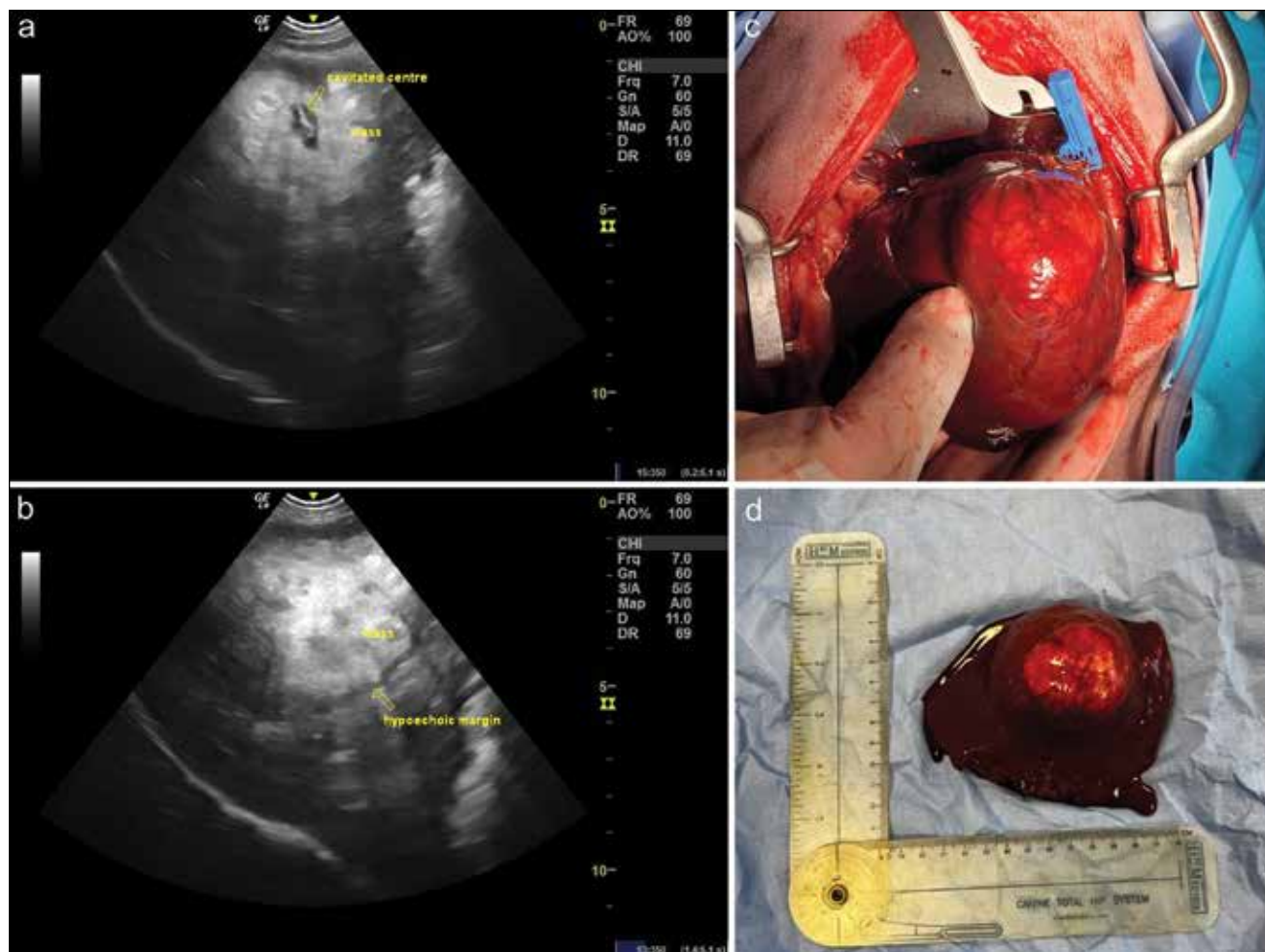


Figure 1. Appearance of the hepatic mass as presented by ultrasonography (depth = 11 cm, frequency = 7 MHz), and post liver lobectomy. a – Hepatic mass extending from the left lateral liver lobe with a cavitation (yellow arrow). b – Hypoechoic margin of the mass at the deep margin of the liver lobe (yellow arrow). c – Hepatic mass as photographed *in situ* from the left lateral liver lobe during exploratory celiotomy and (d) resected mass on the surgical table beside a measuring tape (cm).

After being placed in dorsal recumbency, the dog was clipped, aseptically prepared, and draped for surgery. A ventral midline celiotomy was performed. The falciform ligament was excised, and the liver lobes were exteriorized. A 68.0 mm × 73.4 mm mass was noted *in situ* and arising from the left lateral liver lobe (Figure 1 c). A lobectomy of the left lateral liver lobe was performed with a 60 mm thoracoabdominal stapler and LigaSure (Medtronic, Minneapolis, Minnesota, USA). The remainder of the abdomen was evaluated for abnormalities. The linea alba was closed with 0 PDS (Ethicon, Johnson & Johnson, New Jersey, USA) in a simple continuous suture pattern. The subcutaneous layer was closed with 3-0 Monocryl (Ethicon) in a simple continuous suture pattern. The skin was apposed with 3-0 nylon (Ethicon) in a continuous Ford interlocking suture pattern. The resected left lateral liver lobe (Figure 1 c, d) was fixed in formalin and submitted to Antech (Mississauga, Ontario) for histopathology examination.

Histopathology of the liver mass is shown in Figure 2 a, b. The final diagnosis was a benign hepatoma. The liver mass was composed of disorganized sheets and cords of well-differentiated hepatocytes, which were separated by sinusoid-like vascular

channels; many of which were markedly dilated. There were numerous blood vessels of various diameters within the tumor, with no evidence of bile ducts or portal tracts. The hepatocytes had moderate amounts of eosinophilic cytoplasm, and the cells were smaller and stained darker than those in the remainder of the liver. Nuclei were oval and uniform with a fine chromatin pattern, and the mitotic count was 0. Excision was complete, with at least 9 mm of normal liver at the proximal margin.

Discussion

Hepatic tumors are rare, accounting for fewer than 1.5% of all primary canine tumors (1). Primary liver tumors can arise from hepatocytes, bile duct epithelium, or neuroendocrine cells of the liver. Metastatic tumors to the liver are reported in about 30.6 to 36.8% of dogs with non-hepatic neoplasia (2). Three morphologic types describe liver tumors: massive, nodular, or diffuse. This dog was ultimately diagnosed with a massive hepatoma (or hepatocellular adenoma, HCA).

Other primary tumors arising from hepatocytes include hepatocellular carcinoma (HCC) and hepatoblastoma. The HCC is the most common primary liver tumor in dogs, accounting

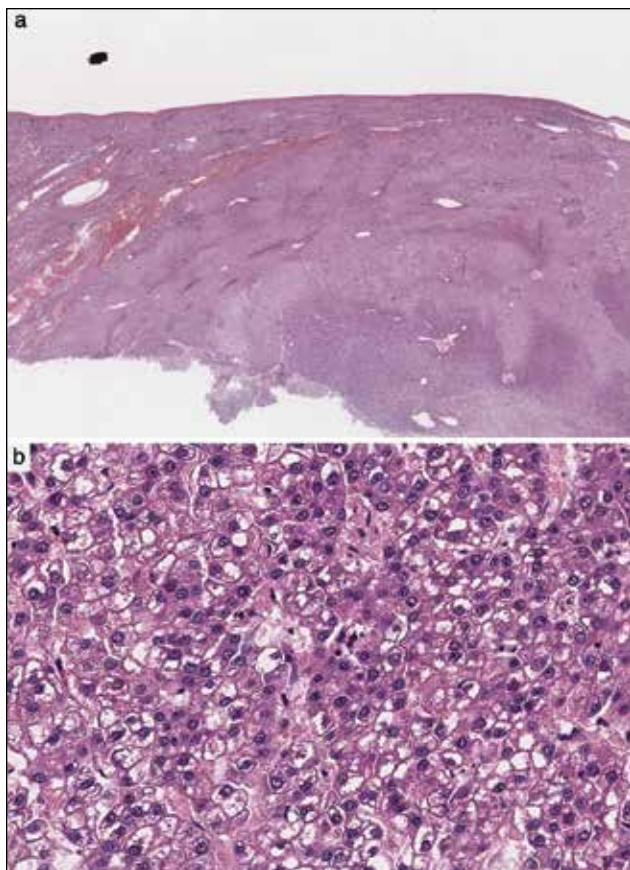


Figure 2. Histopathology of the resected hepatoma/HCA. Images obtained by hematoxylin and eosin (H&E) staining of formalin-fixed and sectioned liver tissue with scanning overview of sectioned slide of liver (a) and cellular appearance (b) with 20 $\times$ magnification on light microscopy.

for about 77% of cases (1). Hepatocellular adenoma has been diagnosed incidentally in dogs at post-mortem examination and can occasionally be difficult to distinguish from nodular hyperplasia of hepatocytes. Hepatoblastoma, a tumor of primordial hepatic stem cells, is exceedingly rare, having only been reported in a 13-year-old female Maltese dog (3). Metastasis to common sites: regional lymph nodes (LNs), abdominal organs, and lungs occurs in about 0 to 37% of dogs with massive HCC and 93 to 100% of dogs with nodular or diffuse HCC (1).

A breed or genetic disposition has not been confirmed in dogs with hepatocellular tumors. Presenting signs are often non-specific, such as lethargy, anorexia, unexplained weight loss, and vomiting. Other signs such as abdominal distension, jaundice, diarrhea, and seizures have also been reported (2). Common hematologic abnormalities detected include anemia, leukocytosis, and thrombocytosis. In a study of dogs with massive HCC, elevated ALT [mean: 1083 IU/L], ALP (mean: 1932.7 IU/L), and GGT (mean: 14.6 IU/L) were represented in 95.2%, 88.1%, and 53.8% of dogs, respectively (4). Paraneoplastic hypoglycemia has been reported in both canine HCC (5) and HCA (6) with secretion of insulin-like growth factor type-II linked to the former tumor type and hypoinsulinemia in the latter.

In this case, the referring veterinarian had an initial clinical suspicion for biliary disease or biliary neoplasia owing to the markedly elevated GGT (by 27.3-fold). Cholangiocellular tumors, the most common being biliary cystadenoma (bile duct adenoma), or cholangiocarcinoma (bile duct carcinoma) can also present similarly in dogs (2). The gallbladder, located between the right medial liver lobe and the quadrate lobe, concentrates and releases bile into the duodenum for the emulsification of fat. Gamma-glutamyltransferase is an induced, cell-membrane bound enzyme that is widely used as a marker of hepatobiliary disease in veterinary medicine. It is involved in the metabolism of amino acids and catalyzes the transfer of gamma-glutamyl functional groups from glutathione, an important antioxidant in mammals. In a study of 270 dogs with and without liver disease, other causes of elevated GGT described are: cholestasis, cholelithiasis or cholecystitis, gall bladder mucocele, steroid hepatopathy, hepatic necrosis, and portosystemic shunts (7). Based on the biochemical profile, bile duct obstruction may have occurred from an impinging tumor; however, functional obstruction of the gallbladder was not seen during ultrasound examination or surgery.

Mounting evidence from studies in humans show that GGT is highly expressed in many tumor types, including breast (8), pancreatic (9), and gastrointestinal (10) cancers. It also has been postulated to be involved in carcinogenesis, elevated cancer risk, and resistance to chemotherapy (11,12). Interestingly, abnormal expression of a human hepatoma specific GGT (HS-GGT) isoenzyme and alteration of its gene methylation status has been associated with HCC (13). In this study, hypomethylation of CCGG sites of GGT genes, along with detected elevation of HS-GGT was determined to be a sensitive tumor marker for HCC diagnosis. A separate study identified a prognostic value of evaluating GGT in 469 human patients with resected and histologically confirmed HCC (14). In veterinary medicine, elevated serum GGT has also been identified in dogs with renal carcinoma (15,16), but whether tumor specific GGT isoenzymes explain a total elevation of GGT in primary hepatocellular tumors has yet to be elucidated.

Surgical removal by curative-intent liver lobectomy is the mainstay therapy for the management of massive hepatocellular tumors. Right-sided liver tumors are more difficult to resect due to proximity to the caudal vena cava, and pre-operative screening for coagulopathy before liver lobectomy has been strongly recommended (1).

Median survival time (MST) is the time in days after diagnosis or treatment, for which 50% of dogs are still alive. Overall survival (OS) is the time from diagnosis or treatment to the time of death in days. In massive HCC, the MST was significantly longer in dogs treated with liver lobectomy (MST = 1460 d) than those without surgery (MST = 270 d) (4). In a 2017 study, dogs receiving complete histologic excision of HCC had a longer median OS of > 1836 d compared to dogs with incomplete excision (median OS = 765 d) (17). The liver, being capable of regeneration can continue to function normally and regenerate even with up to 75% resected (2). Prognosis for dogs with HCC/HCA is good to excellent, with most cases considered biologically nonaggressive. Local recurrence is reported in

0 to 13% of dogs with massive HCC after liver lobectomy, and about 9.5% of dogs after surgery eventually die because of their disease (4). In a 2022 study, median time to develop recurrence was 367 d, with no significant difference in median OS for dogs which develop recurrence *versus* those which did not (851 *versus* 970 d) (18).

Acknowledgments

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Answers to Quiz Corner

Corrigé du test éclair

1. C) Treat this dog with chronic/compensated congestive heart failure (CHF) with furosemide and pimobendan. Furosemide is a diuretic and pimobendan is a positive inotrope. An ACE-inhibitor (e.g., enalapril) may also be prescribed.

Always confirm the diagnosis of CHF with thoracic radiographs before starting therapy. Not all dogs with a heart murmur are in CHF. They can have a concurrent and unrelated (i.e., non-cardiac) cause of cough such as tracheal collapse or chronic bronchitis.

In small dogs with a heart murmur mitral valve disease most commonly causes CHF, particularly in at-risk breeds such as the Cavalier King Charles spaniel and Dachshund. In large dogs, particularly at-risk breeds such as the Doberman pinscher, dilated cardiomyopathy more commonly causes CHF. Use outpatient treatment for stable patients in which CHF is confirmed by thoracic radiographs. Patients with acute heart failure require hospitalization with oxygen and diuretic therapy (i.e., furosemide) for stabilization $\pm$ antiarrhythmics and additional diuretics (e.g., spironolactone).

Reference

1. Cohn L, Côté É. Clinical Veterinary Advisor-Dogs and Cats. 4th ed. St. Louis, Missouri: Elsevier, 2020:525–527.

2. E) This cat has diabetic ketoacidosis (DKA) and requires emergency treatment with IV fluids and regular insulin. DKA is a life-threatening condition and requires aggressive treatment.

Confirm the diagnosis with routine bloodwork, ketone testing of the urine and serum, $\pm$ blood gas analysis. Administer IV fluids first to address perfusion and correct dehydration. Correct and monitor common electrolyte abnormalities (e.g., hypokalemia and hypophosphatemia).

Next, treat with regular insulin — a short-acting insulin with a rapid onset of action. It can be given IV as a constant rate infusion or as IM injections every 4 to 6 hours. Do not give SQ initially due to poor perfusion in a dehydrated animal.

Diabetic ketoacidosis occurs due to a lack of insulin plus utilization of fat stores for energy. Breakdown of fats results

1. C) Il faut traiter ce chien souffrant d'insuffisance cardiaque congestive (ICC) chronique/compensée au moyen de furosémide et de pimobendane. Le furosémide est un diurétique et le pimobendane est un médicament inotrope positif. Un inhibiteur de l'ECA (comme l'énalapril) peut également être prescrit.

Il faut toujours confirmer le diagnostic d'ICC par des radiographies thoraciques avant d'amorcer un traitement. Ce ne sont pas tous les chiens qui présentent un souffle cardiaque qui souffrent d'ICC. La toux peut avoir une cause concomitante autre (c'est-à-dire non cardiaque), comme un collapsus trachéal ou une bronchite chronique.

Chez les petits chiens ayant un souffle cardiaque, une valvulopathie mitrale est la cause la plus fréquente de l'ICC, en particulier chez les races à risque comme l'épagneul Cavalier King Charles et le teckel. Chez les grands chiens, la cause la plus fréquente d'ICC est la cardiomyopathie dilatée, en particulier chez les races à risque comme le doberman.

Les patients dont l'ICC est confirmée par des radiographies thoraciques et dont l'état est stable peuvent être traités à la maison. Ceux qui présentent une insuffisance cardiaque aiguë doivent être hospitalisés et recevoir de l'oxygène et un traitement diurétique (furosémide) pour stabiliser leur état, avec parfois des antiarythmiques et des diurétiques supplémentaires (spironolactone).

Référence

1. Cohn L, Côté É. Clinical Veterinary Advisor-Dogs and Cats. 4th ed. St. Louis, Missouri: Elsevier, 2020:525–527.

2. E) Ce chat souffre d'acidocétose diabétique et a besoin d'un traitement d'urgence par une fluidothérapie intraveineuse et de l'insuline régulière. L'acidocétose diabétique est une maladie qui met la vie en danger et nécessite un traitement énergique.

Confirmez le diagnostic avec les tests sanguins usuels et la détection de corps cétoniques dans l'urine et le sérum, et facultativement l'analyse des gaz sanguins. Administrez d'abord une fluidothérapie intraveineuse pour assurer la perfusion et rétablir l'hydratation. Corrigez et surveillez les



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in the production of ketone bodies which are highly osmotically active, causing worsening dehydration. Ketone bodies also cause acidemia.

Diabetic ketoacidosis typically occurs when a cat with unknown diabetes mellitus develops concurrent disease, e.g., pancreatitis, urinary tract infection, or ascending bacterial cholangiohepatitis. The subsequent release of cortisol and other counter-regulatory hormones causes an increased production of ketone bodies, resulting in ketosis and acidosis.

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2. Ettinger SJ, Feldman EC, Côté E. Textbook of Veterinary Internal Medicine Expert Consult. 8th ed., Milton, Ontario: Elsevier Canada, 2017:592–598.

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anomalies électrolytiques courantes (comme l'hypokaliémie et l'hypophosphatémie).

Administrez ensuite de l'insuline régulière (une insuline à courte durée d'action qui agit rapidement). Elle peut être administrée par voie intraveineuse en perfusion à débit constant ou par des injections intramusculaires toutes les 4 à 6 heures. Ne l'administrez pas par voie sous-cutanée initialement en raison de la mauvaise perfusion chez l'animal déshydraté.

L'acidocétose diabétique est due à un manque d'insuline et à l'utilisation des réserves adipeuses pour l'énergie. La mobilisation des graisses entraîne la production de corps cétoniques qui sont très osmotiquement actifs, ce qui aggrave la déshydratation. Les corps cétoniques provoquent également une acidémie.

L'acidocétose diabétique survient généralement lorsqu'un chat atteint de diabète mellitus non diagnostiqué développe une maladie concomitante, comme une pancréatite, une infection urinaire ou une cholangiohépatite bactérienne ascendante. La libération subséquente de cortisol et d'autres hormones contre-régulatrices entraîne une production accrue de corps cétoniques, menant à l'acidocétose.

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1. Cohn L, Côté É. Clinical Veterinary Advisor-Dogs and Cats. 4th ed. St. Louis, Missouri: Elsevier, 2020:254–255.
2. Ettinger SJ, Feldman EC, Côté E. Textbook of Veterinary Internal Medicine Expert Consult. 8th ed., Milton, Ontario: Elsevier Canada, 2017:592–98.

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Veterinary Dermatology

Dermatologie vétérinaire

Isoxazolines for treating canine demodicosis, sarcoptic mange (scabies), and lice infestation

Vincent E. Defalque

In 2014, a new class of parasiticides was introduced to the Canadian small animal health market. Isoxazoline drugs include afoxolaner, fluralaner, lotilaner, and sarolaner. A plethora of oral and topical spot-on products are now commercially available and contain either a single isoxazoline or an isoxazoline in combination with 1 or 2 other active ingredient(s). There are geographical differences in the availability and licensure of these drugs. Therefore, one must judiciously consider regional prescribing recommendations. Isoxazolines currently available for use in dogs in Canada are listed in Table 1.

Isoxazolines have had impressive results in controlling canine demodicosis (Figure 1 A, B), sarcoptic mange (scabies) and lice infestation. This article reviews the clinical use (both label and extra label) of isoxazolines in Canada for cutaneous parasites affecting dogs.

Canine demodicosis

Demodicosis is a common skin disease caused by proliferation of *Demodex* mites. The efficacy of isoxazolines was evaluated in 697 dogs enrolled in 20 studies.

Oral afoxolaner

The efficacy of oral afoxolaner was evaluated in 253 dogs enrolled in 7 studies (1–7). Details are summarized in Table 2.

Oral/topical fluralaner

The efficacy of oral or topical fluralaner was evaluated in 373 dogs enrolled in 10 studies (8–17). Details are summarized in Table 3.

Oral lotilaner

The efficacy of oral lotilaner was evaluated in 1 case series (18). Ten dogs were treated orally 3 times, 28 d apart. All dogs were mite-free at Day 70. There were no adverse effects.

Oral sarolaner

The efficacy of oral sarolaner was evaluated in 2 controlled studies. In the first study (19), 8 dogs were treated 3 times, 30 d apart. All dogs were mite-free at Day 44. There were no adverse effects. Another 8 dogs were treated with a weekly spot-on containing imidacloprid and moxidectin. Sarolaner performed better than the spot-on. The second non-inferiority study (20) compared the same 2 products. Fifty-three dogs were treated 30 d apart. All dogs were mite-free at Day 150. Another 28 dogs were treated weekly or monthly with the imidacloprid-moxidectin spot-on. There were no adverse effects with oral sarolaner. Once again, sarolaner performed better than the spot-on.

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Table 1. Isoxazolines currently available for use in dogs in Canada.

Product name (market year)	Manufacturer	Route	Isoxazoline	Macrocytic lactone	Other	Label use	Extra-label use
Bravecto (2014)	Merck/Intervet	Oral	Fluralaner	N/A	N/A	E,T	D,S,L
Bravecto topical solution (2018)	Merck/Intervet	Topical	Fluralaner	N/A	N/A	E,T	D,S,L
Bravecto one (2021)	Merck/Intervet	Oral	Fluralaner	N/A	N/A	E,T	D,S,L
Credelio (2019)	Elanco	Oral	Lotilaner	N/A	N/A	E,T	D,S
Credelio plus (2022)	Elanco	Oral	Lotilaner	Milbemycin oxime	N/A	E,T,R,HT	D,S
NexGard (2014)	Boehringer Ingelheim	Oral	Afoxolaner	N/A	N/A	E,T,D	S
NexGard spectra (2019)	Boehringer Ingelheim	Oral	Afoxolaner	Milbemycin oxime	N/A	E,T,D,H,K,R,W,HT	S
Simparica (2016)	Zoetis	Oral	Sarolaner	N/A	N/A	E,T	D,S,L
Simparica trio (2020)	Zoetis	Oral	Sarolaner	Moxidectin	Pyrantel	E,T,H,K,R,HT	D,S,L

D — Demodicosis; F — Fleas; HK — Hookworm; HT — Heartworm; L — Lice infestation; R — Roundworm; S — Sarcoptic mange (scabies); T — Ticks; W — Whipworm.
N/A — Not available.

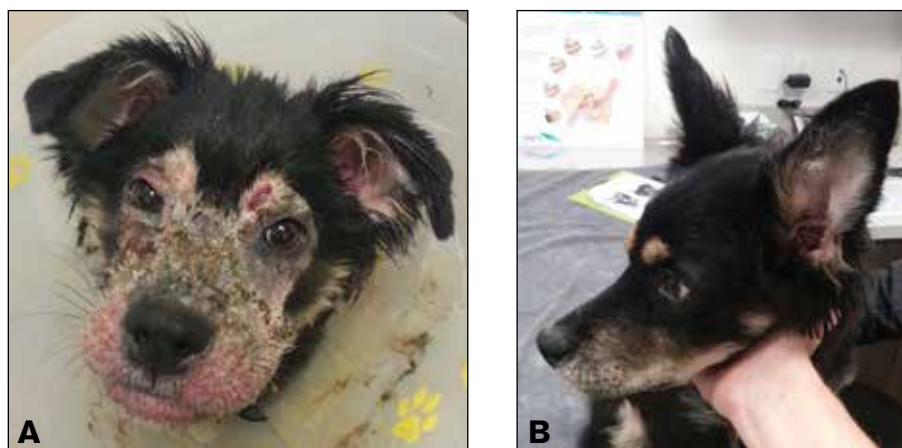


Figure 1. Juvenile demodicosis in a 6-month-old intact male Australian shepherd. Note the facial lesions on initial presentation, including alopecia, erythema, and crusts. Before (Day 0; A) and after (Day 44; B) treatment with a single dose of oral fluralaner.

Canine sarcoptic mange (scabies)

Canine sarcoptic mange (scabies) is a pruritic and contagious skin disease caused by the mite *Sarcoptes scabiei* var. *canis*. The efficacy of isoxazolines was evaluated in 464 dogs enrolled in 9 studies.

Oral afoxolaner

The efficacy of oral afoxolaner was evaluated in 1 controlled study (21). Ten dogs were treated twice, 28 d apart. All dogs were mite-free at Day 28. The efficacy of oral afoxolaner or the combination of afoxolaner-milbemycin oxime was evaluated in 2 case series (22,23). In the first study, 65 dogs were treated twice, 30 d apart; 99.7 to 100% of the dogs were mite-free at Day 60. In the second study, 142 dogs were treated with a single dose. All dogs were mite-free at Day 56. There were no adverse effects in these studies.

Oral/topical fluralaner

The efficacy of oral or topical fluralaner was evaluated in 1 controlled study (24). Nine dogs were treated with a single oral dose and 11 dogs were treated with a single topical spot-on dose. All dogs were mite-free at Day 28. There were no adverse effects. The efficacy of oral fluralaner was evaluated in 1 case series (25).

Seventeen dogs were treated with a single oral dose. All dogs were mite-free at Day 14. Adverse effects were not recorded.

The efficacy of oral or topical fluralaner was evaluated in 1 case series (26). Fifty-four dogs were treated with a single oral dose and 46 dogs were treated with a single topical spot-on dose. All dogs were mite-free at Day 56. There were no adverse effects.

Lastly, the efficacy of a single dose of oral fluralaner was evaluated in 1 case report of crusted — Norwegian-like-scabies (27). The dog was mite-free at Day 30.

Oral lotilaner

The efficacy of oral lotilaner was evaluated in 1 case series (28). Eight dogs were treated orally 3 times, 30 d apart. All dogs were mite-free at Day 30. There were no adverse effects.

Oral sarolaner

The efficacy of oral sarolaner was evaluated in a placebo-controlled laboratory study and in a controlled field study (29). Forty-four dogs were enrolled in the laboratory study. Twenty-two dogs were treated with oral sarolaner, whereas another 22 dogs received a placebo tablet on 2 occasions, 30 d apart. All sarolaner-treated dogs were mite-free at Day 30. Seventy-nine dogs were enrolled in the field study. Fifty-three

Table 2. Canine demodicosis – Afoxolaner studies.

Reference/year	Treatment protocol and outcome
(1) 2016	Controlled study — 8 dogs 3 doses, 14 d apart and a fourth dose 28 d later 100% mite-free at Day 84 No adverse effects Another 8 dogs were treated with a spot-on containing imidacloprid and moxidectin (same intervals) Afoxolaner performed better than the spot-on
(2) 2016	Case series — 4 dogs 3 doses, 28 d apart 100% mite-free at Day 56 Adverse effects not recorded
(3) 2017	Unpublished case series — 102 dogs Treated every 2 to 4 wk 100% mite-free at Day 90 Adverse effects not recorded
(4) 2018	Case series — 6 dogs 1, 2 or 3 doses; 21, 28, 35 or 42 d apart 100% mite-free at Day 77 No adverse effects
(5) 2018	Case series — 15 dogs Treated with the combination of afoxolaner-milbemycin oxime 3 doses, 28 d apart 99.9% mite reduction at Day 84 No adverse effects
(6) 2018	Case series — 50 dogs Treated with afoxolaner (31 dogs) or the combination of afoxolaner-milbemycin oxime (19 dogs) 3 doses, 28 d apart 98% mite reduction at Day 84 Adverse effect: vomiting (1 dog)
(7) 2019	Case series — 68 dogs Treated with the combination of afoxolaner-milbemycin oxime Single dose 82.4% mite reduction at Day 28 Adverse effects not recorded

dogs were treated with oral sarolaner, whereas another 26 dogs were treated with a spot-on containing imidacloprid and moxidectin, twice, 30 d apart. All sarolaner-treated dogs were mite-free at Day 60. Oral sarolaner was noninferior to topically applied imidacloprid/moxidectin. There were no adverse effects in either study.

The efficacy of oral sarolaner was evaluated in 1 case series (26). Twenty-six dogs were treated twice, 28 d apart. All dogs were mite-free at Day 56. There were no adverse effects.

Canine lice infestation

The efficacy of oral fluralaner was evaluated in 1 controlled study (30). Fourteen dogs with a sucking lice infestation caused by *Linognathus setosus* were treated with a single dose. All dogs were lice-free at Day 28. Another 10 dogs were treated once with a spot-on containing permethrin. There were no adverse effects. Fluralaner performed better than the spot-on.

The efficacy of a single oral dose of sarolaner was evaluated in 1 dog with a biting louse infestation caused by *Heterodoxus spiniger* (31). The dog was lice-free at Day 28. There were no adverse effects.

Table 3. Canine demodicosis – Fluralaner studies.

Reference/year	Treatment protocol and outcome
(8) 2015	Controlled study — 8 dogs Single oral dose 100% mite-free at Day 56 No adverse effects Another 8 dogs were treated with a spot-on containing imidacloprid and moxidectin (3 doses, 28 d apart) Oral fluralaner performed better than the spot-on
(9) 2015	Case series — 163 dogs Single oral dose 100% mite-free at Day 60 No adverse effects
(10) 2016	Case series — 4 dogs 2 oral doses, 60 d apart 98% mite reduction at Day 90 Adverse effects not recorded
(11) 2017	Case report — 1 dog with <i>Demodex injai</i> Single oral dose 100% mite-free at Day 49 Adverse effects not recorded
(12) 2018	Case report — 1 dog with hyperadrenocorticism and hypothyroidism Single oral dose 100% mite-free at Day 60 Diffuse nonpruritic erythematous papules on trunk 3 d after administration (resolved spontaneously within a few days)
(13) 2018	Case series — 67 dogs 1 to 3 oral doses, 84 d apart 100% mite-free at Day 90 No adverse effects
(14) 2019	Case series — 20 dogs Single oral dose 100% mite-free at Day 56 No adverse effects
(15) 2019	Controlled study — 8 dogs Single topical spot-on dose 100% mite-free at Day 84 No adverse effects Another 8 dogs were treated with a spot-on containing imidacloprid and moxidectin (at weekly to monthly intervals over 84 d) Topical spot-on fluralaner performed better than the imidacloprid/moxidectin spot-on
(16) 2020	Controlled study — 100 dogs Single oral or topical spot-on dose 100% mite-free at Day 84 (oral) 98% mite-free at Day 84 (topical spot-on) No adverse effects Another 24 dogs were treated with a spot-on containing imidacloprid and moxidectin (at weekly to monthly intervals over 84 d) Oral and topical spot-on fluralaner performed better than the imidacloprid/moxidectin spot-on
(17) 2021	Case report — 1 dog with localized demodicosis Single oral dose 100% mite-free at Day 56

What is the recommend dosage and number of doses?

The number of recommended doses, based on a review of the available scientific literature, is summarized in Table 4. It is recommended to use the labelled dosage for flea and tick

Table 4. Number of recommended doses of isoxazolines (use either a single isoxazoline product or a combination product).

Disease	Number of doses
Canine demodicosis	1 oral or topical dose of fluralaner 3 monthly oral doses of afoxolaner or lotilaner or sarolaner
Canine sarcoptic mange (scabies)	1 oral or topical dose of fluralaner 1 oral dose of afoxolaner 2 monthly oral doses of lotilaner or sarolaner
Canine lice infestation	1 oral or topical dose of fluralaner 1 oral dose of sarolaner

prevention/control/treatment, and to conform to the minimum age and body weight requirements. Due to reduced drug bio-availability in the fasted state, fluralaner and lotilaner should be administered with food, whereas for afoxolaner and sarolaner plasma concentrations are the same, regardless of whether the drug is given with or without food.

What are the potential side effects of isoxazolines?

Isoxazolines have potential side effects (including vomiting, diarrhea, anorexia, lethargy, and seizures). They should only be used in suitable patients (*i.e.*, use with caution in dogs with a history of seizures or neurological disorders), and under veterinary supervision.

Conclusion

The recent introduction of isoxazolines in veterinary medicine has resulted in effective and safe treatment of canine demodicosis, sarcoptic mange (scabies) or lice infestations, with low frequency of administration.

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Diagnostic Ophthalmology

Ophthalmologie diagnostique

Lynne S. Sandmeyer, Shayna Levitt, Marina L. Leis

History and clinical signs

A 13-year-old neutered male Labrador retriever cross was examined by the ophthalmology service at the Western College of Veterinary Medicine. This dog was presented for evaluation of a mass of the third eyelid of the right eye which had been present for 1 y. The mass had been previously removed by the referring veterinarian but had recurred. The menace responses, and palpebral, oculocephalic, direct and consensual pupillary light reflexes were normal bilaterally. Schirmer tear test (Schirmer Tear Test Strips; Alcon Canada, Mississauga, Ontario) values were 16 and 24 mm/min in the right and left eyes, respectively. The intraocular pressures were estimated with a rebound tonometer (Tonovet; Tiolat, Helsinki, Finland) and were 20 and 19 mmHg in the right and left eyes, respectively. Fluorescein staining (Fluorets; Bausch & Lomb Canada, Markham, Ontario) of the corneas was negative bilaterally. On direct examination there was a large, hyperemic, irregular, multilobulated mass involving the bulbar surface of the third eyelid of the right eye. Palpation revealed the mass extended into the deep ventral orbital region. Following application of 0.5% tropicamide (Mydracyl; Alcon Canada, Mississauga, Ontario), examination of both eyes using a transilluminator (Welch Allyn Finoff Transilluminator; Welch Allyn, Mississauga, Canada) and handheld biomicroscope (Kowa SL-17 Portable Slit Lamp; Kowa, Tokyo, Japan) revealed nuclear sclerosis and iris atrophy in both eyes and indirect ophthalmoscopic (Heine Omega 500; Heine Instruments Canada, Kitchener, Ontario) examination was completed and did not reveal abnormalities in either eye. A photograph of the eye at presentation is provided for your assessment (Figure 1).

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

Discussion

The ophthalmic diagnosis was a third eyelid mass. The primary differential diagnosis was third eyelid neoplasia with third eyelid inflammation and cyst formation considered less likely based on



Figure 1. Anterior segment photograph of the eye of a 13-year-old Labrador retriever cross.

the history in this case. The third eyelid is situated in the ventromedial orbit and is completely covered by conjunctiva which is divided into bulbar and palpebral surfaces. The conjunctiva is composed of the substantia propria covered by non-keratinized stratified squamous epithelium. T-shaped hyaline cartilage supports the structure of the third eyelid and the gland of the third eyelid sits superficially to the base of the cartilage on the bulbar surface. The gland of the third eyelid is a tubuloacinar, seromucoid gland in dogs and is an important component of aqueous tear-film production (1). Third eyelid neoplasia can be divided into 2 types; those that affect glandular tissue or those that arise from the conjunctiva or substantia propria. Neoplasia affecting the third eyelid gland include adenocarcinoma, adenoma, squamous cell carcinoma, basal cell carcinoma, myoepithelioma, and plasmacytoma (2–5). Neoplasia of the conjunctiva or substantia propria include hemangiosarcoma, hemangioma, melanoma, papilloma, angiokeratoma, squamous cell carcinoma, and lymphoma (6–8). Orbital neoplasia with subconjunctival extension into the third eyelid should also be considered in this case (9). Inflammatory conditions of the third eyelid that mimic neoplasia include atypical nodular granulomatous episclerokeratitis (NGE), idiopathic granulomatous inflammation, and nodular fasciitis (8). In addition, dacryops or cysts of glandular origin may originate from the gland of the third eyelid and may cause subconjunctival, fluid-filled masses (10,11). However, these are usually congenital and present in younger dogs. Third eyelid gland prolapse was considered unlikely in this case due to the irregular, multilobular nature of the mass and the mature age of the dog, as 75% of third eyelid gland prolapse occurs in dogs less than 1 y old (12).

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Definitive diagnosis of a mass is best achieved with light microscopic examination of tissue obtained either from an incisional or excisional biopsy. This mass had been removed previously and the histopathology was consistent with an adenocarcinoma of the third eyelid gland. The owner declined a repeat biopsy to confirm the diagnosis; however, recurrence of adenocarcinoma was considered likely. In this case, the mass had palpable extension beyond the ventral orbital rim and computed tomographic (CT) imaging of the orbit to evaluate the size and extent of the mass was recommended but also declined.

Adenocarcinomas are the most common third eyelid gland neoplasm in dogs making up 85%, with adenomas at 14% and squamous cell carcinoma at 0.8% (2). The average age of presentation for third eyelid neoplasia in dogs is ~11 y (2). Clinical manifestations of adenocarcinoma of the third eyelid usually include localized, firm, smooth, pink swellings involving the gland. Adenocarcinomas are characterized histologically by neoplastic epithelial cells often forming features indicative of glandular origin such as acini, ducts, or cytoplasmic features of secretion. Malignancy is indicated by poor cellular differentiation, cellular features of anaplasia, desmoplastic mesenchymal tissue, locally invasive behavior, or vascular invasion (2,13).

Removal of the entire third eyelid is the recommended treatment for third eyelid gland neoplasia (8). The metastatic rate for third eyelid gland adenocarcinomas is reported between 9.3 and 14% and the local recurrence rate is between 13 and 57% (2,13). In a large retrospective study, Dees *et al* (2) reported no significant difference in survival times between dogs with third eyelid gland adenocarcinoma with incomplete surgical margins compared to complete/narrow margins, nor between those with suspected or confirmed recurrence compared to those without recurrence. The only difference in survival times occurred between dogs with confirmed or suspected metastasis and those with no confirmed metastasis (2). In this case, prior to surgery, a complete blood (cell) count was within normal limits and serum biochemistry revealed moderately elevated liver enzymes. Cytology following regional lymph node aspiration was unremarkable, and thoracic radiographs and abdominal ultrasound were completed which showed no evidence of metastasis.

Due to extension of the neoplasia into the orbit, third eyelid removal was considered inadequate in this case. Exenteration (surgical removal of all orbital tissues, including the globe) was recommended as this is appropriate for neoplasia originating in the orbit, or for those with orbital extension. The exenteration was completed under general anesthesia and the tissues were submitted for light microscopic examination. This revealed a poorly circumscribed, unencapsulated neoplasm consistent with

an adenocarcinoma and tumor extension into the cut borders of the exenterated tissues. The prognosis in this case, therefore, is guarded as the potential of local recurrence remains. Adjunctive therapy including the addition of external beam radiation was recommended, but was declined. Ongoing monitoring was recommended.

In conclusion, neoplasia is the primary differential diagnosis for a mass involving the third eyelid in older dogs. Adenocarcinoma is the most common third eyelid gland neoplasia in dogs. Biopsy is recommended for diagnosis and surgical excision of the entire third eyelid can be curative if the neoplasia is confined to the third eyelid. Advanced imaging is recommended to determine tumor extent when not confined to the third eyelid. Extension of neoplasia into the orbit requires exenteration with adjunctive therapy for the best possible outcome. Finally, staging to evaluate for metastasis is important to determine prognosis.

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Veterinary Practice Management

Gestion d'une pratique vétérinaire

No shelter: What the data say on animal relinquishments

Ce que révèlent les données sur les abandons d'animaux

Chris Doherty

At the onset of the COVID-19 pandemic, with a large segment of the population working from home, and most other activities inaccessible, it seemed nearly everyone wanted a pet. Many people turned to purchasing or adopting a new cat or dog, for companionship, entertainment, a way to keep their children occupied, or myriad other reasons.

Almost as soon as this trend began, the discussion started to shift to the inevitable post-COVID world, in which offices re-opened, workers left their homes, activities resumed, and the “pandemic pets” were cast aside as fast as they were originally added to the family.

Over just the last few months, there have been stories from the CBC, CTV, and Global News, discussing increasing numbers of pet surrenders. The articles explain that the volumes of pets are inundating humane societies and rescues across Canada, such as Regina, Sudbury, and Calgary, straining their ability to accommodate all the animals.

As one example, CBC published a story in July 2022, with the headline “Pandemic pets ending up in shelters as owners return to office, struggle with rising costs.” There has been a 63% increase in the number of pets landing in shelters this year compared to the same period in 2021, as surrenders climbed from 520 to 845 over the first half of the year.

It then goes on to attribute this surge to the lifting of pandemic restrictions and accelerating inflation, including the

Au début de la pandémie de COVID-19, comme une grande partie de la population était en télétravail à la maison et la plupart des activités étaient inaccessibles, tout le monde voulait un animal de compagnie. Beaucoup de gens ont acheté ou adopté un nouveau chien ou un nouveau chat pour briser l'isolement, pour se divertir, pour garder leurs enfants occupés, ou pour diverses autres raisons.

Dès que cette tendance a été décelée, certains ont tout de suite commencé à penser à l'inévitable après-COVID, c'est-à-dire le moment où les bureaux rouvriraient, où les travailleurs quitteraient leurs maisons, où les activités reprendraient, et où les « animaux de la pandémie » seraient mis de côté aussi rapidement qu'ils ont été ajoutés à la famille.

Au cours des derniers mois, CBC, CTV et Global News ont rapporté un nombre croissant d'abandons d'animaux de compagnie. Les reportages expliquent que les refuges partout au Canada, que ce soit à Regina, à Sudbury ou à Calgary, reçoivent tellement d'animaux qu'ils n'arrivent plus à tous les accueillir.

À titre d'exemple, un article publié sur le site de CBC en juillet 2022 clame que les animaux de la pandémie aboutissent dans les refuges alors que leurs propriétaires retournent au bureau et n'ont plus les moyens de les garder. Il affirme que le nombre d'animaux admis dans les refuges a augmenté de 63 % cette année par rapport à la même période l'an dernier, comme

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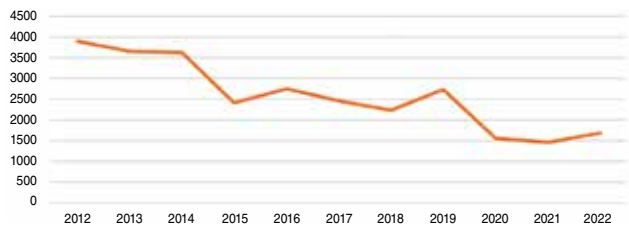


Figure 1. Annual animal surrenders to Toronto Animal Services, 2012 to 2022./Nombre annuel d'animaux confiés au refuge Toronto Animal Services, de 2012 à 2022.

rising costs of veterinary services. Taking a step back to assess the broader situation, however, paints a more positive picture.

Figure 1 shows the number of animals surrendered to Toronto Animal Services each year from 2012 through 2021. For 2022, the 845 figure for the first half the year is doubled, to just shy of 1700 forecasted surrenders for the full year.

Although this would result in the number of relinquishments in 2022 surpassing those in both 2020 and 2021, it would wind up well below relinquishments in 2012 through 2019, when the number of surrendered animals fluctuated from approximately 2200 to 3600 per year. Looking across Canada as a whole, the data tell a similar story to that of Toronto Animal Services.

Figure 2 shows the cumulative number of admissions to Canadian shelters per quarter, from the first quarter of 2016 through to the second quarter of 2022, categorized by stray animals, transferred animals, and owner surrenders.

Owner relinquishments of animals reached a low of approximately 5000 in the second quarter of 2020 and have since climbed to just under 8000 in the second quarter of 2022. This figure, however, is roughly in line with pre-pandemic volumes. In addition, as more agencies across the country have begun reporting their admission statistics, the cumulative numbers will inevitably climb as a result of a larger sampling database.

To adjust for this, we can instead look at the average surrender volume per reporting agency.

Figure 3 shows the number of animals surrendered for the first half of the year to the average Ontario shelter, and the average Canadian shelter. Across both groups, relinquishments have increased from 2020 and 2021 levels yet remain well below pre-pandemic levels.

There are, undoubtedly, those rescues and humane societies that are struggling with the number of animals in their care, whether due to a localized uptick in relinquishments, a hoarding situation, or another unique set of circumstances. Yet, it is clear from the data, that there is little evidence in support of widespread surrendering of animals.

This is, to some extent, relatively unsurprising. Over recent decades, the human-animal bond has become increasingly strong and important for most people. In a recent Ontario survey of pet owners conducted by the OVMA, the vast majority felt that their pet was akin to a member of their family or even their child. In addition, when asked where they would cut back spending if financial issues required it, only 1 in 5 indicated

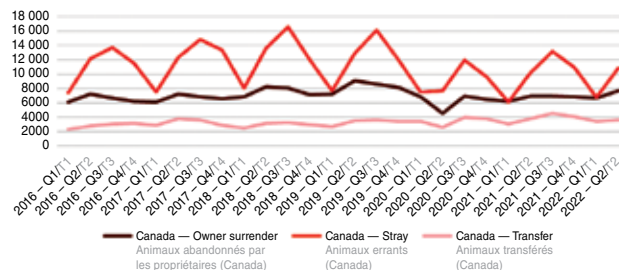


Figure 2. Admissions to Canadian shelters, Q1 2016 to Q2 2022./Nombre d'animaux admis dans les refuges au Canada, du premier trimestre de 2016 au deuxième trimestre de 2022.

l'indique le nombre d'abandons durant la première moitié de l'année qui est passé de 520 en 2021 à 845 en 2022.

L'article poursuit en expliquant que cette hausse serait liée à la levée des restrictions imposées en raison de la pandémie et à l'accélération de l'inflation, qui a entraîné une hausse des coûts des services vétérinaires. Toutefois, prendre du recul pour évaluer la situation dans son ensemble donne une image plus positive.

La figure 1 illustre le nombre d'animaux confiés au refuge Toronto Animal Services chaque année de 2012 à 2021. Le nombre indiqué pour 2022 a été obtenu en doublant le chiffre de 845 abandons au cours des six premiers mois de l'année, ce qui donne un peu moins de 1700 abandons prévus pour l'année entière.

Ainsi, même si le nombre d'abandons en 2022 devrait dépasser celui de 2020 et de 2021, il sera tout de même bien inférieur au nombre d'abandons observé chaque année de 2012 à 2019, période pendant laquelle il a fluctué entre 2200 et 3600 par année. Ailleurs au Canada, les données sont similaires à celles compilées par Toronto Animal Services.

La figure 2 montre le nombre cumulatif d'admissions dans les refuges canadiens par trimestre, du premier trimestre de 2016 au deuxième trimestre de 2022, par catégorie d'animaux (animaux errants, animaux transférés, ou animaux abandonnés par leurs propriétaires).

Le nombre d'animaux abandonnés par les propriétaires a été à son plus bas au deuxième trimestre de 2020, soit à environ 5000, et il a ensuite remonté pour se situer à un peu moins de 8000 au deuxième trimestre de 2022. Ce chiffre est toutefois comparable à ceux observés avant la pandémie. De plus, étant donné qu'un nombre croissant d'organismes à travers le pays ont commencé à dévoiler leurs statistiques concernant les admissions, le nombre cumulatif augmentera inévitablement en raison de l'augmentation de l'échantillonnage et de la quantité de données.

Il convient donc d'en tenir compte et d'examiner plutôt le volume moyen d'abandons par organisme.

La figure 3 présente le nombre d'animaux abandonnés durant la première moitié de l'année dans un refuge ontarien moyen et dans un refuge canadien moyen. Dans les deux cas, le nombre d'abandons a augmenté cette année par rapport à 2020 et à 2021, mais il reste bien inférieur aux nombres observés avant la pandémie.

Il y a sans aucun doute des refuges qui sont pleins, que ce soit en raison d'une hausse localisée des abandons, d'une situation

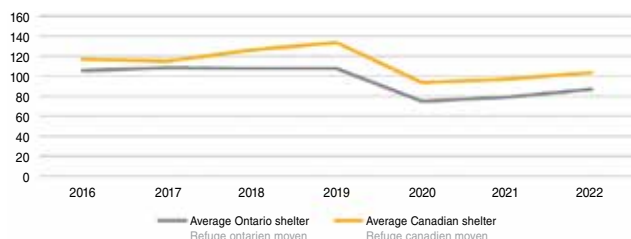


Figure 3. Number of owner surrenders for the first half the year, average Ontario shelter, and average Canadian shelter, 2016 to 2022./Nombre d'animaux abandonnés par leurs propriétaires durant la première moitié de l'année dans un refuge ontarien moyen et un refuge canadien moyen, de 2016 à 2022.

that they would seek to reduce spending on their pets; they were more likely to trim expenditures on entertainment, clothing, electronics, household items, and even groceries.

For most pet owners, regardless of how long they've had their animal, or the initial driving motivation for obtaining it, the idea that they would give them up simply because of a change in circumstance, such as a return to in-office work, is unthinkable. Encouragingly, the data support this.

Notes: Data on animal relinquishment graciously provided by the Toronto Humane Society, sourced from animal welfare organizations nationally that are using Petpoint database software. ■

d'accumulation ou d'un autre ensemble unique de circonstances. Cependant, il ressort clairement des données qu'il y a peu de preuves à l'appui d'une situation généralisée d'abandon massif d'animaux de compagnie.

Dans une certaine mesure, ces résultats ne sont pas tellement surprenants. Au cours des dernières décennies, le lien entre l'humain et l'animal est devenu plus fort et plus important pour la plupart des gens. Lors d'un récent sondage mené en Ontario par l'OVMA auprès de propriétaires d'animaux de compagnie, la grande majorité des répondants ont indiqué qu'ils percevaient leur animal comme un membre de leur famille, voire même comme leur enfant. De plus, lorsqu'on leur a demandé comment ils réduiraient leurs dépenses s'ils éprouvaient des difficultés financières, seulement 20 % ont indiqué qu'ils essaieraient de dépenser moins pour leurs animaux; dans l'ensemble, les répondants étaient plus susceptibles de couper dans les dépenses liées aux divertissements, à l'habillement, à l'électronique, aux articles pour la maison et même à l'épicerie.

Pour la plupart des propriétaires, peu importe depuis combien de temps ils ont leur compagnon ou la raison initiale pour laquelle ils l'ont adopté, l'idée d'abandonner leur animal simplement en raison d'un changement de circonstances, comme un retour au travail au bureau, est impensable. C'est ce que nous révèlent les données, et c'est encourageant.

Remarques : Les données sur les abandons d'animaux ont été gracieusement fournies par la Toronto Humane Society et proviennent d'organismes de protection des animaux à l'échelle nationale qui utilisent le logiciel de base de données Petpoint. ■



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