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LA REVUE VÉTÉRINAIRE CANADIENNE

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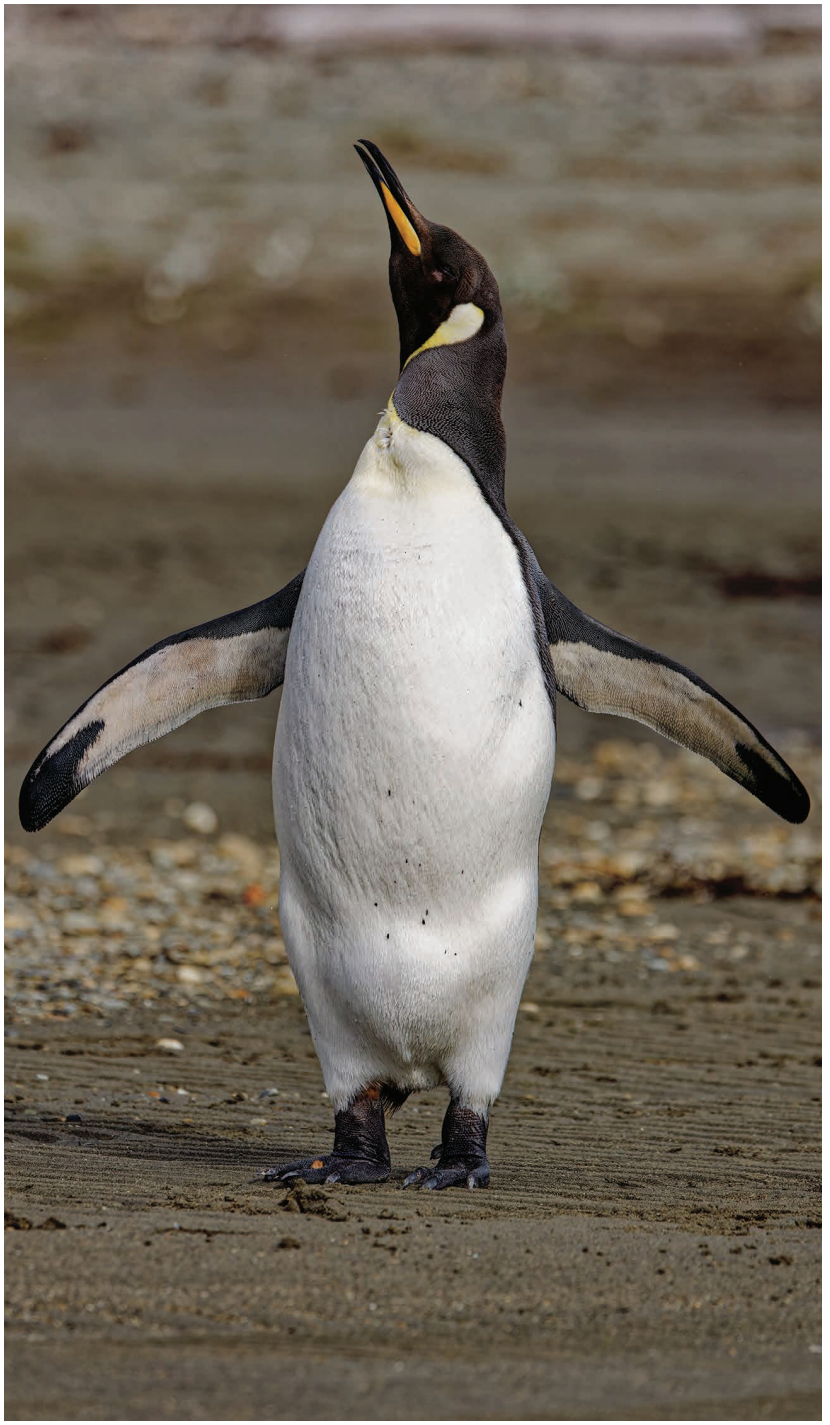

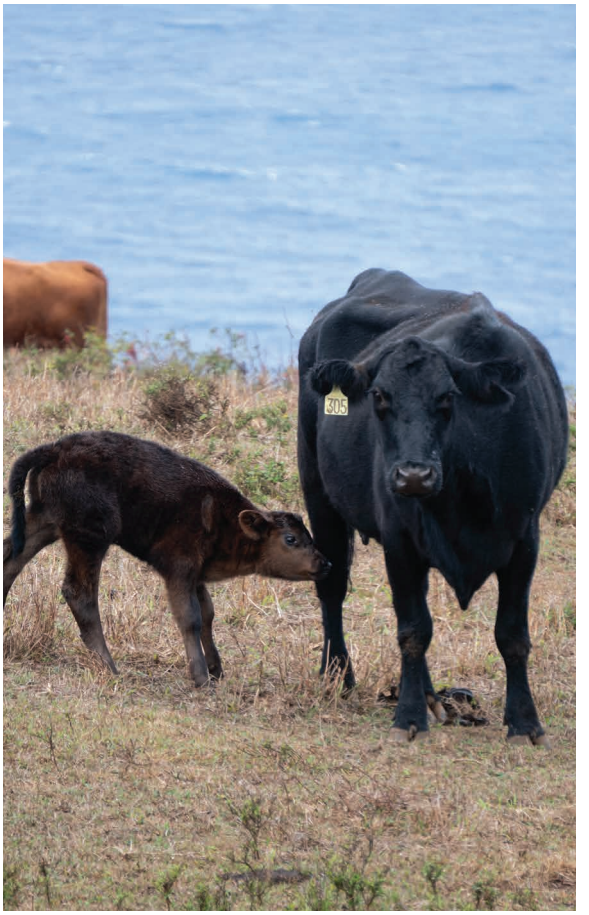

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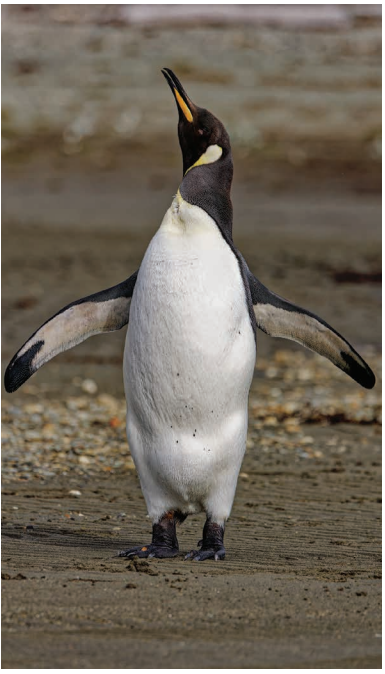

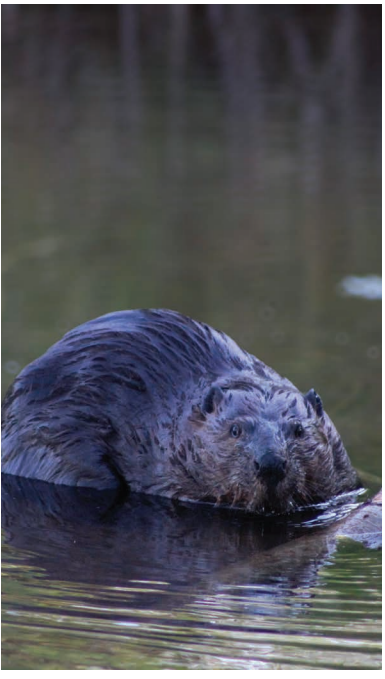

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- Report on Compensation and Benefits for Associate Veterinarians
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06 2023

PRESIDENT'S MESSAGE
LE MOT DU PRÉSIDENT

CVMA 2.0 — The new CVMA
ACMV 2.0 – La nouvelle ACMV

Greetings everyone and welcome to the CVMA 2.0! We are now one and a half years into an organizational shift, and I am so proud of the way the staff and our volunteers have bought into the new focus of taking a more active role in addressing issues that impact our profession. The CVMA has always been good at identifying issues and taking a stance. The new CVMA is getting really good at doing something about the problems for the betterment of the profession and for the Canadian public.

So, what am I talking about? I am talking about getting the ear of government and of the press. More importantly, I am talking about getting the recognition of these 2 institutions so that they are now coming to us and asking for opinions.

WHAT IS THE AGENDA WE HAVE BEEN ADVANCING ON PARLIAMENT HILL?

1. Canada needs a robust veterinary workforce. We have been asking the government to drop the need for a Labour Market Impact Assessment when trying to hire an internationally trained veterinarian or technologist who is willing to immigrate to Canada. The government's own statistics have already shown that we are in a labor shortage for the foreseeable future, so why do we have to prove it? We have also been asking for the funding of a National Testing Center at the Western College of Veterinary Medicine to help eliminate the continual backlog of international veterinarians waiting to take the practical exam. These people are a very valuable resource that Canada is not taking advantage of, especially in the face of a workforce shortage.

Bonjour et bienvenue à l'ACMV 2.0! Voilà maintenant un an et demi que nous avons entamé un virage organisationnel et je suis très fier de la manière dont le personnel et les bénévoles appuient notre nouvelle orientation, qui consiste à jouer un rôle plus actif dans la résolution des problèmes qui touchent notre profession. L'ACMV a toujours su identifier les enjeux et prendre position. La nouvelle ACMV fait avancer les choses, dans l'intérêt de la profession et du public canadien.

Plus précisément, je fais allusion au fait que nous avons réussi à attirer l'attention du gouvernement et de la presse, et plus important encore, à obtenir la reconnaissance de ces deux institutions, de sorte qu'elles s'adressent désormais à nous pour nous demander notre avis.

QUELS POINTS AVONS-NOUS SOULEVÉS SUR LA COLLINE DU PARLEMENT?

1. Le Canada a besoin d'une main-d'œuvre vétérinaire solide. Nous avons demandé au gouvernement de ne plus exiger une étude d'impact sur le marché du travail pour l'embauche de vétérinaires ou de techniciens formés à l'étranger et désireux d'immigrer au Canada. Les statistiques du gouvernement montrent déjà que nous sommes confrontés à une pénurie de main-d'œuvre qui perdurera au moins un certain temps, alors pourquoi devons-nous le prouver? Nous avons également demandé du financement pour la création d'un centre national d'examen au Western College of Veterinary Medicine afin de réduire les délais pour les vétérinaires étrangers qui attendent de passer l'examen pratique. Ces

2. Mental health support for our profession. We all know how difficult this job can be for our mental health. On The Hill we have been raising awareness of our issues and suggesting that we should be classified and given the same supports as first responders. We would like financial support for a national "safety net" specific to our profession instead of having to fund projects like this from membership dues.
3. Access to drugs and biologics. The number of tools available to veterinarians in food production medicine has been on a steady decline and the number of products available in other countries that are not on the Canadian market has increased. We would rather be using preventative tools and health supplements or older generic medications instead of having to rely on antibiotics important to human medicine to put the fire out. If a product is licensed in Europe or the U.S., should we not also have access to it here?

HOW ARE WE ADVANCING OUR AGENDA?

The CVMA has been on Parliament Hill twice in the last year. We have held meetings with members of Parliament (MP) of all political parties, with policy advisors, and with members of the Senate.

We have joined forces with other interested parties who share our priorities. The ask for the National Testing Center has been gaining momentum thanks to a letter spearheaded by CVMA that contains the support of multiple agricultural and educational associations (internally we call it the NASCAR letter because of all the logos on it) all asking for this project to be funded. The work on the drug and biological's issue has been greatly aided by teaming up with the Dairy Farmers of Canada who have been active in this area for longer than we have.

We have given 2 presentations to the National Press Gallery. The gallery is a direct link to all of Canada's media outlets as well as the offices of members of Parliament. These appearances have resulted in a huge rise in the number of requests for interviews from the media on topics such as animal sentience, mental health, cost of care, workforce shortage, animal welfare, and dog exportation. The press now knows who we are and is reaching out, allowing us to add in the topics that we wish to discuss.

We have also been quite active in giving our opinions on issues to which the profession needs to respond. We have given The Honourable Chrystia Freeland our opinion that the Capital Gains changes were detrimental to

professionnels constituent une ressource très précieuse dont le Canada ne profite pas, surtout dans le contexte actuel de pénurie de main-d'œuvre.

2. Il faut soutenir la santé mentale de notre profession. Nous savons tous à quel point notre travail peut être difficile pour notre santé mentale. Nous avons sensibilisé les élus et proposé que les médecins vétérinaires soient classés comme les premiers intervenants et reçoivent le même soutien qu'eux. Nous aimerions obtenir des fonds pour créer un « filet de sécurité » national propre à notre profession, au lieu de devoir financer des projets de ce type à partir des cotisations de nos membres.
3. L'accès aux médicaments et aux produits biologiques est préoccupant. Le nombre d'outils à la disposition des vétérinaires dans le domaine de la médecine des animaux destinés à la production d'aliments diminue continuellement, alors que le nombre de produits qui sont disponibles dans d'autres pays et ne sont pas sur le marché canadien a augmenté. Nous préférerions utiliser des mesures préventives, des suppléments ou des médicaments génériques plus anciens plutôt que de recourir à des antibiotiques importants pour la médecine humaine. Si un produit est approuvé en Europe ou aux États-Unis, ne devrions-nous pas y avoir accès ici aussi?

COMMENT FAISONS-NOUS AVANCER CES DOSSIERS?

L'ACMV s'est rendue deux fois sur la colline du Parlement au cours de la dernière année. Nous avons rencontré des députés de tous les partis politiques, des conseillers politiques et des membres du Sénat.

Nous avons uni nos forces à celles d'autres parties prenantes intéressées qui partagent nos priorités. La demande concernant la création d'un centre national d'examen a gagné du terrain grâce à une lettre rédigée par l'ACMV et soutenue par de nombreuses associations des domaines de l'agriculture et de l'enseignement (à l'interne, nous l'appelons la lettre NASCAR en raison de tous les logos qui sont dessus) qui réclament le financement de ce projet. Le travail sur la question des médicaments et des produits biologiques a été grandement facilité par la collaboration avec les Producteurs laitiers du Canada, qui sont actifs dans ce dossier depuis plus longtemps que nous.

Nous avons fait deux présentations à la Tribune de presse nationale, qui constitue un lien direct avec tous les médias canadiens ainsi qu'avec les membres du Parlement. Ces présentations ont entraîné une augmentation considérable du

the profession. We have let The Honourable Marc Miller know that decreasing immigration targets should not include internationally trained veterinarians. We let The Honourable Mark Holland know that the handling of the recent changes in the rules concerning dog importation to the U.S. was problematic for the public and our profession and have asked to have a seat at the next round of discussions. We have sent a statement to Fisheries and Oceans Canada giving them our opinion of the proposal to stop open net salmon farming on the west coast and won a huge victory when Canada agreed with our lobbying to ban the use of strychnine as a predacide.

The CVMA has also made, and continues to make, as new information becomes available, submissions to the Standing Committee on Agriculture and Agri-food in relation to Bill C 355, *Prohibition of the Export of Horses by Air for Slaughter Act*.

At the same time CVMA is still doing all the things it used to do. We are still researching and publishing position papers on Animal Welfare and National Issues. Position statements on Artificial Intelligence in Veterinary Medicine, Access to Veterinary Care in Canada, and Animal Sentience have recently been approved and made available to the public, as well as an overhaul of the Code of Practice for Canadian Cattery Operations (better known as the "cat code") is in the works. The annual convention in Calgary, Alberta, was a great success, and we are looking forward to next year's edition in Victoria, British Columbia. The communications department has kept members in touch with our new initiatives and the Workforce Advisory Group continues to look for ways to address the dire veterinary workforce shortage in Canada.

CHANGE HAS BECOME COMMONPLACE

The Diversity, Equity, and Inclusion Working Group recently merged with the Wellness Committee, which itself had only recently been upgraded from an advisory group. Why? Because it had become obvious that the 2 issues had so much overlap and needed long-term commitments from the organization. The work of this group was considered so important that a new position of Director, Wellness, Diversity, Equity, and Inclusion was created and filled by Dr. Kathy Keil.

The CVMA's mentorship program will be relaunched this year and will look like something that the profession has never experienced before. Instead of being a one-on-one link to another experienced veterinarian, this program will address all the background issues that drag us from loving what we do and place us in a quest to just get through the day.

The Canadian Veterinary Journal has moved to a strictly online format and the user interface has been dramatically upgraded. They are continuing efforts to make the Journal more relevant to the practicing veterinarian while balancing this with the need for the profession to be aware of advancements in medicine.

To summarize, the organization has been invigorated and filled with a new sense of purpose. Staff and volunteers now feel that they are making a difference and are empowered to think outside the box and propose new solutions. I would like to make the same request of members. Please approach your local MP's and discuss our problems. The CVMA has a Government Relations Toolkit that will guide you through the message. If you have ideas about how to help our profession, contact us. If you want more information about what we are doing, please send me an email at cvmapresident@cvma-acmv.org.

Tim Arthur

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nombre de demandes d'entrevues de la part des médias sur des sujets tels que la sentience animale, la santé mentale, le coût des soins, la pénurie de main-d'œuvre, le bien-être des animaux et l'exportation des chiens. La presse sait désormais qui nous sommes et nous sollicite, ce qui nous permet d'aborder les sujets dont nous voulons discuter.

Nous avons également donné activement notre avis sur diverses questions qui touchent la profession. Nous avons fait part à l'honorable Chrystia Freeland de notre opinion selon laquelle les modifications apportées au taux d'inclusion des gains en capital étaient préjudiciables à la profession. Nous avons fait savoir à l'honorable Marc Miller que les objectifs de réduction de l'immigration ne devraient pas inclure les médecins vétérinaires formés à l'étranger. Nous avons informé l'honorable Mark Holland que les récents changements apportés aux règles concernant l'importation de chiens aux États-Unis étaient problématiques pour le public et notre profession, et nous avons demandé de

participer aux prochaines séries de discussions. Nous avons envoyé une déclaration à Pêches et Océans Canada pour donner notre avis sur la proposition d'arrêter l'élevage du saumon en enclos à filet ouvert sur la côte ouest, et nous avons remporté une grande victoire lorsque le gouvernement canadien a accepté nos arguments pour interdire l'utilisation de la strychnine comme prédacide.

L'ACMV a également présenté des observations au Comité permanent de l'agriculture et de l'agroalimentaire concernant le projet de loi C-355, *Loi sur l'interdiction de l'exportation par voie aérienne de chevaux destinés à l'abattage*, et continuera de le faire à mesure que de nouvelles données seront disponibles.

En parallèle, l'ACMV poursuit ses activités habituelles. Nous continuons à étudier les questions relatives au bien-être des animaux et aux enjeux nationaux et à publier des énoncés de position sur ces questions. Nous avons récemment approuvé et mis à la disposition du public des énoncés de position sur l'intelligence artificielle en médecine vétérinaire, sur l'accès aux soins vétérinaires au Canada et sur la sentience animale, et une révision du Code de pratiques pour les chatteries est en cours. Le Congrès annuel de l'ACMV qui s'est tenu à Calgary en Alberta a connu un franc succès, et nous préparons avec enthousiasme la prochaine édition qui aura lieu à Victoria en Colombie-Britannique. Le service des communications tient les membres au courant de nos nouvelles initiatives et le groupe consultatif sur la main-d'œuvre s'affaire à trouver des solutions pour remédier à la grave pénurie de main-d'œuvre vétérinaire au Canada.

LE CHANGEMENT EST DEVENU CHOSE COURANTE

Le Groupe de travail sur l'équité, la diversité et l'inclusion a récemment fusionné avec le Comité sur le bien-être, qui lui-même est récemment passé du statut de groupe consultatif à celui de comité. Ce changement s'explique par le fait qu'il était devenu évident que les deux thèmes se recoupent et qu'ils nécessitent un engagement à long terme. Le travail dans ce dossier est à ce point important qu'un nouveau poste de directeur ou directrice du bien-être, de l'équité, de la diversité et de l'inclusion a été créé et il a été pourvu par la D^re^ Kathy Keil.

Le programme de mentorat de l'ACMV sera relancé cette année avec une nouvelle approche que la profession n'a jamais connue auparavant. Au lieu de proposer un lien individuel avec un autre médecin vétérinaire d'expérience, il abordera les problèmes de fond qui sapent notre passion pour notre travail et nous mettent dans une position où nous voulons simplement passer à travers nos journées.

La Revue vétérinaire canadienne est passée à un format strictement en ligne et l'interface utilisateur a été grandement améliorée. Les efforts se poursuivent pour rendre cette revue plus pertinente pour les vétérinaires praticiens, tout en tenant compte de la nécessité pour la profession d'être informée des progrès de la médecine.

En résumé, l'ACMV est revigorée et portée par un nouvel élan appuyant notre raison d'être. Le personnel et les bénévoles ont le sentiment de faire une différence et ont la possibilité de sortir des sentiers battus et de proposer de nouvelles solutions. J'aimerais inviter les membres à faire de même. Prenez contact avec vos députés locaux et discutez de nos problèmes. L'ACMV propose une boîte à outils pour les relations gouvernementales pour vous guider dans la présentation de votre message. Si vous avez des idées sur la façon d'aider notre profession, n'hésitez pas à communiquer avec nous. Si vous souhaitez en savoir plus sur ce que nous faisons, envoyez-moi un courriel à l'adresse cvmapresident@cvma-acmv.org.

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DÉONTOLOGIE VÉTÉRINAIRE

ETHICAL QUESTION OF THE MONTH — DECEMBER 2024

As a veterinarian contemplating a position at a federal meat processing plant, I am extremely uncomfortable with the recent federal injunction to forgo the requirement to ensure insensibility before hoisting/processing an animal to be slaughtered for the Kosher market without prior stunning. The rationale for the injunction, as I read it, is a concern that doing the sensibility checks takes too much time and it is resulting in a reduction in available product for that market. I feel that this is an unacceptable rationale given the risk that an animal being processed might still be sensible and how that conflicts with my personal ethics as well as the veterinary oath, but I am also aware of the charged societal implications. **So, my question is, is it acceptable for a government to knowingly allow a practice that will pose considerable risk of suffering to an animal to address the concerns of a group with an ideology that accepts the risk of animal suffering to create a rules-based product?**

QUESTION DE DÉONTOLOGIE DU MOIS – DÉCEMBRE 2024

En tant que vétérinaire envisageant un poste dans un abattoir fédéral, je ressens un profond malaise à l'égard de la récente injonction qui suspend l'obligation de vérifier l'inconscience d'un animal avant de le suspendre ou de commencer la découpe dans le cadre de l'abattage rituel sans étourdissement préalable pour le marché de la viande cachère. D'après ce que j'ai lu, l'injonction repose sur la crainte que les vérifications de l'inconscience prennent trop de temps et qu'elles entraînent une diminution de la disponibilité de la viande cachère sur le marché. J'estime qu'il s'agit d'un raisonnement inacceptable compte tenu du risque qu'un animal soit débité alors qu'il peut encore ressentir de la douleur et que cette situation va à l'encontre de mon éthique personnelle et du serment de vétérinaire, mais j'ai également conscience des implications sociétales qui sont en jeu. **Ma question est donc la suivante : est-il acceptable qu'un gouvernement autorise sciemment une pratique qui présente un risque considérable de souffrance pour un animal afin de répondre aux préoccupations d'un groupe dont l'idéologie accepte le risque de souffrance animale pour créer un produit conforme à ses règles?**

ETHICISTS' COMMENTARY ON BALANCING RELIGIOUS TOLERANCE AND ANIMAL WELFARE

This question is framed around a veterinarian contemplating a job at a meat processing plant but raises the much-discussed issue of how to balance religious tolerance and animal welfare in the context of ritual slaughter without stunning.

First, some background. Regulations introduced at federal level in Canada in 2018, but only fully enacted in 2024, required additional checks on animals during the process of ritual animal slaughter without stunning. These involved testing for the absence of rhythmic breathing, of palpebral reflex, and of corneal reflex before animals are suspended. These new requirements slowed down processing at slaughter plants, arguably increasing costs and reducing availability of these meats. In response to these concerns, religious communities took the relevant authority to the Canadian Federal Court and won their case, leading to a suspension of the regulations.

The question before us raises several issues. First, there is an empirical issue about how much the regulations improved animal welfare. The regulations aimed to reduce the risk of suffering that would otherwise occur if an animal was suspended while still conscious, but the size of this risk

is unknown. Second (assuming the regulations at least have some risk-reducing effect) there is an ethical issue about how to weigh any animal welfare benefit against economic costs, especially if these costs result in reduced availability of locally produced meat suitable for the affected religious groups. Third, and most obviously, there are broader issues about the ethical acceptability of ritual slaughter without stunning, and how legal and political bodies should make decisions about it.

In answer to the veterinarian's question, we believe that policy about handling the basic dilemma between cultural tolerance and risk of animal suffering should be made, on an informed basis and after widespread consultation, by elected politicians with guidance from the courts following normal democratic procedures. Different jurisdictions prioritize different values; some, like Sweden, have banned ritual slaughter without stunning and others have prioritized religious tolerance. In this specific case, the federal court has ruled that the new regulations restricting ritual slaughter in Canada should be suspended, and the Canadian government is constitutionally obliged to follow this ruling.

Individual veterinarians will have their own ethical views about ritual slaughter without stunning and are free to choose to work (or not) in slaughterhouses where ritual slaughter takes place. Professional veterinary organizations generally recognize divergent ethical views and respect decisions taken by the relevant democratic institutions. The CVMA, for instance, reluctantly accepts current Canadian regulation of religious slaughter without stunning. That said, professional organizations can be an important voice in the public square. Thus, the veterinarian in question could work with the CVMA to lobby for new regulations that improve the welfare of animals at slaughter.

Drs. Clare Palmer, Peter Sandøe, and Dan Weary

ETHICAL QUESTION OF THE MONTH — MARCH 2025

Is it ethical for veterinarians to use their credentials to act as an "expert" despite having limited or no knowledge of the issues in another aspect of veterinary medicine? This may happen innocently when veterinarians are asked for opinions on issues outside their expertise, or when veterinarians with an agenda try to undermine an aspect of animal use for which they do not agree. These individuals have much more credibility, given their educational credentials, than lay animal activists. For example, is it ethical for a small animal veterinarian to criticize veterinarians who care for feedlot cattle, despite not having exposure or experience with the conditions of these animals? Similarly, is it detrimental to the veterinary community if a swine veterinarian were to publicly castigate laboratory animal veterinarians for the use of animals in research? **Should such egregious cases be potential reasons for complaints to the licensing body?**

Submitted by Mike Petrik, M.Sc., D.V.M.

QUESTION DE DÉONTOLOGIE DU MOIS – MARS 2025

Est-il éthique pour les médecins vétérinaires d'utiliser leur titre afin d'agir comme « experts » alors qu'ils ont une connaissance limitée ou inexistante des enjeux concernant la médecine vétérinaire hors de leur champ d'exercice? Cette situation peut se produire de façon involontaire lorsque des vétérinaires sont invités à donner leur avis sur des questions qui ne relèvent pas de leur expertise, ou de manière plus intentionnelle par ceux qui tentent de dénoncer un aspect de l'utilisation des animaux avec lequel ils ne sont pas d'accord. Compte tenu de leur formation, les médecins vétérinaires ont beaucoup plus de crédibilité que les autres militants de la cause animale. Par exemple, est-ce éthique qu'un médecin vétérinaire en pratique des petits animaux critique ses collègues qui s'occupent des bovins dans les parcs d'engraissement même s'il n'a pas travaillé avec ces animaux et constaté par lui-même leurs conditions de vie? Dans la même optique, est-il préjudiciable pour la communauté vétérinaire qu'un vétérinaire en pratique porcine dénigre publiquement les vétérinaires en pratique des animaux de laboratoire en raison de l'utilisation d'animaux en recherche? **Des cas aussi flagrants devraient-ils constituer des motifs potentiels de plainte auprès des organismes de réglementation de la pratique vétérinaire?**

Question soumise par Mike Petrik, M. Sc., D.M.V.

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 Canadian Veterinary Medical Association, Attn: Journals Department, 339 Booth Street, Ottawa, Ontario K1R 7K1; email (bettinadvm@gmail.com). A longer response may appear as a Letter to the Editor.**

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 **par la poste (Choix déontologiques, Association canadienne des médecins vétérinaires, À l'attention de : Journals Department, 339 rue Booth, Ottawa, Ontario, K1R 7K1) ou par courriel (bettinadvm@gmail.com). Les réponses plus longues pourraient être publiées dans le courrier des lecteurs.**

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.

BOOK REVIEW
COMPTE RENDU DE LIVRE

THE VET AT NOAH'S ARK: STORIES OF SURVIVAL FROM AN INNER-CITY ANIMAL HOSPITAL

Mader D. Apollo Publishers. New York, New York. 2022. 392 pp. ISBN: 978-1-954641-044.

Dr. Doug Mader has penned an engaging, practice-based memoir of his time serving as a small-animal and exotics veterinarian in the inner city of Los Angeles. The colourful cast of characters is as diverse as his patient profile — from the retired footballer with no fewer than seven Pomeranians to the feisty reptile clientele and the underground ferret world. Memoirs such as this reveal the incredible professional diversity within the veterinary profession.

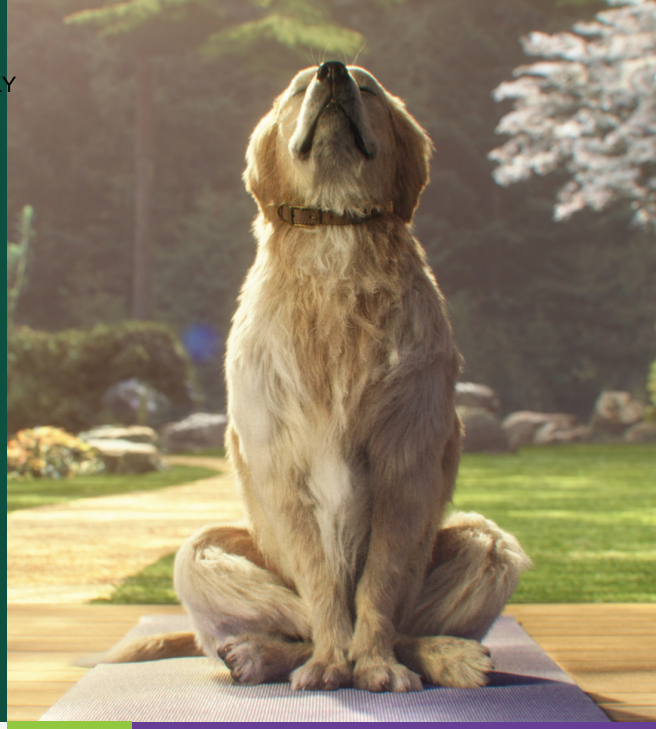
Dr. Mader is an engaging storyteller and achieves that tricky balance between explaining sufficiently to keep the nonexpert engaged and keeping it interesting for those with knowledge of the veterinary profession. His stories offer a perspective far different from the classic rural, mixed-animal style of James Harriot and the like. For instance, there is the frequent, casual mention of heading to the beach, in the same way a Canadian veterinarian might describe picking up something from Tim Hortons on the way to the clinic. The inner-city neighborhood and contemporary events that occurred there (gang violence, riots, poverty) make the location almost a character on its own. And in an interesting choice for a memoir, Dr. Mader starts not at the beginning, but somewhere soundly in the middle of his life's journey. Jumping right into a specific time in his practice, he offers surprisingly little about his background and vet school experiences, leaving me with the impression (and hope!) that further volumes are in the works.

Reviewed by Jamie Rothenburger, DVM, MVetSc, PhD, DACVP, Faculty of Veterinary Medicine, University of Calgary, Calgary, Alberta.

Elanco™

Zenrelia™ (Ilunocitinib Tablets) Launches in Canada

Innovative, once-daily oral JAK inhibitor for dogs offers a new option to control itch for veterinarians and pet owners



The itch of canine allergic dermatitis can make life miserable for dogs and owners alike.

New to the Canadian market, Zenrelia™ (ilunocitinib tablets) can treat itchy dogs suffering from chronic, acute or seasonal itch in a single, once daily dose.

Zenrelia targets itch where it starts

Zenrelia is a safe, highly effective, and convenient once-daily oral JAK inhibitor for control of pruritus (itching) associated with allergic dermatitis and control of atopic dermatitis in dogs at least 12 months of age[1].

By blocking the pathways involved in allergic itch and breaking the itch-scratch cycle, Zenrelia targets itch at its source, working quickly and providing continuous relief from itch and inflammation.

An effective, safe solution in canine dermatology

The Veterinary Drugs Directorate (VDD) of Health Canada approved Zenrelia, a once-daily oral JAK inhibitor for dogs with allergic and atopic dermatitis. In a head-to-head clinical trial in 338 client owned dogs, Zenrelia showed similar efficacy as Apoquel™ (at primary endpoint Day 28) with once daily dosing from the start[2].

1 in 5
canine patients

seen by a Canadian veterinarian in a typical month is considered to have allergic dermatitis[3].

1 in 3 of these are newly diagnosed cases[4].

> *"Zenrelia offers veterinarians a new tool to combat the frustrations felt by so many pets and their owners when faced with canine allergies."*
>
> *-Michelle McCotter, General Manager of Elanco Canada*

Delivering on innovation

Zenrelia marks another innovation in pet dermatology by Elanco, a global leader in animal health. Offering a new option to control itch for veterinarians and pet owners, Zenrelia highlights Elanco's commitment to delivering on its innovation pipeline and pioneering advancements in pet health.

"Zenrelia is an exciting addition to Elanco's Canadian pet health portfolio expanding our presence in the dermatology market," said Michelle McCotter, General Manager of Elanco Canada. "Offering fast and continuous relief from itch and inflammation along with simple, once daily dosing from the start, Zenrelia offers veterinarians a new tool to combat the frustrations felt by so many pets and their owners when faced with canine allergies."

Learn more at zenrelia.ca

Zenrelia™ (ilunocitinib tablet)

[1]Zenrelia Canadian Label
[2]Forster S, Boegel A, et al. Veterinary Dermatology. 2025;00: 1–10 (v1.0)
[3]Elanco Market Research Canada Dermatitis 2024
[4]Source: Kynetec (2024)

QUIZ CORNER
TEST ÉCLAIR

1. A two-year-old neutered male Birman cat is brought to the clinic with a one-week history of lethargy and anorexia. Physical examination reveals muscle wasting and a palpable abdominal fluid wave.

An abdominal fluid sample has high viscosity (Figure 1) and total protein of 5.0 g/dL. Fluid cytology shows non-septic pyogranulomatous inflammation. Feline infectious peritonitis (FIP) is the top differential.

1. Un chat sacré de Birmanie castré de deux ans est amené à la clinique en raison d'une léthargie et d'une anorexie qui durent depuis une semaine. L'examen physique révèle une fonte musculaire et un mouvement de vague à la palpation indiquant la présence de liquide abdominal.

L'échantillon de liquide abdominal prélevé a une viscosité élevée (figure 1) et un taux de protéines totales de 5,0 g/dL. La cytologie du liquide montre une inflammation pyogranulomateuse non septique. La péritonite infectieuse féline (PIF) est le principal diagnostic différentiel.

FIGURE 1
Highly viscous abdominal fluid sample.
(Image courtesy of Dr. Kalumet — https://commons.wikimedia.org/wiki/File:FIP_Punktat_Tropfprobe.jpg).
Échantillon de liquide abdominal visqueux.
(Image du Dr Kalumet, https://commons.wikimedia.org/wiki/File:FIP_Punktat_Tropfprobe.jpg.)

Which point-of-care diagnostic test on the fluid would help differentiate FIP from other causes of effusion?

A. Specific gravity
B. Wright's stain
C. Coombs test
D. Nissl stain
E. Rivalta test

Quel test de diagnostic effectué en clinique sur l'échantillon de liquide abdominal permettrait de différencier la PIF d'autres causes d'épanchement?

A. Densité
B. Coloration de Wright
C. Test de Coombs
D. Coloration de Nissl
E. Test de Rivalta

2. A one-year-old neutered male Labrador retriever dog is examined for acute onset of ataxia and depressed mentation about 6 to 8 h after exposure to a liquid in the garage.

A bench-side ethylene glycol test result is positive.

At this stage, what ultrasound finding would support the positive result?

A. Increased renal cortical echogenicity

B. Appearance of stone shadowing in the urinary bladder

C. Scant free fluid around both kidneys

D. Decreased renal size bilaterally

E. Ureteral dilation

2. Un labrador castré d'un an est examiné en raison de l'apparition aiguë d'une ataxie et d'une altération de l'état mental environ 6 à 8 heures après avoir été exposé à un liquide dans le garage.

Le résultat d'un test de dépistage de l'éthylène glycol effectué en clinique est positif.

À ce stade-ci, quelle observation à l'échographie pourrait appuyer le résultat positif?

A. Augmentation de l'échogénicité du cortex rénal

B. Présence de cônes d'ombre associés à des calculs dans la vessie

C. Faible quantité de liquide libre autour des deux reins

D. Diminution bilatérale de la taille des reins

E. Dilatation urétérale

(See p. 338 for answers./Voir les réponses à la page 338.)

The questions and answers are provided by Zuku Review, online veterinary test prep.

Les questions et les réponses sont gracieusement fournies par le site de préparation aux examens vétérinaires Zuku Review.

BRIEF COMMUNICATION
COMMUNICATION BRÈVE

Evaluation of publication bias in the assessment of probiotic treatment for gastrointestinal disease in dogs and cats

J. Scott Weese

ABSTRACT

Background

Systematic reviews and meta-analyses underpin the evidence-to-decision framework used for guideline development. Publication bias is important to understand when assessing the strength of evidence.

Objective

To evaluate the peer-reviewed-journal publication rate of abstracts from 2 veterinary internal medicine conferences regarding probiotic treatment for gastrointestinal disease in dogs and cats.

Animals and procedure

Abstracts from the American College of Veterinary Internal Medicine Forum (2000 to 2023) and European College of Veterinary Internal Medicine Congress (2002 to 2023) that reported clinical gastrointestinal disease outcomes of probiotic treatment for dogs, cats, or both were included. PubMed and Web of Science databases were searched to identify corresponding peer-reviewed publications.

Results

Twelve abstracts were identified; 6 (50%) were subsequently published as peer-reviewed publications. Five of 6 (83%) that were published reported positive clinical outcomes, whereas 4/6 (67%) that were not published reported no beneficial clinical outcomes. Overall, 5/7 (71%) abstracts that reported a clinical effect were published, compared to 1/5 (20%) that did not.

Conclusion

Publication bias complicates assessment of the literature and guideline development.

Clinical relevance

The potential impact of publication bias should be considered when evaluating the literature and developing guidelines.

RÉSUMÉ

Évaluation du biais de publication dans l'évaluation du traitement probiotique des maladies gastro-intestinales chez les chiens et les chats

Contexte

Les revues systématiques et les méta-analyses soutiennent le cadre de décision fondé sur les données probantes utilisé pour l'élaboration des lignes directrices. Il est important de comprendre le biais de publication lors de l'évaluation de la force des preuves.

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Objectif

Évaluer le taux de publication dans des revues avec comité de lecture de résumés de deux conférences de médecine interne vétérinaire concernant le traitement probiotique des maladies gastro-intestinales chez les chiens et les chats.

Animaux et procédure

Les résumés du Forum de l'American College of Veterinary Internal Medicine (2000 à 2023) et du Congrès de l'European College of Veterinary Internal Medicine (2002 à 2023) qui ont rapporté les résultats cliniques des maladies gastro-intestinales du traitement probiotique pour les chiens, les chats ou les deux ont été inclus. Les bases de données PubMed et Web of Science ont été consultées pour identifier les publications évaluées par des pairs correspondantes.

Résultats

Douze résumés ont été identifiés; 6 (50 %) ont été ultérieurement publiés dans des publications évaluées par des pairs. Cinq des six (83 %) études publiées ont fait état de résultats cliniques positifs, tandis que 4/6 (67 %) études non publiées n'ont fait état d'aucun résultat clinique bénéfique. Au total, 5/7 (71 %) des résumés faisant état d'un effet clinique ont été publiés, contre 1/5 (20 %) qui n'en faisait pas fait état.

Conclusion

Le biais de publication complique l'évaluation de la littérature et l'élaboration des lignes directrices.

Pertinence clinique

L'impact potentiel du biais de publication doit être pris en compte lors de l'évaluation de la littérature et de l'élaboration des lignes directrices.

(Traduit par Dr Serge Messier)

Can Vet J 2025;66:250–254

Formal evidence-synthesis approaches are increasingly being used to provide clinical guidance, with systematic reviews and meta-analyses underpinning the evidence-to-decision framework. One core area of evidence assessment is evaluation of risk of bias, both in individual studies and the collection of studies available for review. Included in this is publication bias, whereby the results of a study influence whether the study is ultimately published. Of greatest concern is the potential for overestimation of the effect of an intervention if "negative" results are less likely to be published. Whereas assessment of publication bias is a component of standardized guideline development, it can be difficult to assess. Centralized registration of clinical trials is not required for veterinary studies, making it challenging to discern which studies were completed but ultimately not published. Concerns about publication bias are heightened when the available literature consists mainly of a small number of small trials (1), something that is very common in veterinary medicine. Methods such as funnel plots can be used to infer whether publication bias may be present, but these have limitations and it has been stated that funnel plots and statistical tests for asymmetry should require at least 10 (or perhaps at least 5) available studies (1). Therefore, the paucity of controlled trials in veterinary medicine can preclude use of these tools. Accordingly, it can be difficult to determine if publication bias is present, and this can weaken evidence assessment and guideline development.

The objective of this study was to evaluate the peer-reviewed-journal publication rate of conference abstracts regarding probiotic treatment for gastrointestinal disease in dogs and cats.

Abstract proceedings from the American College of Veterinary Internal Medicine (ACVIM) Forum (2000 to 2023) and European College of Veterinary Internal Medicine (ECVIM) Congress (2002 to 2023) were searched for "probiotic" in the title or abstract text using the Veterinary Information Network database (http://www.vin.com), which houses full-text abstracts for those conferences. For each abstract, the full text was then screened to determine if it was a prospective research study that evaluated clinical gastrointestinal disease outcomes of probiotic treatment on dogs, cats, or both. Studies that only evaluated nonclinical outcomes (*e.g.,* microbiota, hematological data) or non-gastrointestinal disease (*e.g.,* renal disease) were excluded.

To determine if studies had been published in the peer-reviewed scientific literature, PubMed and Web of Science databases were searched, using combinations of keywords

TABLE 1. Abstracts included in evaluation of the potential for publication bias in therapeutic trials of probiotics for gastrointestinal disease in dogs and cats.

Conference, year	Title	Published (Yes/No), year	Reference
ACVIM, 2003	The efficacy of a probiotic strain, *Lactobacillus acidophilus* DSM 13241, in the recovery of cats from clinical *Campylobacter* infection	No	(10)
ECVIM, 2005	Efficacy of probiotics in acute GI disease in dogs and cats	Yes, 2010	(11)
ACVIM, 2009	Effect of *Bifidobacterium animalis* AHC7 on resolution of acute diarrhea in the canine	Yes, 2009	(12)
ACVIM, 2010	Effect of *Enterococcus faecium* SF68 supplementation on diarrhea in cats housed in a northern Colorado animal shelter	Yes, 2011	(13)
ACVIM, 2012	Effects of *Enterococcus faecium* SF68 on stress diarrhea	No	(14)
ACVIM, 2015	Effect of the probiotic *Enterococcus faecium* SF68 on the presence of diarrhea in weanling kittens	No	(15)
ACVIM, 2015	The effect of the probiotic Sivoy on clinical and histopathological parameters in cats with chronic idiopathic constipation and megacolon	Yes, 2018	(2)
ACVIM, 2015	Effect of *Enterococcus faecium* strain SF68 on the gastrointestinal clinical signs of cats administered amoxicillin-clavulanate	Yes, 2017	(16)
ACVIM, 2018	Treatment with *Enterococcus faecium* NCIMB 10415 does not affect the outcome of chemotherapy-induced diarrhea	No	(17)
ECVIM, 2020	The use of a combined prebiotic and probiotic oral product and its impact on stool consistency in dogs undergoing radiotherapy	No	(18)
ACVIM, 2020	Use of a synbiotic for treating antibiotic-induced diarrhea in cats	No	(19)
ACVIM, 2022	Clinical and gastrointestinal changes in healthy research dogs administered prednisone, prednisone/omeprazole, or prednisone/probiotics	Yes, 2023	(20)

ACVIM — American College of Veterinary Internal Medicine; ECVIM — European College of Veterinary Internal Medicine.

from each title and each author's name, as well as a general search of "probiotic" and each author's name. The search was done on March 28, 2024 and repeated on July 11, 2024, shortly before manuscript submission.

Twelve abstracts that evaluated the effect of probiotics on clinical indicators of gastrointestinal disease (*e.g.,* effects on vomiting, diarrhea, fecal score) were identified — 10 from ACVIM and 2 from ECVIM (Table 1). The abstracts described studies on dogs (n = 6), cats (n = 5) or both dogs and cats (n = 1). Eleven (92%) were reported to be randomized controlled trials, whereas 1 was an uncontrolled prospective study (2).

Subsequent peer-reviewed publications were identified for 6 (50%) of the abstracts — 3 involving cats, 2 involving dogs, and 1 involving both dogs and cats. Abstracts for these were presented in 2005, 2009, 2010 (n = 1, each), 2015 (n = 2), and 2022 (n = 1), with a median time from presentation to publication of 1.5 y (range: < 1 to 5 y). Five (83%) of the abstracts that were published as scientific papers reported ≥ 1 positive clinical outcomes, whereas 1 reported no beneficial clinical effects. Five of the 6 (83%) involved a commercial probiotic product or a probiotic strain used in commercial products. The commercial status of the probiotic in the remaining study was unclear from the abstract.

The 6 abstracts not associated with a peer-reviewed publication were presented in 2003, 2012, 2015, 2018 (n = 1 each), and 2020 (n = 2). Four studies involved dogs and 2 involved cats. Four of the 6 (67%) reported no beneficial clinical outcome of probiotic treatment. Of the remaining 2, 1 reported a significant difference in prevalence of a specific fecal score threshold based on a presumably *post hoc* subset analysis and suggested a positive effect on duration of diarrhea with an unsupportive P-value (P = 0.47). One other abstract reported positive clinical outcomes but provided no corresponding numerators, denominators, or clear analysis. Five of the 6 (83%) abstracts involved a commercial probiotic product or a probiotic strain used in commercial products, whereas the commercial status of the other was unclear.

Overall, 5/7 (71%) abstracts that reported a clinical effect were published, compared to 1/5 (20%) that did not. Statistical comparison of publication rates was not done because of the small sample size.

These data indicated that publication bias may be an important concern when assessing the clinical impact of probiotic therapy in dogs and cats, consistent with concerns about publication bias for probiotics in human medicine (3,4). Here, unpublished abstracts generally

described no or limited (and possibly questionable) clinical effects, in contrast to the more positive effects in published studies, even though some of the positive effects reported in published studies would have been of limited clinical importance. This bias toward publishing of "positive" trial results was consistent with studies of human and laboratory animal abstracts (5–7).

A recent systematic review and meta-analysis evaluated the effect of probiotics on acute diarrhea in dogs and identified what was considered a trivial positive effect, based on 4 studies (8). Given the small sample size for that meta-analysis, the unpublished studies identified here could have influenced that result and corresponding clinical guidance, had they been published.

Although there was substantial under-publication of abstract data, it must also be recognized that submission and acceptance of an abstract was required for studies to be scrutinized. It is possible that other studies were completed but results were not presented in abstract form, something that would increase the effect of publication bias, assuming that studies that did not reach the stage of an abstract did not have favorable results.

There can be various reasons why an abstract is not subsequently published as a peer-reviewed paper. These include abandonment of a study because of changes in personnel (*e.g.,* a graduate student graduating before completion), changing interests of the lead author or research team leading to reduced motivation to continue a study, rejection by a peer-reviewed journal, lack of motivation to publish a negative result, and pressure from commercial sponsors. Unpublished studies could also have been abandoned because of poor recruitment or poor initial results, in cases where there was still a desire to release the initial information or have a citation but the authors felt that data were inadequate or underpowered to warrant a full publication. Some of these factors (*e.g.,* company pressures, editorial interest, author motivation, poor initial results leading to lack of funding or motivation for completion) would be more likely with negative studies. Regardless of the reason for lack of publication, failure to publish all studies and a tendency for underreporting negative studies are of concern. Small sample size may have been an important factor in failure to publish, related to either authors' motivation to publish or success in the peer-review process. Whereas statistical analysis may not be appropriate for small studies and valid conclusions about efficacy cannot be made, the data can be important for subsequent evidence synthesis, including meta-analysis.

Funnel plots and statistical tests for asymmetry can be used to assess publication bias (9). Funnel plots were not used here because of the small number of studies and the variability in how effects were reported, preventing plotting of a standardized response metric. Statistical tests of asymmetry were not done for the same reasons.

This study only evaluated 2 conferences because of limitations in abstract access and searchability, plus an *a priori* assumption that those 2 conferences, which are the main international veterinary internal medicine conferences, would be leading conferences for presentation of abstracts of this nature. It is possible that probiotic efficacy abstracts were presented at other conferences. A broader standardized and systematic approach evaluating more conferences could have provided more abstracts to evaluate and increased the power for potential statistical comparisons. However, that did not affect the focus of this study and there were no apparent reasons why publication rates would differ for abstracts presented at other conferences.

Evidence-to-decision frameworks for guideline development involve assessment of publication bias, but this can be challenging. For subjects with a limited number of studies and limited sample sizes within those studies, publication bias could have a major effect on assessment of clinical efficacy, resulting in overestimation of the effect of treatment. Lack of a mandatory clinical trial registry and a central, searchable database of conference abstracts complicate objective assessment of publication bias, and the small number of studies that are present for many topics complicate the use of measures such as funnel plots. However, the results of this study supported concerns that publication bias may be important and that additional search strategies may be indicated, particularly for therapeutic trials, when the published studies are small in both number and sample size. CVJ

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CASE REPORT
RAPPORT DE CAS

Jeongyun Jeong, Minjoo Kim, Jaehwan Kim, Kidong Eom

Retropharyngeal salivary adenomatous hyperplasia mimicking tumor metastasis in a dog

ABSTRACT

This report describes the case of a 13-year-old castrated male poodle with respiratory distress and coughing. The dog had had its right thyroid gland and ipsilateral lymph node resected because of thyroid follicular carcinoma originating in the right thyroid gland and metastasis to the ipsilateral medial retropharyngeal lymph node. The dog was initially treated for chronic bronchitis but showed no resolution of the clinical signs. Ultrasonography revealed an enlarged hypoechoic left medial retropharyngeal mass. Computed tomography further revealed an enlarged, heterogeneously enhanced left medial retropharyngeal mass with irregular margins. The mass compressed the laryngeal borders and was considered responsible for the coughing and respiratory distress. Based on the dog's history of thyroid carcinoma, metastatic lymphadenopathy of the left medial retropharyngeal lymph node was suspected, and the mass was surgically removed. Histopathologic examination revealed mild adenomatous salivary hyperplasia with duct ectasia. No evidence of neoplasm or severe inflammation was observed. The final diagnosis was salivary adenomatous hyperplasia in the retropharyngeal region. Salivary adenomatous hyperplasia can be responsible for clinical signs, depending on size and location. Differentiating salivary adenomatous hyperplasia from malignancies based on imaging findings alone can be difficult. This case demonstrated how salivary adenomatous hyperplasia may mimic malignant tumors, particularly in animals with a history of adjacent tumor malignancy.

Key clinical message:

To the best of our knowledge, this is the first report in a dog of salivary adenomatous hyperplasia that mimicked tumor metastasis. Differentiating between malignant and salivary adenomatous hyperplasia can be difficult using imaging findings alone. Despite being histologically benign, salivary adenomatous hyperplasia may cause clinical signs.

RÉSUMÉ

Hyperplasie adénomateuse salivaire rétropharyngée imitant une métastase tumorale chez un chien

Ce rapport décrit le cas d'un caniche mâle castré de 13 ans souffrant de détresse respiratoire et de toux. Le chien avait subi une résection de la glande thyroïde droite et du ganglion lymphatique ipsilatéral en raison d'un carcinome folliculaire thyroïdien originaire de la glande thyroïde droite avec métastase au ganglion lymphatique rétropharyngé médial ipsilatéral. Le chien a été initialement traité pour une bronchite chronique mais n'a montré aucune résolution des signes cliniques. L'échographie a révélé une masse rétropharyngée médiale gauche hypoéchogène élargie. La tomodensitométrie a également révélé une masse rétropharyngée médiale gauche élargie et hétérogène avec des marges irrégulières. La masse

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comprimait les bords du larynx et était considérée comme responsable de toux et de détresse respiratoire. Sur la base des antécédents de carcinome thyroïdien du chien, une lymphadénopathie métastatique du ganglion lymphatique rétropharyngé médial gauche a été suspectée et la masse a été retirée chirurgicalement. L'examen histopathologique a révélé une légère hyperplasie salivaire adénomateuse avec ectasie canalaire. Aucun signe de néoplasme ou d'inflammation sévère n'a été observé. Le diagnostic final était une hyperplasie adénomateuse salivaire dans la région rétropharyngée. L'hyperplasie adénomateuse salivaire peut être responsable de signes cliniques, selon la taille et la localisation. Il peut être difficile de différencier l'hyperplasie adénomateuse salivaire des tumeurs malignes en se basant uniquement sur les résultats de l'imagerie. Ce cas a démontré comment l'hyperplasie adénomateuse salivaire peut imiter des tumeurs malignes, en particulier chez les animaux ayant des antécédents de malignité tumorale adjacente.

Message clinique clé :

À notre connaissance, il s'agit du premier rapport chez un chien d'une hyperplasie adénomateuse salivaire imitant une métastase tumorale. Il peut être difficile de différencier une hyperplasie adénomateuse maligne et salivaire en utilisant uniquement les résultats de l'imagerie. Bien qu'elle soit histologiquement bénigne, l'hyperplasie adénomateuse salivaire peut provoquer des signes cliniques.

(Traduit par Dr Serge Messier)

Can Vet J 2025;66:255–261

Salivary adenomatous hyperplasia is an uncommon disease in human medicine that histologically presents as benign nonneoplastic enlargement with normal-appearing salivary tissues (1,2). Adenomatous hyperplasia has been rarely reported in veterinary medicine, occurring in the *rete ovarii,* mammary glands, biliary tract, and kidney (3–7). However, to the authors' knowledge, no reports have addressed salivary adenomatous hyperplasia in dogs. This case report describes salivary adenomatous hyperplasia in the retropharyngeal region mimicking tumor metastasis in a dog.

CASE DESCRIPTION

A 13-year-old castrated male poodle was presented with a 1-month history of respiratory distress and coughing. Seventeen months earlier, the dog had undergone surgical excision of the right thyroid gland and ipsilateral medial retropharyngeal node because of a suspected tumor. Histopathologic examination confirmed a thyroid follicular adenocarcinoma in the right thyroid gland with metastasis to the right medial retropharyngeal lymph node. The left medial retropharyngeal lymph node was unremarkable in the computed tomographic (CT) examination completed just before the surgical excision of the right thyroid gland and right medial retropharyngeal lymph node (Figure 1).

The dog had a body condition score of 4/9 and an unremarkable body temperature (39.1°C). Systolic blood pressure was elevated (200 mmHg) but was attributed to anxiety. Blood work findings were unremarkable except for elevated alkaline phosphatase (1659 U/L). However, other liver enzymes, including alanine transaminase, aspartate transferase, and gamma-glutamyl transpeptidase, were within normal ranges. Thoracic radiography (Titan 2000M; COMED Medical System, Seoul, Korea) revealed a mild, generalized, and unstructured bronchointerstitial lung pattern (Figure 2 A, B). Chronic bronchitis was initially suspected and the dog was prescribed theophylline (10 mg/kg, q12h, PO) and doxycycline (5 mg/kg, q12h, PO).

Five days later, the owner reported that the dog's clinical signs had not resolved. Routine abdominal ultrasonography (Aplio 500; Canon, Tokyo, Japan) with a linear-array transducer (10 MHz) was performed; however, no abnormalities were identified except for gallbladder sludge. Cervical ultrasonography to check for thyroid tumor recurrence revealed an enlarged hypoechoic mass in the left medial retropharyngeal region. The mandibular salivary glands and lymph nodes were unremarkable bilaterally. Fine-needle aspiration was not done due to concerns about penetrating the adjacent mandibular salivary gland and vascular structures.

To further investigate the left medial retropharyngeal mass, CT was done using a 16-slice CT scanner (Revolution ACT; GE HealthCare, Chicago, Illinois, USA) with the following scanning parameters: 120 kVp, 85 mA, matrix size: 512 × 512, rotation time: 1.2 s, slice thickness: 2.5 mm. The dog was placed in sternal recumbency under general anesthesia. The contrast medium (iohexhol, 350 mg/mL, Omnipaque; GE HealthCare, Chicago, Illinois, USA) was

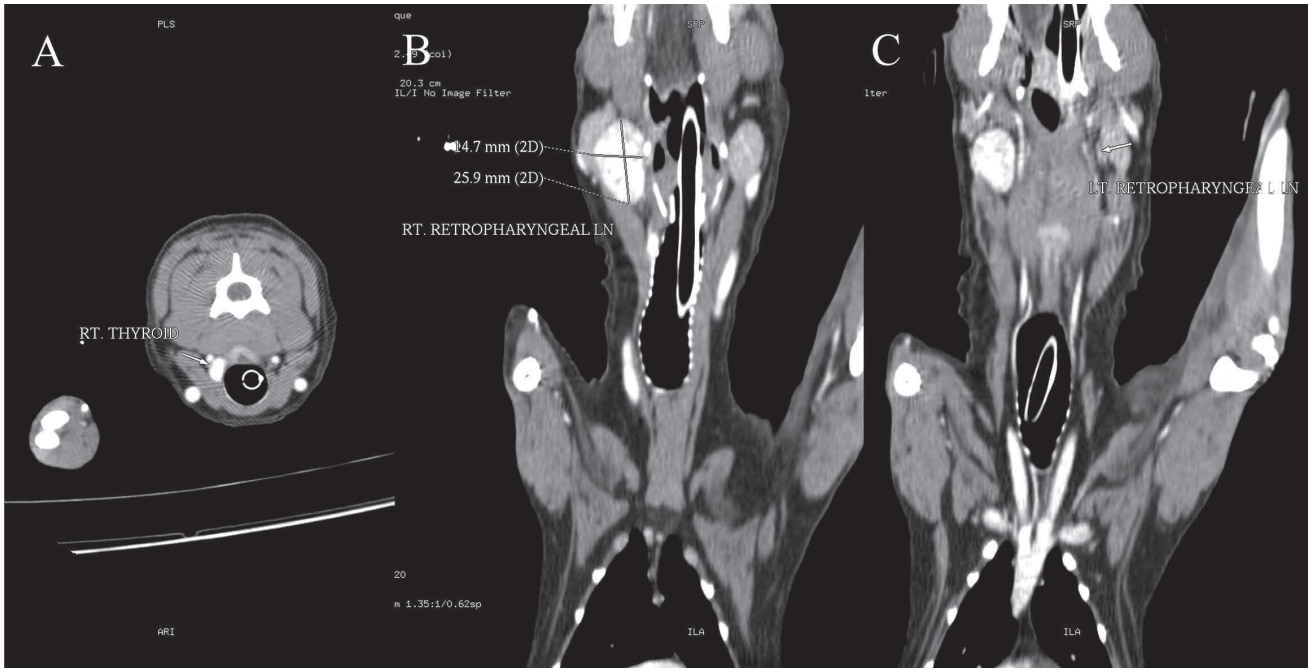

FIGURE 1. Postcontrast computed tomographic images in transverse plane (A) and dorsal planes (B, C) in the soft-tissue window, showing previously diagnosed thyroid follicular carcinoma and lymph node metastasis. The right thyroid gland (A) and the ipsilateral medial retropharyngeal lymph node (B) exhibit strong enhancement with size enlargement. The left medial retropharyngeal lymph node (C) is unremarkable in terms of size and attenuation before surgical excision of the right thyroid gland and right medial retropharyngeal lymph node.

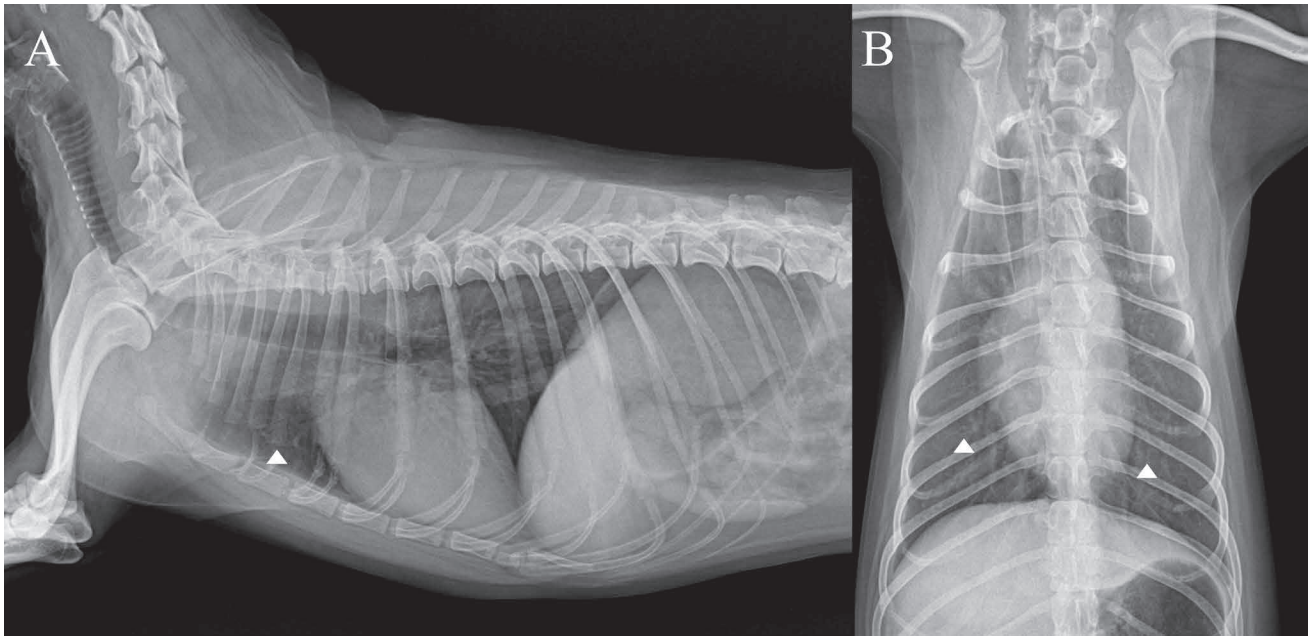

FIGURE 2. A and B — Thoracic radiographic images show a mild, generalized, unstructured broncho-interstitial lung pattern (arrowheads).

administered manually *via* the right cephalic vein. Postcontrast images were obtained 70 s after contrast administration.

Computed tomography revealed an enlarged left medial retropharyngeal mass (L × W × H: 1.5 × 1.4 × 1.6 cm) with irregular margins and heterogeneous enhancement (Figure 3 A, B). The mass was adjacent to the mandibular salivary gland and compressed the dorsolateral borders of the laryngeal wall. The mass was initially considered as a medial retropharyngeal lymphadenopathy because it was located where the medial retropharyngeal lymph node normally is. The mandibular and parotid salivary glands were

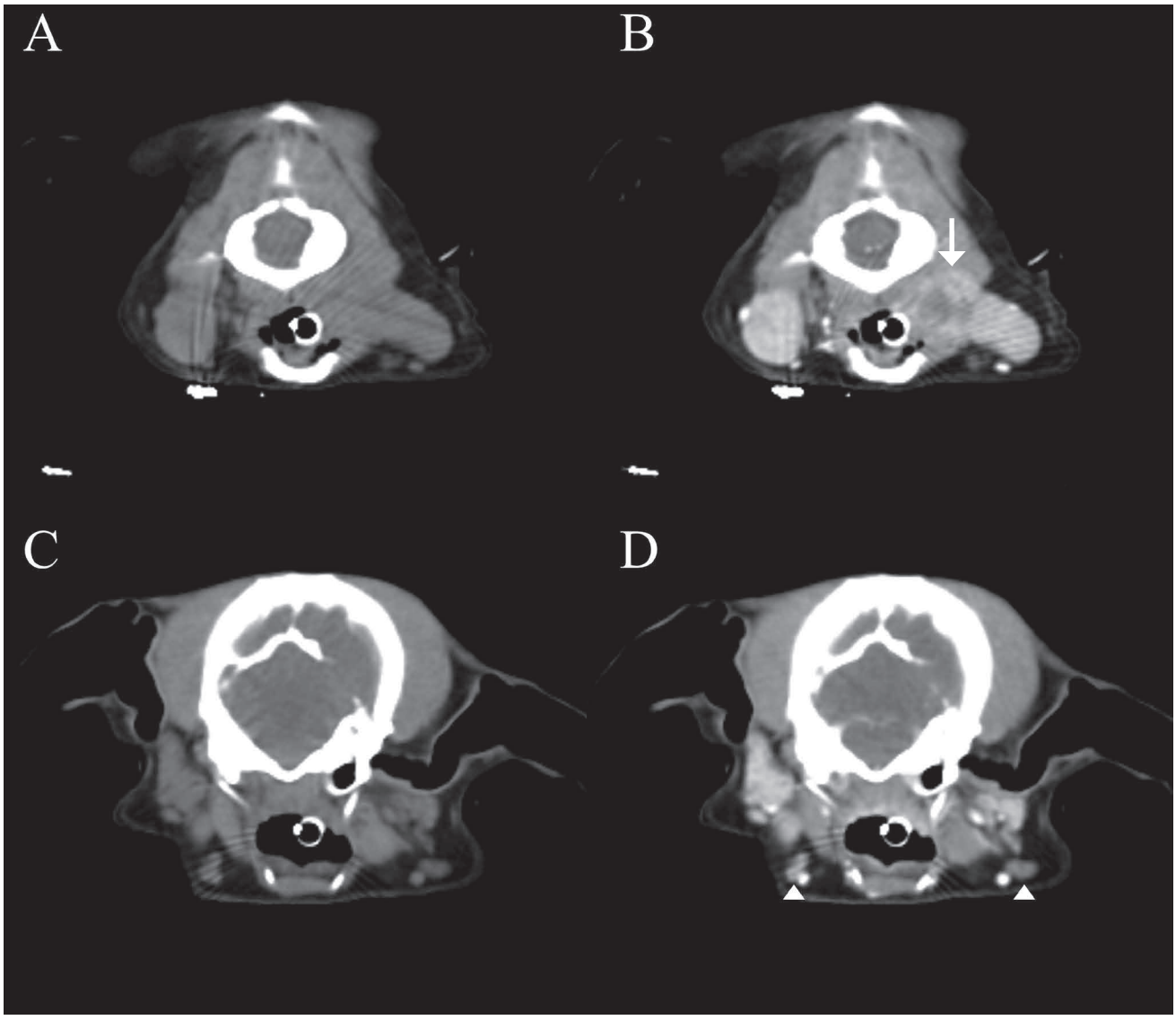

FIGURE 3. Pre- and postcontrast computed tomographic images in transverse planes in the soft-tissue window, showing the left medial retropharyngeal mass (A, B) and the bilateral mandibular lymph nodes (C, D). An enlarged left medial retropharyngeal mass (arrow) with irregular margins and heterogeneous enhancement is noted. The bilateral mandibular lymph nodes are mildly enlarged, with homogeneous enhancement (C, D).

unremarkable bilaterally. Mild enlargement of the homogeneous bilateral mandibular lymph nodes was observed (Figure 3 C, D). The findings of the left thyroid gland were unremarkable. Although the enhancement of the suspected left medial retropharyngeal lymphadenopathy was less pronounced than that of the previously excised metastatic right medial retropharyngeal lymph node, metastatic lymphadenopathy was presumed because of a history of thyroid follicular carcinoma and the heterogeneous enhancement of the mass. However, primary neoplastic and reactive lymphadenopathies could not be excluded. Compression of the mass on the laryngeal borders was deemed responsible for the coughing and respiratory distress. Reactive lymphadenopathy was considered to explain the mild homogeneous lymphadenopathy of the bilateral mandibular lymph nodes.

The owner elected for surgical removal of the left medial retropharyngeal mass. The mass appeared to be well-encapsulated and did not adhere to other adjacent structures (Figure 4 A). Histopathologic examination revealed mild adenomatous salivary hyperplasia and duct ectasia (Figure 4 B). There was no evidence of neoplastic cells or

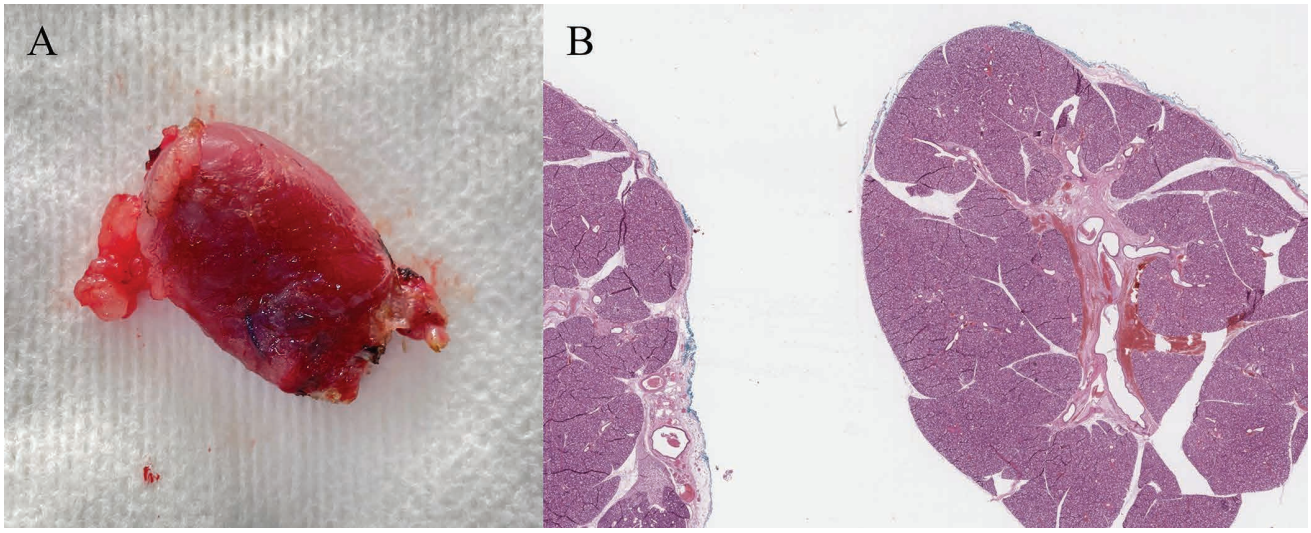

FIGURE 4. Gross morphology (A) and histopathologic examination (B) of the surgically removed left medial retropharyngeal lymph node. The histopathologic examination revealed mild salivary adenomatous hyperplasia and duct ectasia. No evidence of neoplastic cells or substantial inflammation is noted. Hematoxylin and eosin staining, 12.5× magnification (B).

substantial inflammation. The final diagnosis was salivary adenomatous hyperplasia in the left medial retropharyngeal region. Upon follow-up examination, the owner reported that coughing and respiratory distress had disappeared.

DISCUSSION

In veterinary medicine, adenomatous hyperplasia is a rare condition that has only been reported in a limited number of histopathologic studies (3–7). Adenomatous hyperplasia of the *rete ovarii* in a beagle presented as proliferation of gland-like tubular structures (3). Adenomatous hyperplasia was reported in mammary glands, including fibroadenomatous hyperplasia in cats and teat sinus and duct adenomatous hyperplasia in a dog (4,5). Teat sinus and duct adenomatous hyperplasia involved proliferating teat ducts and progressive differentiation into teat sinuses (5). The bland cell morphology and absence of invasive growth or clinical behavior represented the benign nature of adenomatous hyperplasia (5). In an experimental study with dogs, inoculation of bacteria into the biliary tract resulted in mild to severe adenomatous hyperplasia of bile duct epithelium, with proliferation of mucus-producing glandular elements in the wall and epithelial hyperplastic changes (6).

Salivary adenomatous hyperplasia was addressed in a retrospective study of canine and feline oral tumor and tumor-like lesions (8). The authors reported a single case of adenomatous hyperplasia of the minor salivary gland in a cat (8). Similar to previously reported adenomatous hyperplasia cases in humans, the dog in our case exhibited histopathologic findings of hyperplasia without evidence of malignant features. Before histopathologic examination, the history of previously diagnosed thyroid carcinoma and imaging findings of a retropharyngeal mass led to suspicion of malignancy rather than salivary tissues. Thus, salivary adenomatous hyperplasia mimicked tumor metastasis in this case.

In humans, salivary adenomatous hyperplasia occurs in the minor salivary glands (1,2,9,10). The clinical significance of this presentation is that it resembles salivary gland neoplasms (1,2). Histopathologic findings include multiple aggregation of normal mucous acini in varying sizes (1). Inflammatory cell infiltrates are not a crucial feature in salivary adenomatous hyperplasia (1). In the tissue removed from the retropharyngeal area of this dog, there was hyperplasia of acinar epithelial cells with no substantial inflammation, similar to the histopathologic findings for human salivary adenomatous hyperplasia. Salivary adenomatous hyperplasia of minor salivary glands may occur at any location where oral mucosa exists but is most common in the hard and soft palates (1,9). The etiology of salivary adenomatous hyperplasia is not well understood; however, some reports suggest it may be due to local trauma or chronic irritation leading to reactive hyperplasia (1,10). However, most cases are considered idiopathic (1). For the dog reported herein, the cause of salivary adenomatous

hyperplasia was deemed idiopathic because there was no history of chronic irritation after surgical removal of thyroid carcinoma and no evidence of inflammation was identified in the histopathologic examination.

Three possible origins of salivary tissues were considered in this case: i) heterotopic salivary tissue in medial retropharyngeal lymph node, ii) salivary adenomatous hyperplasia in minor salivary gland, and iii) salivary adenomatous hyperplasia in accessory salivary tissue. Heterotopic salivary tissue is present outside the major and minor salivary glands and does not show the histopathologic findings of branchial cleft anomalies (11). In humans, the heterotopic tissue occurs at various locations, including the pituitary gland, middle and external ears, mandible, gingiva, thyroglossal duct, and cervical lymph nodes (12). The retropharyngeal mass in this case was present where medial retropharyngeal lymph node normally exists in CT images, which raised the possibility of heterotopic salivary tissue in the medial retropharyngeal lymph node. However, absence of evidence of lymph node structures in the histopathologic examination made this hypothesis unlikely. Minor salivary glands in dogs are located throughout the lips, cheeks, tongue, hard palate, soft palate, pharynx, and esophagus (13,14). In humans, adenomatous hyperplasia of minor salivary gland occurs where the oral mucosa exists, but the mass in the present case was located at the retropharyngeal space (15). In addition, the mass was well-encapsulated, with no continuity of oral mucosa during surgical removal. Furthermore, oral mucosa tissues were not evident in the histopathologic examination. Although the possibility of minor salivary gland adenomatous hyperplasia could not be completely ruled out, it was considered unlikely. Salivary adenomatous hyperplasia of accessory salivary tissue was most likely the origin since the mass occurred adjacent to the mandibular salivary gland.

Imaging findings of salivary adenomatous hyperplasia are poorly investigated in both human and veterinary medicine. Palatal and parotid gland adenomatous hyperplasia in a neonate and an adult had soft-tissue attenuation in CT images (16,17). Accessory salivary tissue demonstrated similar attenuation to normal salivary glands (18). We expected salivary adenomatous hyperplasia to exhibit similar attenuation to salivary glands since it histologically consisted of acinar cells. However, CT images of the mass had heterogenous enhancement with attenuation different from that of normal salivary glands. The mass mimicked a malignant tumor such as a tonsillar salivary gland adenocarcinoma with heterogenous enhancement (19). Differentiating adenomatous salivary tissue from malignancies *via* imaging findings may be challenging, and cytologic or histopathologic examination is crucial.

Salivary adenomatous hyperplasia of minor glands in humans is asymptomatic in most cases, but swelling could lead to pain or dysphagia (1,2). In the case described herein, the mass effect of salivary adenomatous hyperplasia was likely responsible for the dog's coughing and respiratory distress, since the clinical signs disappeared after surgical removal. Therefore, although salivary adenomatous hyperplasia is a benign disease entity, it may cause clinical signs depending on the size and location.

In conclusion, we report a case of salivary adenomatous hyperplasia in the retropharyngeal region of a dog that mimicked a malignant tumor. Although rare, salivary adenomatous hyperplasia may be included in the differential diagnosis if a mass is identified within the oral cavity or adjacent to the salivary glands. CVJ

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CASE REPORT
RAPPORT DE CAS

Successful treatment of infraspinatus tendon-bursa ossification in a Labrador retriever

Sophie Cormillot, Colin Sereda

ABSTRACT

This case report describes the successful surgical treatment of a young (3-year-old) male Labrador retriever dog with mineralization of the tendon and bursa of the infraspinatus muscle. The condition was diagnosed *via* physical and orthopedic examination in addition to computed tomographic imaging. The dog underwent medical treatment involving rest, controlled exercise, deracoxib, shockwave therapy, and intra-articular glucocorticoid injections without success before surgical correction. Surgical treatment involved resection of the mineralized material and tenectomy of the infraspinatus insertion on the proximal humerus. The dog's lameness and pain resolved completely after surgery and the dog continues to experience no lameness or pain 7 mo post-surgery.

Key clinical message:

The successful surgical treatment of mineralization of the tendon and bursa of the infraspinatus muscle in a dog is described. The diagnostic approach, treatment, and clinical outcome are detailed to provide a reference for the potential treatment of future cases.

RÉSUMÉ

Traitement réussi de l'ossification du tendon infra-épineux et de la bourse séreuse chez un labrador retriever

Ce rapport de cas décrit le traitement chirurgical réussi d'un jeune chien labrador retriever mâle (âgé de 3 ans) présentant une minéralisation du tendon et de la bourse du muscle infra-épineux. La condition a été diagnostiquée par un examen physique et orthopédique ainsi que par tomodensitométrie. Le chien a été soumis à un traitement médical impliquant du repos, des exercices contrôlés, du déracoxib, une thérapie par ondes de choc et des injections intra-articulaires de glucocorticoïdes sans succès avant une correction chirurgicale. Le traitement chirurgical impliquait la résection du matériel minéralisé et la ténectomie de l'insertion de l'infra-épineux sur l'humérus proximal. La boiterie et la douleur du chien ont complètement disparu après l'opération et le chien continue de ne ressentir aucune boiterie ni douleur 7 mois après l'opération.

Message clinique clé :

Le traitement chirurgical réussi de la minéralisation du tendon et de la bourse du muscle infra-épineux chez un chien est décrit. L'approche diagnostique, le traitement et le résultat clinique sont détaillés pour fournir une référence pour le traitement potentiel des cas futurs.

(Traduit par Dr Serge Messier)

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Problems involving the soft tissues of the canine shoulder joint are not uncommon. More commonly diagnosed conditions that present with similar symptoms include pathologies associated with the supraspinatus or biceps muscle and tendon. These conditions are most common in adult, medium-to-large-breed dogs (1,2), with the Labrador retriever overrepresented (2). For the more commonly diagnosed shoulder pathologies and infraspinatus bursal ossification, the most common presenting sign is unilateral or bilateral weight-bearing forelimb lameness (1–6). The lameness is often intermittent and worsens with exercise (6). In dogs with supraspinatus tendinopathy or infraspinatus bursal mineralization, there are often bilateral changes as well as concurrent intra-articular tendon or ligament pathologies (1). Many of the soft-tissue shoulder conditions are challenging to diagnose and are presented with relatively nonspecific physical examination and diagnostic findings.

Although the orthopedic examination for a dog with shoulder pathology can reveal the clinical signs mentioned, it is not uncommon for the pathology to present more insidiously, with no overt signs of pain or lameness (2). In addition to a clinical and orthopedic examination, other diagnostic modalities may include radiography, arthrography, arthroscopy, ultrasonography, magnetic resonance imaging, computed tomography (CT), scintigraphy, and synovial fluid analysis (1).

Infraspinatus tendon-bursa ossification is rarely reported in the veterinary literature. This condition is most commonly described in Labrador retrievers and an underlying genetic basis related to conformation, gait, or repetitive injury has been suggested (2,4). Clinical findings for infraspinatus tendon-bursa ossification include unilateral or bilateral lameness (depending on whether one or both shoulders are affected), atrophy of the spinatus muscles, pain when direct pressure is applied over the point of insertion of the infraspinatus tendon, and pain on flexion or extension of the shoulder. Radiographs may show the presence of mineralized masses surrounding the humerus or glenohumeral joint. The bone adjacent to the affected areas has also been shown to be irregular, with increased radiopacity. Some affected dogs will have areas of poorly defined radiopaque regions caudal to the greater tubercle, as well as glenohumeral periarticular osteophytes and enthesophytes of the acromion (2).

Many treatment options associated with varying degrees of success have been reported for soft-tissue shoulder injuries. For infraspinatus tendon-bursa ossification, medical and surgical therapies have been used. Medical therapies involving rest, non-steroidal anti-inflammatory drugs (NSAIDs), and/or long-acting corticosteroid injections have been used (2). Surgery has involved the removal of the ossified portion of the tendon-bursa (2).

This report describes a case of infraspinatus tendon-bursa mineralization in a 3-year-old Labrador retriever with intermittent right forelimb lameness that was ultimately diagnosed using CT imaging. Treatment was initially attempted with deracoxib, triamcinolone joint injections, and controlled regular exercise. When this approach was unsuccessful, surgical excision of the mineralized tendon was completed, with complete resolution of clinical signs. This case report is unique because it describes the use of CT imaging to diagnose and describe a case of infraspinatus tendon-bursa ossification, as well as the complete resolution of all clinical signs following surgery.

CASE DESCRIPTION

A 3-year-old, male, working Labrador retriever was presented with right forelimb lameness that had developed over the previous month. The lameness was consistently present, with varying degrees of severity that seemed unrelated to whether the dog had been active or rested. The orthopedic examination revealed consistent pain with full flexion of the glenohumeral joint, particularly with concurrent extension of the elbow. Direct palpation over the proximal humerus also resulted in a consistent pain response. At this time, the primary differential diagnoses included biceps tendinopathy or an injury of the supraspinatus. A 2-week trial of deracoxib (Deramaxx; Elanco Animal Health Canada, Mississauga, Ontario) was prescribed at a dosage of 2 mg/kg, PO, q24h, but was unsuccessful in resolving the lameness. Therefore, further investigation was pursued. The dog was sedated for a CT scan (TSX-303B/SR 64 slice) of the forelimbs (Aquilion Prime SP; Canon Medical Systems Canada, Markham, Ontario). The CT scan revealed marked mineralization lateral to both glenohumeral joints, associated with the insertion of the infraspinatus tendons (Figure 1).

Following the CT scan, an intra-articular injection of triamcinolone (triamcinolone acetonide, Vetalog, 0.1 mL of a 40 mg/mL suspension; Boehringer Ingelheim Vetmedica, Burlington, Ontario), 0.1 mg/kg, was administered in the right shoulder. Shockwave therapy (VersaTron 4 Paws high-energy shockwave device; Pulse Veterinary Technologies, Alpharetta, Georgia, USA) of the right shoulder was applied, using 1000 pulses at the E5 setting. This treatment resulted

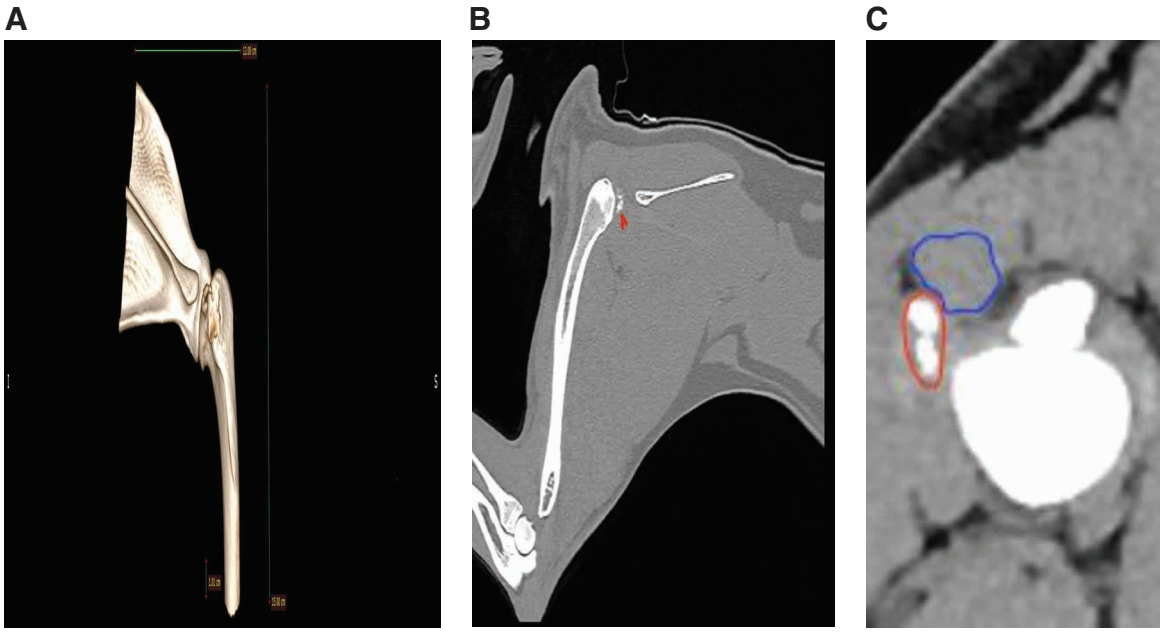

FIGURE 1. A — A 3D computed tomographic (CT) reconstruction from the forelimb of the dog, demonstrating irregular mineralization overlying the lateral aspect of the right shoulder joint. The lesion is immediately cranioventral to the acromion and within the musculotendinous junction of the infraspinatus muscle. B — A sagittal CT image of the affected shoulder. The red arrow represents mineralization within the infraspinatus tendon. C — An axial CT image of the affected shoulder. The red circle indicates the muscle/tendon junction of the infraspinatus and the blue circle indicates the supraspinatus muscle/tendon interface.

in resolution of the lameness for ~1 wk. A second triamcinolone injection and shockwave treatment, 2 wk after the first, also resulted in improvement for ~1 wk. One week after the second steroid injection, NSAID therapy was reinstated, using deracoxib at a dosage of 2 mg/kg, PO, q24h, in addition to several weeks of restricted activity. Despite this, little change in the lameness was appreciated.

The decision was made to proceed with arthroscopy using a 2.7-millimeter, 30° scope (Arthrex, Naples, Florida, USA). Arthroscopic evaluation of the right shoulder used a cranial egress portal and lateral arthroscope portal placed just distal to the acromion, as described by Beale *et al* (6). The arthroscopic examination revealed normal intra-articular structures.

Following arthroscopy, a craniolateral approach to the right shoulder was used as described by Piermattei *et al* (7), *via* an incision through the deep fascia, starting at the acromion and continuing over the cranial aspect of the acromial part of the deltoideus muscle. Caudal retraction of the deltoideus revealed the insertion of the infraspinatus on the proximal humerus. Moderate fibrosis and thickening of the tendon present at its insertion obscured any delineation of the tendon from its associated bursa. A large region (1.5 × 0.7 cm) of firm, bone-like mineralization could be palpated within the distal portion of the tendon, immediately proximal to its insertion. The abnormal mineralized tissue was excised from the tendon using a combination of blunt and sharp dissection. Following its removal and assessment of the remaining tendon, the decision was made to excise the distal 2 cm of the infraspinatus tendon. A splash block, using 0.5% bupivacaine (bupivacaine hydrochloride; Pfizer Canada, Brandon, Manitoba), was then applied for local analgesia. The deep fascial incision was closed with 3-0 poliglecaprone 25 (Monocryl monofilament poliglecaprone 25 suture; Johnson & Johnson, Markham, Ontario). Additional local analgesia was provided using 0.5% bupivacaine injected subcutaneously along the incision. The subcutaneous tissue and dermis were closed with 3-0 poliglecaprone 25. Tissue glue (Dermabond Advanced Topical Skin Adhesive; Johnson & Johnson MedTech, Guelph, Ontario) was used topically to ensure closure.

The dog was prescribed gabapentin (Apo-gabapentin; Apotex, Brantford, Ontario) at 300 mg, PO, q8h for 3 d. In addition to gabapentin, the dog was also prescribed continued use of an NSAID (Deramaxx; Elanco, Greenfield, Indiana, USA), 37.5 mg, q24h for 7 d. Four days following surgery, the dog was able to move well and was not exhibiting any further lameness. Soundness of gait was based on the owner's report and veterinary assessments. Activity was restricted to short, on-leash walks for 2 wk, followed by a

gradual reintroduction to normal exercise over another 2 wk, through progressively longer leash walks and light off-leash play.

At the time of writing, the dog had remained sound for > 14 mo since the time of surgery. The dog had undergone direct examination by one of the authors, the surgery diplomate, at 3-month intervals following the procedure. No pain, discomfort, or gait change had been appreciated. The dog had retained normal range of motion in the shoulder joint and continued to lead an active working/hunting lifestyle.

DISCUSSION

This report describes a case of infraspinatus tendon-bursa ossification that was resolved with surgical excision and tenectomy. The dog in this case was a young, medium-to-large-breed dog that was highly active. This was consistent with the reported signalment for the condition (1,2). Studies have shown no significant difference in prevalence between sexes (2). The Labrador retriever breed is overrepresented in cases of tendon and ligament pathologies of the shoulder and has been almost exclusively affected by infraspinatus bursal ossification (1).

Most dogs with infraspinatus tendon-bursa ossification have a history of progressive weight-bearing thoracic limb lameness (1). Clients often note that the dogs become lamer with increased exercise intensity (1), as was seen in our case. In dogs with infraspinatus bursal ossification, direct pressure applied to the infraspinatus tendon often results in a painful response from the dog (1). Similar findings were apparent in this case, but manipulation could not definitively localize the proximal humeral pain to the infraspinatus tendon alone. For the dog in this report, pain was also identified when the shoulder was fully flexed with concurrent elbow extension.

Given the diagnostic challenges when using physical examination alone, diagnostic imaging is often used during workup of shoulder-related lameness cases. Radiographs are frequently obtained, especially where advanced imaging is not available. In cases of infraspinatus tendon-bursa ossification, mediolateral and caudocranial radiographs may show mineralized tissue (2), particularly lateral to the proximal humerus (1). The bone surrounding the mineralized tendon insertion may be irregular, showing increased radiopacity (2) and sclerosis (1). The presence of osteophytes or enthesophytes may be evident (2). The use of orthogonal views is imperative to ensure any osseous changes are appreciated. If the condition is suspected to be unilateral, as it was in our case, projections of the contralateral shoulder can be used for comparison.

In this case, CT imaging was used and led to the diagnosis of infraspinatus bursal ossification. We are unaware of any studies in the current veterinary literature that specifically describe CT findings for a dog with infraspinatus bursal ossification. The findings of a report by Mikkelsen and Ottesen support the use of CT as an adjunct test for the diagnosis of shoulder pathologies, especially when concurrent soft-tissue mineralization is suspected (3). Although the pathogenesis of tendon mineralization is not completely understood, it may be the result of indirect trauma that disrupts the blood supply and causes hypoxia. This may result in collagen transformation into fibrocartilage that ultimately undergoes dystrophic mineralization (8). The dog in this case report had marked mineralization of the infraspinatus tendon.

Concurrent intra-articular conditions and pathologies have been reported in a high proportion of dogs with infraspinatus tendon-bursa ossification (2), and arthroscopic evaluation is recommended as a component of the workup. In this case, arthroscopy failed to identify any other intra-articular abnormalities.

Nonsurgical treatments for shoulder pathologies involving the tendons or ligaments include NSAIDs (2), long-acting intra-articular corticosteroid injections (2), exercise restriction (1,2), hydrotherapy (1), weight loss for obese dogs (1), low-intensity extracorporeal shockwave therapy (5,6), and therapeutic exercises (6). The response to NSAID treatment for dogs with ossification of the infraspinatus tendon-bursa has been inconsistent (2). The dog in this report responded partially to the use of deracoxib, but the lameness persisted and ultimately worsened despite medical treatment.

Long-acting glucocorticoids are commonly used intra-articularly to manage acute or chronic shoulder ligament and tendon pathologies in dogs (1). In ~50% of dogs with soft-tissue shoulder conditions, improvement is noted following injection (1). The dog in this report responded briefly to intra-articular shoulder injections. Considering the lack of intra-articular pathology as documented *via* arthroscopy, we suggest this was likely the result of the glucocorticoid's effects on inflammation present at the level at which the shoulder joint capsule blends with the infraspinatus tendon and bursa.

Shockwave therapy has been used successfully in dogs with biceps and supraspinatus tendinopathies (5). One study reported that dogs treated with a piezowave-focused

shockwave once weekly for 3 treatment sessions had significantly improved sonographic appearance of the tendon as evidenced by reduced echogenicity, improved fiber definition, and better fiber organization. The goal of extracorporeal shockwave therapy is to promote tissue regeneration as well as "modulation of neovascularization, differentiation of mesenchymal stem cells, and local release of angiogenetic factors to promote tissue regeneration" (6). We cannot confidently comment on the effectiveness of shockwave therapy for the dog in this case report because there were only 2 treatments given in conjunction with intra-articular steroid therapy.

Surgical correction of tendon or bursal shoulder injuries may include a tenotomy (1), tenodesis (1), or removal of mineralized or ossified tissue (1,2). The surgical approach to treat ossification of the infraspinatus bursa in a dog was described by McKee and Macias (2), who recommended surgical resection of the ossified masses and release of the associated tendon. McKee *et al* reported a case series of 13 dogs with ossification of the infraspinatus tendon and bursa and described a craniolateral approach to the infraspinatus tendon and bursa followed by removal of the identified region of ossification. In 6 of 13 dogs, the infraspinatus tendon-bursa ossification was treated with surgery. Of those 6 dogs, 4 (66.6%) showed improvement in their lameness with surgery alone (2). The dog in this study underwent surgical correction of the mineralized infraspinatus as described herein.

When histopathological samples of affected biceps and supraspinatus tendons were examined, most lesions were noninflammatory in nature (6). This finding was not consistent with changes reported by McKee *et al,* who showed focal areas of synoviocyte hyperplasia and villous synovitis associated with ossification of the infraspinatus bursa (2). Unfortunately, in the case reported herein, the resected tissue was not sent for histopathological analysis.

Mineralization of the infraspinatus tendon-bursa is a rarely reported cause of forelimb lameness in dogs. Its presentation is similar to that reported for other soft-tissue shoulder pathologies, as are its treatment options. In the case we report, medical therapy failed to provide a satisfactory response, but surgical treatment was straightforward and resulted in complete resolution of clinical signs.

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CASE REPORT
RAPPORT DE CAS

Usefulness of transnasal volume-reduction treatment for nasal tumors by ultrasonic emulsification suction in 2 dogs

Shinya Mizutani, Yuko Mizutani, Yoshimichi Goda, Taketoshi Asanuma, Shidow Torisu

ABSTRACT

Intranasal tumors in dogs are rare neoplastic diseases with obvious clinical signs, such as epistaxis, nasal congestion, and facial deformity. Radiation therapy is the treatment of choice but is not always accessible due to geographical location, logistics, or financial constraints. Other treatments may not be used because of various restrictions. We performed transnasal intranasal tumor volume reduction in 2 dogs with intranasal tumors; 1 dog had an adenocarcinoma and the other had a fibrosarcoma. In both cases, improvement in the quality of life (QOL), including reduced clinical signs and increased activity, was observed ~1 wk after treatment. No obvious complications were associated with this treatment. Although tumor recurrence was noted in both cases, this treatment could be applied multiple times. In conclusion, transnasal nasal tumor volume reduction is a palliative method that contributes to improvement of clinical signs and QOL.

Key clinical message:

We report palliative treatment of intranasal tumors in dogs. The treatment described in this report is available to most veterinarians and helps improve the QOL of dogs with nasal tumors, including improving respiratory status.

RÉSUMÉ

Utilité du traitement de réduction transnasale du volume pour les tumeurs nasales par émulsification et succion chez 2 chiens

Les tumeurs intranasales chez le chien sont des maladies néoplasiques rares qui présentent des symptômes cliniques évidents, tels que l'épistaxis, la congestion nasale et la déformation de la face. La radiothérapie est le traitement de choix, mais elle n'est pas toujours accessible en raison de la situation géographique ou de contraintes logistiques et financières. Cependant, ces traitements peuvent ne pas être réalisés en raison de diverses restrictions. Nous avons procédé à une réduction du volume de la tumeur intranasale par voie transnasale chez deux chiens atteints de tumeurs intranasales. Les tumeurs intranasales de la cavité nasale étaient des adénocarcinomes et des fibrosarcomes. Dans les deux cas, une amélioration de la qualité de vie, telle que l'amélioration des symptômes cliniques et de l'activité, a été observée environ une semaine après le traitement. Aucune complication évidente n'a été associée à ce traitement. Une récidive tumorale a été constatée dans les deux cas. Ce traitement a pu être réalisé plusieurs fois. Cette réduction transnasale du volume de la tumeur nasale est une méthode palliative. Elle est considérée comme un traitement qui contribue à l'amélioration des symptômes cliniques et de la qualité de vie.

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Message clinique clé :

Nous rapportons un traitement palliatif de tumeurs intranasales chez le chien. Le traitement employé dans ce rapport est à la portée de la plupart des vétérinaires et contribue à améliorer la qualité de vie des chiens atteints de tumeurs nasales, notamment en améliorant leur état respiratoire.

(Traduit par les auteurs)

Can Vet J 2025;66:267–272

Nasal tumors account for 1 to 2% of canine tumors (1). Clinical signs include nasal discharge, epistaxis, sneezing, and reverse sneezing, and are initially mild (2,3), leading to delayed diagnosis. However, as tumors progress, dyspnea, facial deformity, and exophthalmos may develop, and quality of life (QOL) declines. Reported median survival rates are 3 to 5 mo without aggressive treatment and 8 to 25 mo with radiation therapy or surgery (1,2). Surgical treatment is seldom recommended due to the high incidences of postoperative complications and mortality (3,4). The result may also be esthetically undesirable. Radiation therapy is the gold standard for treatment of intranasal tumors (2), but it has limited availability, is generally costly, and may cause toxicity and esthetic changes.

Ultrasonic emulsification suction devices are popular in human medicine (5). These devices use ultrasound waves generated from a titanium tip to crush (cavitate) tissue with high water content and irrigate and aspirate it with a handpiece. In dogs, their use has been reported for liver and prostate tumors (6,7), and thus it was suggested that volume reduction could also be achieved for intranasal tumors by crushing of tumor tissue, perfusion, and aspiration. Therefore, this technique was used in the cases reported herein.

CASE DESCRIPTIONS

Case 1

A 7-year-old spayed female toy poodle dog weighing 2.6 kg had a 2-month history of epistaxis from the left nostril when it sneezed. Epistaxis was relieved by medical treatment (tranexamic acid: 10 mg/kg, PO, q12h) by the referring veterinarian, but the dog had another episode of epistaxis from its left nostril and was referred to us. The dog had sneezing, reverse sneezing, and nasal discharge, though no apparent external factors, such as trauma to the nose or bleeding disorder, were suspected. Laboratory tests indicated a mild decrease in white blood cell count, an increase in C-reactive protein, and a mild increase in alkaline phosphatase (Table 1). However, blood coagulation system tests indicated no abnormalities.

TABLE 1. Results of laboratory blood tests.

Item	Result		Reference interval
	Case 1	Case 2	
White blood cells (/μL)	4900	26 200	6000 to 17 000
Red blood cells ($\times 10^6$/μL)	7.52	5.72	5.5 to 8.5
Hemoglobin (g/dL)	16.8	11.7	12.0 to 18.0
Platelets ($\times 10^3$/L)	401	40.4	2200 to 500
Blood urea nitrogen (mg/dL)	18.0	21.1	9.2 to 29.2
Creatinine (mg/dL)	0.6	0.6	0.4 to 1.4
Alanine aminotransferase (U/L)	31	33	17 to 78
Alkaline phosphatase (U/L)	404	374	47 to 254
Calcium (mg/dL)	10.1	11.1	9.3 to 12.1
C-reactive protein (mg/dL)	6.9	0.9	0.0 to 1.0

Radiographs revealed increased radiopacity in the left nasal cavity but no osteolysis of the nasal septum. Computed tomography (CT) revealed a space-occupying lesion (SOL) with a contrast-enhancing effect on the caudal side of the left nasal cavity and part of the frontal sinus. The SOL did not extend to the left ventral nasal meatus, and the respiratory tract to the pharynx was maintained. In addition, the SOL was confirmed to be ~40 mm caudal to the external nostril. No other findings suggestive of osteolysis, such as nasal septum, lamina cribrosa, or orbit, were detected, and no swelling or distant metastasis of the regional lymph nodes were observed. Therefore, the lesion was designated a Stage-1 lesion, based on the modified Adams staging system (8).

A biopsy of the SOL was obtained using endoscopic biopsy forceps and was subjected to histopathological examination. The dog was diagnosed with intranasal adenocarcinoma. The owner declined surgery or radiation therapy and elected to start the dog on medical treatment with piroxicam (0.3 mg/kg, PO, q48h). After 4 mo, clinical symptoms such as worsening of the respiratory condition at bedtime, open-mouth breathing, and nasal-obstruction sounds apparent even while the dog was at rest became remarkable. When CT was repeated, the tumor in the nasal cavity had increased and extended to the left abdominal nasal passage, and osteolysis of the orbit and right displacement of the nasal septum were observed (Figure 1 A, B, C). According to the modified Adams staging system, the lesion was designated as Stage 3.

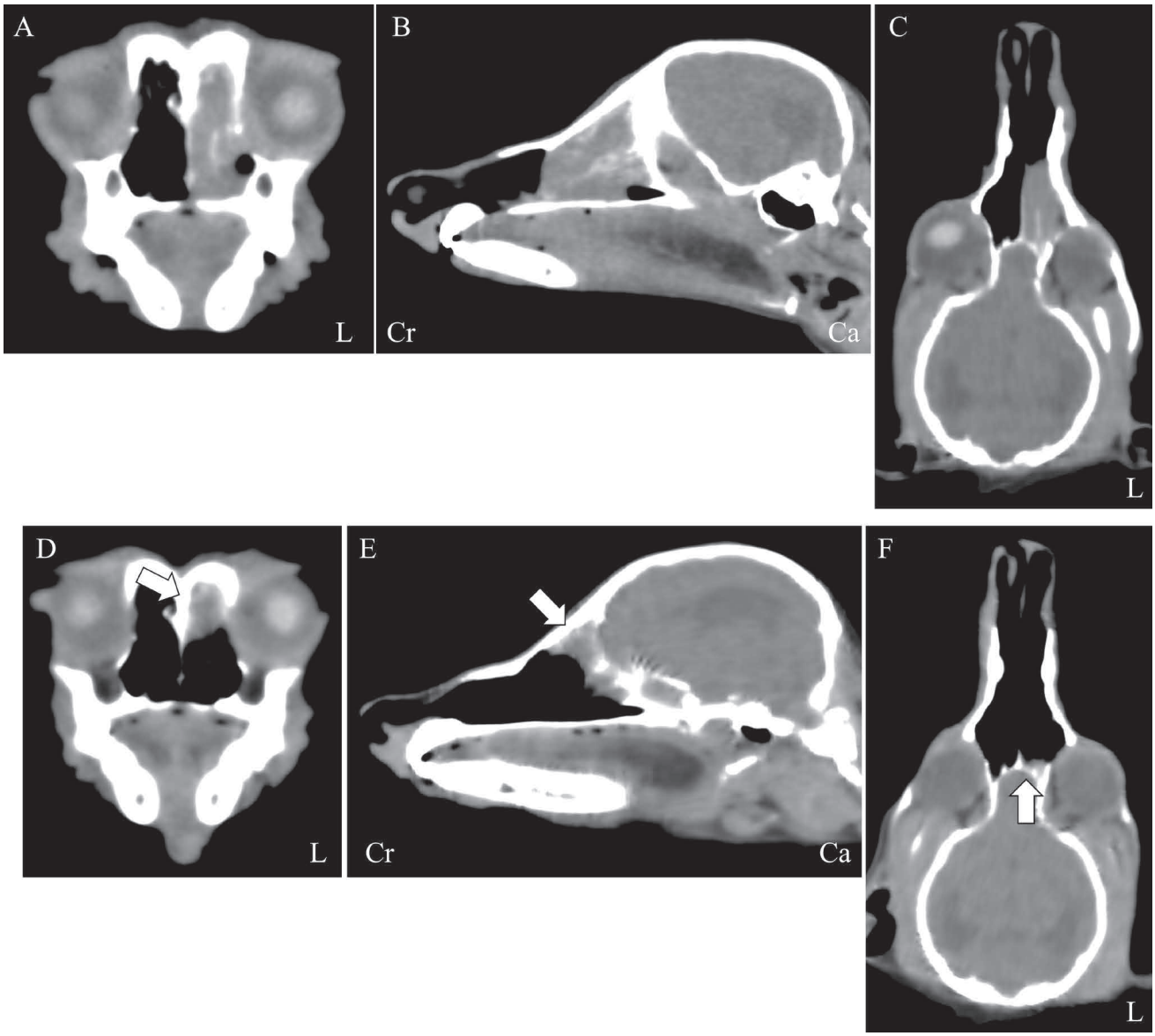

FIGURE 1. Computed tomographic (CT) evaluation of transnasal volume-reduction treatment for nasal tumors in dogs (Case 1, both pre- and posttreatment images). A — Transverse (pre-treatment); B — Sagittal (pre-treatment); C — Coronal (pre-treatment); D — Transverse (1 mo post-treatment); E — Sagittal (1 mo post-treatment); F — Coronal (1 mo post-treatment). Pre-treatment, the tumor in the nasal cavity had increased and extended to the left abdominal nasal passage, and osteolysis of the orbit and right displacement of the nasal septum were observed (A to C). Post-treatment, the nasal tumor was reduced in size, although complete disappearance was not achieved (arrows in D to F).

Ca — Caudal; Cr — Cranial; L — Left side; Post — CT image at the posttreatment checkup (1 mo after treatment); Pre — CT image just before treatment.

The owner was offered a more aggressive treatment option but did not consent. Instead, a transnasal volume-reduction treatment for nasal tumors was proposed and accepted. Under general anesthesia, CT was used to determine the distance from the external nostril on the rostral side to the site of tumor development, and the degree of lateral and ventral-dorsal extension of the lesion. Next, an ultrasonic suction device (SonoSurg-IU; Olympus Medical Systems, Tokyo, Japan) was inserted through the rostral nostril, and the volume of the tumor was reduced while using CT images as a guide. The most important precautions were the distance and angle from the external nostril to the cribriform plate area and from the external nostril to the orbit, so that the tip of the ultrasonic suction device did not enter the skull from the cribriform plate or the orbit. The distance and angle were measured in advance, and the volume was reduced with great care.

Although total removal of the intranasal tumor was not possible, the volume reduction of the intranasal tumor was sufficient, as evidenced by CT 1 mo after treatment

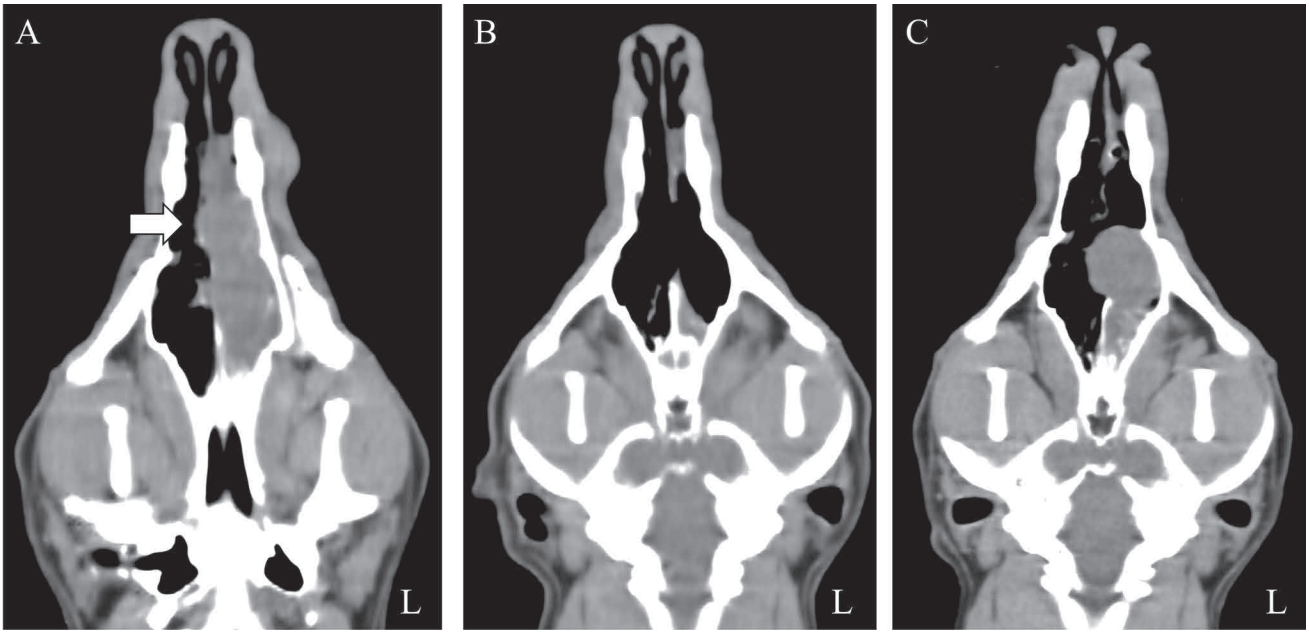

FIGURE 2. Computed tomographic (CT) imaging of a dog with an intranasal fibrosarcoma (Case 2). A — Dorsal (pre-treatment); B — Dorsal (3 mo post-treatment); C — Dorsal (7 mo post-treatment). The left nasal cavity and turbinate were partially lysed (arrow in A). At 3 mo post-treatment, the nasal tumor was reduced (B). At 7 mo post-treatment, the nasal tumor recurred (C).

L — Left side; Post — CT image at the posttreatment checkup; Pre — CT image just before the start of treatment.

(Figure 1 D, E, F). Epistaxis was a postoperative complication but subsided within ~7 d with no medical treatment. A few days postoperatively, the dog showed much improvement in QOL compared to preoperatively, including a stable respiratory condition (stable sleep, disappearance of open-mouth breathing and nasal congestion at rest) and increased appetite.

The dog was monitored for clinical signs of recurrence, and a CT scan was done every 2 mo to monitor recurrence of the intranasal tumor. Over time, the size of the intranasal tumor gradually increased. In addition, epistaxis was sometimes observed approximately once per week; however, after medical treatment (tranexamic acid), it was no longer observed.

Six months after the volume-reduction treatment, the intranasal tumor had grown to ~60 to 70% of its pretreatment size, and the nasal bone was substantially reduced. Therefore, transnasal volume-reduction treatment was performed again. After the second volume-reduction treatment, the tumor volume was reduced to the same extent as after the first treatment. The dog continued to live without obvious clinical deterioration except for occasional epistaxis. Thereafter, volume-reduction treatment was performed approximately once every 6 mo and, apart from occasional epistaxis, no obvious progression of intranasal tumors was observed. No major complications other than epistaxis were observed after additional treatment. No change in appearance was observed due to progression of the intranasal tumor, and the dog died for reasons unrelated to the intranasal tumor > 5 y after diagnosis.

Case 2

A 12-year-old female Shiba Inu dog weighing 8.4 kg had experienced increased sneezing and a blood clot expelled from the nasal cavity ~1 mo earlier. After medical treatment (antibiotics, antihistamines: details unknown) by the referring veterinarian, the dog exhibited nearly constant epistaxis and was referred for further examination. Laboratory tests indicated an elevated white blood cell count and mild elevation of alkaline phosphatase (Table 1), but blood coagulation system tests indicated no abnormalities.

Head CT revealed an SOL in the left nasal cavity with a poor contrast-enhancing effect (Figure 2 A). In addition, the nasal septum had partial osteolysis on the right side, but no infiltration of the lamina cribrosa or orbit was observed. No other findings suggestive of metastasis were observed. The nasal lesion was classified as Stage 2 according to the modified Adams staging system. Histopathological examination revealed that the intranasal tumor was a fibrosarcoma.

Based on these results, a transnasal volume-reduction treatment of the nasal tumor using ultrasonic emulsification

suction was performed. Following the procedure, the dog had epistaxis that subsided within 7 d with no medical treatment, but no other major complications were observed. Neither epistaxis nor nasal discharge were observed at an examination 3 mo after treatment, and the dog's general condition was good. Although CT revealed an intranasal tumor near the lamina cribrosa, the overall volume was reduced (Figure 2 B).

At 7 mo after treatment, CT indicated a clear recurrence of the tumor in the left nasal cavity (Figure 2 C). The tumor in the nasal cavity was removed using an ultrasonic emulsification suction device. The dog was subsequently untreated and died 7 mo after the second treatment.

DISCUSSION

In the cases reported herein, an ultrasonic emulsification suction device was used to reduce the volume of an intranasal tumor from the rostral side. Although it is necessary to identify the site of the intranasal tumor using CT, this approach enables volume reduction of the intranasal tumor from the rostral side while using the CT image as a guide. Compared to general surgical procedures, the approach is minimally invasive, does not require skin incisions or removal of the nasal bone, and can be completed easily — all major advantages. The only postoperative complication of this procedure was epistaxis for ~1 wk in both cases. It was noteworthy that both dogs had substantial posttreatment improvement in their respiratory function and QOL.

This treatment was not intended to be a substitute for radiation therapy but was limited to palliative volume reduction, and relapse of clinical signs occurred. The interval from treatment to relapse (asymptomatic period) was 6 to 7 mo; the length of this interval may depend on the type of intranasal tumor. This treatment has potential as part of a multimodal approach with radiation therapy and/or toceranib (9), or after relapse, to extend survival, but further investigation is needed.

For this technique, CT was necessary to determine the location of the lesion and the insertable range of the ultrasonic emulsification suction device. Intranasal tumors may cause changes in the appearance of the head, by causing osteolysis of the surrounding bones (*e.g.,* nasal bone and maxilla) as the tumor grows. Some owners have difficulty accepting this change in appearance. Although there was osteolysis around the tumor in both cases we report, treatment prevented further progression and did not alter the head's appearance. Therefore, this technique was also considered effective from an esthetic perspective.

A challenge of our volume-reduction treatment would be its application in cases of intranasal tumor arising in the frontal sinus or from the cribriform plate. The frontal sinus is likely inaccessible to ultrasonic emulsification suction devices owing to its anatomic angle and depth. The cribriform plate is adjacent to the brain and, even if the location and angle of nasal tumor development have been determined *via* CT, sufficient care must be taken. Therefore, we inferred that this method may be most appropriate for treatment of nasal tumors arising in the nasal cavity and nasopharyngeal regions other than the frontal sinus.

In Case 1, deemed Stage 3 based on the modified Adams staging system, the nasal adenocarcinoma that had invaded the orbit disappeared after treatment. This suggested that ultrasonic emulsification suction may have successfully removed the tumor that had invaded beyond the orbital bone. Our method in Case 1 did not involve aggressive treatment in the orbital direction. One possible reason for the disappearance of the orbital lesion was that the ultrasonic emulsification treatment-induced hyperthermia may have been effective. However, the actual temperature and range of heating by the equipment were not known, and aggressive use of this treatment for orbital lesions may cause ophthalmologic problems. Therefore, this treatment should not be used in modified Adams Stage-3 or Stage-4 cases and may be feasible for patients at modified Adams Stage 1 or Stage 2.

In conclusion, this transnasal volume-reduction treatment has a limited therapeutic effect and should be regarded as a palliative treatment. However, the treatment was easy to perform, and improvements in QOL, such as respiratory conditions, were promptly observed. Therefore, it should be considered an effective treatment option for intranasal tumors.

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- A landscape shot should be at least a 46 MB file; a portrait should be 27 MB
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ARTICLE

Megan Campbell, Briana N.M. Hagen, Basem Gohar, Jeffrey Wichtel, Andria Q. Jones

Don't ignore the tough questions: A qualitative investigation into occupational stressors impacting veterinarians' mental health

ABSTRACT

Objective

To explore Canadian clinical veterinarians' perspectives of occupational stressors. Although extant research has emphasized quantitative reporting of workplace stressors in veterinary medicine, a qualitative approach can lend depth and context.

Procedure

One-on-one interviews were conducted with 25 veterinarians at the 2016 Canadian Veterinary Medical Association Conference.

Results

Thematic analysis revealed 9 occupational stressor themes: nature of the profession, veterinary relationships, client interactions, inadequate personal finances, early-career veterinarian strain, practice-owner strain, onus of responsibility, self-described personal characteristics, and moral stressors and moral distress. Participants also discussed perceived implications of these stressors.

Conclusion

This study contributes to knowledge on veterinarians' mental health and discusses recommendations for mitigating occupational stressors to promote veterinarian well-being.

Clinical relevance

Understanding the occupational stressors that clinical veterinarians experience and the effects of these occupational stressors can lead to more targeted and comprehensive strategies to support veterinarians' mental well-being in a clinical setting.

RÉSUMÉ

N'ignorez pas les questions difficiles : une enquête qualitative sur les facteurs de stress professionnels ayant un impact sur la santé mentale des vétérinaires

Objectif

Explorer les points de vue des vétérinaires cliniciens canadiens sur les facteurs de stress professionnels. Bien que les recherches existantes aient mis l'accent sur la déclaration quantitative des facteurs de stress professionnels en médecine vétérinaire, une approche qualitative peut apporter de la profondeur et du contexte.

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This manuscript is part of Megan Campbell's thesis that was completed at the University of Guelph in 2022.

Unpublished supplementary material (Appendix 1) is available online from: Supplementary Materials.

Editor's note: This article contains discussions of suicide, moral injury, and the mental health challenges faced by veterinarians. If you or someone you know is struggling, please consider seeking support from a mental health professional or contacting a crisis hotline (988 in Canada).

Note de la rédaction : Cet article parle de suicide, de souffrance morale et des problèmes de santé mentale auxquels sont confrontés les médecins vétérinaires. Si vous ou une personne de votre entourage vivez des moments difficiles, n'hésitez pas à demander de l'aide à un professionnel de la santé mentale ou à contacter un service d'assistance téléphonique (988 au Canada).

Procédure

Des entretiens individuels ont été menés auprès de 25 vétérinaires lors de la conférence 2016 de l'Association canadienne des médecins vétérinaires.

Résultats

L'analyse thématique a révélé 9 thèmes de facteurs de stress professionnels : la nature de la profession, les relations vétérinaires, les interactions avec les clients, les finances personnelles inadéquates, la tension en début de carrière des vétérinaires, la tension du propriétaire de la clinique, le fardeau de la responsabilité, les caractéristiques personnelles auto-décrites, les facteurs de stress moraux et la détresse morale. Les participants ont également discuté des implications perçues de ces facteurs de stress.

Conclusion

Cette étude contribue aux connaissances sur la santé mentale des vétérinaires et discute des recommandations pour atténuer les facteurs de stress professionnels afin de promouvoir le bien-être des vétérinaires.

Pertinence clinique

Comprendre les facteurs de stress professionnels auxquels sont confrontés les vétérinaires cliniciens et leurs effets peut mener à des stratégies plus ciblées et plus complètes pour soutenir le bien-être mental des vétérinaires en milieu clinique.

(Traduit par Dr Serge Messier)

Can Vet J 2025;66:274–287

INTRODUCTION

Occupational stress is a dynamic process resulting from an imbalance between high work pressures and an inability to cope (1,2). A stressor is a perceived challenge or threat to an individual (3). Associations between occupational stressors and perceived high stress (4,5) in veterinarians have been reported (6). High work demands (4,6,7) and client challenges (4,6,8), moral distress (*i.e.,* psychological distress when individuals violate their morality due to external constraints) (5,9) related to factors such as convenience euthanasia or balancing animal care with clients' financial constraints, and animal welfare concerns have also been reported in veterinarians (5,10).

Personality elements (*e.g.,* perfectionism) may increase susceptibility to stress, particularly within already stressful contexts such as veterinary medicine. Perfectionism is defined as requiring a higher expectation of oneself or others than the situation warrants (11,12). High perfectionism may be a prevalent personality trait in the veterinary community (8), despite some dissent (13). Trait perfectionism, a facet of perfectionism, is having consistently high standards for oneself or others and has been linked to psychological distress in veterinarians (5). Veterinarians with high levels of perfectionism are also more psychologically susceptible to moral stressors (5). Hence, although personality is not the cause of stress in veterinary medicine, perfectionism may exacerbate the effects of occupational stressors faced by veterinarians.

Chronic stress has been associated with burnout (14) and workforce attrition (10) in veterinarians. Furthermore, some veterinarians experiencing high levels of occupational stress also experience elevated anxiety (4,5) and depression (4,15). Indeed, longitudinal studies illustrated a causal relationship between occupational stress and anxiety or depression in other workforce sectors (16,17).

Although several quantitative survey studies have identified occupational stressors in veterinarians (6,7), qualitative studies, with their focused use of open-ended questions, allow participants to share ideas beyond those considered. For example, euthanasia is widely regarded as a stressor in the veterinary profession (6,7); however, when it was explored using semi-structured qualitative interviews, only some aspects of euthanasia were identified as stressful (having a close bond with the animal, identifying with the client during euthanasia, or euthanizing unwanted animals) (8). Hence, qualitative exploration of perceived stressors among veterinarians may provide new insights. The aim of the present study was to explore veterinarians' perceptions of occupational stressors.

MATERIALS AND METHODS

Participant recruitment

Participants were recruited *via* newsletters and emails from provincial and national veterinary and practitioner organizations [*e.g.,* Ontario Veterinary Medical Association, Canadian Veterinary Medical Association (CVMA)] and flyers sent to veterinary clinics. The researchers and the Ontario Veterinary College (Guelph, Ontario) communications team also publicised the study *via* social media [Twitter (now "X") and Facebook].

Eligibility criteria were holding a Doctor of Veterinary Medicine (DVM) degree or equivalent; being English-speaking; and attending the CVMA Conference on July 7 to 10, 2016, in Niagara Falls, Ontario. An *a priori* sample size of 25 participants was elected based on logistical demands and similar sample sizes used in other qualitative veterinary studies (8,10). Theoretical data saturation (18) was also considered, as additional interviews would have been conducted if participants continued to provide new insights not heard in previous interviews.

Interviews

One-on-one research interviews were conducted at the CVMA conference and averaged 57 min in length (range, 24 to 90 min). A semi-structured interview guide was used. Questions pertained to participants' direct experiences with stress and poor mental health, effects of personal well-being on work, and supports for resilience and coping. Additional information can be found in the discussion guide (Appendix 1, available online from: Supplementary Materials). Only results related to stress and stressors are reported. All interviews were audio-recorded and transcribed verbatim by a professional transcriptionist.

Analyses

This study used a phenomenological approach within a constructivist paradigm (19). Transcripts were analyzed to identify meaningful patterns within the dataset using thematic analysis (20), and to offer a diversity of perspectives, while acknowledging consistencies and variations in insights within and across the dataset (20,21).

The primary author (MC) carefully read the transcripts to explore the dataset for initial patterns (20), and drafted an initial codebook. Three analysts (authors MC, BH, AJ) inductively and independently open-coded the same 3 transcripts selected by the primary author. This analysis team discussed the codes, and the draft codebook was modified to produce the working codebook (21) that was used by at least 2 investigators to analyze each remaining transcript. As new codes and themes were uncovered, the working codebook was refined through an iterative process. Quirkos v.2 data-analysis software (22) was used to organize and examine codes to assist in rich interpretations (21). Candidate themes were refined, merged, and/or separated as needed until the analysis team was satisfied that each theme helped reveal the underlying significance of the dataset (20). We used STATA v.16 software (23) to calculate frequencies and means for the demographic data.

Credibility was established using member-checking and peer debriefings (24,25). Dependability was enhanced using an audit trail to establish a clear pathway of the decision-making process (26). Conformability was strengthened by the primary author's use of a reflexivity journal during the analysis stage and by having multiple researchers collaboratively analyze the dataset (26,27).

TABLE 1. Demographic information of 25 veterinarian participants.

Variable	Subcategory	*n*	Percentage	Range
Gender	Woman	20	80	—
	Man	5	20	—
Age range (y)				31 to 69
	30 to 40	7	28	—
	41 to 50	4	16	—
	51 to 60	9	36	—
	61 to 70	5	20	—
Type of veterinary medicine practiced[a]	Small animal	19	76	—
	Equine/bovine	4	16	—
	Avian/exotic	6	24	—
	Small ruminant	1	4	—
	Other[b]	6	24	—
Relationship status	Married	21	84	—
	Divorced	1	4	—
	Committed relationship	2	8	—
	Single	1	4	—
Salary range ($K)				45 to 200
	45 to 95	16	64	—
	96 to 145	6	24	—
	146 to 200	3	12	—
Role at clinic	Associate	13	52	—
	Owner	4	16	—
	Other[c]	5	20	—
	Missing/did not respond	3	12	—

[a] More than 1 response was possible; hence, values sum to > 100%.
[b] "Other" included educators at veterinary institutions, locum practitioners, and specialists.
[c] "Other" included academic, locum practitioner, specialist, owner who was transitioning back to an associate, and unspecified.

Ethical considerations

The study protocol was approved by the University of Guelph Ethics Board (REB # 16MY029) and all participants

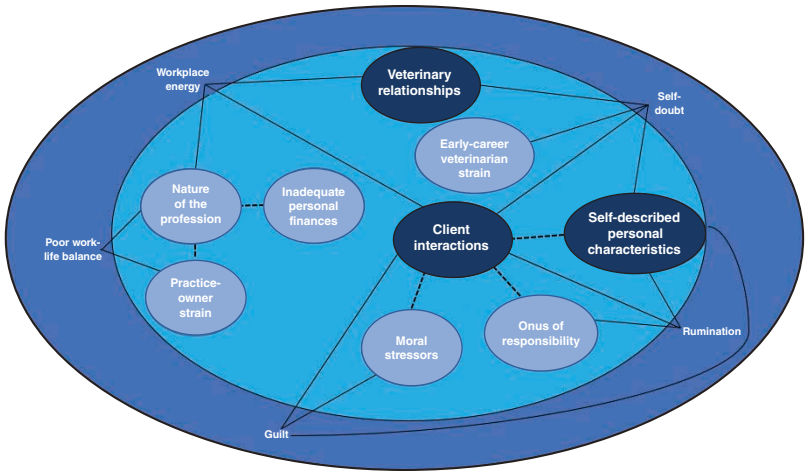

FIGURE 1. Thematic map of interconnected stressor themes and their connected implications. The inner circle contains the 9 stressor themes, and the outer circle represents various implications. A solid line indicates a stressor was described as having a direct relationship with the implication; a dotted line indicates a stressor described to exacerbate another stressor. Darker themes are stressors described by participants to most greatly impact their mental health.

provided written informed consent. Following interview completion, each participant received a $100 (CAD) honorarium. Identifying data (names, dates, and places) were removed to protect participant confidentiality.

RESULTS

Most participants self-identified as women (20/25; 80%), were married (21/25; 84%), practiced small-animal medicine (19/25; 76%), and were associate veterinarians (13/25; 52%). The mean age was 49.7 y (Table 1).

Participant descriptions of occupational stress and stressors were captured by 9 major themes: i) nature of the profession, ii) veterinary relationships, iii) client interactions, iv) inadequate personal finances, v) early-career veterinarian strain, vi) practice-owner stress, vii) onus of responsibility, viii) self-described personal characteristics, and ix) moral stressors and moral distress (Figure 1). Many participants also readily discussed implications of occupational stressors. Each of the themes and their associated sub-themes are discussed below.

Theme 1: Nature of the profession (Table 2)

Many participants commented on the "grueling," "day after day," continuous work overload associated with veterinary practice. They described high work demands stemming from unanticipated additional appointments being "crammed" into their work schedules or feeling as though there is "so much [work] to catch up on" due to late appointments.

Participants further described long working hours — those beyond scheduled shift time, due to paperwork or emergency cases at the end of shifts — and being on call as all being "unspoken rule[s]" of the veterinary industry. All were associated with feelings of exhaustion and poor work-life balance. Other effects of persistent high work demands included self-reported "burnout," "anxiety," "loss of control," "making mistakes," "exhaustion," "time-constraint stress," "focus issues," and decreased quality of care as "things get missed." Several participants described exhaustion as increasing propensity for mistakes and resulting in mentally "shutting down."

To combat long working hours, high work demands, and their associated implications, 1 participant proposed having 1 h of flex time scheduled into veterinarians' workday, to "catch up on cases that were in the hospital" or "return [phone] calls," whereas another recommended compulsory breaks. Break times were reported to reduce participants' feelings of being overwhelmed, by enabling downtime to "turn myself off for 20, 25 minutes."

Theme 2: Veterinary relationships (Table 3)

Although many participants described good camaraderie and teamwork, some participants noted that "toxic relationships" or "infighting" contributed to occupational stress. Three categories of poor veterinary relationships were identified: veterinarian-technician, associate veterinarian-owner/employer, and veterinarian-veterinarian relationships.

TABLE 2. Occupational stressors: Nature of the profession.

Sub-themes	Exemplar quotes
Overwhelming caseload	*"You know, when you throw another case on a really busy day, and you're drowning, that's a stressor that you know, one straw after another, that becomes negative reinforcement, and I think we see that a lot in the vet industry. We get burdened with far too much work, day after day."* — (DVM 15)
	"And then of course you're trying to rush to catch up, so you don't take the time to eat, you don't take the time to sit down for 5 minutes and gather your thoughts, it's just person to person to person to person without giving yourself time to process anything and I feel like that gets really overwhelming at times." — (DVM 17)
Long working hours	*"But the fact that our colleagues are constantly working 12-hour shifts that are actually 16-hour shifts, okay, and so that feeds your ability to have a life outside of practice, ability to spend time with your kids, ability to have 8 hours of sleep, ability to exercise or eat well."* — (DVM 1)
	"We're dispensable as people, and so you burn out, you leave, doesn't matter, we'll fill another — and maybe that's because of where I am now, I'm in an emergency specialty clinic, where it's get the job done, and you have to do your shift, and yet when you're done your shift you're still responsible for your reports... and I'm not an emergency doctor, but it's a minimum of 10, 12, 14 hours, and then you have to do your records, even if you were so busy, there's no vet to relieve you, there's nobody in that time." — (DVM 15)
Implications	
Loss of control	*"It was out of control, like booked too heavily, and then an extra thing would happen on top of what you already knew was going to be a busy day, and like an emergency came in or whatever. And I think it was that loss of control...but it's feeling like you have to somehow handle it all, and you know it's like oh, I don't know how I'm going to do the best possible job for each of these cases when it's so rushed."* — (DVM 23)
Lack of energy	*"So, by the end of your workday, you'd given out so much energy there was no energy left, so that's why I think all the self-care things that normal people hopefully will do for themselves, like prepare a proper meal, that wasn't happening... Just, you know, the plug was pulled, and the water drained out."* — (DVM 3)

TABLE 3. Occupational stressors: Veterinary relationships.

Sub-themes	Exemplar quotes
Poor veterinarian-technician relationship	*"A technician can make or break your mental health, I think, and if you have positive technicians, who are helpful, and um, work as a team, I think it can make your life so much better. If you work with negative technicians who are always bitching and second guessing you, and saying, 'Dr. So-and-so would have done it this way,' they can kick you [LAUGHS] down to the depths of Hell."* — (DVM 4)
Poor associate veterinarian-employer relationship	*"But at the same time if you're acknowledging that there's such a high rate of suicide in the profession, why don't you take better care of the interns and the people that you work with? There should be better awareness if you acknowledge this as a problem. I don't know, I just felt like there was this total discord between acknowledgement of the issue and actually doing anything to deal with it."* — (DVM 20)
Poor veterinarian-veterinarian relationship	*"And it's frustrating because it's like I'm a peer, and you're just throwing me under this hypothetical bus, and it gets really upsetting because this is a person who should have my back."* — (DVM 17)
Implication	
Strained staff relationships affecting clinic vibes	*"Managers often say, you can figure out the emotional status of a practice within a minute of walking in the door. I think that's very true. And we may not see it, or feel it necessarily, but we can walk into other businesses ourselves and you know feel that right away [SNAPS FINGERS]."* — (DVM 2)

Early-career veterinarians discussed conflict with veterinary technicians. Three participants expressed feeling frustrated or insecure and having low self-esteem when veterinary technicians questioned or opposed their case management. One participant described that perceived "resistance" from veterinary technicians hindered her decision-making.

Several associate veterinarians mentioned poor relationships with their employers. These participants described sources of tension stemming from owners saying they were "not billing enough," receiving "no positive reinforcement," a "lack of support," or "nepotism." Some effects of these poor relationships with employers were described as long-standing. One participant described being suspicious of her new employer's intentions as she "look[ed] for the game in it" or wondered, "Is it a test?" due to her strained relationship with her previous boss. Another participant felt that the clinicians overseeing her internship had "very little care as to how [interns] were handling it, how overworked they were, how tired they were." There was a "lack of compassion" from her supervisors despite them recognizing the mental health issues prevalent within the veterinary profession.

A few veterinarians described veterinary colleagues as being unsupportive or "just not being helpful," having a "cutthroat mentality," and "putting each other down," and suggesting that "vets kind of, yeah, talk negatively about other vets." One veterinarian attributed commission-based pay to "damaging" relationships with fellow colleagues, whereas another indicated that a lack of mentorship could foster an unsupportive work environment. Others expressed feeling unable to share calls with specialists, as veterinarians were afraid that these colleagues would "steal their case" or that they would ultimately lose a client. One veterinarian postulated that this competitive "individual[istic]" nature contributed to the longer working hours of veterinarians. Veterinarians felt that they needed "to be, do everything" and that this resulted in their needing to continuously "work, work, work."

Interpersonal dynamics among members of the clinic team were reported to affect the overall "feel of the clinic." One participant described having "zero patience'" when other staff members began to divulge their own "personal drama" Another shared that, when they bring pessimism into the workplace, "my technicians, my assistants, tend to all kind of chime in with their negativities, too." Impacts of interpersonal dynamics thus extended beyond the individuals and affected everyone in the clinic. In fact, a palpable sense of "workplace energy" was said to be readily apparent to everyone from staff to clients. For example, participants described clients being able to sense if the staff was "upbeat," as employees were "smiling," which "sets the tone for the entire exam." Conversely, participants described being able to "walk in the practice" and "feel" tension or issues with one or more staff members.

Theme 3: Client interactions (Table 4)

Many veterinarians spoke highly of their long-term clients, noting that good clients positively contributed to their mental health. For example, one participant noted, *"And when you do get those patients that call back, 'Oh, he's doing great, thank you so much,' it's really an ego boost, right?"* — (DVM 5). Other participants spoke about having "good clients" they were able to develop trust with. Client trust was the backbone to building a good veterinarian-client relationship in which the client valued and listened to the veterinarian's medical advice. However, most participants readily described unfavorable veterinarian-client interactions as part of the occupational stressors they encountered. Some participants spoke of the distrustful nature of some clients, including clients questioning their competencies or disregarding their diagnoses after accessing online health information (*e.g.,* 'Dr. Google'), or the client perception that veterinarians are "money gougers." Indeed, billing clients for services rendered was a commonly described stressor. One veterinarian spoke about the difficulty of "being under the microscope" or having "[clients who] are assessing your skills and then you have to get money from them." Some clients were described as trying to "impart guilt" onto the veterinarian for "charging" for their services. One participant felt "hypocritical" and guilty billing pet owners when there was an unfavorable outcome.

Several participants described contending with underappreciation and often feeling as though theirs was a "thankless job." Commonly, participants said their clients' lack of understanding of the veterinary profession was a source of stress. For instance, the perceived client belief that veterinarians just "play with dogs and cats all day long" was said to contribute to client underappreciation of the depth of a veterinarian's knowledge. This underestimation of veterinary expertise was further demonstrated when participants described clients that tried to "be a vet" and "Google those symptoms."

Many participants described an influence of the Canadian human medical system on clients' perceptions and expectations of veterinary medicine. For example, several participants described clients not understanding the cost of veterinary medicine was the likely result of Canadians not "footing the bill" for their own healthcare or "because [clients] have no idea what they pay for their [human] medicine." Other participants described clients who based their final decisions on costs, yet did not consider the level of veterinary care reflected in the prices.

Due to a strong human-animal bond, many companion animals were described as "part of the family." This status was often noted as beneficial, as it could mean clients were willing to seek more options for patient care. And yet, this human-animal bond also led to "extra emotional considerations [being placed] on these pets" that further elevated clients' expectations and added to veterinarians' stress.

Typically, veterinarians recounted poor patient outcomes as fueling client dissatisfaction. Sometimes, dissatisfied clients left negative reviews online (which could detract from the business and contribute to client distrust) or would "rage, and be rude, or be unreasonable." These interactions were described to dampen workplace energy, contribute to veterinary stress, reduce participants' self-confidence, fuel self-criticism, and overshadow the beneficial contributions veterinarians had made.

TABLE 4. Occupational stressors: Client interactions.

Sub-themes	Exemplar quotes
Clients comparing veterinary medicine to human medicine	*"The expectation that people have [is] that they want veterinary medicine, the care to be on par with human medicine, but they don't want to pay the money."* — (DVM 5)
Price discrepancies	*"Because [clients are] like, 'Why can I go [to a different clinic] and get it done for 60 bucks, or 150 dollars? And you guys are charging me 300?'... You know, I have three [registered veterinary technicians] RVTs I employ and they're closely monitoring your animal the entire time... And we're giving pain meds for so many days after, we're seeing you for rechecks, no charge afterwards, to make sure everything is fine. Like they don't understand what goes into the 300 dollars."* — (DVM 16)
Billing clients when outcome is unfavorable	*"I'm embarrassed about handing this person a bill for X amount when the outcome was poor. If the outcome was good, I'd be like 'Here, I don't have any guilty feelings [about] you paying this much.' Cuz, you always second-guess yourself if the outcome was poor, you always say, 'If I'd done this, would this be a different outcome?'"* — (DVM 24)
Client underappreciation	*"When you're acting from a very good place, it's very hard when people come in and either sort of try to tell you how to do your job, or you know, don't respect your job."* — (DVM 16)
	"And I think vets start to feel that way after a little while too, just really unappreciated for what they do...and you feel like society has kind of lost faith and trust in what you do and what you recommend, and that gets really frustrating and overwhelming at times." — (DVM 17)
Implication	
Implication of client dissatisfaction	*"Absolutely, forget all the good things you've done because that one person is just nagging in the back of your brain, I've definitely experienced that. That's frustrating, because you go home and you've done like amazing things all day, and all you can focus on is this one person is angry, what could I have changed, what could I have done better,* versus *'hey I did all these awesome things today'. So again, it's a war with ourselves, right?"* — (DVM 17)

Some participants described a physiological response to client anger, such as sweating, nervousness, or in rare instances, responding with anger or curtness themselves. Whereas the experience of negative interactions with clients was common and said to be highly impactful, several veterinarians also spoke about taking perspective as a coping mechanism, reflecting on the "good" of one's life, or learning to "side-step" client-provoked emotions.

TABLE 5. Occupational stressors: Inadequate personal finances.

Theme	Exemplar quotes
Inadequate personal finances	*"We are so underpaid compared to the amount of education we do, so that's really disheartening when you get out of school, you've put all this time into school, and you're not really making any more than, say, a nurse, and they may have only done 5 years of education, of school, right?"* — (DVM 10)
	"I guess just because of the financial stress, not only that, the hours. It's not how much money you make in a year, it's how much you make per hour, and for many years the number of hours, the amount of money I made per hour was minimum wage. And especially if you counted [being on-] call."

Theme 4: Inadequate personal finances (Table 5)

Many veterinarians shared feelings of frustration with the perceived lack of appropriate compensation in the veterinary profession, and that "we're not paid nearly as well as 'real' doctors." This was compounded with younger participants expressing concern over having to pay off substantial student debt. Many veterinarians believed that higher remuneration would decrease their "money stress" and enable prioritization of their health and mental well-being.

Theme 5: Early-career veterinarian strain (Table 6)

The transition from veterinary school into clinical practice was described as turbulent for some participants, who referred to it as a "hard" and "shocking" time. Participants with the most difficult adjustments to a clinical environment frequently described working alone and being devoid of mentorships. Veterinarians early in their careers often described "second-guessing" their case management and doubting their veterinary skills.

One participant noted that eventually gaining clinical experience quelled her self-doubt and gave her more self-confidence. Other participants described self-doubt regularly resurfacing, especially when conducting difficult procedures and surgeries. Participants also mentioned that veterinary medicine "doesn't end up being a career that a lot

TABLE 6. Occupational stressors: Early-career veterinarian strain.

Sub-themes	Exemplar quotes
Lack of confidence	*"I think that [the stress] largely had to do with the sort of like gnawing in the pit of your stomach when you don't know what's coming in the door, and you're just not sure if you're going to be able to deal with it properly."* — (DVM 12)
Lacking the benefit of experience	*"Experience, I would say. I mean when you do things enough or you do things over and over you start to see patterns, and just even seeing most of the cases and going through them, you're more confident in your diagnosis because you've seen this before, now you've treated like 5 or 6 of the same case, and you're like okay, now I know what to do."* — (DVM 8)
Reality *versus* expectations in the veterinary field	*"From my experience? There's a big disconnect between our intentions when we went to school of you know being Dr. Dolittle, and helping all the animals, and what we're allowed to do, mostly by clients, mostly because of financial constraints, I think that's very stressful."* — (DVM 14)

of kids dream it's going to be" or that they were "expecting so much more [from veterinary medicine] than what [I] got in the end." This conflict between the expectations and reality of a clinic environment was considered a "struggle."

Mentorship was said to be helpful for all veterinarians, from new graduates transitioning into clinical practice to veterinarians with more experience who wanted a "sounding board" from their colleagues. Mentors were described to help participants "talk things through" or be a reassuring source of support, such as when supportive colleagues would say, "No, nobody has those answers," or "That sucks, it really sucks." Whereas mentorship was described as beneficial, few participants said they received this guidance at any stage in their career.

Theme 6: Practice-owner strain (Table 7)

Veterinarians who owned clinical practices reported needing to manage high work demands and poor work-life balance while also undertaking large financial and managerial responsibilities. Several practice owners commented on the difficulty of needing to "deal with staff conflict" or "babysit the staff" to ensure employees remained on-task. Financial stress was readily described as "trying to struggle to make ends meet." Role conflict was another issue common to multiple practice owners who described difficulty in managing demands of their personal and professional lives.

TABLE 7. Occupational stressors: Clinic-owner strain.

Sub-theme	Exemplar quote
Role conflict	*"Children need parents, and they need support, and you have to be able to spend the time. And if you're stretched to the point of trying to make the business work and succeed and grow, uh, you know it comes down to choices, and it's really hard to do it all."* — (DVM 2)

Practice-owner stress was also said to affect staff, with 1 associate veterinarian commenting that "it's just not a nice work environment when the boss is stressed." Practice owners described accessible business training as a potential solution to help prospective or current owners navigate the "cold and hard" financial industry. However, even with the added responsibilities and stressors of ownership, 2 practice owners shared enjoying the autonomy of owning their own clinic, with one saying, *"One of the reasons that I don't just sell immediately and go back to being an associate is that I kind of like being my own boss and not having somebody tell me what to do and impose their ways of doing business on me"* — (DVM 14).

Theme 7: Onus of responsibility (Table 8)

Participants described "being responsible for other people and other living things" as an occupational stressor. Some participants disliked "making those final calls" or the looming notion that "if something that goes wrong, I'm going to be the one that kills [the pet]." Others described feeling pressured by clients to make decisions on behalf of the animal, and the added pressure associated with intense, loving, human-animal bonds. For example, participants recounted clients who exclaimed, "You have to save [the pet], he's all I've got in the whole world." For some participants, this responsibility did not remain at the clinic but was said to permeate into personal off-work hours. Participants recounted, "I just can't stop thinking about this cat," or "[I spent] the last 48 h living [the client's] pet for [them]."

Theme 8: Self-described personal characteristics (Table 9)

Numerous participants indicated that specific personal characteristics contributed to self-imposed stress. Participants commonly described characteristics such as "Type-A," "perfectionistic," "driven," "overachieving," and "introverted" as contributing to high stress and poor

TABLE 8. Occupational stressors: The onus of responsibility.

Sub-themes	Exemplar quotes
Client pressures	*"You start to realize that these clients really count on you as a person more than they should [CHUCKLES], that there's a big responsibility on helping people make very big decisions in their life, like putting this animal to sleep or not spending 5000 dollars, or I mean going and taking a loan out or not, to fix their pet. And a lot of that — we're ill-equipped, we're ill-equipped to deal with those types of situations."* — (DVM 19)
Feeling responsible outside veterinary clinic hours	*"'I think [the cat] needs to be cleaned up.' It's like 2 or 3 o'clock in the morning... I got up out of bed, my partner got up out of bed, and we went into the clinic and gave the cat a bath. [My partner was] like, 'Do you realize this is a little bit crazy, like the cat is okay, fine, but you're getting out of bed at this hour because you can't let it out of your mind?'"* — (DVM 3)

TABLE 9. Occupational stressors: Self-described personal characteristics.

Sub-themes	Exemplar quotes
Superhero complex	*"Maybe just, I don't know, the tendency to, well, I guess, again, not to show your weakness, that you want to handle everything, you want to be on top of everything, and you can't let, I don't know... It's just destructive because I feel like it's a false — it's a non-realistic ambition, I guess, it just makes you feel like you have to do everything and be everything all the time, and that's, like, virtually impossible."* — (DVM 20)
Introversion/ extraversion	*"It's made me more comfortable with people, because I got into veterinary medicine so I wouldn't have to deal with people and got into vet medicine to just deal with animals, but I've learned how to be a situational extrovert, so that has helped."* — (DVM 13)
Self-criticism	*"Yeah, yeah. Just thinking about a case, you had that day, and you wake up and go, 'Oh, I should have done this differently,' and then you can't fall back asleep."* — (DVM 19)

mental health. Whereas a few participants described these characteristics as assets (*e.g.,* helping them gain admission to veterinary college or be able to "meet work goals,") most spoke of an inability to "put limits on my work life" and noted that their drive in "meeting work goals" was "at the expense of our mental health." The data painted a picture of a "superhero mindset": participants described needing to complete all tasks perfectly, independently, without the aid of colleagues, all the time. In addition to contributing to feelings of being overwhelmed, this superhero mindset was also reported to impede veterinarians' help-seeking behaviour. For example, 3 participants described feeling unable to ask for help because, if they were "true professionals," they should be capable of fixing their own problems.

Being introverted but needing to interact with other humans was another personal characteristic described by participants as heightening occupational stress. Several participants explained that they elected for careers in veterinary medicine due to their affinity for animals over humans. Thus, having to engage with human clients in a professional capacity was described as "very stressful" for some. Nevertheless, 2 veterinarians described how veterinary medicine had helped them refine their people skills.

Participants frequently described being self-critical when they could not meet their high self-expectations. Intense self-criticism often surfaced when making mistakes, when unable to "figure out" a clinical case, or when "a case goes poorly." Self-criticism was described as "beat[ing] myself up" and "taking things personally." Although participants sometimes recognized that "there is no way I can do anything differently" when cases took an unexpected downturn, they nevertheless often expressed guilt because, "[well] I'm not God, I guess." Self-criticism was frequently described in conjunction with self-doubt and contributed to poor work life balance, "sleepless nights," lowered self-esteem, and self-reported anxiety.

Less commonly described was the practice of self-compassion in responding to mistakes. One participant openly discussed oversights she had made at work with her children, to normalize mistake-making behaviour. She said, *"And I think what saves many of us [veterinarians], myself included, is I recognized that fairly early on, you are going to make mistakes. You have to understand that, and just try not to make the same exact one the next time"* — (DVM 12).

Theme 9: Moral stressors and moral distress (Table 10)

Moral distress was a key theme affecting the mental well-being of participants and was often described as having to balance the needs of clients and the animals. Since "[the animals] don't have a voice," veterinarians frequently described pets' medical needs being overshadowed by the financial or personal motivations of the pet-owner. For example, participants spoke about clients who demanded "cheap fixes" and expected the veterinarian to provide care

TABLE 10. Occupational stressors: Moral distress.

Sub-themes	Exemplar quotes
Cost constraints resulting in a euthanasia	*"I mean, killing an animal, especially a healthy one, or a potentially healthy one, that could be healthy, but for the lack of 1000 dollars, it's tough."* — (DVM 19)
Unable to help a suffering animal	*"The guilt is that the animal is essentially suffering, or to my perception that the animal is in pain, and the guilt is the inability to do something about it."* — (DVM 9)

to restore their pet's health "for very little money." In reality, those cheap fixes failed to treat the underlying health problem of the animal and instead treated the symptoms. Veterinarians were "only covering [the problem] up, there's nothing we're treating."

Frequently, participants described being restricted by a client's financial circumstances, which resulted in euthanasia of the animal. These financial constraints fueling euthanasia were "stressful" and a "struggle" for participants. Similarly, moral distress was evident when veterinarians described clients who refused both treatment and then subsequent euthanasia of the animal, thus prolonging patient "suffering."

A less common but still meaningful aspect of euthanasia described by participants was the "euthanizing of healthy pets," also referred to as "convenience euthanasia." A small number of participants described having the autonomy to refuse convenience euthanasia that they "don't agree with"; however, this was not without stress. For example, 1 participant stated that her refusal to "euthanize a healthy, like, 2-year-old cat that has a laceration," led to client anger; others described consequences of clients "bad-mouthing" them or the clinic. Although circumstances of euthanasia had resulted in moral distress for some participants, many veterinarians had "reconciled" euthanasia for sick or elderly animals, and this was not described to negatively affect veterinarians' well-being.

Guilt was a common response for veterinarians experiencing moral distress resulting from being unable to help an animal. To circumvent moral distress and the accompanying guilt, 2 veterinarians discussed learning to separate their personal values from their clients' values. One veterinarian elaborated, *"You also have to accept that pets are different to everybody; in that situation, that is their pet, and that pet means something different to them than it might to you, and that's okay"* — (DVM 1).

TABLE 11. Participants' reported implications of occupational stressors in veterinary medicine.

Exemplar quotes
"Sometimes I'd look at difficult animals, especially if, like, they're really wriggly, you can't get a catheter into them, or they're really sick. I was like, I don't, I don't care anymore. I just hit a point where I was just like, 'I don't care if you live or die, just go away.' And that was probably a really low point." — (DVM 5)
"[CRYING] Well, practice is very difficult, and as much as you love working with the animals, it's very difficult to stay motivated, and not to have to deal with everything that goes on there. And I'm not just talking about the business, its clients, and staff, and after so many years you just get beaten down." — (DVM 22)
"So, I learned very quickly that was a situation where I didn't want to be, very soon after graduating, I didn't want to be a veterinarian anymore, because I didn't have any support. And I wanted to escape really badly, I wanted to get out of that — well, not just that situation, but when you don't have a mentor and you're taught that you can't fail or you've got to achieve, and you've got to know everything and you shouldn't ask anyone because you're supposed to know, and really don't have anyone to ask, and it's very competitive." — (DVM 3)

Implications of the stressors (Table 11)

Many of the occupational stressors experienced by participants were described as occurring simultaneously, having synergistic effects in amplifying stress, and having negative impacts. Although not the focus of this paper, words used to described implications of the cumulative effects of stressors were "want[ing] to explode," "frustration, helplessness, desperation," "burning out," "sheer exhaustion," "hopeless," and being under a "black cloud." Self-reported compassion fatigue, burnout, and depression were all described as mental health outcomes associated with the burden of various occupational stressors, as were thoughts of leaving veterinary medicine.

Whereas negative effects of stressors were the focus of the participants' discourse, it is important to note that not all described stressors resulted in distress. For example, 1 veterinarian described the positive contributions of stress as "what helps empower you, and helps you grow." Many veterinarians took solace knowing that other veterinarians experienced similar occupational stress, as this meant they did not feel "alone" within the veterinary community.

DISCUSSION

A broad range of occupational stressors in the veterinary profession have been reported (6,7,28). In this study, we explored clinical veterinarians' perceptions and lived experiences of occupational stressors through qualitative methods, providing additional context and depth of understanding.

The high work demands and long working hours typical of the profession were discussed by the participants and are well-known stressors within the veterinary profession (4–7). Ways to mitigate the high work demands and long working hours of the profession could include reserving 30 min for specific appointments so that veterinarians do not feel rushed (29), allocating time to catch up on past work (29), and making more fulsome use of registered veterinary technicians' skillsets to better manage veterinarians' time (30). Participants described a deep sense of identity tied to being a veterinarian, which caused them to "neglect" other roles in their lives. Ideally, veterinarians could explore and devote time to other aspects of their identities to improve their overall well-being. However, organizational changes and decreased workloads are likely required in many clinics to facilitate this.

Interpersonal conflicts within the clinic were described as stressors affecting work satisfaction and mental health. Several early-career veterinarians described their frustration and self-doubt when veterinary technicians doubted their case management. This is supported by Moore and colleagues (31), who reported that some registered veterinary technicians questioned the capabilities of veterinarians who were perceived as unconfident or lacking skill (31). Lack of employer or colleague support is cause for concern, given that this stressor was reported to contribute to veterinary turnover in clinical practice in Canadian (32) and Australian (10) studies.

Veterinary conflict was also described to occur between veterinarians and their employers. Not only did associate veterinarians identify veterinarian-employer conflict as a source of stress, but associate veterinarians also indirectly experienced personal negative effects from practice-ownership stressors experienced by clinic owners. In line with previous reports from veterinary employers (33), our findings highlight the need for accessible business training for veterinarians, which could reduce ownership stress and the transference of stress to others in the workplace. Although strides have been made to incorporate such training into the veterinary curriculum, the effectiveness of this remains largely unknown (33) and is a future direction for research. Another avenue to reduce ownership strain could be hiring a practice manager. Although a practice manager represents an additional cost for the practice, their management of the daily activities of the clinic could allow the veterinarian-owner to serve more clients and generate additional income for the practice (34).

The tense interpersonal relationships described in this study affected the well-being of the people sharing the space and "set the tone" for the day, similar to another report in which negative energy from veterinary team members dampened the mood, affected the morale of the entire team, and contributed to a toxic work environment (31). Such toxicity has been negatively correlated with job satisfaction and positively correlated with cynicism and exhaustion (35). Conflict management could be one option to combat poor interpersonal relationships. Conflict management techniques and measures are implemented in the workplace to help veterinary teams resolve disputes when they occur (36). Approaches to manage conflict include talking with team members promptly after conflict occurs, providing job responsibilities for all staff, and ensuring that the resources and training are in place for every employee to do their job (36). Emotional-intelligence training can help employees better recognize, understand, express, and regulate their emotions, which can help reduce personal and interpersonal tensions and better position team members to respond to those stressors (37).

Research has shown that pet owners are more receptive to veterinarians' recommendations when there is a strong veterinarian-client relationship and clients trust their veterinarian (38). In other reports, some clients were suspicious of veterinary professionals' intentions and whether recommendations were being made to generate revenue rather than from concern for animal well-being (39). In our study, words associated with underappreciation and disrespect suggested that clients' distrust detracted from participants' sense of meaning and purpose. As connection with meaning and purpose are positively correlated with well-being (40), strengthening of client-veterinarian communication to build trust could have benefits beyond the relationships themselves. To strengthen the veterinarian-client relationship, veterinarians are encouraged to explain costs, clarify how veterinary service could improve pet health, and seek out and address clients' concerns where possible (41).

Several challenges of transitioning from veterinary school to clinical practice were discussed in this study, including the absence of a mentor and working in isolation, similar to elsewhere (42). These results may indicate a need for increased independence of veterinary schools to better prepare students for the reality of the veterinary workplace, and for formal mentorship programs in the workplace. Yet mentorships may prove difficult to provide if time constraints limit mentors' abilities to meaningfully advise their mentees (42). In the Netherlands, early-career veterinarians

reported increased self-esteem and better communication with colleagues and clients after completing a development program with online modules plus 6 in-person training days (43). In addition to mentorship programs, virtual or hybrid development programs may be another avenue for career development for Canadian veterinarians. This represents an important research direction.

One interesting finding of this study was that participants described a clear need for high drive, independence, and perfectionism — to the point of feeling the need to be "a superhero." Many participants reported feeling the need to do all tasks perfectly, independently, and self-sufficiently, all of the time. This intense attempt to be a superhero is not unique to veterinarians but may apply to the broader culture of healthcare professionals. For example, physicians in New Zealand and Canada have described pressure to perform professionally when feeling hungry, ill, or exhausted — behaviors said to stem from intrinsic pressures but also perpetuated by senior healthcare professionals (44) and society (45). The "superhero complex" in the context of veterinary medicine has also been discussed by Steffey and colleagues, who stated that the need to be a superhero has been required and reinforced through various policies, systems, and workplaces that veterinarians' have encountered (46). It is unknown whether participants in this study experienced the "superhero complex" because of intrinsic pressure or a wider systemic issue within the profession, but this could be a future direction of research. Regardless, the possibility of a culture in veterinary medicine that drives the superhero mindset requires review and change. Although such systemic, profession-wide/institutional change is imperative, cognitive reframing and self-compassion training to challenge thoughts around needing to be unexceptionally perfect could also be helpful (47).

Moral stressors in veterinary medicine have been cited in relation to the following: animal-welfare concerns when balancing the needs of clients and patients (5), clients' inability to pay for veterinary services (5), and "convenience euthanasia" (10); all of these were identified in this study. One proposed strategy to help mitigate cost-restraint euthanasia-related moral stress is promotion of pet insurance. One study concluded that only 10% of pets whose owners had pet insurance underwent euthanasia compared to 37% of animals not insured for a specific animal health condition (48). Clinics could establish standard policies regarding specific moral stressors (*e.g.*, convenience euthanasia), outlining when euthanasia would be recommended and when veterinarians could refuse based on the condition or age of the animal, for example (49).

Informal sharing and debriefing with colleagues, as well as self-compassion training, could also be helpful in mitigating the emotional toll veterinarians may be experiencing. Furthermore, self-compassion training could help veterinarians manage emotions around moral stressors and difficult days in caregiving (50). Occupational stressors reported in this study were numerous and varied. Participants shared insights into perceived effects, such as burnout, compassion fatigue, depression, and risk of attrition from the profession. These are supported by extant research on anxiety and depression (4) and burnout and suicidal ideation in the veterinary profession (51). With society facing serious issues related to veterinarian shortages, these findings serve as a strong call to action for systemic structural changes and investment in veterinary team well-being.

Strengths and limitations

This study provides context for and in-depth insights into a variety of occupational stressors from veterinarians of varying ages with a variety of clinical roles. This study used a nonrandom sample of veterinarians attending a national conference, which limited the ability for extrapolation. Qualitative data are not meant to be generalized to all individuals in a population; rather, they are meant to garner rich, in-depth, individualistic perspectives (27). A further limitation of this study was inclusion of only veterinarian perspectives. Views of other veterinary team members, such as veterinary technicians, animal care assistants, and hospital managers, would provide important insights. Finally, these data were collected before the COVID-19 pandemic and stressors encountered by clinical veterinarians during that public health emergency (52) were not captured in this study.

In conclusion, participating veterinarians faced a myriad of occupational stressors, summarized across 9 themes, ranging from self-imposed internal pressures to professional relationships, pressures stemming from clients, and nature of the profession. The effects described included substantial emotional tolls, depression, compassion fatigue, burnout, and attrition, which could have serious ramifications for society by way of a depleted veterinarian workforce. Veterinary student curriculum developments, clinic-level adaptations, professional continuing education, and further research are worthwhile exploring as strategies to improve veterinary team well-being and to support sustainability of the profession.

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ARTICLE

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Predictors and barriers for biosecurity uptake and risk understanding among Ontario horse owners

ABSTRACT

Objective

This study aimed to describe implementation of biosecurity practices by Ontario horse owners and investigate whether biosecurity implementation was associated with horse-owner demographic characteristics and personality traits.

Procedure

A cross-sectional questionnaire was administered to a convenience sample of horse owners in Ontario to collect data on demographics, personality traits, risk comprehension, and biosecurity practices. Hierarchical cluster analysis was used to identify clusters of participants with shared personality traits, and univariable associations between clusters and demographic and biosecurity variables were examined.

Results

A total of 271 participants were included in the analysis. Participants were primarily female (86%), from 25 to 44 y old (57%), and engaged in leisure riding (64%). Facility-level biosecurity plans were reported to be in place by 59% of participants, with 47% indicating that vaccinations were required within those plans. Other biosecurity practices were reported to be used less often by participants; for example, boot washing (31%) and disinfecting hands (27%). Two clusters of participants were identified according to similarities in personality traits: Cluster 1, which was characterized by high extraversion scores; and Cluster 2, which was characterized by high neuroticism scores. Cluster 1 participants were more involved in competitions, sought information from other horse owners, and received disease outbreak news from veterinarians. Cluster 2 participants exhibited higher variability in biosecurity practices implemented.

Conclusion

Biosecurity is variably implemented on Ontario equine facilities, which warrants the need for ongoing efforts to increase uptake at high-risk facilities. Recommendations include fostering collaboration, providing tailored support and resources, and improving communication channels.

Clinical relevance

Demographic, personality, and other lifestyle traits influence horse owners' biosecurity behaviors. Equine veterinarians may benefit from considering these factors to ensure effective communication and implementation of biosecurity plans at equine facilities.

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Unpublished supplementary material (Appendix 1) is available online from: Supplementary Materials.

RÉSUMÉ

Prédicteurs et obstacles à l'adoption de la biosécurité et à la compréhension des risques chez les propriétaires de chevaux de l'Ontario

Objectif

Cette étude visait à décrire la mise en œuvre des pratiques de biosécurité par les propriétaires de chevaux de l'Ontario et à déterminer si la mise en œuvre de la biosécurité était associée aux caractéristiques démographiques et aux traits de personnalité des propriétaires de chevaux.

Procédure

Un questionnaire transversal a été administré à un échantillon de convenance de propriétaires de chevaux en Ontario afin de recueillir des données sur la démographie, les traits de personnalité, la compréhension des risques et les pratiques de biosécurité. L'analyse hiérarchique des groupes a été utilisée pour identifier les groupes de participants ayant des traits de personnalité communs, et les associations univariées entre les groupes et les variables démographiques et de biosécurité ont été examinées.

Résultats

Au total, 271 participants ont été inclus dans l'analyse. Les participants étaient principalement des femmes (86 %), âgées de 25 à 44 ans (57 %) et pratiquant l'équitation de loisir (64 %). Cinquante-neuf pour cent des participants ont indiqué que des plans de biosécurité au niveau des établissements étaient en place, et 47 % d'entre eux ont indiqué que des vaccinations étaient requises dans le cadre de ces plans. D'autres pratiques de biosécurité ont été signalées comme étant utilisées moins souvent par les participants; par exemple, le lavage des bottes (31 %) et la désinfection des mains (27 %). Deux groupes de participants ont été identifiés en fonction des similitudes dans les traits de personnalité : le groupe 1, caractérisé par des scores d'extraversion élevés; et le groupe 2, caractérisé par des scores de névrosisme élevés. Les participants du groupe 1 étaient davantage impliqués dans les compétitions, recherchaient des informations auprès d'autres propriétaires de chevaux et recevaient des nouvelles sur les épidémies de la part des vétérinaires. Les participants du groupe 2 ont montré une plus grande variabilité dans les pratiques de biosécurité mises en œuvre.

Conclusion

La biosécurité est mise en œuvre de manière variable dans les installations équines de l'Ontario, ce qui justifie la nécessité de déployer des efforts continus pour accroître son adoption dans les installations à haut risque. Les recommandations incluent la promotion de la collaboration, la fourniture d'un soutien et de ressources personnalisés et l'amélioration des canaux de communication.

Pertinence clinique

Les caractéristiques démographiques, la personnalité et d'autres caractéristiques liées au mode de vie influencent les comportements des propriétaires de chevaux en matière de biosécurité. Les vétérinaires équins pourraient avoir intérêt à prendre en compte ces facteurs pour garantir une communication et une mise en œuvre efficaces des plans de biosécurité dans les installations équines.

(Traduit par Dr Serge Messier)

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INTRODUCTION

Protecting the equine industry from disease is crucial for the health and welfare of horses and the economic viability of the industry. Equine disease outbreaks can have profound effects on horse health and welfare, leading to morbidity, reduced athletic performance, or death (1). This not only affects the health of individual horses, but also can negatively affect population-level health, interrupt equine-related activities and equestrian events, and disrupt horse sales, resulting in societal and economic consequences (1).

Equine "biosecurity" refers to a set of measures used to reduce the introduction and spread of pathogens (2). By implementing measures such as isolation, quarantine, vaccination, hygiene practices, and regular health monitoring, biosecurity has a crucial role in reducing the risk

of pathogen acquisition and minimizing outbreaks among equine populations (1). Despite the importance of biosecurity, there are few to no federal, provincial, or other regulatory requirements for horse owners to implement biosecurity measures at equine facilities in Canada (1). Core vaccines, including rabies, tetanus, West Nile virus (WNV), eastern equine encephalitis (EEE), and western equine encephalitis (WEE), are optional but recommended for all horses in Ontario (3). Risk-based vaccines, including equine influenza (EI), *Streptococcus equi* (strangles), and equine herpesvirus 1 and 4 (EHV 1 and 4), are recommended for horses considered at high risk of pathogen acquisition and high risk of severe outcomes, such as foals, pregnant mares, and those boarded at high-traffic facilities (3). An influential factor in successful implementation and effectiveness of biosecurity practices is the knowledge and proactive behaviors of horse owners. However, recent disease outbreaks in Ontario, such as those caused by strangles and EHV, emphasize gaps in biosecurity implementation (4). These outbreaks raise concerns about the potential for widespread disease incidents that could affect not only the horse-owning population within Ontario, but also the wider national industry.

Various health-behavior theories, such as the Health Belief Model and the Theory of Planned Behavior, outline how factors such as perceived responsibility, barriers, benefits, and perceived behavioral control influence an individual's intentions and actions, all of which are influenced by demographic and psychological characteristics (5). Despite limited research examining the relationship between personality and uptake of biosecurity among horse owners, findings from other agricultural industries suggest that this warrants further investigation (6–8). Therefore, this study aimed to i) describe demographic characteristics and biosecurity implementation among a sample of equine facilities, and ii) explore potential associations between demographic and personality variables and biosecurity uptake among Ontario horse owners.

MATERIALS AND METHODS

Recruitment

This study used a cross-sectional questionnaire to gather data on horse owner and facility characteristics. From January to March 2023, participants were recruited to complete the questionnaire using a combination of social media and in-person methods. Participants were eligible to participate in the questionnaire if they were $>$ 18 y of age, resided in Ontario, and either owned or leased a horse. Recruitment posters were posted to equestrian-related Facebook pages encompassing various horse disciplines. Recruitment also occurred at a local in-person event for equestrian practitioners, where interested practitioners were asked to distribute posters to their clientele. This study was reviewed and approved by the University of Guelph Research Ethics Board (REB # 22-03-034).

Questionnaire design and data collection

Individuals who met the eligibility criteria and provided informed consent to participate were directed to complete the questionnaire, which was created and distributed using Qualtrics software (Qualtrics, Provo, Utah, USA). The questionnaire included 4 sections with questions related to participant and facility demographics, personality assessment, risk comprehension, and biosecurity implementation. A copy of the questionnaire is available in Appendix 1 (available online from: Supplementary Materials).

To assess personality, the short version of the Big Five Inventory (BFI), consisting of 11 questions, was used (9). The BFI is a standardized self-reporting personality test that measures individuals on 5 broad personality dimensions: extraversion, agreeableness, conscientiousness, neuroticism, and openness (10). Participants rank themselves on a scale of 1 to 5 (1 representing "strongly disagree" and 5 representing "strongly agree") for each item, which then places them on a scale within each dimension. The short version of the BFI was developed for researchers limited by time, and thus was chosen over the original, 44-item version, to minimize study completion time and maintain participant focus (9). The BFI-10 captures 70% of the original BFI variance and 85% of retest reliability (9). The only significant correlation loss was indicated in the agreeableness scale; therefore, another item ("Is considerate and kind to almost everyone") was added to the 2 other corresponding items in the short version (9). The other 4 personality dimensions each consisted of 2 items.

To assess understanding of risk, participants were first asked about their familiarity with certain equine diseases, as well as the perceived severity of diseases in relation to their horse's current health. Participants were then presented with 3 scenarios and were asked to rate their horse's risk of infection in each scenario while considering their horse's current health status. The scenarios included i) a 4-day competition event where their horse would be present, ii) a situation in which their horse was grazing in a field at home that had frequent wildlife visitors, and iii) a scenario in which their horse was boarded in a barn

TABLE 1. Demographic characteristics collected from a cross-sectional questionnaire of horse owners in Ontario (n = 271).

Variable	Level	Number (%)
Age (y)	18 to 24	45 (16.6)
	25 to 34	87 (32.1)
	35 to 44	68 (25.1)
	45 to 54	37 (13.7)
	55 to 64	29 (10.7)
	65 +	5 (1.8)
Ownership status	Own	257 (94.8)
	Lease	43 (16.0)
	Both own and lease	29 (10.7)
Main equestrian activity[a]	Breeding	39 (14.4)
	Companion, no riding	46 (17.0)
	Dressage	63 (23.2)
	Eventing	36 (13.3)
	Hacking	173 (63.8)
	Lessons	103 (38)
	Racing	19 (7.0)
	Retired	41 (15.1)
	Show jumping	85 (31.4)
	Other[b]	51 (18.8)

[a] Participants could choose > 1 option.
[b] "Other" activities included western performance, clicker training, driving, *etc.*

TABLE 2. Facility characteristics collected from a cross-sectional questionnaire of horse owners in Ontario (n = 271).

Variable	Level	Number (%)
Facility type[a]	Boarding facility	156 (57.6)
	Breeding farm	33 (12.2)
	Co-op facility	11 (4.06)
	Competition stables	44 (16.2)
	Livestock farm	39 (14.4)
	Lesson barn	63 (23.2)
	Owned private property	107 (39.5)
	Other[b]	20 (7.4)
Management of facility	Sole owner/manager	114 (42.1)
	Has owner of facility	84 (31.0)
	Has manager of facility	25 (9.2)
	Has both owner and manager	35 (12.9)
Horse maintenance	Barn employees (full-time)	107 (39.5)
	Barn employees (part-time) and you (part-time)	71 (26.2)
	You personally (full-time)	92 (33.9)
	Friend/family member (full-time)	20 (7.4)
	Friend/family member (part-time) and you (part-time)	35 (12.9)
	Other	28 (10.3)

[a] Participants could choose > 1 option.
[b] "Other" facilities included racetrack, rented property, therapy facility, *etc.*

with horses that frequently participated in competitions. These scenarios were designed to understand how horse owners assess their horses' risk of contracting specific diseases in real-life scenarios.

Finally, participants were asked about the presence or absence of certain biosecurity measures at their facilities. They were also asked to indicate how strongly they agreed or disagreed with individual statements related to barriers and motivators for implementing biosecurity practices, which were informed through a previous qualitative study of Ontario horse owners (11).

Descriptive and statistical analyses

All responses were exported from Qualtrics to a Microsoft Excel (Microsoft, Redmond, Washington, USA) spreadsheet file before being exported to R statistical software (R Core Team, Vienna, Austria; 2023) for analysis. Descriptive statistics of the variables were examined, and frequency distributions were determined for all categorical variables.

Hierarchical cluster analysis (HCA) was used to determine if participants could be clustered based on similarities in their responses to the 11 personality items. Each personality dimension corresponded to 2 personality items (3 for agreeableness). To score the BFI, some items first had to be reverse-scored, and then the corresponding items within each personality dimension were averaged to achieve mean values (9). Mean values for each BFI dimension were then used as the input values for HCA. Hierarchial cluster analysis was done using the "cluster" package in R, which identifies clusters based on the calculation of a dissimilarity matrix using Euclidian distances and the application of Ward's agglomeration method (12). The corresponding dendrogram, as well as the silhouette and elbow method, were used to determine the optimal number of clusters (13). To identify which personality dimensions were significantly different between clusters, the Kruskal-Wallis test was used. To investigate univariable associations between cluster membership and demographic, risk, and biosecurity categorial variables, the X^2 test or Fisher exact test was used. Statistical significance was set at = 0.05. For non-dichotomous categorical variables, *post-hoc* analyses using residuals were done with a Bonferroni correction.

RESULTS

Questionnaire responses

The questionnaire received 425 responses. A total of 130 responses were removed because respondents either did not fully comple the questionnaire or did not meet eligibility criteria. In addition, 18 participants were removed for not meeting the inclusion criteria of owning or leasing a horse, 4 participants were removed for having a low ReCAPTCHA score (in which a score < 0.5 indicates a higher likelihood of fraudulent or bot behavior), and 2 participants were removed for having inconsistent responses

(skipping through questions but still finishing the survey). A final total of 271 responses were included in the analysis.

Participant and facility demographics

Most participants identified as female (86.0%, 233/271), owned > 1 horse (57.0%, 155/271) and had > 10 y of experience with horses (76.4%, 207/271) (Table 1). Furthermore, 51% (138/271) of participants reported currently competing at competitions, with 24.0% (65/271) competing at unsanctioned events.

Most participants reported being aware of their horse's vaccination status (85.6%, 232/271). Among those who knew their horse's vaccination status, the most frequently administered were core vaccinations, such as rabies (94.5%, 240/254), followed by tetanus (89.5%, 229/256), EEE/WEE (86.3%, 220/255), and WNV (78.5%, 201/256). Among risk-based vaccinations, EI was frequently administered (75.9%, 195/257), followed by EHV (70.8%, 182/257), with *S. equi* (strangles) being the least commonly administered (37.1%, 95/257).

When participants were asked about factors that influenced where they chose to board their horse, the most common factors included location of the facility (42.4%, 115/271), cost of boarding (36.5%, 99/271), and type of social environment at the facility (22.1%, 60/271) (Table 2). Furthermore, 67.9% (165/243) of participants reported purposely changing boarding facilities either recently or in the past for reasons such as "poor quality of care" and "disagreements with management."

Risk perceptions and knowledge of diseases

When asked about familiarly with certain diseases, more participants either had experience with strangles (15.9%, 43/271) or knew someone that had experienced strangles (31.4%, 85/271) compared to other equine diseases. Participants were least familiar with equine protozoal myeloencephalitis (EPM) (13.3%, 36/271) and equine herpesvirus myeloencephalopathy (8.9%, 24/270). In terms of perceived severity of certain diseases, participants more frequently thought their horses would behave normally (have no clinical signs) with diseases such as Lyme disease (10.0%, 27/270), EHV (9.7%, 26/269), and EPM (9.3%, 25/268). In contrast, some participants thought signs would be extremely severe for their horse if they contracted diseases such as leptospirosis (42.1%, 112/266), EEE (32.3%, 87/269), WEE (32.5%, 87/268), or EPM (31%, 83/268).

When presented with the scenario about participating at a 4-day competition, participants indicated that their horse was not at risk for vector-borne diseases including Lyme disease (63.3%, 171/270), WNV (47.8%, 129/270), and EPM (43.9%, 119/271). Some participants indicated that their horse was at extremely high risk for communicable diseases such as strangles (11.4%, 31/271), EHV (11.1%, 30/270) and EI (10.7%, 29/270). When presented with the scenario in which their horses were grazing in a field frequented by wildlife, participants reported that their horse would be at extremely high risk of diseases such as EPM (17.4%, 47/270), WNV (16.4%, 44/268), and rabies (12.9%, 35/271). Finally, when presented with the scenario of boarding at a facility where other horses frequently competed, few participants (< 5%) felt that their horse was at extremely high risk of disease. Participants indicated that this scenario was only slightly risky for diseases such as EI (48%, 130/271), strangles (45.4%, 123/271), and EHV (44.6%, 121/271).

Biosecurity

Participants used the term "biosecurity" (35.8%, 97/271), or both "infection control" and "biosecurity" (34.7%, 94/271), in reference to disease-prevention practices. Eight percent of participants reported that disease-prevention practices were not discussed at all at their facility (21/271). If participants had questions about disease prevention, most reported they would either ask their veterinarian (91.1%, 247/271) or refer to educational websites (69.4%, 188/271). In contrast, participants primarily heard about equine disease outbreaks *via* social media (82.7%, 224/271) and word of mouth (72.3%, 196/271).

Among participants, 59.0% (160/271) reported having a biosecurity plan at their facility, 26.2% (71/271) reported not having a plan, and 14.8% (40/271) were unsure about whether a plan was in place. Direct-to-horse practices, such as isolating sick horses (46.9%, 127/271), quarantining incoming horses (36.9%, 100/271), and core vaccinations (47.2%, 128/271), were commonly required at facilities (Figure 1). Measures such as risk-based vaccinations (32.5%, 88/271) and disinfecting hands (19.6%, 53/271) were often recommended at facilities. Participants reported that measures such as boot washing (31.4%, 85/271), not letting horses touch noses (28.4%, 77/271), and disinfecting hands (26.9%, 73/271) were recommended but were not being done. Thirty-two percent (87/271) of participants implemented measures not specifically

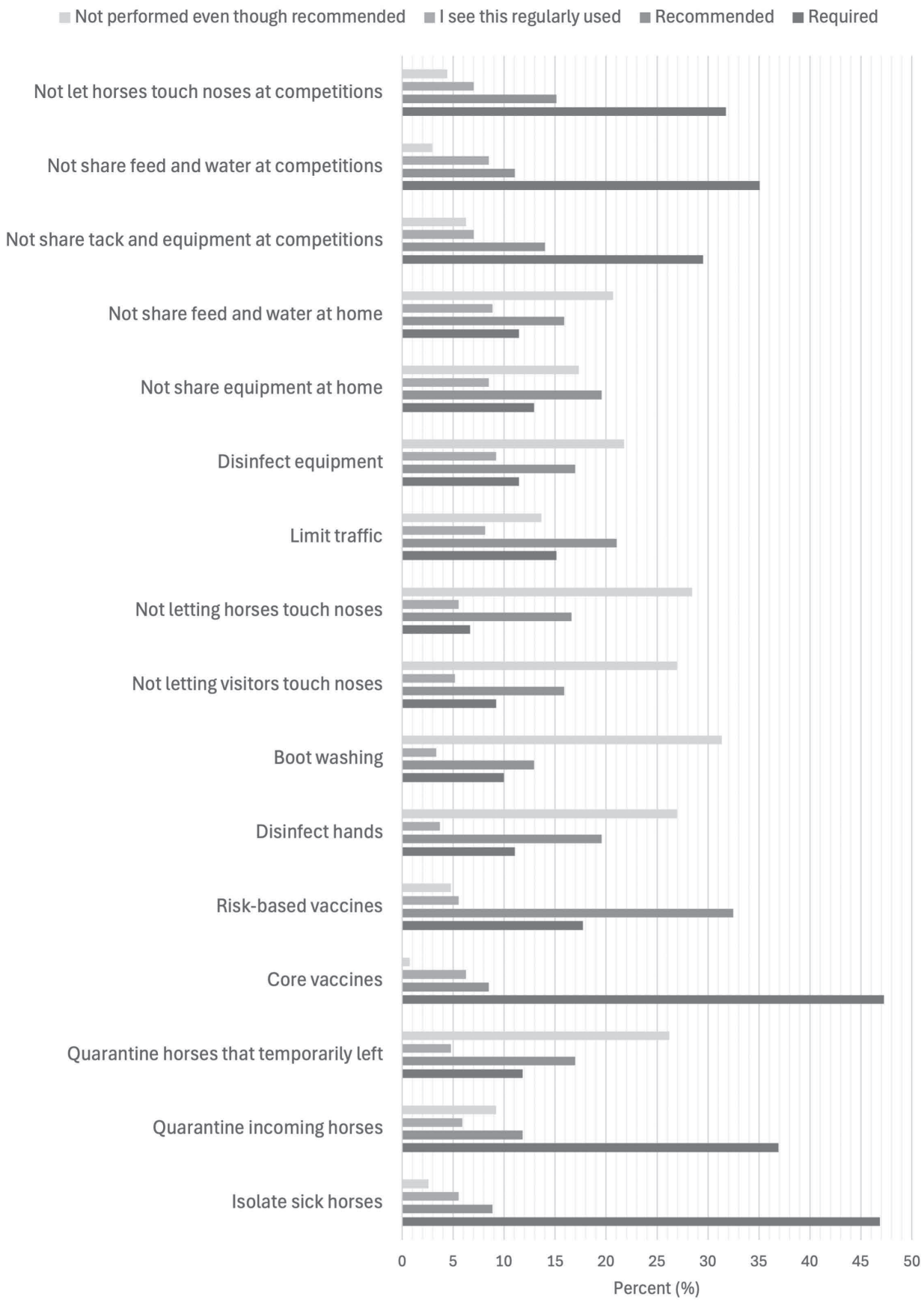

FIGURE 1. Levels of biosecurity practices observed by Ontario horse owners who participated in a cross-sectional questionnaire (n = 271).

required by the facility, including core vaccinations (72.4%, 63/87), risk-based vaccinations (57.5%, 50/87), and changing clothes when traveling between barns (57.5%, 50/87). Fifty-five percent (150/270) of participants had a quarantine area at their facility, and 11.7% (120/271) had a quarantine area they used off-site from their facility. If participants had neither an on-site nor an off-site quarantine area, 80.2% (85/106) reported being able to set up a temporary quarantine area in the event of a disease outbreak.

When asked about potential barriers to biosecurity implementation, 12.3% (33/268) of participants strongly agreed they were often discouraged by a lack of facilities. Other participants strongly agreed they were discouraged by a lack of equipment available (5.2%, 14/270) and the concern that they would be labeled as overly cautious if they carried out biosecurity measures (4.8%, 13/269). In terms of motivators for practicing biosecurity, most participants felt they had a moral obligation to protect their horse from potential diseases that other horses may be carrying (81.0%, 218/269), and preferred to take a proactive approach to biosecurity rather than a reactive one (70.0%, 189/270).

Hierarchical cluster analysis (HCA)

Two personality clusters were identified through HCA. Cluster 1 included 131 participants who had a higher overall mean (± SD) score on the extraversion scale (3.84 ± 0.70) compared to those in Cluster 2 (2.46 ± 0.75). Cluster 2 included 140 participants who had a higher overall mean score on the neuroticism scale (3.40 ± 1.0) compared to those in Cluster 1 (2.26 ± 0.80). Extraversion is typically associated with being sociable, energetic, and outgoing; whereas neuroticism is typically associated with experiencing higher levels of negative emotions such as anxiety, worry, and emotional instability (10). Overall mean scores for the other 3 personality types (agreeableness, openness, and conscientiousness) did not significantly differ between clusters.

There were minor differences in demographic profiles between clusters. Cluster 1 had more individuals who identified as male (21.4%, 28/131) compared to Cluster 2 (5.7%, 8/140; $P < 0.001$), and more individuals who had < 1 y of experience with horses (5.3%, 7/131) compared to Cluster 2 (0%, 0/140; $P = 0.001$). Cluster 1 also had more individuals who boarded their horses at co-op facilities (where responsibility for the barn is shared among horse owners who board their horse) (6.9%, 9/131) compared to Cluster 2 (1.4%, 2/140; $P = 0.049$). More individuals from Cluster 2 reported purposely changing boarding facilities either recently or in the past (67.9%, 95/140) compared to Cluster 1 (53.4%, 70/131; $P = 0.014$). A greater proportion of participants in Cluster 1 reported that they competed in competitions (59.5%, 78/131) compared to those in Cluster 2 (42.9%, 60/140; $P = 0.009$), though there were no significant differences in the level of competition. A greater proportion of participants in Cluster 1 received news about disease outbreaks from their veterinarian (73.3%, 96/131) compared to those in Cluster 2 (60%, 84/140; $P = 0.028$). However, Cluster 1 participants were more likely to consult other horse owners if they had questions about disease prevention (50.4%, 66/131) compared to Cluster 2 participants (36.4%, 51/140; $P = 0.028$).

In reference to specific biosecurity practices, more participants from Cluster 1 reported that core vaccinations were required at their facility (54.2%, 71/131) compared to Cluster 2 (40.7%, 57/140; $P = 0.035$). In addition, more participants from Cluster 1 reported that other measures not listed in the questionnaire were required or recommended at their facility (18.3%, 24/131) compared to Cluster 2 (5%, 7/140; $P = 0.003$). More individuals in Cluster 1 also reported having boot-washing stations (35.1%, 46/131) at their facility compared to those in Cluster 2 (17.1%, 24/140; $P < 0.001$). Furthermore, more Cluster 1 individuals implemented visitor logs in their facility (25.2%, 33/131) compared to Cluster 2 individuals (8.6%, 12/140; $P < 0.001$). Last, more Cluster 1 individuals reported using a quarantine area off-site from their facility (8.4%, 11/131) compared to Cluster 2 individuals (2.1%, 3/140; $P = 0.013$).

DISCUSSION

This study contributed to our understanding of the demographic characteristics, biosecurity implementation, and potential determinants of biosecurity use among a sample of Ontario horse owners. This study also examined participants' perceptions and understanding of risks associated with equine diseases, as well as the extent of biosecurity practices implemented at their facilities. Furthermore, it explored possible relationships between these variables and personality traits of participants.

In this study, core vaccines were more frequently used than risk-based vaccines. This aligned with current recommendations based on varying risk-taking activities among horse owners. There has been some international research exploring barriers to uptake of certain vaccines within the equine industry, to explain reasons for low usage — for example, with the Hendra virus vaccine in

Australia. Some identified barriers for Hendra virus vaccine uptake were cost and the perception of immediate risk for the horse, as well as concerns about the vaccine's effectiveness and safety (14). However, it is important to note that the emergence of Hendra virus and creation of a vaccine were relatively new at the time of its introduction, which caused apprehension among Australian horse owners (14). Vaccines mentioned in this survey are more established, and perceptions may differ when it comes to newer vaccines.

Participants often associated communicable diseases (*i.e.,* strangles, EHV, and EI) with attendance at competitions, with little perceived risk of vector-borne diseases (*i.e.,* Lyme disease and WNV). Outbreaks have been frequently reported at competition events — most recently an EHV-1 outbreak in Valencia, Spain in 2021 and an EI outbreak in Great Britain in 2019; but also larger-scale outbreaks such as the 2011 EHV-1 outbreak in Utah, USA and the 2007 EI outbreak in Australia (15–18). Those outbreaks demonstrated how competition events may increase the risk of contracting communicable diseases, suggesting that participants' concerns about these risks are well placed. Vector-borne diseases should still be considered, especially when spending long intervals outdoors where vector populations (*e.g.,* mosquitoes) are established (3). However, the risk of contracting vector-borne diseases may fluctuate depending on location and type of environment (*e.g.,* marshes) (3). As changes in climate and other ecological factors continue to increase, perceptions of these diseases are likely to change as the actual risk of disease increases over the coming years (19).

Furthermore, participants perceived only a slight risk regarding communicable diseases when their horse was boarded with other horses that frequently attended competitions. However, it is important to recognize that communicable diseases, such as strangles and EHV, are transmissible from horse to horse. Without proper separation between competition and regularly boarded horses, the risk extends to all horses at the facility (3). Evidently, participants seemed less concerned about others attending competitions than about they themselves attending. Although $> 1/2$ reported having a biosecurity plan involving quarantining or isolating sick or incoming horses, and requiring horses to be up to date on core vaccinations, implementation of measures such as risk-based vaccinations, handwashing, boot washing, and preventing nose-to-nose contact among horses at home facilities was relatively low. These measures were often recommended but not consistently adopted by most participants. This suggested a prioritization of direct-to-horse efforts over daily practices at the horse-owner level.

The low uptake of certain biosecurity measures among horse owners could be due to perceived ineffectiveness, a barrier described in other equine and bovine biosecurity studies (8,20). If horse owners doubt the effectiveness of certain measures, they may not feel motivated to practice them (20). In addition, limited facilities and equipment availability were identified as barriers hindering full implementation of recommended measures. Some participants also expressed concerns about being labeled as "overly cautious" by peers. Relying on social media or word of mouth for disease outbreak information can lead to misinformation and worries about stigmatization, as seen in various health contexts (21–23). Improved communication channels and reliable disease news sources are needed to reduce misconceptions and support informed decision-making among horse owners.

Two distinct personality clusters were identified in this study. Cluster 1 included participants who scored higher on the extraversion scale. In the context of this study, Cluster 1 participants exhibited behaviors such as being more involved in competitions, seeking information from other horse owners, and receiving news about disease outbreaks from their veterinarians. Their higher level of extraversion may contribute to their willingness to engage with others and actively participate in equine-related activities. In contrast, participants in Cluster 2 scored higher on the neuroticism scale. These individuals may be more prone to stress and may have a greater sensitivity to potential risks or threats (24). Cluster 2 individuals exhibited more variability with their biosecurity decisions than Cluster 1 individuals, who exhibited more consistent behavior.

In health-behavior studies, neuroticism and extraversion tend to be frequently correlated with certain health behaviors. Neuroticism in individuals has been linked to mental health diagnoses such as depression, as well as physical ailments such as cardiovascular disease and poor sleep quality (25–27). In contrast, extraversion has been linked with positive health outcomes and a more positive mental disposition (28,29). A similar study, which focused on sociopsychological factors and biosecurity use on French duck farms, used HCA and identified 3 distinct clusters (30). One cluster had traits associated with neuroticism, with farmers feeling more socially responsible for disease prevention, acknowledging a farmer's role in public health (30). Another cluster had positive attitudes

towards biosecurity, believing biosecurity to be beneficial in terms of productivity and disease prevention (30). In contrast, the final cluster exhibited low conscientiousness and had negative attitudes towards biosecurity, doubting its cost-effectiveness and time-saving nature (30). These findings stressed the importance of considering individual differences and tailoring strategies to match attitudes and behaviors linked to various personality traits.

There were several limitations of this study. First, we relied on self-reported data, which may be subject to recall or social desirability bias. Participants might have provided responses that they believed were expected or socially acceptable, potentially leading to inaccuracies, such as underreporting of negative behaviors such as low biosecurity use. In addition, recruitment methods such as social media and in-person approaches could have introduced selection bias, limiting representation of certain subgroups within the equestrian community. Moreover, for efficiency, this study also relied on the shortened version of the BFI to assess personality traits, thus potentially not capturing the full complexity of those traits. It is also important to note that personality traits are nuanced and variation may exist within identified clusters. Although clustering aimed to distinguish distinct groups based on personality profiles, it does not imply identical traits or behaviors within each cluster.

In conclusion, based on the findings of this study, several recommendations can be made to enhance biosecurity implementation among Ontario horse owners. First, fostering collaboration and improving communication channels among horse owners, veterinarians, and industry professionals is crucial to promote a culture of accepted biosecurity use within the industry. By working together and ensuring accurate and timely dissemination of information on disease risks, industry members can normalize and encourage adoption of best practices. Second, providing tailored support and resources to the horse industry, such as offering checklists and guidelines matched to different types of facility, can account for differences in personality, facility characteristics, risk factors, and risk understanding. By addressing individual differences in risk perceptions, anxiety levels, and information-seeking preferences, tailored strategies can be designed to effectively promote biosecurity use among horse owners. Further studies should explore how personality can be integrated into educational materials. Future research should focus on specific subgroups within the horse community, to identify their unique barriers and motivators. In addition, evaluating the effectiveness of current interventions may help identify gaps in knowledge translation and inform development of targeted strategies to enhance biosecurity implementation.

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ARTICLE

Jenna Feyler, Etienne Côté, Chick Weisse, Sue Dawson

Computed tomographic angiographic study of common carotid artery anatomic relationships in the dog

ABSTRACT

Objective

To further understand spatial relationships of common carotid arteries to adjacent structures through evaluation of computed tomographic angiograms in dogs.

Animals

24 pet dogs.

Procedure

A database was searched for triplanar computed tomographic angiograms that included the heart base caudally and the 5th cervical vertebra cranially, without macroscopic abnormalities. Measurements included brachiocephalic trunk length, common carotid arteries' position relative to the trachea, transverse (axial) thoracic height and width, manubrium length, and length of the 7th cervical vertebra (C7).

Results

Measurements (mean + SD) included brachiocephalic trunk length = 3.65 ± 1.34 cm (n = 24), mean thoracic inlet height = 6.51 ± 2.03 cm (n = 23), mean thoracic inlet width = 4.69 ± 1.35 cm (n = 20), mean manubrium length = 3.52 ± 1.15 cm (n = 22), and mean length of C7 = 1.93 ± 0.46 cm (n = 23).

Conclusion

Some or all measurements were feasible in all dogs. Understanding interindividual variation in spatial relationships is pertinent to differentiating normal from abnormal, for surgical planning, and possibly for elucidating the pathogenesis of certain disorders.

Clinical relevance

It is possible to obtain these measurements in dogs. This technique could be applied to subgroups of dogs (*e.g.,* breeds) and dogs with cervical or thoracic abnormalities.

RÉSUMÉ

Étude angiographique par tomodensitométrie des relations anatomiques de l'artère carotide commune chez le chien

Objectif

Mieux comprendre les relations spatiales des artères carotides communes avec les structures adjacentes grâce à l'évaluation des angiogrammes par tomodensitométrie chez les chiens.

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Preliminary results were presented in abstract form at the National Veterinary Student Scholars Symposium, Minneapolis, Minnesota, USA, August 5 and 6, 2022.

Generous funding was provided by the Ptarmigan Foundation and by the Atlantic Veterinary College — University of Prince Edward Island Student Research and Leadership Program.

Animaux

24 chiens de compagnie.

Procédure

Une recherche a été effectuée dans une base de données pour trouver des angiogrammes par tomodensitométrie triplanaire incluant la base du cœur caudalement et la 5e vertèbre cervicale crânialement, sans anomalies macroscopiques. Les mesures comprenaient la longueur du tronc brachiocéphalique, la position des artères carotides communes par rapport à la trachée, la hauteur et la largeur thoraciques transversales (axiales), la longueur du manubrium et la longueur de la 7e vertèbre cervicale (C7).

Résultats

Les mesures (moyenne ± écart type) comprenaient la longueur du tronc brachiocéphalique = 3,65 ± 1,34 cm (n = 24), la hauteur moyenne de l'entrée thoracique = 6,51 ± 2,03 cm (n = 23), la largeur moyenne de l'entrée thoracique = 4,69 ± 1,35 cm (n = 20), longueur moyenne du manubrium = 3,52 ± 1,15 cm (n = 22) et longueur moyenne de C7 = 1,93 ± 0,46 cm (n = 23).

Conclusion

Certaines ou toutes les mesures étaient réalisables chez tous les chiens. La compréhension des variations interindividuelles dans les relations spatiales est importante pour différencier le normal de l'anormal, pour la planification chirurgicale et éventuellement pour élucider la pathogenèse de certains problèmes.

Pertinence clinique

Il est possible d'obtenir ces mesures chez le chien. Cette technique pourrait être appliquée à des sous-groupes de chiens (par exemple, des races) et à des chiens présentant des anomalies cervicales ou thoraciques.

(Traduit par Dr Serge Messier)

Can Vet J 2025;66:298–307

INTRODUCTION

The positions of the common carotid arteries through the neck of the dog and their relationships to adjacent structures are usually described as being uniform in the species (1). However, some descriptions exist of breed- or somatotype-associated variants. For example, the brachiocephalic trunk (BCT) of dogs is described as being "approximately 4 cm long and 8 mm in diameter" (1). The branching pattern of the vessels off the aortic arch in dogs, from right to left, is typically described as BCT [branching into the right common carotid (RCC), left common carotid (LCC), and right subclavian arteries] and left subclavian artery (1). However, additional work identified interindividual variation in the origin and branching patterns of these vessels (2–5). Common carotid arteries originate from the same point on the BCT in 68% of dogs, from different points on the BCT in 29% of dogs, and from a common, bicarotid trunk that arises from the BCT in 3% of dogs (4). In German shepherd dogs, a similar variety of morphologies exists, with some investigators dividing the bicarotid trunk group into 2 subgroups (2). A bicarotid trunk is commonly identified in dogs with a concurrent persistent right aortic arch (*e.g.,* 17/21, 81%) but only occasionally identified in dogs without a persistent right aortic arch (*e.g.,* 1/192, 0.5%) (5). Overall, such findings have been obtained either with macroscopic dissection of dog cadavers (1–3,6) or using computed tomographic angiography on anesthetized dogs (4,5,7,8).

Few studies of dogs have addressed spatial relationships of the common carotid arteries to adjacent thoracic and cervical structures. In 1 case study, investigators utilized computed tomographic angiography pre- and postoperatively to assess morphology of vessels where they crossed through the thoracic inlet (8). The location at which common carotid arteries are directly lateral to the trachea, associations with thoracic inlet height and width, and length of the BCT compared to skeletal structures as points of reference, have apparently not been described. Carotid arteries have been identified coursing ventrally along the malformed trachea in dogs with tracheal malformations and sometimes within the ventral tracheal groove that is characteristic of tracheal malformation. Vessel/nerve tension or thoracic inlet narrowing along soft, developing tracheal cartilage has been hypothesized as a possible cause for tracheal malformation

TABLE 1. Variables and parameters for measuring them on computed tomographic angiograms of normal dogs.

Variable	Parameter: Definition	Parameter: Method
BCT length (Figure 1)	Distance between origin of the BCT off the aortic arch caudally and origin of the RCC, LCC, or bicarotid trunk cranially	i) Scroll through transverse (axial) images from caudal to cranial and identify the one where BCT is first seen as a distinct structure. Mark this origin of the BCT on the corresponding MPR-synchronized dorsal (coronal) plane image. ii) Scroll through transverse (axial) images while remaining synchronized to the dorsal (coronal) image in (i), above, using MPR. Identify the transverse (axial) image where the RCC is first seen as a distinct structure; *i.e.,* separate from other vascular structures. Mark this origin of the RCC on the corresponding MPR-synchronized dorsal (coronal) plane image. iii) Measure the distance between the 2 marked points.
Thoracic inlet height (Figure 2)	Greatest distance between dorsal aspect of manubrium and corresponding ventral aspect of T1	i) Scroll through transverse (axial) and MPR-synchronized dorsal (coronal) images and identify the orthogonal pair of images where the right and left 1st ribs are best visualized. ii) On the transverse image, measure the distance between the dorsal manubrium and ventral T1.
Thoracic inlet width (Figure 2)	Greatest distance between medial aspects of contralateral 1st ribs on a transverse axial image	As for thoracic inlet height, but measuring the greatest distance in a lateral plane (width) between the medial surfaces of the 2 1st ribs.
Intercarotid distance (Figure 3)	Distance between RCC and LCC at level of RCC origin	i) Scroll through transverse (axial) images from caudal to cranial and identify the image where the RCC and LCC are first seen as distinct structures. ii) Measure the shortest distance between the RCC and LCC on this image. iii) All measurements $<$ 1 mm recorded as $<$ 1 mm.
Carotid artery positions lateral to trachea (Figures 4, 5)	Cervical vertebra corresponding to transverse (axial) image where LCC is directly lateral to the left of the trachea and where RCC is directly lateral to the right of the trachea	i) Scroll through transverse (axial) images from caudal to cranial and identify 2 images: the one where the RCC is directly lateral to the right of the trachea (transverse image of trachea as clockface analogy: 9 o'clock position) and the one where the LCC is directly lateral to the left of the trachea (tracheal clockface analogy: 3 o'clock position). ii) Using MPR, scroll through paramedian (parasagittal) images, while remaining synchronized to each of the 2 transverse (axial) images, to find the midline median (sagittal) image. Use this image to identify the vertebrae corresponding to each of the 2 transverse (axial) images described above (3 o'clock and 9 o'clock). iii) Measure the length of each of the 2 vertebrae on the floor of the vertebral canal and identify in tenths, from cranial (zero tenths) to caudal (10 tenths), the location of each of the 2 corresponding transverse (axial) images.
Carotid artery or BCT position ventral to trachea (Figure 6)	Cervical vertebra where BCT or RCC is directly ventral to the trachea	As for carotid artery positions lateral to trachea, but using the transverse (axial) image where the BCT or RCC is ventralmost to the trachea (6 o'clock position).
Length of manubrium (Figure 7)	Length of manubrium	On midline median (sagittal) image, measure greatest length of 1st sternebra.
C7 length (Figure 7)	Length of 7th cervical vertebra	On midline median (sagittal) image, measure greatest length of body of 7th cervical vertebra (floor of vertebral canal).

BCT — Brachiocephalic trunk; LCC — Left common carotid artery; MPR — Multiplanar reformation; RCC — Right common carotid artery; T1 — 1st thoracic vertebral body.

generation; however, this is currently only a hypothesis (Chick Weisse, Schwarzman Animal Medical Center, New York, New York, USA; personal communication, 2024). Greater understanding of these spatial relationships could improve diagnosis of pathologic malformations of the vasculature, interventional treatment selection (9), and surgical planning (8) — and could offer insights into the pathogenesis of such disorders as tracheal malformation (9,10).

The objective of this study was to evaluate computed tomographic angiograms (CTAs) to quantify spatial relationships between common carotid arteries and adjacent cervical and thoracic structures. We hypothesized that it

is possible to i) make these measurements on the CTAs of normal dogs, and ii) index these measurements to reference points in the dog.

MATERIALS AND METHODS

Animals

A convenience sample was obtained by searching the Atlantic Veterinary College (Charlottetown, Prince Edward Island) Radiology archive for dogs that underwent simultaneous cervical and thoracic computed tomographic angiography (Aquilion 64; Canon, Otawara, Japan). The CTAs that were used had been obtained between July 2, 2020 and June 17, 2022.

Computed tomographic angiography protocol

Each dog was induced and maintained under general anesthesia while endotracheally intubated. The dog was positioned in sternal recumbency with the head facing the CT aperture. In addition, each dog had physical restraint by means of foam wedges and troughs, sandbags, and hook-and-loop straps attached to the table. Images were acquired during breath-hold sequences without contrast, and then after IV administration of iohexol (Omnipaque, 240 mg iodine/mL; GE Healthcare Canada, Mississauga, Ontario), 2.5 mL/kg, administered through a peripheral IV catheter.

Analysis of images

Exclusionary criteria were absence of images that included the heart base at the caudal extent of the CTA, absence of images that included the complete 5th cervical vertebra (C5) at the cranial extent of the CTA, and presence of cervical or intrathoracic abnormalities on CTA. Before making measurements, the investigators used CTA images from 10 dogs from a previous study (11) to establish variables to measure in the current study and to refine measurement parameters. All CTA images were assessed using open-source software (https://horosproject.org). Variables and parameters for their measurements are in Table 1. The lengths of the 7th cervical vertebra (C7) and of the manubrium were measured as reference points to calculate ratios with vascular structures; this was done to explore indexing measurements to account for differences in body size.

Measurements were obtained using 2D multiplanar reformation (MPR) and the software's length measurement function. The bone setting was used for measuring bony structures and the abdomen setting for measuring contrast-filled vascular structures. Additional features of the software, including 3D image rendering and 3D MPR, were used as needed to increase the precision and accuracy of measurements through confirmation of the points of origin of vessels, enhancement of visualization of the course of vessels, and confirmation of the reference vertebra as C7.

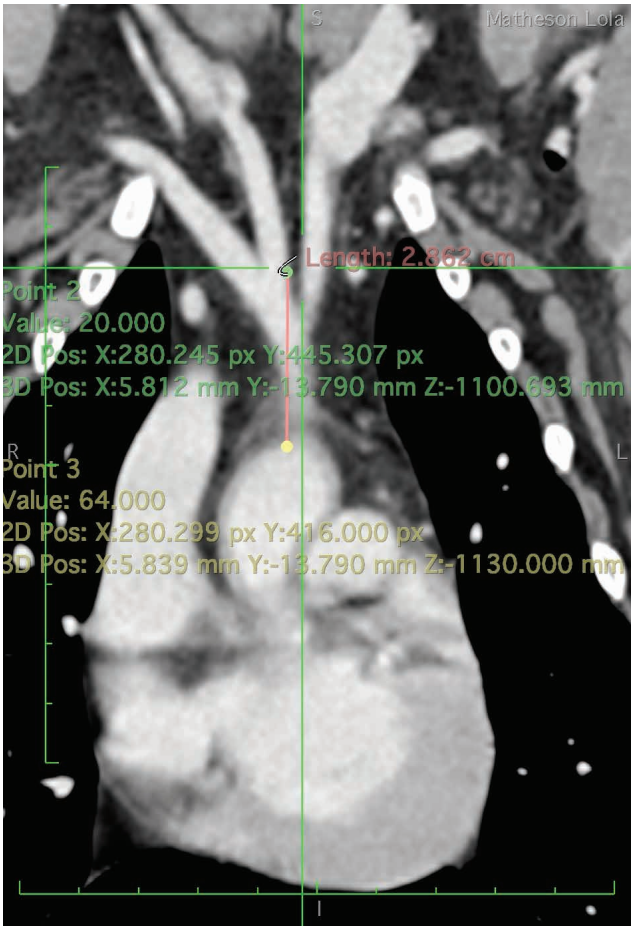

FIGURE 1. Brachiocephalic trunk length in a dog.

Statistical methods

Data were analyzed using commercial software (GraphPad Prism 10.2.2; GraphPad Software, La Jolla, California, USA). Analysis for normality was done using the Shapiro-Wilk test. Normally distributed data are reported as mean ± SD. Non-normally distributed data are reported as median (range). Investigation of correlations between variables was established *a priori* and was done using Pearson correlation for normally distributed data or Spearman correlation for non-normally distributed data (both 2-tailed). For vertebral lengths, results are shown to tenths of a vertebra, for precision. For localization using vertebral lengths as reference points, cervical vertebral lengths were treated numerically without the designation of "cervical" (*e.g.*, C5.3 as 5.3 during statistical analysis). Similarly, thoracic vertebrae were

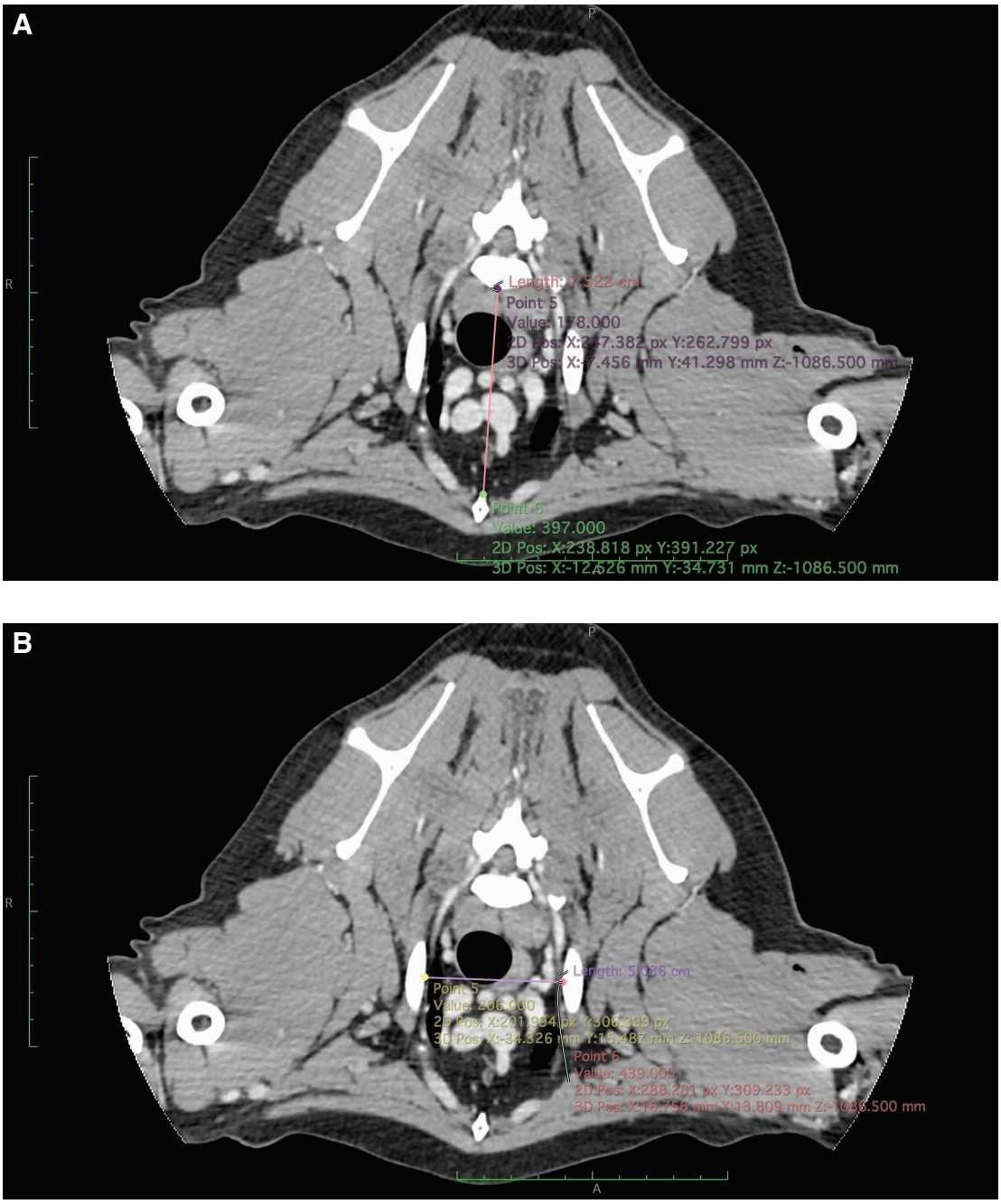

FIGURE 2. Thoracic inlet height (A) and width (B) in a dog.

treated numerically without the designation of "thoracic," and as extensions of cervical vertebrae by extrapolation (*e.g.*, T1.6 as 8.6 during statistical analysis). $P < 0.05$ was considered statistically significant, except for correlation analyses to which a Bonferroni correction was applied.

RESULTS

Of the 35 CTAs retrieved, 11 were excluded due to space-occupying masses (4), megaesophagus (1), esophageal perforation/tear (1), lack of contrast (2), inability to visualize the BCT (2), and a technical issue (missing images) (1). In the 24 dogs studied, some individual measurements could not be made for the following reasons: absence of parallel right and left 1st ribs in a transverse (axial) view (thoracic width, $n = 4$), oblique image of manubrium (length of manubrium, $n = 2$), image series did not reach sufficiently cranially (carotid artery position lateral to trachea (3 o'clock, $n = 2$), carotid artery position lateral to trachea (9 o'clock, $n = 2$), ill-defined margins of C7 (length

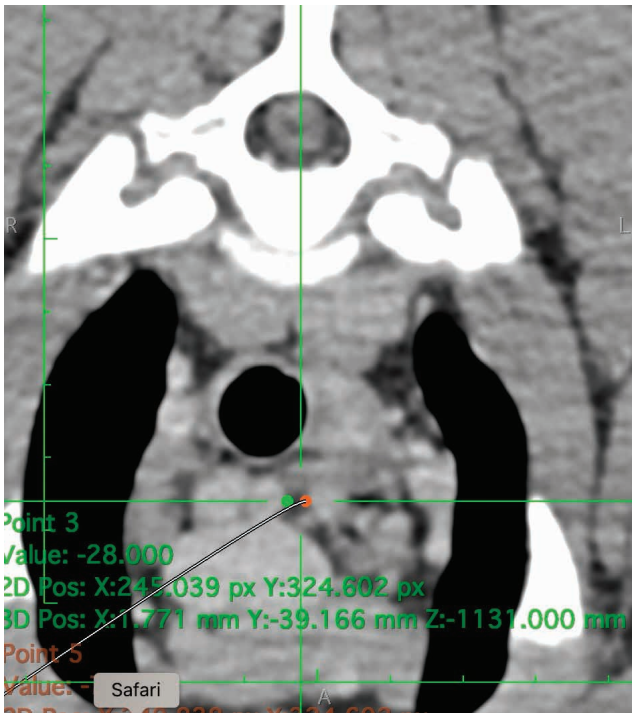

FIGURE 3. Intercarotid distance in a dog.

of C7, $n = 1$), and oblique image of thoracic inlet (thoracic height, $n = 1$).

There were 13 males (10 castrated) and 11 females (9 spayed). On transverse (axial) images, the vessel directly ventral to the trachea was the RCC in 17 dogs (71%) and the BCT in 7 dogs (29%) (Tables 1, 2). No dog had a bicarotid trunk. Measurements and descriptive statistics are presented in Table 2 and correlation analyses in Table 3. After Bonferroni correction for 18 analyses, only the association between BCT length and weight remained significant.

DISCUSSION

This study presented a novel method for assessing spatial relationships of the BCT and common carotid arteries not using cadavers. Measurement of all variables was feasible in most dogs. Inability to measure certain variables in some dogs, such as LCC position lateral to trachea (9 o'clock) or thoracic inlet width, were related to technical issues such as cranial extent of acquisition of images or patient positioning, respectively. Such issues can be addressed proactively at the time computed tomographic angiography is done if the present variables are intended to be acquired and measured, or through 3D reconstruction of CTAs.

Although the BCT is broadly described as being ~4 cm long in dogs (1), there was a strong correlation between BCT length and body weight. Therefore, a single value for BCT length is not expected to be accurate for dogs of all body weights.

Quantitative information on the origin and course of the common carotid arteries was obtained from CTAs of dogs

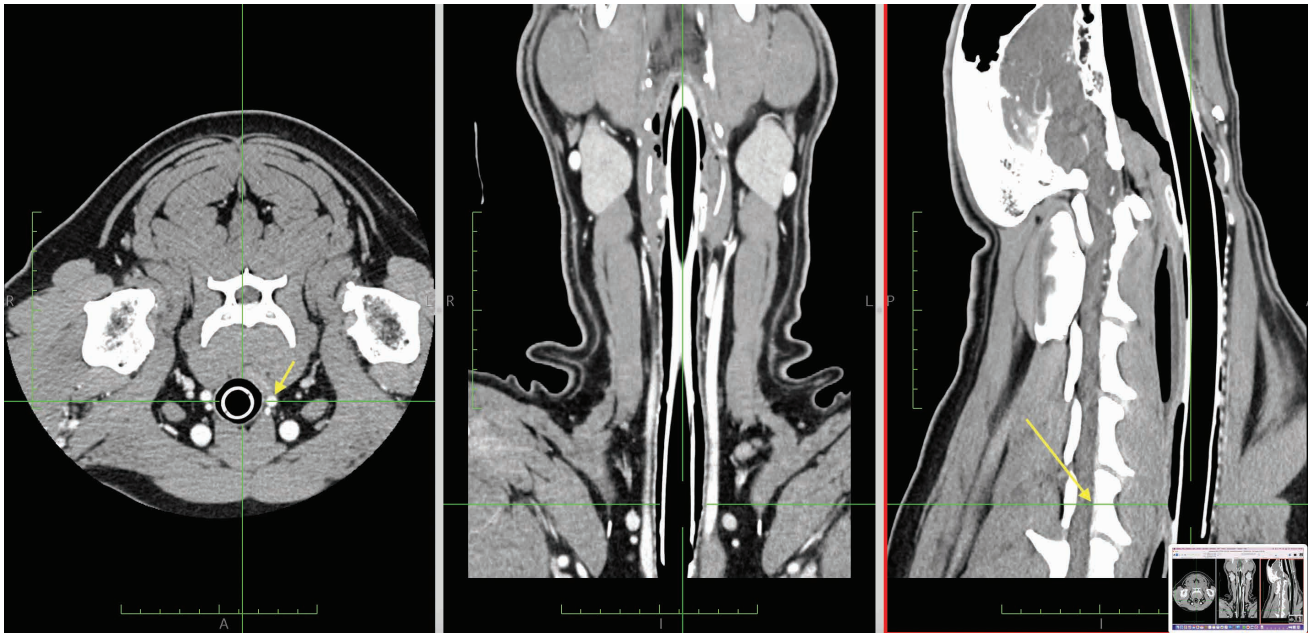

FIGURE 4. Transverse (left image), dorsal (center image), and median (right image) plane views demonstrating the left common carotid artery at the left lateralmost (3 o'clock) position relative to the trachea (short arrow) in the dog. Using multiplanar reformation, the transverse image is identified as corresponding to vertebral level C5.5 (long arrow).

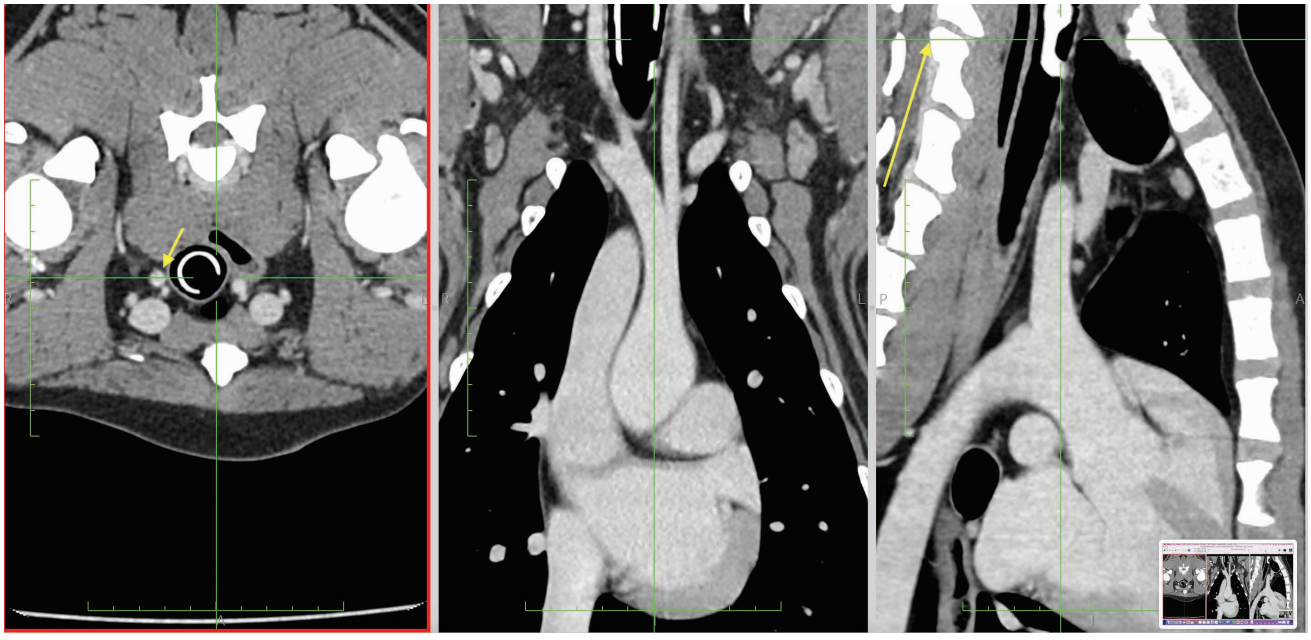

FIGURE 5. Transverse (left image), dorsal (center image), and median (right image) plane views demonstrating the right common carotid artery at the right lateralmost (9 o'clock) position relative to the trachea (short arrow) in the dog. Using multiplanar reformation, the transverse image is identified as corresponding to vertebral level C6.1 (long arrow).

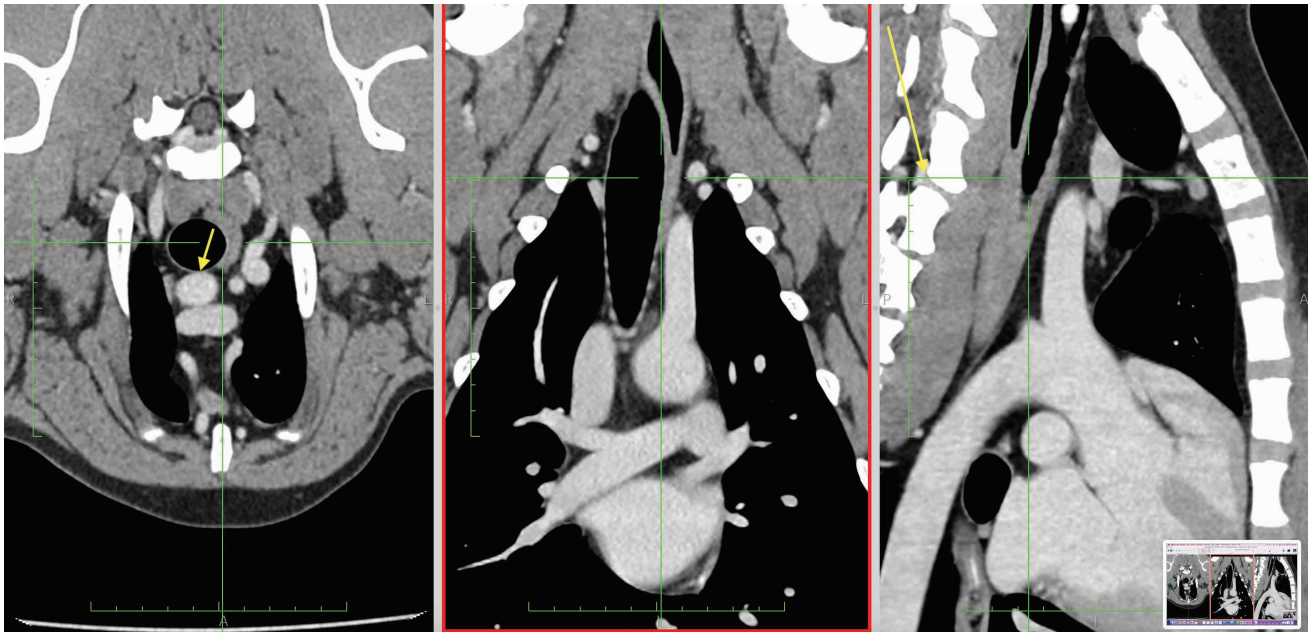

FIGURE 6. Transverse (left image), dorsal (center image), and median (right image) plane views demonstrating the brachiocephalic trunk as the first major artery to be apparent directly ventral to the trachea (6 o'clock position) when scrolling from the heart base cranially (short arrow) in the dog. Using multiplanar reformation, the transverse image is identified as corresponding to vertebral level C7.9 (long arrow).

using the methods of this study. The RCC and LCC origins on the BCT were separated by a distance that varied widely among individuals and was not correlated to body weight. When examining the course of the common carotid arteries from caudal to cranial, both the RCC and LCC first were directly lateral to the trachea at approximately the level of C5 in most dogs. The artery (BCT, RCC, or LCC) that first appeared directly ventral to the trachea when proceeding from caudal to cranial differed among dogs. Indexing BCT length to length of the manubrium or of C7 reduced the

FIGURE 7. Measured lengths of the 7th cervical vertebra (A) and manubrium (B) in the dog.

influence of body weight on BCT length. Such indexing could be evaluated further as part of developing reference intervals for BCT length that apply to dogs of various body weights. The RCC origin on the BCT was noted to occur at the level of the 1st rib (1), and similarly, the present study identified the level of the 1st thoracic vertebra as the mean position of the origin of the RCC. Together, these findings increased the feasibility of quantitatively assessing BCT and common carotid artery structure and course in CTAs of healthy dogs. The feasibility of this approach means that formal validation can be undertaken.

Some limitations could be attributed to the retrospective nature of this study. Many CTAs could not be included because they imaged the neck or the thorax, but not both. This selection bias reduced the number of cases simply because protocols were applied for computed tomographic angiography of the anatomic region of interest.

Positioning during imaging differed among dogs. In 4 dogs, this meant that thoracic inlet width could not be measured, and thoracic inlet height:width could not be calculated, because the right and left 1st ribs could not be visualized on the same transverse (axial) images. Three-dimensional reconstruction could be applied to circumvent this, and similar limitations, in the future.

The mean body weight of dogs in this study was higher than the typical body weight of dogs with tracheal malformation or tracheal collapse. This difference would limit the extent to which the present results can be applied to dogs with such tracheal diseases.

In conclusion, it was feasible to obtain measurements involving the common carotid arteries and BCT of dogs on CTAs. These findings could have clinical implications for surgical planning and for understanding embryogenesis of disorders of the vasculature in the necks of dogs.

TABLE 2. Measurements of variables on computed tomographic angiograms of normal dogs.

Variable	Mean ± SD or median (range)	Number of dogs
Body weight (kg)	21.5 ± 12.3	24
Length of BCT (cm)	3.65 ± 1.34	24
BCT length/C7	1.92 ± 0.35	23
BCT length/manubrium length	1.06 ± 0.26	22
Thoracic inlet height (cm)	6.51 ± 2.03	23
Thoracic inlet width (cm)	4.69 ± 1.35	20
Thoracic inlet height:width	1.38 ± 0.21	20
Intercarotid distance (mm)	0.57 (< 1 to 8.1)	24
LCC position lateral to trachea (3 o'clock) (vertebra)	C5.5 ± 1	22
RCC position lateral to trachea (9 o'clock) (vertebra)	C5.8 ± 0.78	22
Artery position (BCT or RCC) ventral to trachea (6 o'clock) (vertebra)	T1.1 ± 0.75	24
Length of C7 (cm)	1.93 ± 0.46	23
Length of manubrium (cm)	3.52 ± 1.15	22

BCT — Brachiocephalic trunk; C7 — 7th cervical vertebra; LCC — Left common carotid artery; RCC — Right common carotid artery.
Results reported as mean ± SD if normally distributed and median (range) if non-normally distributed.

TABLE 3. Correlation analyses between various variables for computed tomographic angiograms of normal dogs.

IV	DV	*r*	95% CI	*P*
BCT length	Weight	0.82	0.62 to 0.92	**< 0.0001**
BCT length/C7 length	Weight	0.37	−0.05 to 0.68	0.08
BCT length/manubrium length	Weight	0.15	−0.29 to 0.54	0.5
LCC @ 3 o'clock	BCT length	−0.16	−0.54 to 0.28	0.48
RCC or BCT @ 6 o'clock	BCT length	0.16	−0.26 to 0.53	0.46
RCC @ 9 o'clock	BCT length	−0.2	−0.57 to 0.25	0.38
LCC @ 3 o'clock	Weight	−0.25	−0.61 to 0.19	0.26
RCC or BCT @ 6 o'clock	Weight	0.007	−0.4 to 0.41	0.97
RCC @ 9 o'clock	Weight	−0.14	−0.53 to 0.3	0.54
Thoracic inlet height:width	Weight	0.02	−0.42 to 0.46	0.93
Thoracic inlet height:width	BCT length	0.23	−0.23 to 0.61	0.33
Intercarotid distance	Weight	0.13	−0.3 to 0.51	0.56
Intercarotid distance	BCT length	0.34	−0.09 to 0.66	0.11
Intercarotid distance	BCT length/C7 length	0.42	−0.005 to 0.71	0.047
Intercarotid distance	BCT length/manubrium length	0.52	0.11 to 0.78	0.013
Intercarotid distance	LCC @ 3 o'clock	0.1	−0.35 to 0.51	0.67
Intercarotid distance	RCC or BCT @ 6 o'clock	0.04	−0.38 to 0.45	0.86
Intercarotid distance	RCC @ 9 o'clock	−0.12	−0.52 to 0.33	0.61

BCT — Brachiocephalic trunk; CI — Confidence interval; C7 — 7th cervical vertebra; DV — Dependent variable; IV — Independent variable; LCC — Left common carotid artery; RCC — Right common carotid artery; 3 o'clock — LCC position directly left-lateral to trachea on transverse (axial) image; 6 o'clock — RCC or BCT position directly ventral to trachea on transverse (axial) image; 9 o'clock — RCC position directly right-lateral to trachea on transverse (axial) image.
Boldface font indicates statistical significance.

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ARTICLE

A retrospective survey of equine ocular diseases evaluated at a referral hospital in Ontario (2011 to 2021)

Sonja T. Ing, Chantale L. Pinard, Elizabeth M. James-Jenks, Marina L. Leis

ABSTRACT

Objective

Our objective was to investigate the demographics and prevalence of ocular disease in a large referral population of horses in Ontario over a 10-year period.

Animals and procedure

A retrospective analysis of medical records for 283 horses evaluated by Board-certified veterinary ophthalmologists at the Ontario Veterinary College (Guelph, Ontario) was conducted. Signalment and ocular disease were recorded.

Results

The 3 most common ocular abnormalities identified were uveitis (43.7%, 123 horses), ulcerative keratitis (42.0%, 119 horses), and cataract (25.1%, 71 horses). Uveitis was most often secondary to other ocular disease. Middle-aged horses (5 to 15 y) had a lower proportion of ulcerative keratitis than young horses (0 to 4 y) and older horses (16 to 35 y) ($P = 0.015$). Older horses were more likely to be diagnosed with glaucoma than were young and middle-aged horses ($P = 0.022$). Thoroughbred was the most common breed referred. Warmbloods were significantly less likely to receive a diagnosis of uveitis compared to other breeds ($P = 0.05$). Adnexal disease and neoplasia were both more prevalent in draft breeds compared to other breeds ($P < 0.001$).

Conclusion and clinical relevance

For the first time, the most prevalent ocular diseases and breeds referred for ocular disease are reported for horses in eastern Canada. This study serves as a reference for practitioners and sets a baseline for future studies.

RÉSUMÉ

Une enquête rétrospective sur les maladies oculaires équines évaluées dans un hôpital de référence en Ontario (2011 à 2021)

Objectif

Notre objectif était d'étudier la démographie et la prévalence des maladies oculaires dans une large population de chevaux référés en Ontario sur une période de 10 ans.

Animaux et procédure

Une analyse rétrospective des dossiers médicaux de 283 chevaux évalués par des ophtalmologistes vétérinaires certifiés du Ontario Veterinary College (Guelph, Ontario) a été réalisée. Le signalement et les maladies oculaires ont été enregistrées.

Résultats

Les 3 anomalies oculaires les plus fréquemment identifiées étaient l'uvéite (43,7 %, 123 chevaux), la kératite ulcéreuse (42,0 %, 119 chevaux) et la cataracte (25,1 %, 71 chevaux). L'uvéite était le plus

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souvent secondaire à une autre maladie oculaire. Les chevaux d'âge moyen (5 à 15 ans) présentaient une proportion plus faible de kératite ulcéreuse que les jeunes chevaux (0 à 4 ans) et les chevaux plus âgés (16 à 35 ans) (P = 0,015). Les chevaux plus âgés étaient plus susceptibles d'être diagnostiqués avec un glaucome que les chevaux jeunes et d'âge moyen (P = 0,022). Le Thoroughbred était la race la plus couramment mentionnée. Les chevaux de race Warmblood étaient significativement moins susceptibles de recevoir un diagnostic d'uvéite par rapport aux autres races (P = 0,05). Les maladies des annexes de l'œil et les néoplasies étaient toutes deux plus répandues chez les races de trait que chez les autres races ($P < 0,001$).

Conclusion et pertinence clinique

Pour la première fois, les maladies oculaires les plus répandues et les races référées pour maladies oculaires sont décrites chez les chevaux de l'est du Canada. Cette étude sert de référence pour les praticiens et établit une base pour les études futures.

(Traduit par Dr Serge Messier)

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INTRODUCTION

Ocular disease is common in equine populations, with vision-threatening disease, such as equine recurrent uveitis (ERU) or glaucoma, reported in 5 to 10% of horses (1). Other common ocular conditions of horses include corneal ulceration, infectious keratitis, cataract, and ocular neoplasia. However, previous studies have not described the overall prevalence of these diseases (2).

Prevalence of ocular disease in various equine populations has been reported (1,3–9). Ocular diseases in neonatal foals have also been reported (10,11), as have ocular findings in geriatric equids in various locations (12–14). To date, there have not been any non-breed- or age-restricted studies reporting on the prevalence of ocular disease in a Canadian referral hospital population of horses with a wide range of breeds and ages. An understanding of the prevalence of eastern Canadian equine ocular diseases would serve as a baseline for equine practitioners in diagnosing and managing ophthalmic patients, and would aid in monitoring disease patterns and identifying areas for future research.

The objective of this study was to investigate the demographics and prevalence of ocular disease in a large referral population of horses in Ontario over a 10-year period.

MATERIALS AND METHODS

Database

We analyzed medical records of equine patients evaluated by Board-certified veterinary ophthalmologists at the Ontario Veterinary College Health Sciences Centre (OVC-HSC) from January 2011 to December 2021. The ophthalmic examination consisted of a neuro-ophthalmic examination followed by slit lamp biomicroscopy, indirect ophthalmoscopy for fundoscopy using a 15 diopters lens, tonometry, and ocular stains. A subset of cases underwent additional diagnostic testing at the discretion of the ophthalmologist, based on examination findings. Additional diagnostic tests included corneal culture and cytology, imaging (ocular ultrasound, computed tomography scanning, or magnetic resonance imaging), electroretinography, sampling of ocular tissues by aspiration or biopsy, or serologic testing for leptospiral serovars. Animals were excluded if a complete medical record was not available for review. Data collected from the records included age, sex, breed, duration of presenting ocular disease, diseased eye and visual status, diagnosis, treatments applied, and histopathologic analysis of ocular tissues, if available. The animals were categorized by age: young horses (0 through 4 y), middle-aged horses (5 through 15 y), and senior horses (16 through 35 y) (3,9,13). Breeds were registered according to the medical records and included purebreds and mixed breeds. The duration of ocular disease was further classified as congenital, acute if < 7 d, and chronic if > 7 d (15). The ophthalmic diagnoses were classified as orbital, adnexal, corneal, lenticular, uveal, iridocorneal, and posterior segment diseases. Further classifications included congenital disease, neoplasia, traumatic disease, or ocular manifestations of systemic disease. Therapies were classified as medical management alone or a combination of medical and surgical management.

Medical records of all equine patients presented to the OVC-HSC from January 2011 to December 2021 were

TABLE 1. Breeds of horse presented to OVC-HSC from January 2011 to December 2021. Both horse breeds evaluated by Board-certified ophthalmologists and breeds of all horses presented to the OVC-HSC are reported.

	Horses evaluated by Board-certified ophthalmologists		All horses presented to the OVC-HSC from 2011 to 2021	
Breed	*n*	%	*n*	%
American quarter horse	43	15.2	2082	11.1
Appaloosa	13	4.6	151	0.8
Standardbred	24	8.5	3591	19.2
Thoroughbred	51	18.0	4736	25.4
Thoroughbred cross	19	6.7	—[a]	—[a]
Warmblood	73	25.8	4087	21.9
Draft	17	6.0	981	5.3
Other breeds	43	15.2	3053	16.3

OVC-HSC — Ontario Veterinary College Health Sciences Centre.
[a] Data on Thoroughbred crosses not available.

evaluated and breed data were recorded. Breeds were registered according to the medical records and included purebreds and mixed breeds. Unlike when registering the breed data of horses evaluated by Board-certified ophthalmologists, it was not possible to identify horses that were Thoroughbred crosses.

Statistical analysis

Descriptive statistics were obtained to report age distribution, sex, breed, duration of disease, ocular disease diagnoses, therapies recommended, and agreement between clinical and histopathologic diagnoses, when applicable, using Microsoft Excel software (Microsoft, Redmond, Washington, USA). Statistical differences in case distribution between disease diagnosis categories were assessed with a 2-tailed Z-test with Bonferroni correction, using SPSS software (v 23; IBM, Armonk, New York, USA), with age and breed as comparison groups. For these comparisons, corneal disease was further divided into ulcerative and non-ulcerative keratitis categories, and uveal diseases were further classified as uveitis or uveal cysts. The statistical significance level was set at 0.05, and Fisher's exact test was used to generate a *P*-value.

RESULTS

Two hundred eighty-three horses met the inclusion criteria for this study. Horses ranged in age from 0 to 35 y, with a mean of 10.7 y. Young horses were reported at 18.7% (53 horses, mean: 1.5 ± 1.6 y), 60.1% were classified as middle-aged (170 horses, mean: 10.1 ± 3.1 y), and 21.2% were senior horses (60 horses, mean: 20.7 ± 4.0 y). Congenital lesions were detected in 3.2% of horses (9 horses). Young horses had a higher likelihood of congenital disease than middle-aged and older horses ($P = 0.015$). Young horses had a lower proportion of uveal cysts compared to middle-aged and older horses ($P = 0.05$). Young horses also had a lower proportion of neoplasia than middle-aged and older horses ($P = 0.03$). Middle-aged horses had a lower proportion of ulcerative keratitis than young horses and older horses ($P = 0.015$). Older horses were more likely to be diagnosed with glaucoma than young and middle-aged horses ($P = 0.022$).

Cases comprised 36.8% mares (104 horses), 46.3% geldings (131 horses), 2.8% stallions (8 horses), 4.9% colts (14 horses), and 9.2% fillies (26 horses). Of the 18 681 horses presented to the OVC-HSC from 2011 to 2021, independent of department, breed categories consisted of 25.4% Thoroughbred or Thoroughbred crosses (4736 horses), 19.2% standardbred (3591 horses), 11.1% American quarter horse (2082 horses), 0.8% Appaloosa (151 horses), 21.9% warmblood (4087 horses), 5.3% draft (981 horses), and 16.3% other breeds (3053 horses) (Table 1). In comparison, of the horses presented to OVC-HSC that were evaluated by Board-certified ophthalmologists, breed categories consisted of 18.0% Thoroughbred (51 horses), 6.7% Thoroughbred crosses (19 horses), 8.5% standardbred (24 horses), 15.2% American quarter horse (43 horses), and 4.6% Appaloosa (13 horses). Warmbloods represented 25.8% of horses (73 horses), 6.0% of horses were draft breeds (17 horses), and 15.2% of horses were of other breeds (43 horses) (Table 2). Warmbloods were less likely to receive a diagnosis of uveitis compared to other breeds ($P = 0.05$). Adnexal disease and neoplasia were both more prevalent in draft breeds compared to other breeds ($P < 0.001$).

Horses with a presenting complaint considered congenital in origin represented 1.8% of horses (5 horses).

TABLE 2. Warmblood, draft, and other breeds of horse presented to OVC-HSC from January 2011 to December 2021 and evaluated by Board-certified ophthalmologists.

Breed	*n*	% of each breed category
Warmblood		
Hanoverian	13	17.8
Dutch warmblood	9	12.3
Canadian sport horse	5	6.8
Irish sport horse	5	6.8
Canadian warmblood	4	5.5
Oldenburg	4	5.5
Friesian	2	2.7
American saddlebred	1	1.4
American warmblood	1	1.4
Canadian	1	1.4
Holsteiner	1	1.4
Lipizzaner	1	1.4
Rheinlander	1	1.4
Selle Français	1	1.4
Westphalian	1	1.4
Wielkopolski	1	1.4
Non-specified warmblood	17	23.3
Non-specified warmblood cross	3	4.1
Draft		
Clydesdale	6	35.5
Haflinger	3	17.6
Percheron	2	11.8
Dutch harness horse	1	5.9
Icelandic	1	5.9
Irish draught horse	1	5.9
Shire	1	5.9
Non-specified draft cross	1	5.9
Other breeds		
Pony	8	18.6
Paint	7	16.3
Arabian	3	7.0
Rocky mountain horse	3	7.0
Hackney	1	2.3
Paso Fino	1	2.3
Non-specified mixed breed	28	65.1

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Congenital lesions were overall detected in 3.2% of horses, as described, but were not always considered to be the reason for presentation. There were 19.4% of horses presented with an acute history of ocular disease of < 7 d duration (55 horses), whereas 68.9% of horses had a chronic history of ocular disease of > 7 d duration (195 horses). The duration of ocular disease was not specified in 9.9% of horses (28 horses).

Unilateral ocular disease affected 78.8% of horses, [37.5% of right eyes (106 horses) and 41.3% of left eyes (117 horses)], whereas 21.2% of horses were presented with bilateral ocular disease (60 horses). Of the horses presented for bilateral ocular disease, 38.3% were diagnosed with cataracts bilaterally (23/60), 36.7% received a diagnosis of uveitis (22/60), 28.3% had ulcerative keratitis (17/60), 26.7% had posterior segment lesions (16/60), 20% were diagnosed with non-ulcerative keratitis (12/60), 16.7% had uveal cysts (10/60), 6.7% had adnexal lesions (4/60), and 3.3% received a diagnosis of glaucoma (2/60). Ocular lesions secondary to systemic disease were detected in 8.3% of horses with bilateral disease (5/60), congenital disease was present in 6.7% of horses (4/60), and traumatic disease was detected in 3.3% of horses (2/60).

At presentation, 83.0% of horses were visual (235 horses). When presented for unilateral ocular disease, 11.3% of horses were non-visual in the eye of interest (32 horses). When presented for bilateral ocular disease, 2.1% of horses were blind in both eyes (6 horses) and 1.1% of horses were visual in 1 eye and non-visual in the other eye (3 horses). The visual status was unknown for 2.5% of horses (7 horses).

With respect to ocular diagnoses, uveitis was the most common, affecting 43.5% of horses (123 horses) (Table 3). Of these 123 cases, ERU was suspected or confirmed in 35.0% of all uveitis cases (43/123), and evidence of previous uveitis was present in 5.7% of cases (7/123). It was not possible to further classify the uveitis in 13.0% of cases (16/123). Leptospiral serologic testing was done in 40 of the 66 primary uveitis cases, and serologic results were not available for the remaining 26/66 primary uveitis cases. Of the cases where leptospiral serologic testing was done, 72.5% had a positive titer (29/40) and 27.5% had a negative titer (11/40). Of the positive titers, 65.5% had a titer of ≥ 400 (19/29), and 35.5% were weakly positive with a titer or ≤ 200 (10/29). *Leptospira interrogans* Pomona and Bratislava were the most identified serovars in 35.5% (10/29) and 27.6% (8/29) of positive titer cases, respectively. The remaining 46.3% of uveitis cases (57/123) were secondary to other ocular disease; corneal disease predated the uveitis in 96.5% of cases (55/57), whereas 3.5% occurred secondary to a scleral rupture (2/57).

Ulcerative keratitis was the second-most common ocular abnormality, affecting 42.0% of horses (119 horses), whereas non-ulcerative keratitis was present in 17.3% of horses (49 horses) (Table 3). Simple corneal ulcers were considered acute, superficial, noninfected ulcers and were present in 10.9% of ulcerated horses (13/119). Complex corneal ulcers, or deep, infected, or perforating corneal lesions, were diagnosed in 59.7% of ulcerated horses (71/119). Indolent ulcers were considered chronic superficial corneal lesions with loose epithelial edges and were present in 1.7% of ulcerated horses (2/119). Both complex and indolent ulcers were present in 5.9% of ulcerated horses (7/119). Corneal lacerations were noted in 4.2% of ulcerated horses (5/119), corneal foreign bodies were

TABLE 3. Anatomical distribution of ocular disease in horses presented to OVC-HSC from January 2011 to December 2021.

Disease category	*n*	% within disease category	% of all horses
Orbital			
Neoplastic	6	75.0	2.1
Inflammatory	0	0.0	0.0
Other	2	25.0	0.7
Adnexal			
Neoplastic	21	58.3	7.4
Inflammatory	6	16.7	2.1
Traumatic	3	8.3	1.1
Other	6	16.7	2.1
Corneal			
Ulcerative keratitis	119	70.8	42.0
Simple ulcer	13	10.9	4.6
Complex ulcer	71	59.7	25.1
Indolent ulcer	2	1.7	0.7
Complex and indolent ulcer	7	5.9	2.5
Corneal laceration	5	4.2	1.8
Corneal foreign body	4	3.4	1.4
Not specified	17	14.3	6.0
Non-ulcerative keratitis	49	29.2	17.3
Immune-mediated keratitis	7	14.3	2.5
Eosinophilic keratoconjunctivitis	13	26.5	4.6
Equine herpesvirus 1 keratitis	3	6.1	1.1
Stromal abscess	17	35.7	6.0
Not specified	9	18.4	3.2
Iridocorneal			
Primary glaucoma	0	0.0	0.0
Secondary glaucoma	13	92.9	4.6
Idiopathic glaucoma	1	7.1	0.4
Lenticular			
Incipient cataract	51	71.2	18.0
Anterior subcapsular/cortical	33	46.5	11.7
Anterior and posterior subcapsular/cortical	4	5.6	1.4
Posterior subcapsular/cortical	7	9.9	2.5
Unspecified location	7	9.9	2.5
Immature cataract	11	15.5	3.9
Mature cataract	8	11.3	2.8
Hypermature cataract	1	1.4	0.4
Uveal			
Uveitis	123	84.8	43.5
Equine recurrent uveitis	43	35.0	15.2
Secondary to other ocular disease	58	46.3	20.5
Inactive, previous uveitis	7	5.7	2.5
Not specified	15	13.0	5.3
Uveal cyst	22	15.2	7.8
Posterior segment			
Retinal detachment	9	20.0	3.2
Chorioretinal lesions	28	62.2	9.9
Retinal atrophy	1	2.2	0.4
Other	7	15.6	2.5

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diagnosed in 3.4% of ulcerated horses (4/119), and it was not possible to further classify the ulcerative keratitis in 14.3% of ulcerated horses (17/119). Regarding horses with non-ulcerative keratitis, 14.3% of horses were diagnosed with immune-mediated keratitis (7/49), 26.5% with eosinophilic keratoconjunctivitis (13/49), and 6.1% with equine herpesvirus 1-associated keratitis (3/49). Stromal abscesses were present in 35.7% of horses with non-ulcerative keratitis (17/49). It was not possible to further classify the non-ulcerative keratitis in 18.4% of horses (9/49).

The third-most common ocular anomaly was cataracts, in 25.1% of horses (71 horses) (Table 3). There were 71.2% incipient cataracts (51/71) that were further subdivided by location, as 46.5% incipient anterior cortical or subcapsular cataract (33/71), 5.6% incipient anterior and posterior cortical or subcapsular cataract (4/71), 9.9% posterior cortical

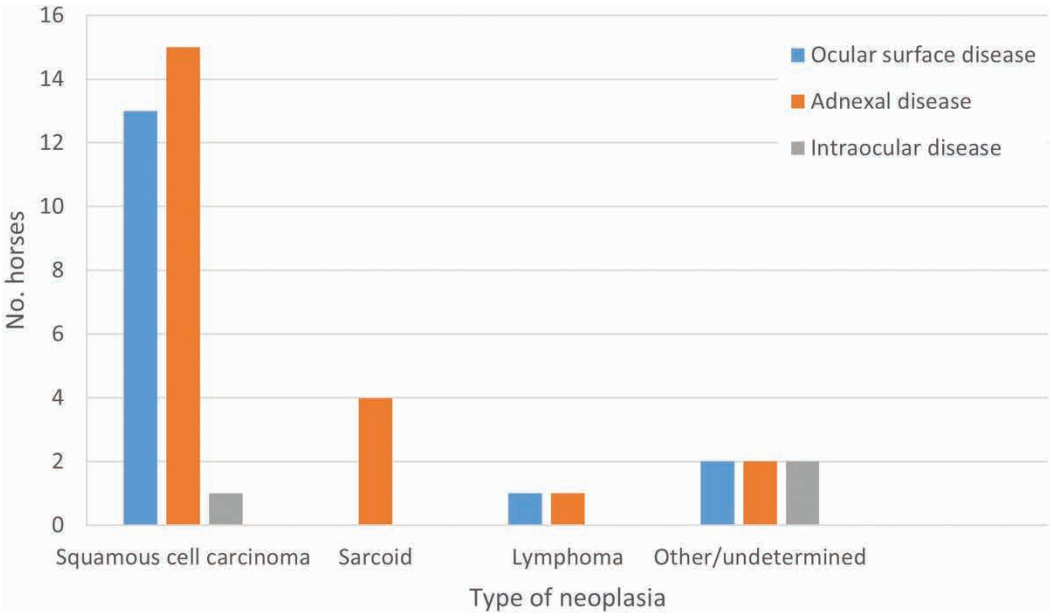

FIGURE 1. Distribution of ocular neoplastic disease in horses presented to Ontario Veterinary College Health Sciences Centre (Guelph, Ontario) from January 2011 to December 2021. The locations of ocular neoplasia were not mutually exclusive.

or subcapsular cataract (7/71), and 9.9% unspecified incipient cataract location (7/71). There were 15.5% of immature cataracts (11/71), 11.3% of mature cataracts (8/71), and 1.4% of hypermature cataract (1/71).

Posterior segment pathology was present in 15.9% of horses (45 horses) (Table 3). Of the horses with posterior segment lesions, 20.0% had a retinal detachment (9/45), 62.2% had chorioretinal lesions (28/45), and 2.2% had retinal atrophy (1/45). There were 15.6% of cases with other posterior segment lesions (7/45) such as small, incidental peripapillary colobomas or retinal folds.

Adnexal disease was diagnosed in 12.7% of horses (36 horses) (Table 3). Horses with neoplastic adnexal lesions represented 58.3% of cases (21/36), inflammatory adnexal disease was diagnosed in 16.7% of cases (6/36), and traumatic adnexal lesions were present in 8.3% of cases (3/36). There were 16.7% of cases with other adnexal disease (6/36), such as entropion or aberrant eyelashes.

Uveal cysts were present in 7.8% of horses (22 horses). Glaucoma was diagnosed in 4.9% of horses (14 horses), in which 92.9% of these cases were considered secondary glaucoma (13/14) and 7.1% were idiopathic glaucoma (1/14). Horses with orbital disease represented 2.8% of horses (8 horses).

Ocular neoplasia was present in 12.7% of horses (36 horses) (Figure 1). Of these horses, squamous cell carcinoma was the most common neoplastic diagnosis (69.4%, 25/36), followed by sarcoids (11.1%, 4/36) and lymphoma (5.6%, 2/36). The type of neoplasia was not specified in 13.9% of cases (5/36). The adnexa were the most common location for ocular neoplastic disease (58.3%, 21/36), followed by corneal or conjunctival disease (36.1%, 13/36) and intraocular disease (8.3%, 3/36). The locations of ocular neoplasia were not mutually exclusive.

TABLE 4. Ocular diseases of enucleated globes in horses presented to OVC-HSC from January 2011 to December 2021.

Disease category	*n*	% of enucleated globes
Corneal		
Ulcerative keratitis		
Complex ulcer	19	36.5
Indolent ulcer	1	1.9
Non-ulcerative keratitis		
Immune-mediated keratitis	1	1.9
Eosinophilic keratoconjunctivitis	1	1.9
Stromal abscess	6	11.5
Not specified	1	1.9
Iridocorneal		
Secondary glaucoma	6	11.5
Idiopathic glaucoma	1	1.9
Uveal		
Uveitis		
Equine recurrent uveitis	7	13.5
Not specified	2	3.8
Posterior segment		
Retinal detachment	1	1.9
Neoplasia	6	11.5

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TABLE 5. Histopathologic diagnoses and clinical agreement for horses with ocular disease presented to OVC-HSC from January 2011 to December 2021. The histopathologic diagnoses were not mutually exclusive.

Disease category	*n*	Submitted tissue	Clinical agreement (%)
Adnexal disease			
Neoplastic	14	Eyelid — 6	
		Eyelid and conjunctiva — 3	
		Globe — 3	
		Nictitans — 1	100.0
Inflammatory	4	Eyelid — 2	
		Eyelid and conjunctiva — 2	25.0
Corneal			
Ulcerative keratitis			
Bacterial keratitis	4	Cornea — 3	
		Globe — 1	100.0
Mycotic keratitis	4	Cornea — 2	
		Globe — 2	100.0
No evidence of infectious organisms	21	Cornea — 12	
		Cornea and conjunctiva — 3	
		Globe — 6	100.0
Non-ulcerative keratitis			
Eosinophilic keratoconjunctivitis	6	Cornea — 5	
		Cornea and conjunctiva — 1	100.0
Stromal abscess	3	Globe — 3	66.7
Iridocorneal			
Secondary glaucoma	1	Globe — 1	100.0
Idiopathic glaucoma	1	Globe — 1	100.0
Uveal			
Uveitis			
Equine recurrent uveitis	6	Globe — 6	100.0
Secondary to other ocular disease	3	Globe — 3	100.0
Not specified	2	Globe — 2	100.0
Posterior segment			
Retinal detachment	4	Globe — 4	100.0
Neoplasia			
Squamous cell carcinoma	19	Conjunctiva — 1	
		Cornea and conjunctiva — 5	
		Eyelid — 7	
		Eyelid and conjunctiva — 1	
		Globe — 1	
		Nictitans — 4	100.0
Sarcoid	3	Eyelid — 2	
		Globe — 1	100.0
Lymphoma	1	Conjunctiva — 1	100.0
Other	2	Cornea and conjunctiva — 2	50.0
Histopathologic diagnosis not available	2	Conjunctiva — 1	
		Eyelid — 1	0.0

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Ocular lesions suspected to be traumatic in origin were present in 8.8% of horses (25 horses). Ocular manifestations of systemic disease, most commonly extensions of neurologic disease, were present in 5.7% of horses (16 horses). Suspected or confirmed neurologic diseases included equine protozoal myeloencephalitis, intracranial neoplasia, and cervical vertebral stenotic myelopathy. Ocular lesions secondary to systemic disease included cranial nerve deficits, active or inactive chorioretinal lesions, and exophthalmos secondary to orbital extension of intracranial neoplasia.

Medical management was pursued for 37.8% of horses (107 horses), whereas combined medical and surgical management was elected in 50.1% of cases (144 horses). Enucleation was done in 18.4% of horses (52 horses) (Table 4). No ocular treatments were applied in 11.3% of horses (32 horses), including those for which monitoring was recommended (12 horses) or those for which euthanasia was elected (6 horses). Ocular tissue samples were submitted for histopathologic analysis in 25.4% of cases (72 horses) (Table 5). There was 90.3% agreement between the clinical and histopathologic diagnoses (65 horses);

9.7% of cases (7 horses) did not have agreement. For 2 cases without clinical and histopathologic agreement, the histopathology results were not available for review as the samples were submitted by the owner. In the 3rd case, a chalazion was suspected clinically, but was determined on histopathology to be a focal eosinophilic granuloma adjacent to the meibomian gland. Squamous cell carcinoma was suspected in the 4th and 5th cases, with histopathology revealing focal epithelial hyperplasia with depigmentation and stromal granulation tissue and lymphoma, respectively. The 6th case involved a suspected fungal corneal stromal abscess, whereas the histologic features observed were not typical of mycotic keratitis. The final case without clinical and histopathologic agreement involved a chronic history of an eyelid sarcoid that had been previously diagnosed through biopsy and histopathology. Inflammatory lesions observed on histopathology represented a reaction to the prior injected material or necrosis of prior neoplastic tissue.

DISCUSSION

This is the first study reporting on the demographics and prevalence of ocular disease in a large referral population of horses in Ontario. The most prevalent ocular disease in this population was uveitis. Most commonly, uveitis was identified as secondary to other ocular disease, such as ulcerative keratitis. Equine recurrent uveitis was diagnosed or suspected in our referral population in 43 horses (15.2% of all horses, 35.0% of horses with uveitis). The prevalence of ERU in the United States is estimated to range from 2 to 25% across the general equine population (16). The prevalence of ERU is lower in Europe and the United Kingdom, estimated at 8 to 10% (17) and 0.3 to 1% (18), respectively, within referral equine populations. Equine recurrent uveitis is thought to be a complex, multifactorial, immune-mediated condition, and though its pathophysiology is not yet completely understood, associations with etiologic agents such as *Leptospira* and genetic predispositions in Appaloosas and German warmbloods have been established and remain under investigation (16,18–21). In the current study, breed predilections were not identified for Appaloosa horses, and warmbloods were significantly less likely to receive a diagnosis of uveitis compared to other breeds. Possible reasons for these disparities include environmental or geographic variability, as well as a small sample size of Appaloosas (13 horses).

Ulcerative keratitis was the second-most identified ocular abnormality in this population of horses. The majority of horses were presented with complex corneal ulcers necessitating aggressive medical or surgical management. Most commonly, horses being managed for simple ulcers in this study had been presented for concurrent primary ocular disease, such as chronic glaucoma or ERU. Perhaps horses with simple ulcers alone are less likely to necessitate referral to a specialty hospital for additional management. In this study, middle-aged horses were significantly less likely to be presented with ulcerative keratitis compared to young and senior horses. Similarly, previous studies have noted that superficial, non-healing corneal ulcers tended to appear in very young (22) or older (22,23) horses. Non-ulcerative keratitis was less common in this study compared to ulcerative keratitis, with horses most often diagnosed with stromal abscesses or eosinophilic keratoconjunctivitis.

Cataracts were identified in 25.1% of cases with focal incipient anterior and/or posterior cortical cataract as the most common presentations. These cataracts were considered incidental findings and unlikely to progress; however, as long-term follow-up with serial ophthalmic examinations was rare in this study, it was not possible to assess for any potential cataract progression and associated clinical significance. Cataracts were reported in previous breed-specific equine ophthalmic surveys (1,3–7,9). No specific breed or age predilections were identified in the current study.

In this study, posterior segment disease most commonly involved an inactive focal to multifocal chorioretinopathy, with bullet-hole lesions more prevalent than butterfly circumpapillary lesions. As these lesions are both typically nonprogressive and non-vision-threatening, they are often considered incidental findings with no appreciable visual compromise (1,13,24). Chorioretinal scars in the horse have been associated with previous systemic infections with equine herpesvirus-1, adenovirus, neonatal septicemia, or *Streptococcus equi* var. *equi,* among other etiologic agents (4,24,25). Whereas circumpapillary lesions have conventionally been thought to be associated with ERU, Mathes *et al* reported that depigmented punctate chorioretinal foci in horses with no other fundic pathology are not indicative of, or associated with, ERU (25).

In this study population, both ocular neoplasia and adnexal disease occurred at a prevalence of 12.7% (36 horses). Although these categories were not mutually exclusive, most adnexal disease was neoplastic in origin. In this study, both adnexal disease and neoplasia were significantly more prevalent in draft horses compared to other horses. This finding was in accordance with previous reports of an overrepresentation of draft horses with ocular

squamous cell carcinoma (6,26–28). Further, a missense mutation in the damage-specific DNA binding protein 2 (DDB2, c.1013C > T p.Thr338Met) has been identified as a recessive genetic risk factor for ocular squamous cell carcinoma in Haflingers (29) and Belgian drafts (30). The current study also identified that young horses were, unsurprisingly, significantly less likely to have neoplasia when compared to middle-aged and senior horses.

The present study also identified that young horses had a significantly lower proportion of uveal cysts compared to middle-aged and senior horses. The average ages for horses being treated for uveal cysts were 10.4 and 12 y in 2 studies (31,32). Senior horses were also more likely to receive a diagnosis of glaucoma in this study, which is in line with previous reports (33).

The main limitation of this study was related to its inherent retrospective nature. Medical records contained variable levels of detail, particularly regarding the progression of cases in which horses were hospitalized for prolonged intervals. Similarly, it was not always possible for ophthalmologists to conduct follow-up examinations. Of the horses that received enucleations, a minority of the removed globes were submitted for histopathologic analysis. In many cases, it was therefore not possible to confirm the diagnosis or identify histologic findings that may not have been evident on clinical examination. Another limitation was that the study population comprised horses presented to a referral and specialty hospital. As such, the population may not have been an accurate representation of all horses residing in Ontario. It is possible that these results were skewed toward more severe ocular diseases that necessitated the expertise of Board-certified ophthalmologists at a referral hospital.

In conclusion, this study identified uveitis, ulcerative keratitis, and cataract as the most common ocular abnormalities present in a large population of horses evaluated at a referral center in Ontario. These data highlighted age groups and breeds more or less susceptible to specific ocular disorders, can serve as a reference for practitioners, and set a baseline for future studies. CVJ

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ARTICLE

Outcomes of total cystectomy with medical treatment in canine urothelial carcinoma of the bladder trigone

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ABSTRACT

Objective

This study aimed to evaluate outcomes and complications in dogs with urothelial carcinoma (UC) of the bladder trigone treated with total cystectomy using uretero-prepuce/vagina/cutaneous anastomosis combined with medical treatment.

Animals

Twenty-one dogs.

Procedure

Total cystectomy was completed as follows: The whole bladder and urethra were removed, and the ureters were anastomosed to the skin in 1 case and to the vagina in 9 cases in females. The entire bladder, prostate, urethra, and penis were removed, and the ureters were anastomosed to the prepuce in 11 males. Medical treatments were administered to all dogs after surgery.

Results

Short-term surgical complications included diarrhea (16 dogs), acute kidney injury (2 dogs), and dehiscence of the ureterovaginal anastomosis (3 dogs). Long-term surgical and medical complications included pyelonephritis (11 dogs) and chronic kidney disease (5 dogs). In the survival analysis, median survival time from the initial diagnosis in all cases was 481 d, which was longer than the previously reported median survival time in dogs with UC involving the trigone.

Conclusion and clinical relevance

Total cystectomy combined with medical treatment prolonged overall survival compared with medical, surgical, or stenting procedures in dogs with UC involving the trigone.

RÉSUMÉ

Résultats de la cystectomie totale avec traitement médical dans le carcinome urothélial canin du trigone de la vessie

Objectif

Cette étude visait à évaluer les résultats et les complications chez les chiens atteints d'un carcinome urothélial (CU) du trigone de la vessie traités par cystectomie totale utilisant une anastomose urétéro-prépuce/vagin/cutanée associée à un traitement médical.

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Unpublished supplementary material (Tables S1–S3) is available online from: Supplementary Materials.

Animaux

Vingt-et-un chiens.

Procédure

La cystectomie totale a été réalisée comme suit : la vessie et l'urètre ont été entièrement retirés et les uretères ont été anastomosés à la peau dans 1 cas et au vagin dans 9 cas chez les femelles. La vessie, la prostate, l'urètre et le pénis ont été entièrement retirés et les uretères ont été anastomosés au prépuce chez 11 mâles. Des traitements médicaux ont été administrés à tous les chiens après la chirurgie.

Résultats

Les complications chirurgicales à court terme comprenaient la diarrhée (16 chiens), une lésion rénale aiguë (2 chiens) et une déhiscence de l'anastomose urétérovaginale (3 chiens). Les complications chirurgicales et médicales à long terme comprenaient une pyélonéphrite (11 chiens) et une maladie rénale chronique (5 chiens). Dans l'analyse de survie, la durée médiane de survie à partir du diagnostic initial dans tous les cas était de 481 jours, ce qui était plus long que la durée médiane de survie précédemment rapportée chez les chiens atteints de CU impliquant le trigone.

Conclusion et pertinence clinique

La cystectomie totale associée à un traitement médical a prolongé la survie globale par rapport aux procédures médicales, chirurgicales ou de pose de stent chez les chiens atteints de CU impliquant le trigone.

(Traduit par Dr Serge Messier)

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INTRODUCTION

Urinary bladder urothelial carcinoma (UC) is the most common tumor of the urinary tract in dogs, accounting for ~2% of all canine malignancies (1). Most canine UC extensively invades the bladder wall and mimic human invasive bladder cancer, based on pathological findings. In addition, canine UC frequently originates from or invades the bladder trigone, where complete resection by partial cystectomy is virtually impossible, resulting in obstruction of the ureter and/or urethra in many cases (2). Medical treatment is essential, and various protocols have been reported using NSAIDs, cytotoxic chemotherapeutic drugs, and molecular targeted drugs, alone or in combination (3). Recently, clinical efficacies were reported for several molecular targeted drugs, including a multi-kinase inhibitor (toceranib), an anti-CCR4 antibody (mogamulizumab), a tyrosine kinase inhibitor (lapatinib) targeting epidermal growth factor receptor and human epidermal growth factor receptor 2, and a v-Raf murine sarcoma viral oncogene homolog B (BRAF) inhibitor (vemurafenib) (4,5). Although medical treatments have improved outcomes in dogs with UC, ureter or urethral obstruction caused by tumor invasion remains a lethal problem in many cases.

In humans, total cystectomy is a common surgical procedure for patients with invasive bladder tumors and is endorsed by global guidelines (6). In dogs, the first case series of total cystectomy with ureterocolonic anastomosis was reported as a completely resectable surgery for UC invading bladder trigone. However, all dogs showed azotemia due to intestinal recycling of urea or infectious pyelonephritis (7). A novel total cystectomy surgery by uretero-prepuce/vagina/uterus/cutaneous anastomosis was reported and feasibility of these procedures was confirmed (8–10). However, the median survival times (MST) post-surgery reported in the 2 case series were 278.6 d (10) and 385 d (8), in which most cases were treated with surgery exclusively. Compared with previous reports of medical treatment alone [MST: 176 to 344 d (1)], total cystectomy did not improve outcomes markedly, mainly due to tumor recurrence and/or metastasis. This study aimed to evaluate the outcomes in dogs with UC of the bladder trigone treated with total cystectomy using uretero-prepuce/vagina/cutaneous anastomosis combined with medical treatment.

MATERIALS AND METHODS

Case selection and retrospective survey

Data were collected through a retrospective survey of the medical records of 21 dogs (10 females and 11 males) with UC of the urinary bladder invading the trigone that were treated with total cystectomy combined with medical treatment at the Veterinary Medical Center, The University of

Tokyo, between April 2016 and November 2021. Clinical data, including sex, age, breed, body weight (BW), surgical technique, operation time, histopathological diagnosis, complications, medical treatments, and cause and date of death, were recorded based on electronic medical records. All pathological diagnoses were made by veterinary pathologists certified by the Japanese College of Veterinary Pathologists, Department of Veterinary Pathology, The University of Tokyo. Informed consent for the use of data in this study was obtained from the owners of all study dogs.

Initial diagnosis and preoperative evaluation

In all cases, physical examination, complete blood (cell) count, serum chemical analysis, urinalysis, abdominal ultrasound, and thoracic and abdominal radiography were completed at the initial visit and after surgery. Preoperative diagnosis was based on the cytopathology of urine sediment and the urinary BRAF gene mutation examination, and postoperative diagnosis was based on the histopathology of the resected tissues in all cases. The $BRAF^{V595E}$ gene mutation was examined by digital PCR assay, as previously described (11). Lung, lymph node, and bone metastases were evaluated post-surgery using ultrasound and radiography in all cases and using computed tomography (CT) in selected cases (19 cases). For the CT scans, an IV infusion of lactated Ringer's solution (Lactated Ringer's Solution "FUSO"; Fuso Pharmaceutical Industries, Osaka, Japan) was started 1 h before the scan, at 3 to 5 mL/kg per hour. During the scan, iohexol (IOHEXOL300 injection; Fuji Pharma, Toyama, Japan), 2mL/kg, was administered rapidly, and 3-phase computed tomographic angiography was completed. After receiving a CT scan, 4 dogs underwent surgery immediately and 15 dogs were recovered from anesthesia and continued receiving IV infusion for about 1 h.

The clinical stages were defined based on the World Health Organization tumor, node, metastasis classification of tumors in domestic animals (12). The T1 and T2 stages were not separately defined and were denoted as T1-2.

Medical treatment

Preoperative medical treatments were applied in all cases. Treatments included NSAIDs alone (piroxicam) in 10 dogs, NSAIDs (piroxicam) with lapatinib in 5, NSAIDs (piroxicam) with sorafenib in 2, NSAIDs (piroxicam) with mogamulizumab in 2, NSAIDs (piroxicam) with toceranib in 1, and NSAIDs (piroxicam) with mitoxantrone and sorafenib in 1. Clinical responses were evaluated according to the RECIST criteria (13).

Postoperative medical treatments were applied in 20 dogs. Treatments included NSAIDs alone (piroxicam) in 6 dogs; NSAIDs (piroxicam in 5 dogs and firocoxib in 1) with lapatinib in 6; NSAIDs (piroxicam) with mogamulizumab in 4; and sorafenib alone, toceranib alone, NSAIDs (firocoxib) with toceranib, and NSAIDs (piroxicam) with mitoxantrone in 1 dog each.

Analgesia/anesthesia and surgery

Before induction of anesthesia, atropine (Atropine sulfate injection, 0.5 mg; Nipro Es Pharma, Osaka, Japan), 10 μg/kg BW; fentanyl (Fentanyl injection, 0.25 mg; Terumo, Tokyo, Japan), 3 to 5 μg/kg BW; and ketamine (Ketalar for intramuscular injection, 500 mg; Daiichi Sankyo Propharma, Tokyo, Japan), 0.3 to 0.5 mg/kg BW, were administered IV as premedication. Propofol (1% propofol; Maruishi Pharmaceutical, Osaka, Japan), 6 to 8 mg/kg BW, IV, was administered for induction of anesthesia. Anesthesia was maintained using isoflurane (ds isoflurane; Bussan Animal Health, Osaka, Japan). For intraoperative analgesia, dogs received fentanyl constant-rate infusion (CRI), 10 to 20 μg/kg per hour; ketamine CRI, 1 to 5 mg/kg per hour; and epidural bupivacaine (Marcain Injection 0.5%; Sandoz Pharma KK, Tokyo, Japan), 1 mg/kg BW, with morphine (Morphine hydrochloride injection 10 mg; Daiichi Sankyo Propharma, Tokyo, Japan), 0.1 mg/kg BW. Anesthetic management was employed with a mean target blood pressure > 60 mmHg, using constant infusion of crystalloid liquid and ephedrine (Ephedrine Hydrochloride 40 mg; Nichi-Iko Pharmaceutical, Toyama, Japan), 0.1 mg/kg BW, IV, and norepinephrine CRI (Noradrenalin injection 1 mg; Alfresa Pharma, Osaka, Japan), 0.05 to 0.2 μg/kg per minute BW, if needed. The SpO_2 was maintained at $> 95\%$ and $ETCO_2$ was controlled within the range of 35 to 55 mmHg using spontaneous or controlled breathing. The body temperature was maintained between 36 and 38°C. For additional postoperative analgesia, fentanyl CRI, 3 to 5 μg/kg per hour, was administered, depending on the pain status. Cefazolin (Rasenazolin; Nichi-Iko Pharmaceutical, Toyama, Japan), 20 mg/kg BW, was administered IV q2h during surgery and q8h for 2 d after surgery.

Total cystectomy using uretero-prepuce/vagina/cutaneous anastomosis and its variant methods was as previously described (8,10). In females, the whole bladder and urethra were removed, and ureters were anastomosed to the skin in 1 dog and to vagina in 9 dogs. In 4 of 9 dogs, a ureter was anastomosed to the vaginal end (end-to-end anastomosis) and the other was anastomosed to a hole

made with a trepan on the side of the vagina (end-to-side anastomosis). In another 4 of 9 dogs, the left and right ureters were anastomosed into a single "V" shape, which was then anastomosed to the vaginal end. In 1 of 9 dogs, both ureters were transplanted into the vagina with 2 separate holes made by a trepan (end-to-side anastomosis). In males, the entire bladder, prostate, urethra, and penis were removed, and ureters were anastomosed to the prepuce in all cases. To anastomose the ureter and prepuce, prepuces were punched using a dermal punch in all cases. Abdominal walls were punched using a dermal punch in 7 dogs, a 1 to 2-centimeter incision of the rectus abdominis muscle was made in 3 dogs, and the method was unrecorded in 1 dog. Histopathological margins of the resected tissue were evaluated in all cases, except for male dogs in which the urethra and penis were completely resected. Scheduling for surgery was decided based on tumor progression owing to a lack of response to preoperative medical treatment, and on owner and veterinarian decisions. The group that underwent surgery within 2 wk of the initial diagnosis was defined as the "early surgery" group, and the group that underwent surgery $>$ 2 wk after the initial diagnosis was defined as the "late surgery" group. Incontinence was managed using a disposable diaper changed several times daily.

Definitions of complications

Medical complications were evaluated according to the VCOG-CTCAE criteria (14) in the pre- and postoperative periods.

Complications that occurred before surgery were defined as preoperative medical complications. Data on preoperative medical complications in the dogs treated with sorafenib could not be collected due to data-masking requirements for the prospective clinical trial.

Complications observed after surgery until discharge from the Veterinary Medical Center, The University of Tokyo were defined as short-term surgical complications; those after discharge were defined as long-term surgical and medical complications. For postoperative complications, the following additional criteria were used. According to the International Renal Interest Society (IRIS) staging guidelines (15), postoperative oliguria or anuria indicates acute kidney injury (AKI). Postoperative pyelonephritis was diagnosed based on ultrasound findings of the kidneys, urinalysis, bacterial culture of the urine, and clinical signs. Hydronephrosis and ureteral obstruction were diagnosed using ultrasonography. Elevated blood creatinine concentration was defined as chronic kidney disease (CKD), based on the IRIS staging guidelines, using the most abnormal blood examination data during the observation period. Dogs diagnosed with CKD before surgery were excluded from the postoperative CKD group.

Statistical analyses

Survival curves and MST were calculated using the Kaplan–Meier method, and univariate analyses used the log-rank test. The MST from the initial diagnosis were compared by the types of preoperative medical treatments, sex, and timing of surgery; MST from the surgery were compared by sex. Length of operation time by sex was compared using the *t*-test. The incidence of AKI according to whether preoperative CT was taken on the day of surgery or on a different day was analyzed using Fisher's exact test. Statistical significance was set at $P < 0.05$. Statistical analyses used SAS Viya software (SAS Institute Austria, Vienna, Austria) and StatView software (SAS Institute Japan, Tokyo, Japan).

RESULTS

Clinical characteristics of the cohort

Twenty-one dogs that underwent total cystectomy combined with medical therapy were included in this study. The dogs included 10 females (7 neutered and 3 intact) and 11 males (9 neutered and 2 intact) with a median age of 11 y (range: 7 to 14 y) and a median BW of 6.2 kg (range: 2.6 to 13.6 kg). Shetland sheepdog and Pomeranian (3 each) were the most common breeds; followed by French bulldog, Jack Russell terrier, and miniature dachshund (2 each); and toy poodle, Scottish terrier, Yorkshire terrier, Welsh corgi, miniature schnauzer, Chihuahua, papillon, mongrel, and Cavalier (1 each). A $BRAF^{V595E}$ gene mutation was observed in 12/20 (60.0%) dogs. The clinical stages at initial diagnosis were T1-2N0M0 in 18 dogs, T3N0M0 in 2, and T1-2N1M0 in 1. A summary of case data is shown in Table S1 (available online from: Supplementary Materials).

Outcomes and complications of preoperative medical treatment

Clinical responses to preoperative medical treatment were evaluated, except for 6 dogs that underwent surgery within 2 wk of the initial diagnosis (early surgery group). Among the 4 dogs that received NSAIDs alone, 2 had progressive disease and 2 had stable disease but progressed and underwent surgery at a median of 62 d (range: 43 to 82 d) from the initial diagnosis. The other 5 dogs that received NSAIDs and lapatinib showed a partial response for a median of 169 d (range: 54 to 394 d) but then progressed

TABLE 1. Short-term postoperative complications.

Female (n = 10)	Number of cases	Male (n = 11)	Number of cases
Diarrhea	8	Diarrhea	8
Acute kidney injury	2	Pyelonephritis	1
Ureteral anastomosis dehiscence	3	Ureteral obstruction	1
Euthanasia (acute kidney injury)	1		

TABLE 2. Long-term surgical and medical complications.

Complication	Female (n = 9)	Male (n = 11)	Total incidence
Pyelonephritis	6	5	55.0%
Chronic kidney disease	2	3	27.8%[a]
Gastrointestinal disorders (vomiting or diarrhea)	2	1	15.0%
Aspiration pneumonia	1	0	5.0%
Elevated alanine aminotransferase	0	1	5.0%
Erythema multiforme	1	0	5.0%

[a] In males, there were 2 cases with preoperative chronic kidney disease (n = 9).

and underwent surgery at a median of 232 d (range: 62 to 475 d) from the initial diagnosis. Two dogs that received NSAIDs and mogamulizumab showed stable disease for 225 and 177 d, but the disease progressed and they underwent surgery on 265 and 182 d, respectively, after initial diagnosis. Of the other 2 dogs that received NSAIDs and sorafenib, 1 showed partial response for 146 d and the other showed stable disease to progressive disease; these dogs underwent surgery at 396 and 153 d, respectively, after initial diagnosis. A dog that received NSAIDs, mitoxantrone, and sorafenib showed stable disease after 2 rounds of treatment with mitoxantrone, but was switched to sorafenib owing to myelosuppression. Although partial remission was achieved for 151 d with sorafenib combined with NSAIDs, the disease subsequently progressed, and surgery was done 477 d after initial diagnosis. Another dog that received NSAIDs and toceranib showed stable disease for 619 d with NSAIDs alone, but then progressed, and toceranib was added. However, the dog showed disease progression, and surgery was done 670 d after initial diagnosis. There were no statistically significant differences in the clinical responses to each preoperative medical treatment (P = 0.1859). A summary of these data is shown in Table S2 (available online from: Supplementary Materials).

Complications of preoperative medical treatment included vomiting or diarrhea in 4 dogs [all Grade (G) 2], elevated BUN (G1, G1, G2, G3) or creatinine (G2) in 4, elevated alanine aminotransferase (G2, G3) in 2, and skin hypopigmentation (G1) and bone marrow suppression (G3) in 1 dog each.

Surgical records and short-term surgical complications

The median operation time was 219 min (range: 170 to 306 min) for females and 228 min (range: 111 to 277 min) for males, with no significant difference in operation time between sexes (P = 0.8579). Of the 10 females, the resection margin of the ureter was complete in 9. In 1 dog, the resected margins were incomplete. The resected margin of the urethra was complete in 5 and incomplete in 5 dogs. No recurrence at the urethral resection site was observed in any case. Of the 11 males, the ureteral resection margin was complete in 8. In 2 dogs, the resected margins were incomplete, and tumor recurrence was observed in 1. In the other dog, the resection margin was unrecorded (Table S3, available online from: Supplementary Materials).

The short-term surgical complications are summarized in Table 1. Short-term surgical complications were observed in 9 of 10 female and 9 of 11 male dogs. Diarrhea was observed in 8 female and 8 male dogs, and a median of 14 d (range: 7 to 105 d) were required for recovery.

There was AKI in 2 of the 19 dogs that underwent contrast-enhanced CT scanning before surgery. There was a statistically significant difference in incidence of AKI between dogs for which CT was used on the day of surgery (2 of 4) and dogs that were scanned > 1 d before surgery (0 of 15) (Fisher's exact test, P = 0.0351). Both dogs with AKI required peritoneal dialysis: 1 recovered and 1 was euthanized because there was no improvement.

Dehiscence of the ureterovaginal anastomosis was observed in 3 female dogs. Three cases of dehiscence of the ureterovaginal anastomosis were observed in 2 neutered dogs and 1 intact dog. Among these cases, 2 required reanastomosis surgery. Pyelonephritis was observed in 1 male. Dogs with pyelonephritis were treated with antibiotics, which resulted in improvement. Obstruction of the ureteral orifice caused by debris-like material was observed in 1 male. The obstruction was relieved by catheter insertion.

Outcomes and complications of long-term surgical and medical treatment

Long-term surgical and medical complications were evaluated in 20 dogs that survived the perioperative period (Table 2). Complications included gastrointestinal (G2 vomiting or

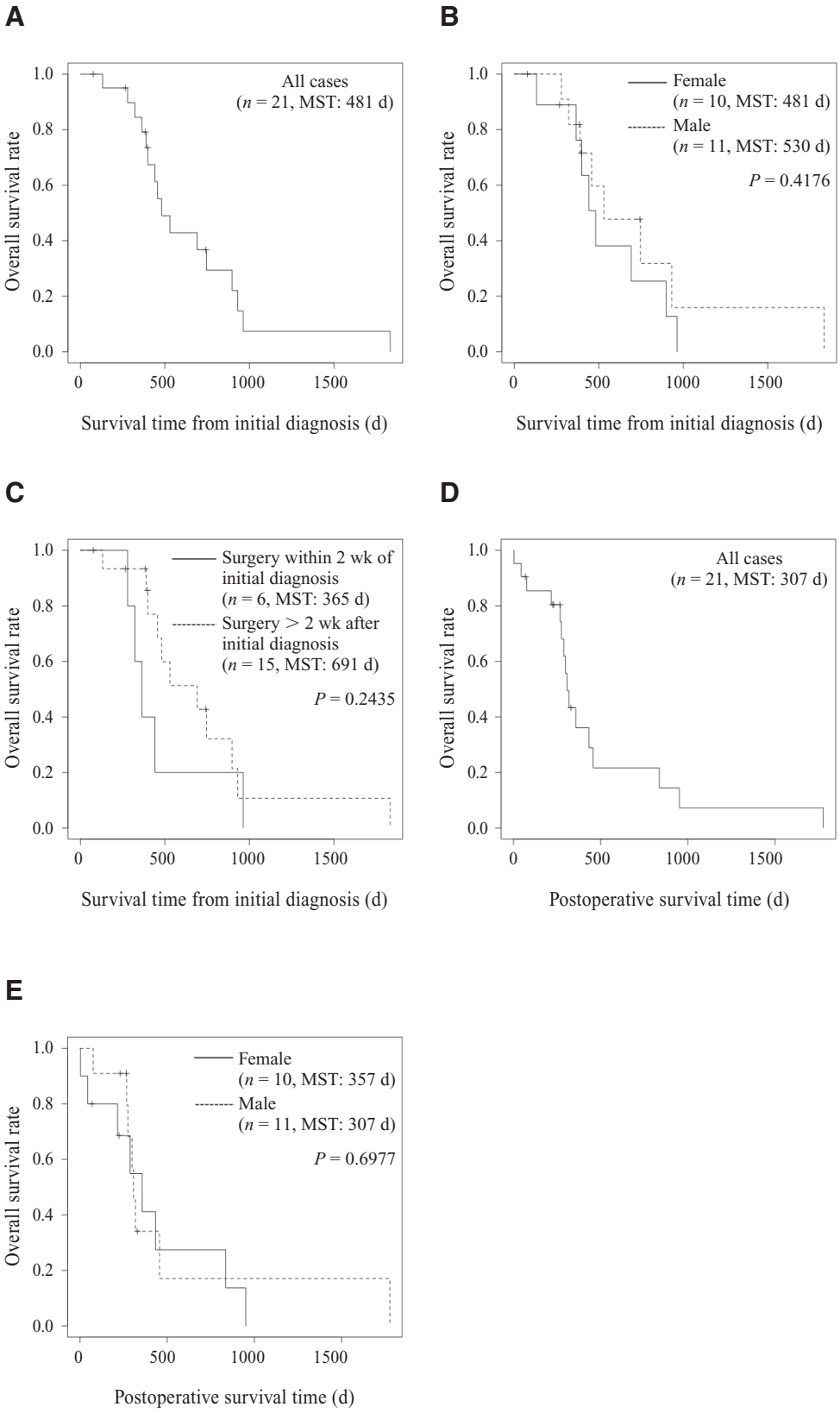

FIGURE 1. Survival analyses of the dogs treated with total cystectomy combined with medical treatment. Kaplan–Meier curves depicting survival time from the initial diagnosis for all dogs (A) and the effects of sex (B) and surgery timing (C); and postoperative survival time for all dogs (D) and the effect of sex (E).

MST — Median survival time.

TABLE 3. Characteristics of dogs with longer survival times.

Case No.[a]	Breed	Age	TNM stage at surgery	Preoperative treatment	Postoperative treatment	Surgical margin	Short-term complications	Long-term complications	Cause of death	Postoperative survival time (d)
1	Scotch terrier	9 y 3 mo	T2N0M0	Piroxicam	Piroxicam	Ureter: clear Urethra: dirty	None	Chronic kidney disease	Renal failure	951
4	Welsh corgi	10 y 9 mo	T2N0M0	Piroxicam Lapatinib	Piroxicam Lapatinib	Ureter: clear Urethra: clear	Ureteral anastomosis dehiscence Diarrhea	Pyelonephritis	Renal failure	836
11	Chihuahua	7 y 5 mo	T1N0M0	Piroxicam	Piroxicam Mitoxantrone	Ureter: clear	Diarrhea	None	Heart and renal failure	1777

TNM — World Health Organization tumor, node, metastasis classification of tumors in domestic animals.
[a] Case No. corresponds to Case No. in Table S1 (available online from: Supplementary Materials).

diarrhea) in 3 dogs, and pancreatitis (G2), aspiration pneumonia (G3), erythema multiforme (G1), and elevated alanine aminotransferase (G3) in 1 each. Urinary tract-related complications were frequently observed; pyelonephritis was observed in 11/20 (55.0%) dogs and CKD in 5/18 (27.8%) dogs. Two were not included in this criterion because of preoperative CKD. Based on antimicrobial susceptibility testing, pyelonephritis responded well to medical treatment using antibiotics; however, disease recurrence was observed in 4 dogs. Chronic kidney disease was categorized as IRIS Stage 2 in 2 dogs and Stage 3 in 3.

In the survival analysis, the MST from the initial diagnosis in all cases was 481 d (Figure 1 A). There was no significant difference in MST from the initial diagnosis between sexes [female (n = 10) *versus* male (n = 11): 481 d (range: 77 to 963 d) *versus* 530 d (range: 279 to 1833 d), P = 0.4176; Figure 1 B]. Comparing the early surgery group and the late surgery group, the MST from initial diagnosis in the late surgery group tended to be longer than that in the early surgery group, though the difference was not significant [early surgery group (n = 6) *versus* late surgery group (n = 15): 365 d (range: 77 to 963 d) *versus* 691 d (range: 132 to 1833 d), P = 0.2435; Figure 1 C]. The postoperative MST of the 21 dogs was 307 d (range: 3 to 1777 d) (Figure 1 D). There was no significant difference in postoperative MST between sexes [female (n = 10) *versus* male (n = 11): 357 d (range: 3 to 951 d) *versus* 307 d (range: 76 to 1777 d), P = 0.6977; Figure 1 E).

Tumor-related death was observed in 11/16 (68.8%) dogs, and 5 were alive during the observation period (survival times from initial diagnosis: 77, 267, 384, 397, and 743 d). Chronic kidney disease-related death was observed in 2 dogs, worsening heart and kidney disease in 1, and perioperative death in 1 (euthanasia due to AKI unresponsive to treatment). Among the non-tumor-related deaths, 3 dogs survived > 2 y after surgery; post-surgery survival times of those dogs were 836, 951, and 1777 d (Table 3). Those cases were clinical stage T1-2N0M0 at initial diagnosis, and no recurrences or metastases were observed during the observation period.

DISCUSSION

In this study, we retrospectively evaluated the outcomes and complications of dogs with UC of the bladder trigone treated with a combination of total cystectomy and medical treatments. We showed that the MST from initial diagnosis in the 21 dogs was 481 d. In previous reports, the MST of dogs treated with total cystectomy alone were 278.6 d (10) and 385 d (8). However, the MST (481 d) from initial diagnosis of the dogs treated with total cystectomy and medical therapy could not be directly compared to the MST from the other 2 studies, as neither accurately identified the preoperative medical management and survival time before surgery. In reports on medical treatment alone, the MST of dogs treated with piroxicam alone was 244 d (1), that of dogs treated with piroxicam combined with carboplatin was 161 d (16), and that of dogs treated with piroxicam combined with doxorubicin was 168 d (17). In reports on local treatment combined with medical treatment, the MST of dogs treated with urethral stents and medical treatment was 153 d (18) and that of dogs treated with ureteral stents and medical treatment was 285 d (19). Therefore, our results suggested that total cystectomy combined with medical treatment prolonged overall survival times compared with surgery or medical treatment alone or stenting procedures and medical treatment in dogs with UC involving the trigone. Moreover, there was no significant difference in the MST from the initial diagnosis between male and female dogs, suggesting that total cystectomy combined with medical treatment was beneficial regardless of sex.

Furthermore, the duration before surgery was 188 d in this study, similar to the reported MST in dogs receiving medical treatment alone (1,16,17). In general, urinary-tract obstruction is the most common cause of death in dogs receiving only medical treatment (20). Moreover, the most frequent reason for undergoing total cystectomy in this study was obstruction of the urinary tract. Total cystectomy relieved the obstruction of the urinary tract caused by urinary-tract alteration. Therefore, in this study, the longer survival in dogs could suggest that the medical treatment prolonged survival during the periods before and after surgery, as well as during the preoperative medical treatments. Further, the postoperative medical treatments and the total cystectomy prevented death caused by urinary obstruction.

However, this study did not clarify the optimal timing of surgical intervention. Theoretically, early radical surgery can completely remove gross tumor lesions and prevent systemic metastases. In contrast, surgery-induced metastasis owing to the induction of angiogenesis and suppression of antitumor immunity has been reported in clinical and preclinical settings (21). Moreover, surgery-induced metastases have been reported in canine UC (21). In fact, the dogs with complete margins in this cohort also had tumor-related deaths. The advantages and disadvantages of radical surgery complicate the optimal timing of total cystectomy in dogs with UC involving the trigone. Because the timing of surgery varied in each dog in this cohort, we evaluated the MST between dogs that underwent early surgery (365 d) and those that underwent late surgery (691 d; $P = 0.2435$). The late surgery group tended to have longer survival compared to the early surgery group, although the difference was not significant, perhaps because of low statistical power due to the small numbers. Further prospective analyses are needed to clarify the optimal timing of surgical intervention in dogs with UC involving the trigone.

As for short-term surgical complications, diarrhea might have been due to pelvic-cavity damage and inflammation associated with surgical manipulations, because the clinical signs disappeared within 15 d in most dogs. To the best of our knowledge, there is no report of diarrhea as a short-term complication in humans undergoing minimally invasive total cystectomy. Therefore, episodes of diarrhea may be prevented by the introduction of minimally invasive surgery, such as robot-assisted surgery, in dogs undergoing total cystectomy (22,23). In 2 dogs with AKI, contrast-enhanced CT was done on the day of surgery and the difference in having AKI was statistically significant ($P = 0.0351$). The cause of the relationship between AKI and contrast-enhanced CT on just the day of surgery was unknown, but there are several possible reasons. A CT scan just before surgery may prolong the anesthesia time and induce kidney injury. The CT contrast agent was reported to induce renal injury in humans (24), and CT contrast-agent injection just before surgery may have induced kidney injury in this cohort. Although further studies regarding the timing of contrast-enhanced CT scans in dogs treated with total cystectomy are needed, contrast-enhanced CT scans just before surgery may be best avoided.

Another common short-term surgical complication was dehiscence of the ureteral anastomosis in 3/24 (12.5%) cases, which was also observed in previous case series (8). In this study, all dehiscences were disruptions of the ureterovaginal anastomosis in female dogs. In female dogs, it is necessary to manipulate the ureter in the abdominal cavity within a narrow surgical field and anastomose the 2 thin ureters with different diameters to the vagina. Moreover, 2 dogs had previously undergone ovariohysterectomy, and the short remaining vagina may have caused tension at the anastomotic site. Therefore, retroperitoneal detachment and caudal transposition of the kidneys may be useful in such cases (25).

Regarding long-term surgical and medical complications, most dogs had pyelonephritis (13/23, 56.5%). Although dogs tolerated disposable diapers, urine retention or fecal contamination in the diaper could be sources of retrograde contamination. Therefore, frequent changing of disposable diapers and careful hygiene management of the ureterostomy site are important considerations to prevent pyelonephritis during long-term care.

Another common long-term surgical and medical complication was CKD (6/21, 28.5%) causing death in 17.6% dogs. In humans, deterioration of renal function was a major postoperative long-term complication, observed in 72% patients who underwent total cystectomy (26). The major causes of postoperative CKD in humans are hydronephrosis, pyelonephritis, and ureteral strictures. In this study, ≥ 1 episodes of postoperative pyelonephritis were observed in 56.5% of dogs; therefore, pyelonephritis might contribute to CKD progression. Moreover, almost all dogs were treated with NSAIDs, which significantly decreased glomerular filtration rate and caused renal damage in dogs (27). Use of NSAIDs may also contribute to CKD development. Although NSAIDs are widely used as evidence-based treatments in canine UC (1,28), more careful use, such as conducting case selection and periodic blood and urine examination, is important to reduce long-term complications and improve outcomes.

This study had several limitations. First, the small number of analyzed cases from the 6-year period of the retrospective study might not have been sufficient to reliably clarify the clinical effects of each parameter in detail, owing to low statistical power. Second, clinical procedures, such as disease staging, timing of surgery, and medical treatment protocol, varied because of the retrospective setting.

To summarize, the combination of total cystectomy and medical treatment prolonged the survival of dogs with UC involving the trigone. Moreover, this study identified several frequent complications, including diarrhea, AKI, and dehiscence, as short-term surgical complications; and pyelonephritis and CKD as long-term surgical or medical complications.

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REVIEW ARTICLE
COMPTE RENDU

Brucellosis in humans caused by *Brucella canis:* A scoping review

J. Scott Weese, Heather E. Weese

ABSTRACT

Background

Brucella canis is a potential cause of brucellosis in humans, but this disease has been poorly characterized.

Procedure

A scoping review was completed.

Results

The review yielded 24 studies that described clinical *B. canis* infection in 68 individuals. The median age was 32 y (range: 17 mo to 71 y). Fever, fatigue, headache, chills, and malaise predominated.

Specific treatments were reported for 30 individuals. A tetracycline (tetracycline, doxycycline, or minocycline) was the sole treatment or part of a combination treatment for most (21/30, 70%) individuals, followed by rifampin (9/30, 30%), trimethoprim/sulfamethoxazole (7/30, 23%), and an aminoglycoside (gentamicin, streptomycin) (7/30, 23%). Clinical outcome was reported for 35 individuals. No mortalities were reported.

A known or suspected source of exposure was reported for 56 cases; 45 (80%) were linked to dogs and 11 (20%) to laboratory exposure. Contact with pet dogs that had aborted or with aborted fetuses accounted for 31% of the canine exposures.

Conclusion and clinical relevance

Brucellosis attributed to *B. canis* can cause a wide range of clinical presentations in humans, but was similar to brucellosis caused by other *Brucella* spp. This nonspecific nature highlights the importance of identifying risk factors for exposure, to determine whether *B. canis* infection should be considered.

RÉSUMÉ

Brucellose humaine causée par *Brucella canis* : une étude de portée

Contexte

Brucella canis est une cause potentielle de brucellose chez l'homme, mais cette maladie a été mal caractérisée.

Procédure

Une étude de portée a été réalisée.

Résultats

L'examen a donné lieu à 24 études décrivant une infection clinique à *B. canis* chez 68 personnes. L'âge médian était de 32 ans (intervalle : 17 mois à 71 ans). La fièvre, la fatigue, les maux de tête, les frissons et les malaises prédominent.

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Des traitements spécifiques ont été rapportés pour 30 individus. La tétracycline (tétracycline, doxycycline ou minocycline) était le seul traitement ou une partie d'un traitement combiné pour la plupart (21/30, 70 %) des individus, suivie de la rifampicine (9/30, 30 %), du triméthoprime-sulfaméthoxazole (7/30, 23 %), et un aminoglycoside (gentamicine, streptomycine) (7/30, 23 %). Les résultats cliniques ont été rapportés pour 35 individus. Aucun décès n'a été signalé.

Une source d'exposition connue ou suspectée a été signalée pour 56 cas; 45 (80 %) étaient liés aux chiens et 11 (20 %) à une exposition en laboratoire. Le contact avec des chiens de compagnie ayant avorté ou avec des fœtus avortés représentait 31 % des expositions canines.

Conclusion et pertinence clinique

La brucellose attribuée à *B. canis* peut provoquer un large éventail de manifestations cliniques chez l'homme, mais elle est similaire à la brucellose causée par d'autres *Brucella* spp. Cette nature non spécifique souligne l'importance d'identifier les facteurs de risque d'exposition, afin de déterminer si une infection à *B. canis* doit être envisagée.

(Traduit par Dr Serge Messier)

Can Vet J 2025;66:327–334

INTRODUCTION

Brucellosis is a globally important zoonotic disease caused by bacteria of the *Brucella* genus. Most human infections are caused by *Brucella* species associated with food animals: *B. melitensis, B. abortus, B. suis* and *B. ovis*. Yet other *Brucella* species can also cause zoonotic infections.

Brucella canis is a dog-adapted *Brucella* species detected in dogs internationally (1–7). Similar to other *Brucella* spp., *B. canis* is a Gram-negative bacterium that can cause persistent infections in its reservoir species and spillover into humans. Reproductive disease is the most common clinical manifestation in dogs (7,8), but other diseases, such as diskospondylitis, can occur (9,10). However, most infected dogs have clinically inapparent infections (3,7,11).

In recent years, *B. canis* has received increasing attention because of concerns involving importation of infected dogs and the associated human risk (12–15). Yet this bacterium has been identified in a wide range of countries, and given the gaps in canine surveillance, endemic sources likely pose a risk in many, if not most, countries.

Since there has been limited study of *B. canis* in humans, the objective of this scoping review was to describe the clinical presentation, diagnosis, treatment, and exposure sources of clinical *B. canis* infections in humans internationally.

METHODS

Population

This scoping review included reports of brucellosis in humans that was attributed to *B. canis*.

Concepts

The key concepts were diagnostic approaches, clinical disease characteristics, exposure sources, treatment, and clinical outcomes.

Content

Academic literature published in English was included in this scoping review. This scoping review included publications worldwide, with no publication date restrictions.

Search strategy

The scoping study protocol was designed as per Preferred Reporting Items for Systematic Reviews and Meta-Analyses for Scoping Reviews (PRISMA-ScR) guidelines (16). The scoping review was conducted in accordance with JBI methodology for scoping reviews (17). A search of PubMed and Web of Science databases was completed on March 15, 2024, to identify publications reporting human infection with *Brucella canis*. Search terms were [Dog OR canine OR canid OR canis OR puppy] AND [Brucella OR brucellosis] AND [Human OR zoonotic OR infection]. Reference lists of included publications were reviewed for additional relevant studies.

Screening process

Only studies reporting clinical infections were eligible. "Infection" was defined as detection of *B. canis* by isolation, antigen detection (*e.g.,* PCR), or serological testing in the presence of clinical signs and symptoms that were attributed to *B. canis* infection. No date range was applied to this search. Reviews were excluded from data extraction but reference lists of reviews were hand-searched to identify primary sources not identified during the initial literature search. Studies that described genomic characterization of isolates with no clinical or epidemiological data were excluded. Studies were excluded if full texts in English were not available.

Two independent reviewers screened the titles and abstracts against the inclusion/exclusion criteria (Level 1, detailed below). Abstracts that fit the Level 1 criteria or for which all aspects of the inclusion criteria could not be determined from the title and abstract were selected for full-text screening (Level 2, detailed below). In cases of nonagreement, the reviewers discussed the evaluation and reached consensus.

Level 1: Title and abstract screening.

1. Is the title/abstract in English?
2. Does the title/abstract describe study of human infection with *B. canis?*
3. Does the title/abstract describe research that used primary or secondary data, including case reports, case series, or observational studies?

Level 2: Full-text screening.

1. Is the full text available and in English?
2. Does the title/abstract describe study of human infection with *B. canis,* including clinical reports?
3. Were the reported infections associated with clinical disease attributable to *B. canis* infection (brucellosis)?
4. Does the title/abstract describe research that used primary or secondary data, including case reports, case series, or observational studies?
5. Are diagnostic, clinical, treatment, exposure, or outcome findings reported?

Data items

Full-text extraction recovered author, year of publication, title, study type (*e.g.,* case report, case series, seroprevalence study), year(s) of sampling, country, number of infected individuals, age(s) of individuals, number of individuals < 18 y of age, clinical disease characteristics, diagnostic method, antimicrobial treatment, outcome, source of infection (if known), and mortality.

Synthesis of results

Data were summarized and described.

Ethical approval

Ethical approvals were not required because this study did not involve human or animal subjects.

RESULTS

The literature search yielded 1455 potentially relevant studies. After de-duplication and relevance screening, 24 studies describing clinical disease attributed to *B. canis* infection were determined to be relevant for this review and were included in data extraction (Figure 1). Details of the 24 studies included in this review are presented in Table 1. Sixteen (67%) were single case reports and 8 (33%) were case series.

The included studies were published between 1969 and 2023; the number of studies per year is presented in Figure 2. Studies were from 5 countries: United States (n = 14, 58%), Argentina (n = 5, 21%), Japan (n = 3, 13%), and 1 study (n = 4.2%) each from Canada and the Netherlands. Details were reported for 68 affected individuals, with 1 to 17 reported per study (median: 1).

Age was described for 45 individuals, whereas 2 others were reported as adults. Affected individuals ranged from 17 mo to 71 y of age. The median age from studies that reported age was 32 y (25th quantile: 15 y, 75th quantile: 46 y) (Figure 3). Fourteen individuals (32%) were < 18 y of age.

Clinical details

Specific clinical details were provided for 31 individuals. Commonly reported clinical signs and symptoms are outlined in Table 2. Both chronic and acute presentations were described. One noteworthy case described fever, malaise, and other clinical signs, recurrent for 19 y, that started when the individual attended an "animal-care school" and handled whelping dogs.

One study involving 17 individuals only reported "symptoms compatible with brucellosis" (18), whereas 2 studies (19,20) reported summary clinical information from 20 individuals with brucellosis caused by multiple *Brucella* spp. Since those reports focused on individuals with typical clinical signs, it is likely that the true prevalence of common signs and symptoms from Table 2, such as fever, chills, malaise, and headache, predominated in those reports.

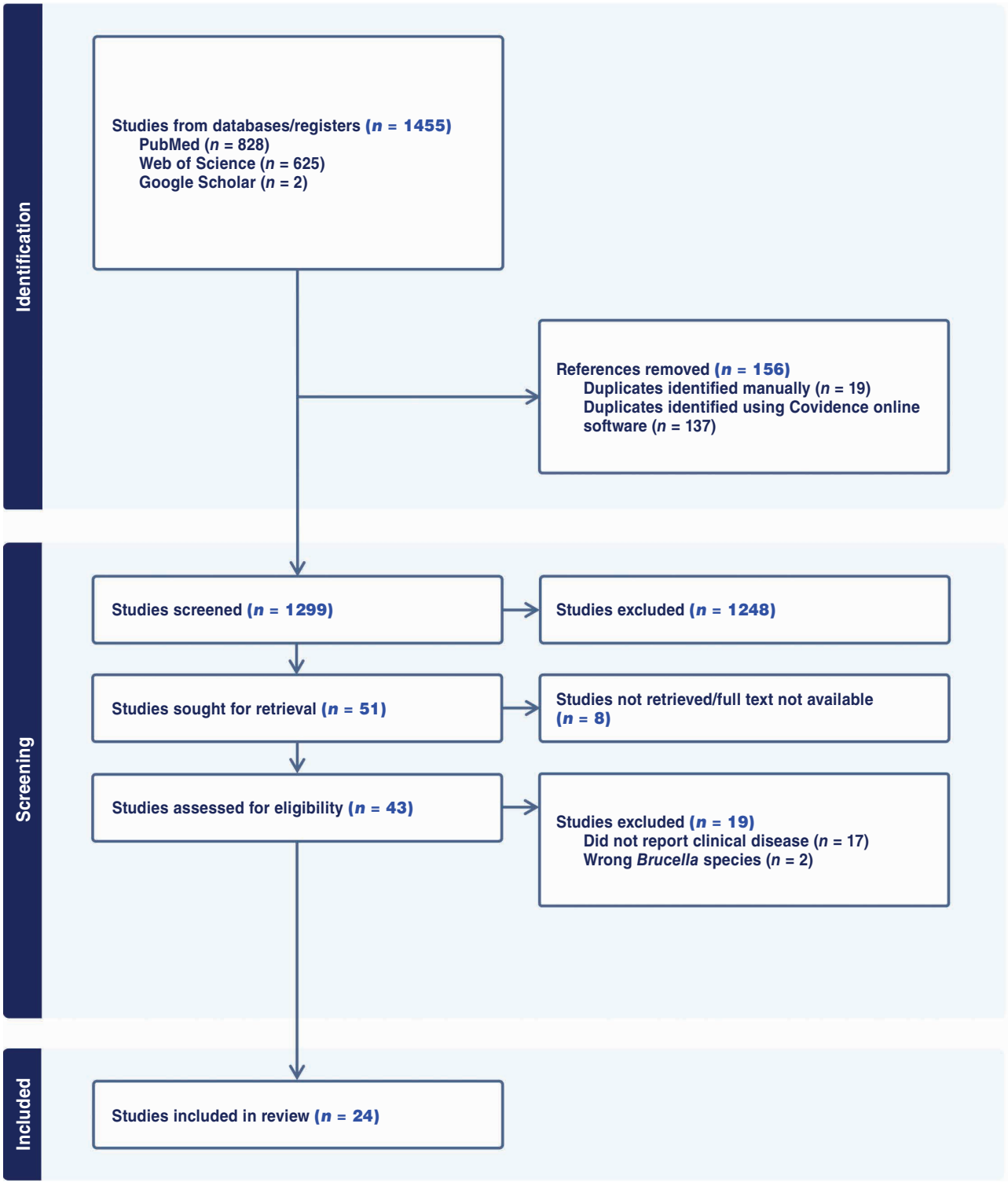

FIGURE 1. Flowchart describing the selection of articles, inclusion and exclusion of studies, and final number of studies for which data extraction was performed.

TABLE 1. Studies included in final data extraction for a scoping review describing clinical *Brucella canis* infection in humans.

Study (first author, publication year)	Study type	Country/ countries	Number of individuals
Ahmed-Bentley *et al*, 2021	Case report	Canada	1
Blankenship *et al*, 1975	Case report	US	1
Dentinger *et al*, 2015	Case report	US	1
Faigel *et al*, 1969	Case report	US	2
Fox *et al*, 1977	Case series	US	16
Ishihara *et al*, 2023	Case report	Japan	1
Javeri *et al*, 2014	Case report	US	1
Kawakami *et al*, 2019	Case report	Japan	1
Kolwijck *et al*, 2022	Case report	Netherlands	1
Lawaczeck *et al*, 2011	Case report	US	1
Lucero *et al*, 2005a	Case report	Argentina	1
Lucero *et al*, 2005b	Case series	Argentina	17
Lucero *et al*, 2010a	Case report	Argentina	4
Lucero *et al*, 2010b	Case report	Argentina	1
Marzetti *et al*, 2013	Case series	Argentina	3
Morisset *et al*, 1969	Case series	US	2
Munford *et al*, 1975	Case series	US	2
Nomura *et al*, 2010	Case series	Japan	2
Piampiano *et al*, 2000	Case series	US	2
Rifkin *et al*, 1978	Case report	US	1
Taylor *et al*, 1989	Case series	US	4
Tosi *et al*, 1982	Case report	US	1
Wallach *et al*, 2004	Case report	US	1
Ying *et al*, 1999	Case report	US	1

US — United States.
References: (18,25,29–43).

In addition, some uncommon presentations were reported, including endocarditis (n = 2), and there were single reports of septic arthritis, transient left arm paresis, Guillain-Barré syndrome, peritonitis, and meningoencephalitis.

Diagnostic method

All studies described diagnostic methods. Twelve (50%) diagnosed *B. canis* infection *via* blood culture, 7 (29%) *via* a combination of blood culture and serology, and 5 (21%) *via* serology alone.

Treatment

Specific treatments were reported for 30 individuals. A wide range of antimicrobials or antimicrobial combinations were used (Table 3). A tetracycline (tetracycline, doxycycline, or minocycline) was the sole treatment or part of a combination treatment for most individuals (21/30, 70%), followed by rifampin (9/30, 30%), trimethoprim/sulfamethoxazole (7/30, 23%), and an aminoglycoside (gentamicin, streptomycin) (7/30, 23%).

Some individuals were not treated for *B. canis* or had what was likely questionably effective treatment. One individual received no antimicrobials and infection was self-limiting. Another individual had clinical resolution without antimicrobials but was subsequently treated with

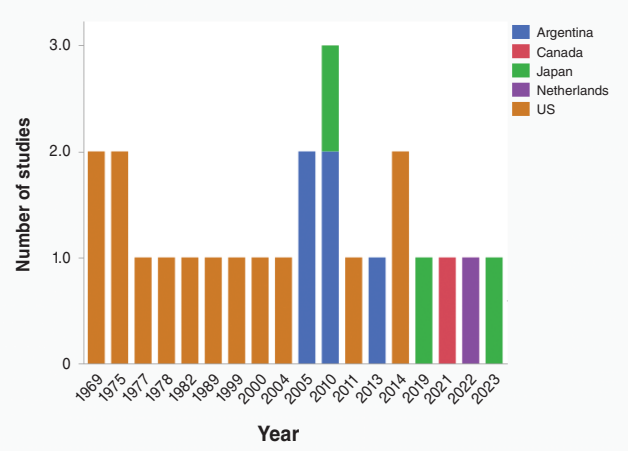

FIGURE 2. Year of publication and country of origin for 24 studies describing brucellosis attributed to *Brucella canis* in humans.
US — United States.

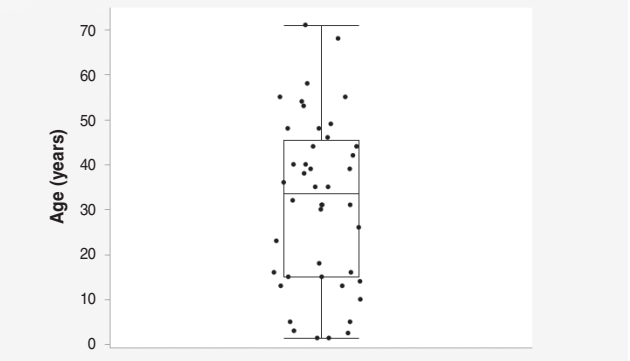

FIGURE 3. Scatterplot of ages of individuals (n = 45) diagnosed with brucellosis attributed to *Brucella canis* in humans.

tetracycline because of persistent but subclinical bacteremia. One received a short course of ampicillin (a drug not typically considered effective against *Brucella*), then was left untreated. Another received ampicillin, then 3 doses of tetracycline before treatment was discontinued.

Outcome

Clinical outcome was reported for 35 individuals. No mortalities were reported. All 35 individuals were reported to have responded clinically to treatment, including those that received no or limited antimicrobial therapy. Long-term consequences were reported for 1 individual who had Guillain-Barré syndrome attributed to *B. canis* infection. That individual was responding to treatment at the time of writing but was still undergoing rehabilitation therapy.

Exposure

A known or suspected source of exposure was reported for 56 cases; 45 (80%) were linked to dogs and 11 (20%) to

TABLE 2. Common clinical findings in 31 human individuals with *Brucella canis* infection.

Symptom	*n* (%)
Fever	21 (68)
Fatigue/lethargy	12 (39)
Headache	9 (29)
Chills	8 (26)
Malaise	8 (26)
Weight loss	4 (13)
Splenomegaly/hepatomegaly	4 (13)
Cough	4 (13)
Vomiting	2 (6.5)
Diarrhea	2 (6.5)
Decreased appetite	2 (6.5)
Nausea	2 (6.5)
Arthralgia	2 (6.5)
Myalgia	2 (6.5)
Lymphadenopathy	2 (6.5)

TABLE 3. Antimicrobial approaches for treatment of *Brucella canis* infection in 30 human individuals.

Drug(s)	*n* (%)
Tetracycline	5 (17)
Doxycycline + rifampin	4 (13)
Doxycycline + streptomycin	2 (6.7)
Trimethoprim sulfamethoxazole (TMS)	2 (6.7)
Doxycycline + rifampin + TMS TMS + rifampin Ampicillin, then nothing Ampicillin, then tetracycline Gentamicin + doxycycline "IV antibiotics" TMS + gentamicin Ceftriaxone, then TMS Tetracycline + streptomycin Doxycycline + ciprofloxacin Ceftriaxone, then doxycycline + rifampin Moxalactam, then chloramphenicol TMS + minocycline Ofloxacin + rifampin + doxycycline Doxycycline + gentamicin Gentamicin, then doxycycline + rifampin No antimicrobial(s)	1 (3.3) each

laboratory exposure (Table 4). Detailed exposure information was often not reported but contact with pet dogs that had aborted or contact with aborted fetuses accounted for 14 cases, representing 31% of canine exposures. Although the risks are greatest from contact with breeding dogs, one infection was linked to an 8-week-old (and therefore sexually immature) puppy (21). In another report, the affected individual's dog was a spayed female, but the source could not be determined because the individual had also interacted with infected dogs in the community (22).

Brucella canis infection status of suspected sources was not always queried, but often (n = 33), contact with a dog known to be infected was identified. Typically, diagnosis of the dog's infection occurred after recognition of disease in a human.

Laboratory exposure accounted for 11 infections. Nine were linked to exposure to laboratory cultures, whereas 2 were linked to contact with infected fetuses. Laboratory exposures were mainly documented in older reports, with 4 individuals exposed *via* that route in 1969, 6 in 1977, and 1 in 2004.

DISCUSSION

These data represent the reported and accessible subset of *B. canis* infections in humans but highlight some important clinical and management aspects of this endemic, zoonotic, canine-associated bacterium. Whereas *B. canis* is endemic in the dog population and has been detected worldwide, reports of disease in humans are limited. Underdiagnosis is an important concern with *B. canis* because commonly used human serological tests are designed to detect food-animal-associated *Brucella* species, not this rough-coated *Brucella* species (23). With an unknown degree of underdiagnosis and only a subset of diagnosed cases reaching the literature, the incidence of *B. canis* infection in humans cannot be ascertained. The majority of cases were reported from 2 countries, despite the presence of this bacterium in dogs worldwide, further suggesting underdiagnosis and underreporting.

Clinical signs were largely those common with brucellosis of any etiology, particularly nonspecific findings such as fever, chills, fatigue, malaise, and headache. This highlights potential clinical challenge for early recognition of *B. canis* infection if risk exposures are not identified and reported. The prevalence of individual signs and symptoms reported here was likely an underestimate, as publication bias tends towards reporting atypical disease. Further, specific clinical details were not provided for 37 individuals, yet 1 study involving 17 individuals indicated symptoms were compatible with brucellosis, presumably meaning presence of fever, chills, and other common abnormalities.

A wide range of treatments was used with apparent success. There are no guidelines for treatment of *B. canis* but use of tetracyclines, aminoglycosides, and rifampin, often in combination, is consistent with approaches to treatment of brucellosis caused by other *Brucella* spp. Use of tetracycline (*versus* doxycycline) and monotherapy was predominantly reported in older publications. Interestingly, multiple infections were apparently self-limiting clinically, with complete resolution in 1 patient, clinical (but not microbiological)

TABLE 4. Known or suspected sources of *Brucella canis* infection in humans (*n* = 56).

Known or suspected source	*n* (%)
Pet dog (no further details)	25 (45)
Pet dog that aborted or contact with aborted fetuses	12 (21)
Pet dogs: Breeding dogs	2 (3.6)
Imported breeding (*n* = 1) or rescue (*n* = 1) dog that had aborted	2 (3.6)
Community dog	1 (1.8)
Pet dog or community dogs	1 (1.8)
Pet dog: Newly purchased	1 (1.8)
Animal care school, handled whelping dogs	1 (1.8)
Laboratory	11 (20)

resolution in another, plus 2 patients that received limited treatment.

Exposures were often not well investigated, but there were many situations in which dog contact was explored and in-contact dogs were tested. There was a high reported prevalence of known contact with aborting dogs or aborted fetuses, and it is possible that the prevalence was higher since limited details were reported in many studies. This underscores the high risk posed by these situations and the need for awareness and use of infection-control practices around breeding animals, particularly those with reproductive disease. Contact with nonbreeding dogs, particularly those that have been spayed or neutered, is thought to pose a lesser risk (24). Although that scenario could not be well investigated in this review due to limited dog-level data for many reports, a large percentage of infections were linked to breeding dogs and aborted fetuses. However, 1 case was linked to a sexually immature, 8-week-old puppy, highlighting the potential for transmission across a range of dog ages and reproductive statuses.

Laboratory exposures accounted for 20% of cases with a known or suspected origin. Most laboratory exposures were from the 1960s and 1970s (20,25,26), but 1 was from 2004 (27). *Brucella canis,* like other *Brucella* species, is a high-risk agent in the laboratory and is supposed to be handled under biosafety level (BSL)/containment level (CL) 3 conditions. Potential laboratory exposures continue to be a concern (28), particularly when *B. canis* is unintentionally isolated using lower containment levels through routine clinical testing.

Clinical outcomes were very good. All but 1 individual for whom information about treatment response was available responded well to treatment. The additional patient, who had Guillain-Barré syndrome, responded to treatment but still had abnormalities that were being addressed through rehabilitation. Outcome was not reported for almost 1/2 of affected individuals, but it is reasonable to hypothesize that fatal infections or severe manifestations would likely have been mentioned. Care must be taken not to overinterpret prognosis from a small dataset, but these data supported the effectiveness of treatment and the likely ability for some infections to resolve without intervention.

Various limitations should be considered. Underdiagnosis and underreporting limit the number of publications describing *B. canis* in humans and make it impossible to infer an incidence of disease from available studies. Exclusion of manuscripts when full text was not available also reduced the number of reported cases, particularly some of the earlier reports of human infections from the 1970s and 1980s. However, this should not have significantly affected the main findings, as there is no information to suggest that clinical aspects of *B. canis* infection in humans have changed. Whereas dogs were the clear source of natural (non-laboratory) infection, investigations and descriptions of exposures were variable and often superficial. This hampered efforts to more clearly define different contact risks, such as those from contact with nonbreeding pet dogs and, in particular, spayed or neutered household pets. This is important for risk communication and requires further study. This scoping review also targeted clinical disease caused by *B. canis,* not asymptomatic infections. Thus, it covers the most clinically relevant subset of infected humans but still only represents a subset. The long-term consequences of asymptomatic *B. canis* infection are not known, but lack of disease at one time point does not mean there are no potential clinical consequences.

These results should not be taken to represent the totality of human *B. canis* infections. In addition to cases missed due to underdiagnosis and lack of reporting, a small number of existing publications were not included because they were older manuscripts for which full text was inaccessible, or they were not published in English. Thus, this review provides an overview of results, with most reported infections, but is not a complete summary. CVJ

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COMMENTARY
COMMENTAIRE

Opinion on the evolution of veterinary practice

J.D. (Jim) Stowe, DVM

At the outset, what I'm about to say may be interpreted as yet another retiree railing against this younger generation who *'don't do things the way we did when I was in practice!'* However, I have had a lengthy career involved in nearly every aspect of veterinary medicine. I also remain reasonably connected with current issues facing the profession, because everything I've done these past decades has been to help this calling thrive. Sadly, I believe that we've allowed this wonderful vocation to be in a troubled state. Clearly, practitioners are brilliant, our schools are state-of-the-art, and practices are providing the utmost in care. But unless I'm completely out of touch, my sense is that our profession is burning at the edges.

All things evolve. We once were merely horse doctors, then farm veterinarians, then mixed animal practitioners, ultimately becoming species or systems specialists. We are proud to have reached such an apogee of expertise. Yet what I hear from colleagues and read online are disturbing reports about dissatisfaction resulting in many veterinarians and nurses/technicians leaving the profession. Many practices are desperately trying to find doctors and nurses/technicians; there is a perceived shortage in our profession (and in many others). The question is, do we simply let these trends continue or do we try to redefine, perhaps reboot a return to what we feel in our heart and soul, what it means to be a veterinarian?

The issues cause us to play the blame game, *e.g.,* veterinarians wanting work-life balance and more females graduating. These are not the real problems, however. As a father/husband who worked 24/7/365 in the early years of practice I applaud the current state of life-to-work. Well done! As a grandfather of 3 granddaughters, I'm overjoyed to see our institutions work towards gender equality in education. Regarding the cost of care, I advocated higher veterinary fees when I established a consulting service and audited clinic finances to see how little we charged — and that was not long ago.

For blame, I think we as a profession must assume full responsibility. We established multiple clinics and hospitals in every community rather than build on the human health care model of a central hospital and doctors' clinics. We tend to be individuals, keen to have our own 'dream practices.'

During the increase in facilities, I worked with like-minded professionals to try to convince groups in communities to merge, to centralize costly services and equipment to reduce fee increases. Instead, collaborations were limited to emergency practices, facilitating time off for family and life away from practice. However, they also enabled even more separate competing practices!

As animal care became an evident multi-billion-dollar industry, entrepreneurs purchased practices; a company owning many practices could economize, scale, and make profits. Several of the originators were people whom I admired for their ingenuity and integrity. In time, though, money became an essential driver. Practices sold for high prices, salaries increased, and cost of care inevitably rose. As a management consultant, my advice was to *never raise a fee unless the perceived value of the item was raised as well.* However, I fear that fees for veterinary care have exceeded perceived value.

Today, Dr. Google is becoming the first call for medical advice. Tomorrow, the Web may become a far more useful alternative, as Artificial Intelligence (AI) becomes more effective. We don't seem to realize that we are inexorably driving caseload away from our businesses. Some feel that

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Dr. Stowe graduated from OVC in 1969 and was in mixed practice. Recognizing the potential of computers, the importance of business acumen and continuing education, he became Head of Veterinary Continuing Education at OVC and organized a Satellite Teleconference in Cardiology. Building on Dr. Ken Leslie's dairy health management program, he created certificate programs in dentistry and imaging. He also co-founded LifeLearn with Dr. Chas Povey, founded EffectivVet, provided management coaching, wrote 2 books on management, and lectured across Canada, the US, and Australia.

pet insurance will resolve gaps between cost and care. However, insurance premiums will rise commensurate with the cost of care, resulting in unaffordability. We risk becoming an "elite service for the wealthy." Too many friends and family tell me they will not replace their last pet because they can no longer afford care.

Our doctorate allows us to care for every animal species on the planet except for one. All of that work ultimately is for the benefit of that creature we don't treat. Our penchant for consumerism and excessive environmental footprints endangers most of the animals for which we are responsible — and drives our profession in the wrong direction. Climate Change and AI are existential threats to the existence of far too many endangered species, to the existence of our profession, to the very existence of our own kind. However, the good news is that veterinarians are key to solutions!

No problem cannot be solved (pardon the double negative) and the opportunities for the veterinary profession are immense. There are gifted practitioners in practice, agriculture, wildlife, *etc.* More graduates will address deficiencies, but will we be sending idealistic veterinarians into a profession they won't love and won't want to work for? I despair to hear that young veterinarians are leaving our profession or worse, considering suicide.

These past few years, I've enjoyed mentoring young entrepreneurs entering into areas like cybersecurity and AI. New challenges (opportunities) never cease. Chas Povey and I created LifeLearn to help veterinarians keep abreast of growing medical knowledge and stay connected with every changing technology. I certainly want us to be at one with the times.

However, we seem to be struggling, thanks to allowing our profession to evolve away from the calling of the special "bond" between humans and animals. I think that spirit still drives every veterinarian; they vehemently desire that compelling love for what they do for a living. Unfortunately, we've created an environment that makes that more difficult to sustain.

Rebooting and reinventing the profession would be a monumental task, requiring concerted efforts from every facet of veterinary medicine. I hope there is dialogue and actions that can mitigate what I worry will continue to be a decline in our image as a profession. If not, this diatribe will simply be an opinion and Time and Trends will win.

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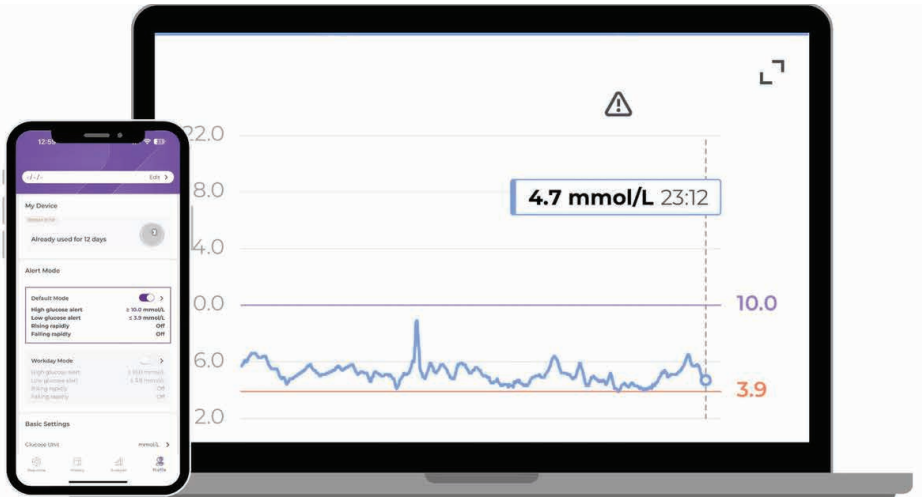

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ANSWERS TO QUIZ CORNER
CORRIGÉ DU TEST ÉCLAIR

1. E) Conduct the Rivalta test to help distinguish feline infectious peritonitis (FIP) from other causes of peritoneal effusion. Mix 8 mL distilled water with a drop of 98% acetic acid in a clear tube. Carefully layer a drop of effusion on top.

If the effusion dissolves in solution, the result is negative; if the effusion remains as a drop or ball, or does not dissolve, the result is positive (Figure 2). The Rivalta test is best at ruling out FIP; a negative test means FIP is very unlikely. A positive Rivalta test requires confirmation with other tests for FIP.

1. E) Le test de Rivalta permet de distinguer la péritonite infectieuse féline (PIF) des autres causes d'épanchement péritonéal. Il faut mélanger 8 mL d'eau distillée et une goutte d'acide acétique à 98 % dans un tube transparent, puis déposer délicatement une goutte de liquide abdominal sur la surface du mélange.

Si la goutte d'échantillon se dissout dans le mélange, le résultat est négatif, mais si elle reste sous forme de goutte ou de boule ou si elle ne se dissout pas, le résultat est positif (figure 2). Le test de Rivalta est surtout efficace pour exclure la PIF – un résultat négatif signifie que la PIF est très improbable, mais un résultat positif doit être confirmé par d'autres tests de dépistage de la PIF.

FIGURE 2

Rivalta test. The effusion in this image contains new methylene blue to improve clarity. (Image courtesy of Dr. Kalumet — https://commons.wikimedia.org/wiki/File:Rivalta_Probe.jpg).
Test de Rivalta. Du nouveau bleu de méthylène a été ajouté à l'échantillon de liquide abdominal pour rendre le résultat du test plus clair.
(Image du Dr Kalumet, https://commons.wikimedia.org/wiki/File:Rivalta_Probe.jpg.)

Biopsy with immunohistochemical staining for FCoV antigen or FCoV RT-PCR assays are more sensitive and specific than the Rivalta test but need to be sent to the lab so results take longer.

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2. A) May identify hyperechoic renal cortical changes on ultrasound in dogs within 4 to 6 h of ingestion of ethylene glycol (EG). Cats can have benign hyperechoic renal cortical changes so interpret with caution in this species.

Ultrasound changes occur due to EG conversion to multiple metabolites, including oxalic acid, which forms calcium oxalate crystals in renal tubules. Crystal accumulation in the kidneys creates the hyperechoic changes.

Several rapid in-clinic EG tests exist but may give false positive results due to cross-reactivity or sample handling. Ultrasound is one way to help confirm the diagnosis, allowing for prompt intervention.

Other supportive tests include metabolic acidosis with elevated anion gap, increased serum osmolality, and crystalluria with monohydrate calcium oxalate crystals.

Azotemia develops in the second stage of toxicity, 1 to 2 d after exposure, and worsens into anuric renal failure and death in stage 3. Renal ultrasound can detect a halo sign when anuria develops around 3 d after ingestion in the dog.

Ethylene glycol toxicosis does not cause ureteral obstruction/dilation and kidney size is normal to increased. Given the rapid progression of the toxicosis, there is not enough time for stone formation. Free fluid is not expected at this stage, although can develop during treatment with anuria and fluid overload.

La biopsie avec coloration immunohistochimique pour la détection de l'antigène du coronavirus félin (FCoV) ou les tests RT-PCR pour la détection du coronavirus félin sont plus sensibles et plus spécifiques que le test de Rivalta, mais comme les échantillons doivent être envoyés à un laboratoire, les résultats sont plus longs à obtenir.

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2. A) Il est possible de constater des changements hyperéchogènes dans le cortex rénal à l'échographie chez les chiens dans les 4 à 6 heures suivant l'ingestion d'éthylène glycol. Les chats peuvent présenter des changements hyperéchogènes bénins du cortex rénal – il faut donc interpréter l'échographie avec prudence chez cette espèce.

Les changements échographiques sont dus à la transformation de l'éthylène glycol en plusieurs métabolites, dont l'acide oxalique qui forme des cristaux d'oxalate de calcium dans les tubules rénaux. L'accumulation de cristaux dans les reins est à l'origine des changements hyperéchogènes.

Il existe plusieurs tests rapides qui permettent de détecter l'éthylène glycol en clinique, mais ces tests peuvent donner des résultats faussement positifs en raison d'une réactivité croisée ou de la manipulation de l'échantillon. L'échographie est un moyen d'aider à confirmer le diagnostic pour une intervention rapide.

Une acidose métabolique avec un trou anionique élevé, une osmolalité sérique accrue et une cristallurie avec des cristaux d'oxalate de calcium monohydraté sont d'autres résultats qui appuient le diagnostic.

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The questions and answers are provided by Zuku Review, online veterinary test prep.

Les questions et les réponses sont gracieusement fournies par le site de préparation aux examens vétérinaires Zuku Review.

Une azotémie se développe au deuxième stade de l'intoxication, soit 1 ou 2 jours après l'exposition, et s'aggrave jusqu'à l'insuffisance rénale anurique et la mort au troisième stade. L'échographie rénale permet de détecter un signe de halo lorsque l'anurie se développe, environ 3 jours après l'ingestion chez le chien.

L'intoxication à l'éthylène glycol ne provoque pas d'obstruction/dilatation urétérale et la taille des reins est normale ou accrue. La progression rapide des effets de l'intoxication ne laisse pas suffisamment de temps pour la formation de calculs. Il n'y a généralement pas de liquide libre à ce stade, mais on peut en observer pendant le traitement avec l'anurie et la surcharge liquidienne.

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VETERINARY DERMATOLOGY
DERMATOLOGIE VÉTÉRINAIRE

Canine atopic dermatitis: An evolving understanding

Jangi Bajwa

Canine atopic dermatitis (cAD), also known as atopy or allergic inhalant dermatitis, is one of the most common primary skin diseases leading to veterinary clinic visits. It is also a frequent cause of secondary otitis and skin infection, including pyoderma and/or *Malassezia* dermatitis.

Canine atopic dermatitis has long been recognized as a multifactorial disease resulting from a complex interaction between the host and the environment, and it is commonly encountered in general practice (1).

First recognized in 1941 as a "spontaneous allergy" (2), our understanding of the disease has evolved substantially over time and continues to progress.

Later, atopic dermatitis was described as a genetically programmed disease in dogs, in which the patient becomes sensitized to environmental antigens that, in non-atopic animals, do not cause disease (3). It has been classically defined as a "type I hypersensitivity toward environmental allergens" (3).

By 2001, the definition was updated by the ACVD Task Force (4) to: "A genetically predisposed, inflammatory and pruritic allergic skin disease with characteristic clinical features, most often associated with IgE antibodies to environmental allergens."

The most recent revised definition (5), based on advances in knowledge and published studies, is from the 2023 International Committee on Allergic Diseases of Animals (ICADA) and states: "Canine atopic dermatitis is a hereditary, typically pruritic and predominantly T-cell driven inflammatory skin disease involving interplay between skin barrier abnormalities, allergen sensitization and microbial dysbiosis."

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The Veterinary Dermatology column is a collaboration of *The Canadian Veterinary Journal* and the Canadian Academy of Veterinary Dermatology (CAVD). Established in 1986, the CAVD is a not-for-profit organization intended for everyone with a professional interest in veterinary dermatology.

CAVD Mission: to advance the science and practice of veterinary dermatology in Canada by providing education and resources for veterinary teams and students, supporting research, and promoting excellence in care for animals affected with skin and ear disease.

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Everyone with a professional interest in dermatology, whether to improve their skills or to promote this area, is invited to join the CAVD (www.cavd.ca). The annual membership fee is $50. Student membership fees are generously paid by Royal Canin Canada.

FIGURE 1. Canine atopic dermatitis patient with facial erythema (Photograph supplied by Dr. Jangi Bajwa).

FIGURE 2. Canine atopic dermatitis patient exhibiting ventral trunk inflammation with secondary pyoderma lesions (Photograph supplied by Dr. Jangi Bajwa).

This updated definition best reflects our current, broader understanding of the pathogenesis of the condition, highlighting factors beyond just allergies (5). It underscores the disease's complexity, which makes it challenging and often frustrating for both pet owners and veterinarians. All veterinarians are encouraged to be aware of this updated definition, as it will aid in implementation of more individualized and multimodal treatment plans for atopic canine patients. Treatment options for canine atopic dermatitis will be reviewed in a future Dermatology Column of *The Canadian Veterinary Journal*.

HEREDITARY FACTORS

The genetic background of a dog, in combination with environmental factors, determines the risk of disease development and the clinical phenotype (1,6). Although many breeds are considered predisposed, the prevalence of the disease varies by geographic region. Five breeds that are considered predisposed to cAD irrespective of the region (*i.e.,* breeds exhibiting worldwide predisposition) are: the boxer, bulldog, Labrador retriever, pug, and West Highland white terrier (1).

PRURITIC, INFLAMMATORY SKIN DISEASE

Pruritus is the primary clinical sign, although a manifestation of pruritus may not always be present. Various inflammatory mediators are involved, including gross inflammation (erythema, skin lesions, and skin changes) being evident in most patients (5,7). An imbalance of the immune system is present including up-regulation of T-helper cell cytokines. In the past decade, a consistently strong central role for interleukin-31 in pruritus has been shown, in line with successful therapies targeting this cytokine for relief of clinical signs of cAD (5).

SKIN BARRIER ABNORMALITIES

Skin barrier dysfunction is considered an important component of atopic disease; however, much remains to be learned about its significance as a primary contributor (8). Although primary skin barrier defects may contribute to cAD and its associated symptoms, many skin barrier alterations may be secondary results of cutaneous allergic inflammation (8).

ALLERGEN SENSITIZATION AND COMMON ALLERGENS IN ATOPIC DERMATITIS

Important, common allergens in cAD include house dust mites, environmental molds, weeds, grasses, and trees (7). Polysensitization, in which multiple allergens trigger reactions, is common in atopic individuals (7). House dust mites are the most common allergen in dogs, similar to humans, with *Dermatophagoides farinae* being the most prevalent house dust mite allergen involved in cAD (1).

Malassezia pachydermatis, part of the normal cutaneous microbiota in dogs, can trigger hypersensitivity reactions in atopic dogs (9).

MICROBIAL DYSBIOSIS

Cutaneous microorganisms, including bacteria, fungi, and parasites, have a crucial role in the local skin immune system. Cutaneous dysbiosis is defined as an imbalance in the composition of the microbial community, often characterized by a reduction in microbial diversity and a decrease in the number of beneficial bacteria (10).

In healthy dogs, the cutaneous microbiome is highly diverse. However, in cases of cAD, microbial diversity is significantly reduced, which promotes the overgrowth of *Staphylococcus pseudintermedius,* leading to an increased risk of secondary skin infections (8,11). There is a higher relative abundance of *S. pseudintermedius* and *Malassezia pachydermatis* on the skin of atopic dogs compared to healthy dogs (8,12). In addition, an increase in the relative abundance of *Corynebacteriaceae* and *Staphylococcaceae* has been observed in lesional skin, with this dysbiosis persisting for up to 2 wk after the remission of skin lesions (13).

Interestingly, skin microbiome diversity significantly increases immediately after the resolution of an allergic flare or bacterial infection, becoming more similar to that of healthy skin (14). However, 4 to 6 wk after treatment, microbial diversity gradually decreases, leading to a return to dysbiosis, with a subsequent rise in *S. pseudintermedius* abundance and an increase in the severity of clinical signs of cAD (14). Whether cutaneous microbial dysbiosis is a cause or consequence of cAD remains uncertain, and further studies are necessary to clarify this relationship (8).

CLINICAL FEATURES OF CANINE ATOPIC DERMATITIS

Canine atopic dermatitis is common in dogs, with an age of onset ranging from 6 mo to 7 y (3,7). Most often, symptoms first appear between 1 and 3 y of age (3,7). Some patients may present to the veterinarian much later in life with moderate to significant dermatological disease, although milder and/or waxing-waning symptoms of disease may have been present for many years prior. Canine atopic dermatitis patients typically exhibit characteristic clinical features, including lesions on the ventrum, pedal skin, flexural skin sites, muco-cutaneous junctions, and ears. Pruritus is the hallmark presenting sign, and gross cutaneous and/or otic inflammation is often present. Manifestations of pruritus include licking, chewing, scratching, rubbing, scooting, and head shaking. Some patients may be non-pruritic despite the visual presence of skin and/or ear disease.

Common primary lesions include erythema (Figure 1), and other findings may include papules, conjunctivitis, otitis, and chronic skin changes including secondary seborrhea, salivary staining, and lichenification, acral pruritic nodules, and acral lick granulomas (3,7). Pruritus and cutaneous inflammation often lead to secondary infections that result in pustular dermatitis, crusting, scaling, and hair loss (Figure 2). Secondary pyoderma, *Malassezia* dermatitis, and otitis externa are common. These cutaneous changes and secondary infections further complicate an already complex, multifactorial dermatological disease.

Fortunately, a variety of treatments are available, and new options are being explored. This provides clinicians with opportunities to tailor treatment to each patient's specific needs. As pets become more integrated into family life, pet owners are increasingly willing to pursue multimodal management. Understanding the complications of this incurable disease can lead to improved quality of life and better outcomes for both pets and their families.

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DIAGNOSTIC OPHTHALMOLOGY
OPHTALMOLOGIE DIAGNOSTIQUE

Lynne S. Sandmeyer, Marina L. Leis

HISTORY AND CLINICAL SIGNS

A 21-month-old Brittany spaniel dog was examined by the ophthalmology service at the Western College of Veterinary Medicine. This dog was presented for evaluation of a pigmented spot on the iris of the right eye. The menace responses, and palpebral, oculocephalic, direct and consensual pupillary light reflexes were normal bilaterally (OU). Schirmer tear test (Schirmer Tear Test Strips; Alcon Canada, Mississauga, Ontario) values were 29 and 31 mm/min in the right (OD) and left eye (OS), respectively. The intraocular pressures were estimated with a rebound tonometer (Tonovet; Tiolat, Helsinki, Finland) and were 14 and 15 mmHg in OD and OS, respectively. Fluorescein staining (Fluorets; Bausch & Lomb Canada, Markham, Ontario) of the cornea was negative OU. Retropulsion of both globes was unremarkable. On direct examination an oval, darkly pigmented lesion was present on the iris between the 2 o'clock and 5 o'clock pupillary zone and collarette. Examination with the handheld biomicroscope (Kowa SL-17 Portable Slit Lamp; Kowa Co, Tokyo, Japan) revealed the lesion to be mildly raised within the stroma of the iris. Following application of 0.5% tropicamide (Mydriacyl; Alcon Canada, Mississauga, Ontario), examination of both eyes using a transilluminator (Welch Allyn Finoff Transilluminator; Welch Allyn, Mississauga, Canada) and handheld biomicroscope revealed no further abnormalities. 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 right eye at presentation is provided for your assessment (Figure 1).

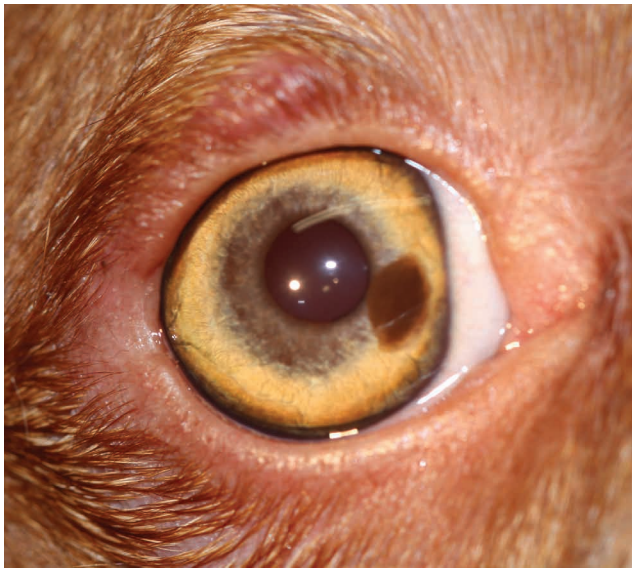

FIGURE 1. Anterior segment photograph of the right eye of a 21-month-old Brittany spaniel.

WHAT ARE YOUR CLINICAL DIAGNOSES, DIFFERENTIAL ETIOLOGIC DIAGNOSES, THERAPEUTIC PLAN, AND PROGNOSIS?

Discussion

The ophthalmic diagnosis was presumed melanocytic neoplasia of the iris OD. Differential diagnoses for a pigmented lesion of the iris include benign or malignant melanocytic neoplasia, non-neoplastic areas of hyperpigmentation such as a freckle or nevus, as well as inherited uveal melanocytosis (1–3).

Non-neoplastic hyperpigmented lesions are common in the canine iris. These present as well-circumscribed, focal, or sometimes multifocal areas of iris hyperpigmentation that may be flat or slightly raised from the iris surface. Iris freckles or benign melanosis represent clusters of benign hyperplasia or increased pigmentation of normal melanocytes in the superficial iris stroma. They do not tend to distort normal iris architecture, do not affect iris mobility, and are not usually raised from the iris surface (2,4). Similarly, an iris nevus is a benign proliferation of cells of

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neuroectodermal origin, which may cause focal thickening in the iris stroma (2). Nevi are less common than freckles and tend to occur more commonly in young dogs (2,3).

Uveal melanocytosis (also called uveal melanosis) is a slowly progressive, bilateral condition described in the Cairn terrier breed and occasionally in Labrador retrievers, boxers, Shih Tzus, and German shepherds (5,6). The condition is characterized by accumulation of non-neoplastic melanocytes and variable numbers of melanophages throughout the uvea (6). The iris appears diffusely hyperpigmented in the early stage of the condition; however, as melanosis progresses, the iris base becomes thickened, melanocytes infiltrate the anterior sclera, resulting in scleral pigmentation, and eventually glaucoma develops due to infiltration of the ciliary cleft and trabecular meshwork (7). Melanosis is an inherited condition in the Cairn terrier and an autosomal-dominant mode of inheritance is thought to be likely (5).

Melanocytic tumors are the most common intraocular neoplasia in dogs and the anterior uvea (iris and ciliary body) is the most common site for these to develop (1,2). The terminology of *melanocytoma* is generally applied to benign melanocytic neoplasms, whereas *melanoma* is used to indicate malignant melanocytic neoplasms (8). Melanocytic uveal neoplasia in dogs most commonly exhibits benign biological behavior, with low rates of metastasis; around 5% based on the literature (4,8–11). The best criterion for histologic identification of ocular melanoma with high metastatic potential in dogs is mitotic index; benign tumors have a mitotic index of ≤ 2 per 10 high power fields (HPF) (approximately 430×), whereas tumors with known malignant behavior have a mitotic index of 4, and often greater than 10 (8).

Benign uveal melanocytoma is the most common form of melanocytic uveal neoplasia in dogs. Uveal melanocytomas are more frequently diagnosed in older dogs (9,10). There may be some breed predilection as German shepherds, and retrievers are more often reported in the literature (10–12). These tumors tend to grow as non-painful nodular and expansive masses within the uvea. As the mass enlarges, the iris and pupil become distorted, and eventually, the tumor extends into the iridocorneal angle and causes intraocular inflammation both leading to painful and blinding secondary glaucoma. The nodular presentation and tendency toward benign behavior contrast with uveal melanocytic neoplasia in cats, which tends to develop as diffuse iris infiltration and has much higher malignant potential, thus the term feline diffuse iris melanoma (13).

Differentiating melanocytic neoplasia from non-neoplastic pigmented foci in the iris is usually based on history, signalment, and serial clinical examination findings. A raised pigmented lesion that is progressively increasing in size and thickness is more likely to be melanocytic neoplasia than a freckle or nevus (2). It is common practice among ophthalmologists to monitor with periodic examinations and clinical photography for several months to monitor for growth or progression of a pigmented lesion to support a presumptive diagnosis. However, definitive diagnosis requires histopathologic examination of the affected iris tissues. Iris tissues may be sampled by biopsy performed by an ophthalmologist or examined following surgical removal of the entire globe to confirm the diagnosis of uveal melanocytoma. Surgical removal of a sighted and non-painful globe is not recommended, however, due to the benign biological behavior of most of these tumors.

Treatment of canine uveal melanocytoma depends on many factors, including the size of the lesion at the time of diagnosis, clinician skill, and client preference. Because most are benign, a conservative approach may be taken to monitor with a plan to enucleate the globe when the tumor becomes extensive enough that it has developed secondary glaucoma.

Interventional therapies aimed at preventing tumor growth, and therefore loss of the globe, include diode laser photocoagulation and surgical excision by an ophthalmologist. These are more likely to be successful if the tumor is small and well-circumscribed at the time of diagnosis. Diode laser photocoagulation is a non-invasive treatment in which application of diode laser energy produces a thermal effect with preferential absorption in melanin-containing tissues resulting in coagulation necrosis (14). Treatment is completed under general anesthesia through a trans-corneal beam. Laser energy is applied to the tumor "to effect" with the goal of causing destruction of neoplastic cells and prevent further growth within the eye. Aside from the potential for inadequate treatment leading to continued tumor development, complications associated with diode laser photocoagulation are minor and include a distorted pupil (dyscoria) due to destruction of iris tissues, and corneal edema due to collateral hyperthermia (14). Diode laser photocoagulation can be repeated if the initial treatment is inadequate or unsuccessful.

Sector iridectomy (or iridocyclectomy) is a surgical procedure employed to remove localized masses of the iris (and ciliary body) that encompass less than a 3-hour clock quadrant or 90 degrees of the iris surface (12). Surgery is

completed through a peripheral corneal incision, adjacent to the lesion. The affected iris is excised and submitted for histopathology to confirm the diagnosis and evaluate surgical margins. Following surgery, the pupil has a distorted appearance due to the removal of iris tissue. Complications of this procedure include intra- and post-operative iris hemorrhage, uveitis, focal posterior synechia, and focal nonprogressive cataract (12). Recurrence is uncommon even when inconclusive margins are obtained (12).

In this case, the well-circumscribed nature of the lesion and its small size made it a good candidate for sector iridectomy. This was completed and the resected iris tissue was submitted for histopathology which confirmed a completely excised, well-differentiated melanocytic neoplasm arising from the iris surface. The mitotic count was less than 1 per 10 HPF verifying a benign melanocytoma. This dog recovered well after surgery and follow-up revealed minor post-operative uveal hemorrhage that resolved within a few days after the procedure. Dyscoria was present, as expected; however, this did not noticeably affect vision or comfort level. We continue to monitor the eye and there has been no re-growth of the tumor $>$ 1 y after surgery.

Anterior uveal melanocytic neoplasia is the most common intraocular neoplasia in dogs. The prognosis for survival is excellent as these tumors are most often benign in their biological behavior. The long-term prognosis for the globe and vision is unfortunately poor, as eventually, infiltration of the iridocorneal angle and uveitis will lead to secondary glaucoma unless these are effectively treated early in their development. Smaller, well-circumscribed lesions may be treated with diode laser photocoagulation or sector iridectomy with a goal of preventing further growth and preserving the eye. For large lesions that are not amenable to these interventions, the conservative route of clinical monitoring until the eye develops glaucoma, with a plan for enucleation, is advised. The enucleated globe should always be submitted for histopathology to confirm the diagnosis and evaluate for potential for malignancy, though this is rare.

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VETERINARY PRACTICE MANAGEMENT
GESTION D'UNE PRATIQUE VÉTÉRINAIRE

Veterinary hospitals need to return to pre-pandemic habits to stop decreasing client numbers

Les cliniques vétérinaires doivent reprendre leurs habitudes d'avant la pandémie pour arrêter de perdre des clients

Amy Noonan, Darren Osborne

Results from the most recent CVMA Practice Owners Economic Survey show the number of pet owners visiting veterinary hospitals continues to decrease. Since hitting an all-time high in 2020, thanks to the COVID-19 driven pet population boom, client visits have fallen to a point in which many hospitals are finding themselves with fewer clients than before the pandemic. Despite experiencing fewer clients for several years, many veterinary hospitals are still behaving as though the pandemic is still on and have done very little to get clients back into the clinic.

Most front-line veterinary staff were hired in the throes of the pandemic and don't know what life was like before. Prior to the pandemic, clients were pre-booked for their next appointment and staff emailed or called clients to schedule and confirm appointments. During the pandemic, resources in the hospital were spread thin, demand was out of control, and many hospitals did not have any available appointment

Les résultats du dernier sondage économique de l'ACMV mené auprès des propriétaires de pratiques vétérinaires montrent que le nombre de clients continue de diminuer. Après avoir atteint un niveau record en 2020, grâce au boom de la population d'animaux de compagnie dû à la pandémie de COVID-19, le nombre de visites a chuté à un point tel que de nombreuses cliniques se retrouvent avec un nombre de clients inférieur à celui d'avant la pandémie. Malgré la diminution du nombre de clients observée au cours des dernières années, beaucoup de pratiques continuent d'agir comme si la pandémie était toujours active et n'ont fait que très peu d'efforts pour faire revenir les clients.

Beaucoup de membres du personnel à la réception des cliniques vétérinaires ont été embauchés pendant la pandémie et ne savent pas comment étaient les choses avant la COVID-19. À cette époque, les clients prenaient rendez-vous à l'avance ou le personnel leur envoyait des courriels

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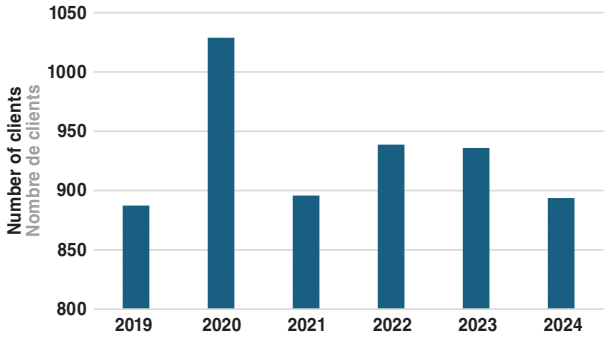

FIGURE 1

National average number of clients per full-time veterinarian in Canada. Moyenne nationale du nombre de clients par vétérinaire à temps plein au Canada.

TABLE 1. Difference in average number of clients per full-time veterinarian in Canada from 2023 to 2024.

Canada	−4.5%
British Columbia	−7.3%
Alberta	−8.6%
Saskatchewan	−16.1%
Manitoba	−8.3%
Ontario	−1.0%
Quebec	−7.0%
New Brunswick	3.3%
Nova Scotia	10.2%
Prince Edward Island	4.7%
Newfoundland & Labrador	n/a

slots. Pre-booking stopped, emailing and calling clients to remind them of their appointment stopped, and staff were trained to keep people out of the clinic. The most recent client numbers from the 2024 CVMA Practice Owners Economic Survey show that hospitals must get back to their old habits to turn client numbers around (Figure 1, Table 1).

The first place to turn for more clients is existing clients. A big mistake small business owners (veterinarians included) make is to focus most of their marketing efforts on new clients. New clients are important, but not as important as retaining existing clients. It is a lot less expensive and easier to retain existing clients because you already have their phone number, their email, their pet's name, and their pet's medical history. All this information can be used to internally market to your existing clients more effectively than searching for people you don't know.

One critical success factor in maintaining a higher number of existing clients is callbacks — either virtual with client contact software or over the phone. Before the pandemic, most front-line staff accepted that emailing, texting, and cold calling clients was a big part of their job. When things were slow, staff did callbacks. Staff called clients to rebook lapsed appointments, they followed up on dental

TABLEAU 1. Variation du nombre moyen de clients par vétérinaire à temps plein au Canada entre 2023 et 2024.

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Alberta	−8,6 %
Saskatchewan	−16,1 %
Manitoba	−8,3 %
Ontario	−1,0 %
Québec	−7,0 %
Nouveau-Brunswick	3,3 %
Nouvelle-Écosse	10,2 %
Île-du-Prince-Édouard	4,7 %
Terre-Neuve-et-Labrador	ND

ou les appelait pour fixer et confirmer les rendez-vous. Pendant la pandémie, les ressources sont devenues très limitées, la demande a explosé, et il n'y avait plus de plages de rendez-vous disponibles dans de nombreuses cliniques. On a cessé de fixer des rendez-vous à l'avance, d'envoyer des courriels de rappel et d'appeler les propriétaires d'animaux pour confirmer leurs rendez-vous, et le personnel a été formé avec la consigne de garder les clients à l'extérieur de la clinique. Les données les plus récentes issues du sondage économique de l'ACMV réalisé en 2024 auprès des propriétaires de pratiques vétérinaires montrent qu'il faut revenir aux anciennes habitudes pour faire remonter le nombre de clients (figure 1, tableau 1).

La première étape est de cibler les clients existants. Une grande erreur que commettent les propriétaires de petites entreprises (y compris les médecins vétérinaires) est de concentrer leurs efforts de marketing sur les nouveaux clients. La prospection de nouveaux clients est importante, mais pas autant que la rétention des clients existants. Il est plus facile et beaucoup moins dispendieux de garder les clients existants parce que vous avez déjà leur numéro de téléphone et leur courriel, ainsi que le nom et les antécédents médicaux de leur animal de compagnie. Ces renseignements peuvent être utilisés pour promouvoir vos services auprès de vos clients existants plus efficacement que si vous vous adressez à des gens que vous ne connaissez pas.

Les rappels, qu'ils soient effectués à l'aide d'un logiciel de gestion de la clientèle ou par des appels téléphoniques, constituent un facteur de réussite essentiel pour conserver un plus grand nombre de clients existants. Avant la pandémie, la plupart des employés de soutien acceptaient le fait qu'une grande partie de leur travail consistait à envoyer des courriels et des textos et à appeler les clients. Durant les périodes creuses, ils faisaient des rappels – ils contactaient les clients pour reporter les consultations manquées, ils

recommendations, and they scheduled diagnostics for clients on chronic medication requiring on-going bloodwork. Even in a small hospital, this was a full-time job.

Deciding who to call involves digging into your practice management software. Unfortunately, most software is designed to only make 3 attempts to get clients in for their appointment. If there is no reply in 3 tries, the software assumes the client does not want to come in and gives up on further communication. This is where the staff have to step in and search for active clients who came in last year and did not come in this year, and follow up with those who require dental recommendations or are overdue (or due) for diagnostic tests.

Callbacks are like financial collections in that the more current the clients, the more likely you are to collect or connect. Someone who just missed their appointment last week may still remember the reason for coming in and is more likely to book than someone who has not been in for over a year. When deciding who to email or call, start with the most current appointments or recommendations and work backwards.

Electronic communication through client communication apps is a lot more effective to get the same message to many people, but it is not the only way. If it worked well, there would be no lapsed clients. If email and text don't work, staff need to pick up the phone and start calling people. Although not nearly as effective as email, a phone call from the veterinary staff does have that personal touch an email or text does not, and it offers the opportunity for staff to explain the importance of the pending appointment or procedure.

Getting back on track with callbacks requires training the new people, setting new operations standards, and allocating specific people to contact clients during specific times. Callbacks never happen on their own. Most staff would rather clean kennels than talk to someone on the phone. Make time in the staff schedule for call backs and set expectations for a certain number of calls per hour, per day, and per week. Help the staff member develop a dialogue that sends a positive message to the client and leaves the client with the impression that the veterinarian and staff care about their pet. Don't say, "you missed your appointment, you need to come in," but rather, "you are due for your appointment. I see Tuesdays work for you. Can I book you in for Tuesday at 1:00 pm?"

Given the number of clients that were coming in during the COVID-19 pet population boom, there is a lot of opportunity. Re-engaging 10 lapsed clients per month would get the average practice back to the boom numbers in less than a year.

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assuraient un suivi concernant les soins dentaires recommandés, et ils planifiaient les visites des patients atteints d'affections chroniques nécessitant une médication à long terme et des bilans sanguins périodiques. Même dans une petite clinique, c'était pratiquement un travail à temps plein.

Pour décider qui appeler, il faut être prêt à fouiller dans le logiciel de gestion de la clinique. Malheureusement, la plupart des logiciels sont conçus pour ne faire que trois tentatives pour obtenir un rendez-vous. S'il n'y a pas de réponse après trois essais, le logiciel suppose que le client ne veut pas venir et cesse de communiquer avec lui. C'est là que le personnel doit intervenir et trouver les clients actifs qui sont venus l'année dernière mais ne sont pas revenus cette année, ainsi que les patients qui ont besoin de soins dentaires ou qui doivent subir des tests de diagnostic.

Les rappels sont comparables au recouvrement des créances : plus votre dernière interaction est récente, plus les chances de réussite sont élevées. Ainsi, un client qui a manqué son rendez-vous la semaine dernière se souvient peut-être encore de la raison pour laquelle il devait emmener son animal et est plus susceptible de prendre rendez-vous qu'une personne qui n'a pas franchi la porte de la clinique depuis plus d'un an. Lorsque vous décidez qui vous voulez tenter de joindre par courriel ou par téléphone, commencez par les clients qui ont manqué un rendez-vous ou reçu des recommandations récemment, et reculez dans le temps par la suite.

La communication électronique par le biais d'applications de communication avec les clients est très efficace pour transmettre le même message à un grand nombre de personnes, mais ce n'est pas la seule option. Si cette méthode était parfaite, on ne perdrait aucun client. Quand les courriels et les textos ne fonctionnent pas, le personnel doit prendre le téléphone et appeler les gens. Même s'ils sont moins pratiques, les appels téléphoniques ont cette touche personnelle que les courriels et les textos n'ont pas, et ils donnent l'occasion au personnel vétérinaire d'expliquer l'importance du rendez-vous ou de l'intervention.

Pour reprendre les bonnes habitudes concernant les rappels, il faut former les nouveaux employés, établir de nouvelles normes opérationnelles et attribuer à des personnes

spécifiques la tâche de contacter les clients à des moments déterminés. Les rappels ne se feront pas d'eux-mêmes, et beaucoup d'employés préfèrent nettoyer les cages plutôt que de parler à quelqu'un au téléphone. Prévoyez du temps dans les horaires du personnel pour les rappels et fixez des objectifs pour atteindre un certain nombre d'appels par heure, par jour et par semaine. Aidez vos collègues à établir un dialogue qui envoie un message positif au client et lui donne l'impression que toute l'équipe se soucie de son animal. Au lieu de dire : « Vous avez manqué votre rendez-vous, il faut que vous ameniez votre animal », ce serait préférable de dire : « Votre animal est dû pour son rendez-vous, et je vois que le mardi vous convient – est-ce que je peux vous inscrire à l'horaire pour mardi à 13 heures? ».

Comme le nombre de clients a atteint un niveau record durant le boom de la population d'animaux de compagnie associé à la COVID-19, il y a beaucoup d'occasions à saisir. En regagnant 10 clients par mois, une clinique moyenne retrouverait ces chiffres élevés en moins d'un an.

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