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Published monthly by/ Publication mensuelle de
Canadian Veterinary Medical Association

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L’Association canadienne des médecins vétérinaires 2017

The Canadian Veterinary Journal is indexed or abstracted in:
La Revue vétérinaire canadienne est indexée ou ses articles sont résumés dans :
AGRICOLA, Biological Abstracts, Capsule Report, Current Contents — Agriculture,
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R esearchers and publishers keep an eye on the annual impact factor of journals. The impact factor for a year is the number of current year citations of articles published in the 2 previous years divided by the total number of articles published in the 2 previous years. For example, if in 2016 there were 400 citations of articles that were published in Journal X in 2014 and 2015 and the total number of articles published by Journal X in 2014 and 2015 was 200, the impact factor for 2016 would be 400 divided by 200 = 2.0. On average, the articles published 1 or 2 years ago were cited 2 times in the 1-year time frame. This could be achieved if 1 article was cited 400 times and the remaining 199 articles were never cited, or if each article had been cited 2 times. Typically, there is a skewed distribution of citations (1,2): “The so-called 80/20 phenomenon applies, in that 20% of articles may account for 80% of the citations” (2).

There is also a 5-year impact factor that tends to suffer less year-to-year variation. The 5-year journal impact factor is the number of previous 5-year citations in the year divided by the total number of articles published in the preceding 5 years.

The impact factor is all about usage of published articles by researchers. It does not take into account the impact clinician researchers make through translation of their articles into improved clinical practice.

Dr. Eugene Garfield (1,3), one of the creators of the journal impact factor has warned that “the impact factor should not be used without careful attention to the many phenomena that influence citation rates…” He notes, for example, that “no effort is made to differentiate clinical vs laboratory studies or, for that matter, practice-based vs research based articles.” He goes on to point out that inclusion of review articles can affect the impact factor because these articles are often used in place of earlier literature and are usually cited more frequently than are research articles. Not surprisingly, journals that publish reviews only are among those with the highest impact factors. He notes, however, that mediocre review papers are not likely to improve a journal’s impact factor (3).

L es chercheurs et les éditeurs surveillent le facteur d’impact annuel des revues. On détermine le facteur d’impact d’une année en établissant le nombre de citations pour l’année en cours des articles publiés au cours des deux années antérieures et en le divisant par le nombre total d’articles publiées au cours des deux années antérieures. Par exemple, si, en 2016, il y avait 400 citations d’articles qui avaient été publiées dans la Revue X en 2014 et en 2015 et que le nombre total d’articles publiés par la Revue X en 2014 et en 2015 était de 200, alors le facteur d’impact pour 2016 serait 400 divisé par 200 = 2,0. En moyenne, les articles publiés il y a un ou deux ans étaient cités deux fois durant une période d’un an. Ce chiffre pourrait être atteint si un article était cité 400 fois et que le reste des 199 articles n’étaient jamais cités ou si chaque article avait été cité deux fois. Habituellement, il se produit une distribution biaisée des citations (1,2) : «Le soi-disant phénomène 80/20 s’applique car 20 % des articles peuvent représenter 80 % des citations» (2).

Il y a aussi un facteur d’impact de cinq ans qui a tendance à afficher moins de variations annuelles. Le facteur d’impact de cinq ans d’une revue est le nombre de citations observées dans une année pour des articles publiés au cours des cinq années antérieures qui est divisé par le nombre total d’articles publiés au cours des cinq années antérieures.

Le facteur d’impact porte principalement sur l’utilisation par les chercheurs des articles publiés. Il ne tient pas compte de l’impact qu’ont les chercheurs cliniciens lorsqu’ils transposent leurs articles afin d’améliorer la pratique clinique.

Le Dr Eugene Garfield (1, 3), l’un des créateurs du facteur d’impact des revues, a mis en garde que «le facteur d’impact ne devrait pas être utilisé sans porter une attention particulière aux nombreux phénomènes qui influencent les taux de citation ….». Par exemple, il signale qu’aucun effort n’est déployé pour différencier les études cliniques de celles de laboratoire ni des articles fondés sur la pratique de ceux axés sur la recherche. Il poursuit en signalant que l’inclusion des articles de compte rendu peut affecter le facteur d’impact parce que ces articles sont souvent...
Currency and accessibility of articles to researchers may also influence impact factor. If an article is delayed for too long in the refereeing/processing stages it will be less current when it does appear and also may lose out in citations to related articles that were published while it was being processed. In this regard, online only journals that provide open access to everyone within days or weeks of accepting an article have an advantage over print journals.

Other factors that influence the likelihood of an article being cited in a research journal include quality of research, area of research (popular areas are more likely to be cited than areas with a small research following), local/international relevance (articles that relate specifically to a country or region are less likely to be cited widely than articles with a broader relevance), reputation of the authors, and reputation of the journal. Case reports that describe rare conditions or procedures are candidates for low citation rates.

Unfortunately, impact factor is now being used to not only judge journals but also to evaluate authors. “The misuse of the Impact Factor has become institutionalized in the research assessment methods of many universities and national evaluation panels, leading to a perverse incentive system” (2). Researchers are under pressure to publish in high impact journals and we now have a system in which papers work their way down the impact factor ladder, with rejections until they find a rung of the ladder where the article is accepted. “Ultimately, the culture will only change when the institutions responsible for overseeing the assessment of researchers and those who constitute the evaluation panels take active steps to change how they assess scientists” (2). Why do we care? We care because, although the impact factor is a measure of impact on researchers and not of impact on practicing veterinarians, the impact factor influences the decisions of clinical researchers engaged in high quality research with regard to where they submit their articles.

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Ethical question of the month — April 2017
Recent studies have shown that taking urban visitors on tours of carefully chosen and well-run livestock operations does not always produce a positive response regarding the care of farm animals. For example, when members of the public visit free stall dairy barns with robotic milking machines where cows are clean and comfortable with only rare cases of lameness and other “production diseases,” the response of the urban visitor is not always positive. Standard farm practices such as the removal of the calf at birth from its mother and the inability of cows to graze at pasture are considered both unnatural and disturbing to many urban visitors. Is educating the public regarding modern livestock production practices the correct approach to convincing the public that current industry practices ensure the welfare of farm animals?

Question de déontologie du mois — Avril 2017
Des études récentes ont montré que l'organisation de visites guidées dans des exploitations d'élevage soigneusement choisies et bien exploitées à l'intention des citadins ne suscite pas toujours une réaction positive à l'égard des soins des animaux d'élevage. Par exemple, lorsque des membres du public visitent des logettes laitières avec des systèmes de traite automatisée où les vaches sont propres et confortables et que seulement quelques rares cas de boiterie et d'autres «maladies de production» sont observés, la réponse du visiteur urbain n'est pas toujours positive. Les pratiques normalisées des fermes, comme la séparation du veau et de la mère à la naissance et l'incapacité des vaches de brouter dans les prés, sont considérées comme n'étant pas naturelles et dérangeantes pour de nombreux visiteurs urbains. L'éducation du public à propos des pratiques d'élevage modernes représente-elle l'approche appropriée pour convaincre la population que les pratiques actuelles de l'industrie garantissent le bien-être des animaux d'élevage?

Comments/Commentaires :

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

Les réponses au cas présenté sont les bienvenues. Veuillez limiter votre réponse à environ 50 mots et nous la faire parvenir par la poste avec vos nom et adresse à l’adresse suivante : Choix déontologiques, a/s du Dr Tim Blackwell, 6486, E. Garafraxa, Townline, Belwood (Ontario) N0B 1J0; téléphone : (519) 846-3413; télécopieur : (519) 846-8178; courriel : tim.e.blackwell@gmail.com
Les propositions de questions déontologiques sont toujours bienvenues! Toutes les questions et situations présentées dans cette chronique s'inspirent d'événements réels dont nous modifions certains éléments, comme les noms, les endroits ou les espèces, pour protéger l’anonymat des personnes en cause.

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Ethical question of the month — January 2017

Welfare audits are becoming a common component of quality assurance programs. In addition, welfare audits are demanded by processors and retailers when videos are released that imply animal welfare abuse on farms supplying products to these processors or retailers. **Should welfare audits be performed by the herds’ own veterinarians?** If a third party audit is specifically requested by a processor or retailer, does a veterinarian need to be licensed in the province where they perform the third party welfare audit? Are there advantages to having all welfare audits performed by non-veterinarians?

Question de déontologie du mois — Janvier 2017

Les vérifications de bien-être deviennent un élément courant des programmes d’assurance de la qualité. De plus, des vérifications de bien-être sont exigées par les transformateurs et les détaillants lorsque des vidéos publiées laissent sous-entendre qu’il s’est produit de la violence envers les animaux dans des fermes fournissant des produits à ces transformateurs ou à ces détaillants. **Ces vérifications devraient-elles être réalisées par les vétérinaires affectés aux troupeaux?** Si une vérification par un tiers est spécifiquement demandée par un transformateur ou un détaillant, un vétérinaire devrait-il détenir un permis dans la province où il effectue la vérification de bien-être de tierce partie? Enfin, y aurait-il des avantages à la réalisation de ces vérifications de bien-être par des non-vétérinaires?

Welfare audits on farms — A comment

In the event of an incident where there is credible evidence of animal cruelty (e.g., Chilliwack dairy abuse case, June 2014), the dairy processing industry would require that a 3rd party welfare audit be conducted by a trained veterinary auditor to restore consumer and customer confidence.

The Canadian dairy processing industry has been collaborating with veterinary associations and regulators to establish a national roster of trained veterinarians to conduct such audits; including provisions for emergency licensure should there be a need for a veterinarian to come from out-of-province (e.g., conflict of interest).

Warren Skippon, DVM, Director, Animal Welfare, Governmental Affaires, Saputo, St-Léonard, Quebec.

An ethicist’s commentary on welfare audits on farms

The creation of the Pew Commission as a result of a collaboration between the Pew Charitable Trusts and the Bloomberg School of Public Health at Johns Hopkins University represented a world-historic event. For the first time since industrial agriculture (a.k.a. factory farms) crowded out traditional husbandry-based agriculture in the 20th century, an eminent group of experts took a critical look at the effects of confinement agriculture on many areas of concern — animal welfare, environmental despoliation, human and animal health, loss of small family farms, domination of agriculture by giant mega-corporate entities, and numerous other issues. I was privileged to serve on this commission, along with some of the brightest minds I ever encountered, with expertise ranging from human health, animal health, environmental preservation, animal welfare, sustainability, government, and numerous other relevant areas. The commission’s work involved two years of thorough investigation of the issues, as well as multiple meetings held around the country listening to all relevant stakeholders, ranging from people living near confined animal feeding operations (CAFOS) to experts in infectious disease, to medical and veterinary school administrators, to environmentalists and animal welfare advocates, to regulators. In 2008, the report of the commission, the first ever account of the costs and benefits of industrial agriculture, was published, with all recommendations requiring unanimous approval of all commissioners.

Initially, many commissioners were quite naïve about the animal welfare issues raised by the sort of animal production being examined. Eventually however, they came to realize that it was probably the most problematic and pressing issue emerging from our study. None of us knew of a good way to assure that the abysmal welfare experienced by animals in CAFOS could be significantly improved. We considered federal legislation, but immediately came up against the question of who would enforce such laws. Though some people suggested the United States Department of Agriculture (USDA), we quickly realized that the job of USDA was to promote agriculture, and that USDA oversight over animals used in biomedical research and teaching was of extremely limited effectiveness. We were particularly reluctant to create yet another government bureaucracy. In the end, it was decided that independent third-party audits were probably the most efficacious mechanism for ensuring farm animal welfare.

With societal concern about farm animal welfare increasing exponentially worldwide (witness recent stirrings in the United States regarding environments suitable for the natures of poultry, and the thrust for slow-growing birds which are less susceptible to musculoskeletal problems), a wide range of corporate entities have begun to use third-party auditors. These entities include restaurant chains, grocery chains, catering industries, food services in universities, etc. And in my experience, this approach works extremely well.
I believe that auditors must be trained to know what to look for, both good and bad. But I certainly do not believe that they need to be veterinarians. Furthermore, they should not work for the entity they are inspecting — I can hardly imagine a greater conflict of interest! The issue of licensure is irrelevant. What is required is a genuine and deep concern for the well-being of the animals, and an ability to be diplomatic yet firm when dealing with farm workers and owners.

It probably helps to have some background in agriculture as well, although that is by no means necessary. In some cases, in fact, having in agricultural background can be a disadvantage, particularly if one has worked in an operation that is far from exemplary, and where, in Temple Grandin’s *mot juste*, “bad has become normal.” Indeed, some of the best auditors I have met grew up in an urban context. It is also essential that the auditor not be easily intimidated, and possesses a superb BS detector. Above all, the auditor must have the solid backing of the management of the entity for whom she/he works.

Gender does not matter. Some first-rate auditors are females totally devoid of macho swagger. What is essential is a commitment to the animals and a deep and powerful sense of honor, which is unfortunately not as widespread and pervasive as it used to be.

*Bernard E. Rollin, PhD*
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†  #1 prescription product in its category in the Canadian animal health market. ImpactVet data, December 2016.
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CA/BRV/0117/0001
1. Which of the following is the most appropriate treatment plan for a cat with a mass in the left second mammary gland and a second mass in the right third mammary gland?
A. No direct intervention is needed; measure the masses monthly to monitor for changes.
B. Simple lumpectomy.
C. Chemotherapy with a cisplatin-based protocol.
D. Mammectomy of the affected glands.
E. Bilateral radical mastectomy of both mammary chains.

2. A 9-year-old castrated male cocker spaniel has a history of polyuria and polydipsia and has an elevated alkaline phosphatase (ALP) concentration. Morning urine is collected at home, and the urine cortisol:creatinine ratio (UCCR) is determined to be 36 (reference range: 8 to 24). Which of the following is the best interpretation of these results?
A. This dog has hyperadrenocorticism, and treatment should be initiated.
B. This dog may have hyperadrenocorticism, and further adrenal function testing is indicated.
C. This dog does not have hyperadrenocorticism.
D. The elevation of the UCCR is due to stress.
E. This dog has hypoadrenocorticism.

3. Which of the following is most correct concerning chocolate toxicity in the dog?
A. Milk chocolate is more toxic than dark chocolate.
B. Clinical signs are mild, and treatment is not necessary.
C. Large quantities of chocolate must be consumed for toxicity to occur.
D. Clinical signs include tachycardia, vomiting, ataxia, muscle tremors, and seizures.
4. A 2-year-old quarter horse mare is being evaluated for an acute onset of neurological signs (circling, stumbling, depression, tremors). A serum chemistry panel reveals severe hepatic dysfunction. A liver biopsy shows hepatocytomegaly, biliary hyperplasia, and fibrosis, with a minimal inflammatory component. Which of the following is the most likely cause of the condition?
   A. Copper  
   B. Pyrrolizidine alkaloids  
   C. Zinc  
   D. Lead  
   E. Maple

5. A 3-year-old cow, lame in the right hind limb, with striations in the white line of the outer claw and soft, focal swelling at the coronary band proximal to this striation, probably has which of the following?
   A. Foot rot  
   B. Hairy heel wart  
   C. Laminitis  
   D. Sole abscess  
   E. Sole ulcer

(See p. 410 for answers.)
2017 SCVMA Symposium

“Take the Bull by the Horns, Take Charge of your Actions”

Summarizing the 2017 Students of the CVMA (SCVMA) Symposium in one short article is not easy considering how amazing the weekend was! On January 20 and 21 the University of Calgary — Faculty of Veterinary Medicine (UCVM) hosted over 200 Canadian veterinary students at the 2017 SCVMA Symposium “Take the Bull by the Horns, Take Charge of your Actions.” First, on behalf of all student attendees, I would like to extend a huge thank you to the UCVM student organizers. This event takes a lot of planning and the hard work the organizers put in over the past year definitely showed throughout the weekend. In addition to thanking the organizers, I would also like to thank the UCVM students who welcomed students from out of town into their homes and helped them navigate Calgary for the weekend. Your hospitality was greatly appreciated by all. My last thank you is for the 2017 Symposium sponsors;

The SCVMA Committee representatives with Dr. Temple Grandin (far left), CVMA President Dr. Troy Bourque (back row with tie), CVMA Vice-President Dr. Terri Chotowetz (front row in white) and SCVMA Coordinator Alexandra Schlesiger (back row in orange).

Les représentants du Comité des ÉACMV avec la Dre Temple Grandin (extrême gauche), le président de l’ACMV Dr’’ Troy Bourque (dernière rangée portant une cravate), la vice-présidente de l’ACMV Dre Terri Chotowetz (rangée avant en blanc) et la coordinatrice des ÉACMV Alexandra Schlesiger (dernière rangée en orange).

Basic Alpaca Handling and Skills wet lab.

Laboratoire sur la manipulation et les soins de base des alpagas.

Symposium 2017 des ÉACMV

“Prenez le taureau par les cornes, assumez la responsabilité de vos actes”

Il n’est pas facile de résumer le Symposium 2017 des Étudiants de l’ACMV (ÉACMV) dans un court article, car nous avons vraiment vécu une fin de semaine extraordinaire! Les 20 et 21 janvier, la Faculté de médecine vétérinaire de l’Université de Calgary (UCVM) a accueilli plus de 200 étudiants en médecine vétérinaire au Symposium 2017 des ÉACMV «Prenez le taureau par les cornes, assumez la responsabilité de vos actes». D’abord, au nom de tous les participants étudiants, j’aimerais transmettre mes chaleureux remerciements aux organisateurs étudiants de l’UCVM. Cet événement exige beaucoup de planification et il était évident pendant la fin de semaine que les organisateurs avaient effectué un énorme travail au cours de la dernière année. J’aimerais aussi remercier les étudiants de l’UCVM qui ont accueilli des étudiants de l’extérieur de la ville dans leur foyer et qui ont facilité leurs déplacements à Calgary pendant la fin de semaine. Votre
Second-year WCVM students, from the left, Shawna Ellis, Fiona Hooch-Antink, Jason Johnson, Garrett Fraess, Bailie Ericson, Kaitlyn Brown, Lauren Bonnell and Krista Davis, enjoying the SCVMA Symposium closing banquet.

Les étudiants de deuxième année du WCVM, de gauche à droite, Shawna Ellis, Fiona Hooch-Antink, Jason Johnson, Garrett Fraess, Bailie Ericson, Kaitlyn Brown, Lauren Bonnell et Krista Davis, s’amusant lors du banquet de clôture des ÉACMV.
your generosity makes this event possible. The 2017 SCVMA Symposium's platinum, gold and silver sponsors include the Canadian Veterinary Medical Association, the University of Calgary Students’ Union, the Canadian Food Inspection Agency, Merial, and Royal Canin.

The 2017 SCVMA Symposium kicked off Thursday night with a CPR Competition between the colleges. Working in teams, students resuscitated simulated patients while utilizing their CPR skills, medical emergency knowledge, as well as their professional communication skills. Team Owl Save You came out on top with honorable mentions going out to Team Cardiopulménagerie, Team Less Compassion: More Compression, Team Get Your Heart On, Team Fibrillicious, and Sleep Apnea a.k.a. Dream Team. You were all amazing!

Friday was full of educational lectures and wet labs; highlights were Dr. Cody Creelman’s lecture on using mobile technology in the field and social media platforms, Dr. Emma Read’s lecture about women pursuing veterinary medicine and the advantages in the field and social media platforms, Dr. Temple Grandin’s keynote speech, “Animal Behavior; Understanding How Animals Talk and Feel.” To close the weekend, students attended a banquet at the Calgary Zoo involving an intercollege game of jeopardy, music, and dancing!

On the last day, students chose to either attend workshops on emergency techniques or professional skills or go on various tours. The tours included going behind the scenes at the Calgary Zoo, the Calgary Police K9 Unit, Moore Equine Veterinary Centre, Cattleland Feedlot, or the Wheatland Hutterite Colony. Saturday afternoon students had the pleasure of listening to Ranchman’s Cookhouse and Dancehall for a barbeque dinner followed by a fun night of socializing, networking, 2-stepping, and even bull riding.

The 2017 SCVMA Symposium was a fantastic experience, and I would encourage all students to attend next year’s conference, hosted by the Atlantic Veterinary College in Charlottetown, Prince Edward Island. Hope to see you all there!

(by Traci Henderson, WCVM, Senior SCVMA Representative)
Volunteers: Enriching Our Society
National Volunteer Week – April 23 to 29, 2017

Les bénévoles enrichissent notre société
Semaine nationale de l'action bénévole — Du 23 au 29 avril 2017

National Volunteer Week provides a wonderful opportunity to honor the veterinarians, veterinary technicians/technologists, students and other volunteers who donate their time and expertise to the various projects undertaken by the Canadian Veterinary Medical Association (CVMA) in support of Canada's veterinary profession.

This year’s National Volunteer Week theme is “Volunteers: Enriching Our Society.” Every volunteer activity enriches the communities in which we live. Communities not only survive because of the enormous amount of time volunteers dedicate to various causes, but they thrive. Volunteers enhance the success of organizations and help cultivate strong relationships within communities. The CVMA depends on the contributions of our devoted volunteers across Canada to help our Association achieve a variety of goals and objectives, and ensure the voice of the Canadian veterinary profession is heard across the country and around the world.

Over 600 volunteers support the work of the Association, through their work on our Executive, Council, various standing committees, advisory groups, and task forces, and by reviewing articles for our journals. CVMA’s volunteers take time from their busy schedules to act as ambassadors in media interviews and represent the CVMA and the veterinary profession on 25 different external boards, associations, legislative and policy-making groups, both in Canada and abroad.

Here is a glimpse into the many examples of how volunteers have recently contributed to CVMA efforts:

Volunteers on the Animal Welfare Committee (AWC) advocate and promote animal welfare within the animal industry, to government, and the public. The Committee has updated a number of Position Statements, including: Thermocautery for Lameness in Horses, Induced Moulting of Poultry, Tail Docking of Dairy

Les membres du Comité sur les enjeux nationaux discutent des enjeux d’actualité dans la collectivité de la médecine vétérinaire. (En haut, de gauche à droite : Dʳ Duane Landals, Dʳ Enid Stiles, CVMA CEO, M. Just am Rhyn, Dr Leigh Rosengren, Dr Randy Bagg. En bas, de gauche à droite : Dʳ Christiane Armstrong, Dʳ Joanne Dias, Dʳ Jaspinder Komal et le gestionnaire des Enjeux nationaux et du Bien-être animal, Dr Shane Renwick).

Members of the National Issues Committee discussing current issues in the veterinary community. (Top left: Dr. Duane Landals, Dr. Enid Stiles, CVMA CEO, Mr. Just am Rhyn, Dr. Leigh Rosengren, Dr. Randy Bagg. Bottom left: Dr. Christiane Armstrong, Dr. Joanne Dias, Dr. Jaspinder Komal, and National Issues and Animal Welfare manager, Dr. Shane Renwick).
Cattle, Castration of Piglets, and Disbudding and Dehorning of Cattle. The Committee also spent time advocating in support of Bill C-246, the Modernizing Animal Protections Act, which was unfortunately defeated in the House of Commons in the fall of 2016. The AWC, and the CVMA as a whole, strongly supports the updating of federal legislation surrounding animal abuse.

The veterinary profession is top of mind for the volunteers on the National Issues Committee (NIC), which provides leadership and advocacy on national veterinary issues affecting the profession. For the first time, in 2016, the CVMA held a National Issues Forum during its Annual Convention highlighting the importation of dogs into Canada. The NIC is using the feedback received during the forum to help finalize the Importation of Dogs into Canada Position Statement. As part of the Federal Action Plan on Antimicrobial Resistance and Use in Canada, members of the NIC joined other like-minded stakeholders for the first meeting of the Federal, Provincial, Territorial (FPT) Antimicrobial Resistance (AMR) Steering Committee. The NIC also advocated on behalf of the World Small Animal Veterinary Association against the international rescheduling of ketamine, an important anesthesia/analgesia agent in veterinary medicine. The NIC is also revising the Transportation of Dogs and Cats Position Statement.

The Veterinary Pharmaceutical Stewardship Advisory Group has dedicated much time to developing the, “Veterinary Oversight of Antimicrobial Use — A Pan-Canadian Framework for Professional Standards for Veterinarians,” in collaboration with the Canadian Council of Veterinary Registrars (CCVR).

The Environmental Advisory Group continues to work on the CVMA Green Veterinary Practice Initiative, providing a web-based source of information on how to improve the environmental impact of veterinary practices and infrastructure. The group continues to encourage practices to share their success with others.

We thank the veterinarians, registered veterinary technicians/technologists, students, and other volunteers who donate their time and expertise to the CVMA. (Left to right: NL Council rep, Dr. Margaret Brown-Bury, AHT/VT Program Accreditation member, Ms. Tammy McLeod, RVITC Council rep, Ms. Lois Ridgway, AHT/VT Program Accreditation member, Ms. Gail Cooper, CVMA President-Elect, Dr. Troye McPherson, and 2017 Convention Chair, Dr. Kathleen MacMillan.)

Nous remercions les médecins vétérinaires, les techniciens et les technologues vétérinaires agréés, les étudiants et les autres bénévoles qui donnt de leur temps et communiquent leur expertise à l’ACMV. (De gauche à droite : la représentante du Conseil de Terre-Neuve-Labrador, Dª Margaret Brown-Bury, la membre du Comité d’agrément des programmes de TVA/TV, Mme Tammy McLeod, la représentante du Conseil de TVAC, Mª Lois Ridgway, la membre du Comité d’agrément des programmes de TVA/TV, Mª Gail Cooper, la présidente désignée de l’ACMV, Dª Troye McPherson, et la présidente du congrès 2017, Dª Kathleen MacMillan.)

On March 4, 2017, the CVMA held a Volunteer Appreciation Dinner during the 2017 CVMA Committee Weekend in Ottawa, Ontario. Le 4 mars 2017, l’ACMV a organisé un dîner d’appréciation des bénévoles durant la Fin de semaine des comités 2017 de l’ACMV qui s’est tenue à Ottawa, en Ontario.
stories with the CVMA and entice others to follow in their environmental footsteps. The Group also remains a resource for the NIC to consult on specific environmental issues.

The Business Management Advisory Group (BMAG) helps the CVMA with one of its 3 strategic objectives: “helping veterinarians achieve a successful career and a balanced life.” These volunteers oversee the delivery of the CVMA’s annual economic benchmarking initiatives such as the Provincial Suggested Fee Guides, Compensation and Benefits Reports for Associate Veterinarians, and Non-DVM Wage Reports. In 2016, the BMAG helped launch CVMA’s online Career and Business Toolkit, providing veterinarians easy access to pertinent online resources and information on personal financial management, veterinary business management, and client management.

Each year volunteers on the Communications Advisory Group help choose the theme and slogan for the annual Animal Health Week campaign. As well, the Group is once again providing expertise and insight into the extended social media awareness campaign. Each month the CVMA shares a social media message and graphic aimed at creating more awareness of issues animals may face and what owners can do to help or prevent illness.

The Professional Development Committee (PDC) helps advance the continuous, professional growth of its members and all veterinarians. The scientific program, workshops and activities offered at the annual CVMA Convention enable veterinarians and other members of the practice team to enhance professional practice and connect with peers from across Canada. For the first time in convention history, the 2016 CVMA Convention was held in Niagara Falls, Ontario. As a result, a record-breaking number (241) of Ontario DVMs attended the convention. Also noteworthy, the Emerging Leaders Program had 2 sponsored representatives from each of the 10 provinces for the first time since its inception in 2009.

Volunteers of the National Examining Board assist with the administration of Canada’s veterinary licensing examinations, participate in the veterinary college accreditation process, and review and evaluate credentials on behalf of some of the provincial licensing bodies. In 2016 the National Examining Board issued 472 Certificates of Qualification to graduates from the 5 Canadian veterinary colleges, as well as to internationally trained veterinarians who completed the NEB exams.

Volunteers of the Animal Health Technology/Veterinary Technician Program Accreditation Committee (AHTVTPAC) work to identify and promote standards and accreditation for animal health technologist and veterinary technician programs. The AHTVTPAC constantly reviews accreditation standards in collaboration with the 19 accredited programs in Canada and partners like the American Veterinary Medical Association to keep up with rapidly changing requirements and evolving needs in veterinary practice. In 2016, accreditation site visits were made at 4 AHT programs across Canada.

The Canadian Veterinary Medical Association’s Canadian Veterinary Reserve (CVR) is a national, volunteer group of qualified Canadian veterinarians who make themselves available to rapidly assist governments in responding to outbreaks of foreign animal disease and other large-scale emergencies and disasters affecting animals.

normes professionnelles régissant les médecins vétérinaires, en collaboration avec le Conseil canadien des registraires vétérinaires (CCRV).

Le Groupe consultatif environnemental continue de travailler à l’initiative de l’ACMV pour une pratique vétérinaire écoresponsable afin de fournir une source d’information sur le Web sur la façon d’atténuer l’impact environnemental des pratiques et de l’infrastructure vétérinaires. Le groupe continue d’encourager les pratiques à communiquer leurs histoires de réussites avec l’ACMV et d’inciter les autres à suivre leur exemple sur le plan écologique. Le groupe sert aussi de ressource au Comité sur les enjeux nationaux qui le consulte sur des enjeux environnementaux particuliers.

Le Groupe consultatif sur la gestion commerciale (GCGC) appuie l’ACMV afin d’atteindre l’un de ses trois objectifs stratégiques, soit celui «d’aider les vétérinaires à obtenir une carrière prospère et à atteindre une vie équilibrée». Ces bénévoles supervisent la livraison des initiatives annuelles d’analyse comparative du rendement de l’ACMV, comme les guides tarifaires suggérés des provinces, les rapports sur la rémunération et les avantages sociaux des vétérinaires salariés et les rapports sur la rémunération des employés autres que les vétérinaires. En 2016, le GCGC a collaboré au lancement de la Trousse d’outils pour la carrière et les affaires de l’ACMV qui se trouve sur le site Web, afin de permettre aux vétérinaires d’accéder facilement à des ressources pertinentes en ligne ainsi qu’à des renseignements portant sur la gestion des finances personnelles, la gestion d’une entreprise vétérinaire et la gestion de la clientèle.

Chaque année, les bénévoles du Groupe consultatif des communications aident à choisir le thème et le slogan de la campagne annuelle de la Semaine de la vie animale. De plus, le Groupe continue de fournir de l’expertise et des conseils sur la vaste campagne de sensibilisation dans les médias sociaux afin de rehausser la sensibilisation. Chaque mois, l’ACMV partage un message et un graphique dans les médias sociaux afin de rehausser la sensibilisation à l’égard des enjeux auxquels sont confrontés les animaux et d’informer les propriétaires sur les mesures qu’ils peuvent prendre pour guérir ou prévenir des maladies.


Les bénévoles du Bureau national des examinateurs facilitent l’administration des examens d’agrément vétérinaire du Canada, ils participent au processus d’agrément des collèges de médecine vétérinaire et examinent et évaluent les titres de compétence au nom de certains organismes de réglementation provinciaux. En 2016, le Bureau national des examinateurs a émis 472 Certificats de compétence aux diplômés des cinq facultés de médecine.
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REGISTRATION NOW OPEN!
The volunteers of the Editorial Committee oversee the operation and editorial content of The Canadian Veterinary Journal and the Canadian Journal of Veterinary Research. These 2 publications could not exist without the volunteer contribution of the numerous editors, peer reviewers and writers.

The Students of the CVMA Committee (SCVMA) and the Student Liaison Advisory Group (SLAG) link the CVMA with student veterinarians and faculty members at Canada’s 5 veterinary colleges. In January, the SCVMA Committee welcomed over 200 students to the 2017 SCVMA Symposium, hosted by the University of Calgary — Faculty of Veterinary Medicine and in November 2016 the first annual Student Leadership Workshop debuted at the Faculté de médecine vétérinaire (FMV).

The Veterinary Wellness Advisory Group’s objective is to develop and promote veterinary wellness initiatives and programs at a national level to complement provincial programs, and help groups and provinces in expanding their own wellness initiatives. In 2016, the Advisory Group developed a new section on the CVMA website dedicated to the health and wellness of veterinarians. The section provides easy access to relevant external resources, tools, and information categorized under emotional and mental health, physical health, and veterinarian wellness. Resources continue to be added as they are identified.

The CVMA also undertook a survey of all the provincial veterinary associations and regulatory bodies to obtain information about their respective wellness/counselling programs available to members; the specific counselling services being offered; the cost to offer such programs; and some aggregate usage statistics. The survey results were compiled and shared with all the provincial VMAs for their information.

The CVMA’s achievements are due to the devotion of our many volunteers. We sincerely thank you for donating your time and expertise.
World Veterinary Day Takes Place on April 29, 2017

Antimicrobial Resistance — From Awareness to Action

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orld Veterinary Day takes place globally on April 29, 2017 under the theme, “Antimicrobial Resistance — from Awareness to Action.”

At the Canadian Veterinary Medical Association (CVMA), we are shifting from awareness to action following the development of the document Veterinary Oversight of Antimicrobial Use — A Pan-Canadian Framework for Professional Standards for Veterinarians. The Framework is a template of professional standards for provincial and territorial veterinary regulatory bodies to use when developing their own regulations, guidelines, or bylaws relating to veterinarians’ professional responsibilities in providing oversight of veterinary antimicrobial use. It is intended to support the development of consistent regulations across the country. The Framework can be downloaded from the CVMA website, under the Policy & Advocacy tab.

The CVMA is facilitating the foundational work for building national surveillance of antimicrobial use (AMU) in animals by the veterinary community. Funded under the Canadian government’s Federal Assistance Program, a workshop gathered key partners in animal and human health in Ottawa, Ontario on February 28 and March 1, 2017. The objective was to build a collective understanding of the existing state of AMU in the veterinary context, and to identify information gaps and requirements to design efficient and effective data/information gathering methods. The workshop was Phase 1 of what is expected to be a multi-year project.

In a separate project focused on enhancing stewardship, and with the support of Agriculture Canada’s Growing Forward 2, the CVMA has commenced the renewal of the CVMA Guidelines for the Prudent Use of Veterinary Antimicrobial Medications. This project will engage the veterinary community in identifying needs for, and the development of, new tools, guidelines and communication strategies to assist veterinarians in making informed decisions about the use of veterinary antimicrobial drugs.

The Framework and resulting new initiatives address the changing veterinary responsibilities that accompany the federal government implementation of increased veterinary oversight of antimicrobials slated for the end of 2017.

The CVMA’s work will help Canada’s commitment to establish and strengthen surveillance systems to identify new threats or changing patterns in antimicrobial resistance and use, in human and animal settings, as described in the Federal Action Plan on Antimicrobial Resistance and Use in Canada: Building on the Federal Framework for Action.

La Journée mondiale vétérinaire aura lieu le 29 avril 2017

L’antibiorésistance — De la sensibilisation à l’action

L’a Journée mondiale vétérinaire se déroulera le 29 avril 2017 à l’échelle mondiale sous le thème «L’antibiorésistance — De la sensibilisation à l’action».

À l’Association canadienne des médecins vétérinaires (ACMV), nous passons de la sensibilisation à l’action après l’élaboration du document Surveillance vétérinaire de l’utilisation des antimicrobiens — Un cadre de travail pancanadien pour les normes professionnelles régissant les médecins vétérinaires. Le cadre de travail est un modèle de normes professionnelles qui sera utilisé par les organismes de réglementation de la médecine vétérinaire lors de l’établissement de leurs propres règlements, lignes directrices ou statuts concernant les responsabilités professionnelles des médecins vétérinaires dans le cadre de la surveillance de l’utilisation des antimicrobiens vétérinaires. Il vise à appuyer l’élaboration de règlements uniformes à l’échelle du pays. Le cadre de travail peut être téléchargé sur le site Web de l’ACMV, sous l’onglet Politiques et défense des intérêts.

L’ACMV facilite les préparatifs pour la mise sur pied de la surveillance nationale de l’utilisation des antimicrobiens par la collectivité vétérinaire. Un atelier financé en vertu du Programme d’assistance fédérale du gouvernement du Canada a réuni les principaux partenaires de la santé animale et humaine à Ottawa le 28 février et le 1er mars 2017. L’objectif consistait à établir une compréhension commune de l’état actuel de la surveillance de l’utilisation des antimicrobiens dans le contexte vétérinaire, à identifier des lacunes en matière d’information et à considérer les exigences en vue de la conception de méthodes et d’approches efficaces pour la collecte des données. L’atelier constituait la première phase de ce qui s’annonce comme un projet pluriannuel.


Le cadre de travail et les nouvelles initiatives qui en découleront aborderont les responsabilités changeantes des médecins vétérinaires en lien avec la mise en œuvre, par le gouvernement fédéral, d’une surveillance vétérinaire accrue qui est prévue à la fin de 2017.

Le travail de l’ACMV appuiera l’engagement du Canada en vue d’établir et de renforcer les systèmes de surveillance afin d’identifier les nouvelles menaces ou l’évolution des tendances du recours et de la résistance aux antimicrobien, dans les contextes humains et animaux, tel qu’il a été décrit dans le Plan d’action fédéral sur la résistance et le recours aux antimicrobiens au Canada : Prolongement du cadre d’action fédéral.
Class of 2017: Your CVMA Membership is FREE Until December!

Class of 2017, congratulations on earning your DVM! As your career begins and your skills strengthen, the CVMA encourages you to meet your profession’s leaders, stay connected with your peers and be aware of Canadian issues affecting veterinarians.

The CVMA wants to help you excel as you transition into your new career and is offering free CVMA membership until December 2017. You’ll soon receive your first CVMA Source Guide and you will continue to receive regular e-mail updates, CVMA’s monthly e-newsletter, a print copy of The Canadian Veterinary Journal by mail and access to CVMA’s early career DVM initiatives, including CVMA’s Mentoring Program.

Continue enjoying your CVMA membership benefits by ensuring your current home and e-mail addresses are reflected in CVMA’s national veterinary database. Here’s how:

1. Go to (www.canadianveterinarians.net).
2. Click on the My Profile tab at the top of the web page.
3. Choose Update Profile and log in using your first and last name and personal password (if you forget your password, you can request it through the login section of the website or contact the CVMA office).

Also, please note the CVMA has annual membership due reductions for new graduates. After your free CVMA membership for the balance of your graduating year, you’ll receive a 75% discount for the calendar year following graduation, a 50% discount for year 2 post-graduation and a 25% reduction for year 3 post-graduation.

The CVMA enjoyed counting you among its student members over the course of your studies and wishes you success in your new career!

For more information about your CVMA membership and to learn more the CVMA’s early career DVM initiatives to help you in your career, contact our Member Services team by phone at 1-800-567-2862, ext. 110, or by e-mail (admin@cvma-acmv.org).

Promotion 2017 : Votre adhésion à l’ACMV est GRATUITE jusqu’en décembre!

Félicitations à la promotion 2017 pour l’obtention du D.V.M. ! Tandis que vous entamez votre carrière et que vous renforcez vos compétences, l’ACMV vous encourage à rencontrer les leaders de votre profession, à garder le contact avec vos pairs et à vous tenir au courant des enjeux qui touchent les médecins vétérinaires canadiens.

L’ACMV désire assurer votre succès lors de cette transition à votre nouvelle carrière et elle vous offre l’adhésion gratuite à l’ACMV jusqu’en décembre 2017. Vous recevrez bientôt votre premier Guide des ressources de l’ACMV et vous continuerez à recevoir des mises à jour régulières par courriel, les numéros mensuels du cyberbulletin de l’ACMV ainsi qu’une version imprimée de La Revue vétérinaire canadienne par la poste et l’accès aux initiatives de l’ACMV pour les vétérinaires en début de carrière, dont le Programme de mentorat de l’ACMV.

Continuez de profiter des avantages de l’adhésion à l’ACMV en vous assurant que nous possédions bien vos adresses actuelles pour votre résidence et votre courriel dans la base de données vétérinaires nationale de l’ACMV. Voici ce qu’il faut faire :

3. Choisissez Modification de profil et ouvrez une session en utilisant votre prénom et nom de famille et votre mot de passe personnel (si vous avez oublié votre mot de passe, vous pouvez le demander dans la section de connexion du site Web ou communiquer avec le bureau de l’ACMV).

De plus, veuillez noter que l’ACMV a mis en place des réductions annuelles de la cotisation pour les diplômés récents. Après votre adhésion gratuite à l’ACMV pendant le reste de l’année d’obtention du diplôme, vous recevez un rabais de 75 % pour l’année civile suivante, un rabais de 50 % la deuxième année après la fin du cours et un rabais de 25 % pour la troisième année.

L’ACMV a été heureuse de vous compter parmi ses membres étudiants durant vos études et nous vous offrons nos meilleurs vœux de succès pendant votre nouvelle carrière !

Pour en savoir davantage à propos de l’adhésion à l’ACMV et pour de plus amples renseignements sur les initiatives de l’ACMV pour les médecins vétérinaires en début de carrière, contactez notre équipe des Services aux membres par téléphone au 1-800-567-2862, poste 110, ou par courriel (admin@cvma-acmv.org).
Earth Day takes place on April 22, 2017. Consider these 10 simple changes you can implement in your practice that will make a positive impact on the environment:

1. Power down equipment (computers, printers, monitors, television, fans, window A/C units) at night for a 25% to 50% reduction in energy use.
2. Paper use — go paperless where you can! Use electronic communication rather than mail. Choose 100% post-consumer recycled paper.
3. Wash and re-sterilize larger sized plastic syringes for multiple use.
4. Water use — choose low-flow toilets or use a toilet dam. Utilize refillable drinking water bottles or filtered water — no throwaways!
5. Post “No Idling” signs in your parking area.
6. Put pressure on veterinary industry representatives for improvements in environmentally friendly packaging and energy efficient medical equipment. Use suppliers who take back packaging/totes for reuse.
7. Lights — turn them off! Use motion detectors and/or timers. Leave minimal lighting on at night for security purposes. Earth Day should happen every day!
8. Get rid of incandescent bulbs — switch to CFL or LED.
9. RECYCLE, RECYCLE, RECYCLE!
10. Use “green” products at every opportunity. Minimize the use of high phosphate products such as bleach.

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

Le Jour de la Terre aura lieu le 22 avril 2017. Veuillez envisager ces dix changements simples que vous pouvez mettre en œuvre dans votre pratique afin d’avoir un impact positif sur l’environnement :

1. La mise hors tension de l’équipement le soir produira une réduction de 25 à 50 % de l’utilisation d’énergie. Ordinateurs/Imprimantes/Écrans/Télévisions/Ventilateurs/Climatiseurs type fenêtre.
3. Lavez et stérilisez de nouveau les seringues de plastique de grand format pour pouvoir les réutiliser plusieurs fois.
5. Affichez des panonceaux «Pas de marche au ralenti» dans votre stationnement.
7. Les lumières — fermez-les! — Utilisez des détecteurs de mouvement et des minuteries. Le soir, allumez un nombre minimal de lumières pour des raisons de sécurité. Le Jour de la Terre devrait être tous les jours!
8. Débarrassez-vous des ampoules incandescentes — remplacez-les par des lampes fluocompactes ou des ampoules DEL.
9. RECYCLEZ, RECYCLEZ, RECYCLEZ!
10. Utilisez des produits «écologiques» toutes les fois que vous en avez l’occasion. Minimisez l’utilisation de produits à forte teneur en phosphates, eau de Javel, etc.

Visitez la section Pratique et finances du site Web de l’ACMV (www.veterinaireaucanada.net) afin d’accéder à l’initiative d’une Pratique vétérinaire écoresponsable.
2017 CVMA Convention
Charlottetown, July 13–16
Unleash Your Potential!

The CVMA Convention in Charlottetown (July 13–16, 2017) is less than 3 months away. Looking at the evaluations of the 2016 CVMA Convention, the location of the Convention is the number one factor to influence DVMs whether they will attend the CVMA Convention.

We are hoping that Atlantic Veterinary College (AVC) alumni will feel nostalgic and plan a return visit to this charming city. The AVC is hosting an all-year alumni reunion on Friday, July 15 at the college; a wonderful opportunity to reconnect with classmates. And for others, Charlottetown is an excellent example of a vibrant seaside capital city with historic charm and pride of place. It provides links to the past and carries on the tradition of hospitality and the sense of belonging that the entire province of Prince Edward Island is noted for. A summer destination to be enjoyed!

The 2016 Convention evaluation also identified that continuing education (CE) sessions are the 2nd factor to influence whether to attend the CVMA Convention. Last month’s article described the diverse wet labs that will be offered. The concurrent sessions begin on Friday, July 14 and run through Sunday, July 16. These sessions cover companion animals, equine, ruminant, and small flock poultry health with over 40 speakers from Canada and the United States. Topics include dentistry, soft-tissue surgery, exotics, and pocket pets, pain management, dermatology, animal welfare, ophthalmology, diagnostic imaging, and much more.

On Thursday, July 13, Dr. Ernie Ward from North Carolina will present 6 sessions in the Practice Management stream —
“A Successful Career: A Balanced Life.” Dr. Ward will discuss how to improve diagnostic accuracy and communication, how to deal with conflict, and reveal tips for the entire team on how to make your clinic happier and healthier. He will also discuss an innovative practice of introducing a 9-month pet visit.

The CVMA Summit entitled “The Future of Veterinary Medicine: Embracing Change and Innovation” will be held on Thursday, July 13 with 3 thought-provoking speakers. Nick Stace, with the Royal College of Veterinary Surgeons in the United Kingdom, will discuss the results of a report dealing with veterinary futures. Dr. Caleb Frankel from Pennsylvania will look at “Innovation in the Veterinary Practice” and the new technologies that are emerging. Dr. Adam Little, with Texas A&M University, will look at the “Uber in Veterinary Medicine.” This year’s Summit will be chaired by Dr. Troye McPherson, CVMA president-elect.

On Thursday, July 13 from 2 to 5 pm, the National Issues Forum, sponsored by Wood Wyant, will look at alternative medicine and discuss whether it’s still an alternative. Dr. Jim Berry will discuss the issue as a small animal practitioner who uses some acupuncture; Dr. Christine Savidge will view the issue through the lens of an academic and a small animal internal medicine specialist, and Dr. Laura Taylor will provide insight from an equine holistic private practice.

A discussion and audience participation with live polling will help contribute to the formal review of CVMA’s official position on complementary and alternative medicine that is taking place this year.

These CE offerings should be of interest to most DVMs and RVTs and provide the rationale for attending the convention. The 2017 CVMA Convention program was reviewed and approved by the AAVSB RACE program to offer a total of 125 CE credits (27 maximum) being available to any one RVT and 72 veterinary technician credits (27 maximum) being available to any one RVT. It’s a great opportunity to earn CE.

If you haven’t registered, go to the website (www.canadianveterinarians.net). Register today for an exceptional CE opportunity in eastern Canada. See you in Charlottetown!

(by Ruta Klicius, CMP, CVMA Manager, Conventions)

Le jeudi 13 juillet, le D' Ernie Ward de la Caroline du Nord présentera six ateliers dans le volet sur la gestion d’une pratique – «Une carrière prospère : une vie équilibrée». Le D’ Ward discutera de la façon d’améliorer l’exacititude du diagnostic et de la communication, comment gérer les conflits et il révélera des conseils qui permettront à toute l’équipe de créer un environnement plus heureux et plus sain à la clinique. Il discutera aussi la pratique innovatrice de l’introduction d’une visite de 9 mois pour les animaux de compagnie.


Le jeudi 13 juillet, de 14 h à 17 h, le Forum sur les enjeux nationaux, qui est commandité par Wood Wyant, se penchera sur la médecine parallèle et explorera le sujet pour déterminer s’il s’agit toujours d’une médecine parallèle. Le D’ Jim Berry abordera cette question à titre de praticien pour petits animaux qui fait appel à des traitements d’acupuncture; la D’Christine Savidge examinera la question du point de vue d’une universitaire et spécialiste en médecine interne des petits animaux et la D’ Laura Taylor présentera des commentaires du point de vue de la pratique équine holistique privée.

Une discussion et la participation de l’auditoire avec des sondages en direct contribueront à l’examen formel de la position officielle de l’ACMV sur la médecine complémentaire et parallèle qui se déroulera cette année.

Ces ateliers de formation continue devraient intéresser la plupart des médecins vétérinaires et des techniciens vétérinaires agrés (TVA) et ils permettent de justifier la participation au congrès. Les ateliers du congrès 2017 de l’ACMV ont été évalués et approuvés par le programme RACE de l’AAVSB afin d’offrir un total de 125 crédits de formation continue (maximum de 27) qu’ils sont disponibles aux médecins vétérinaires et de 72 crédits pour les techniciens vétérinaires (maximum de 27) qui sont proposés aux TVA. C’est une excellente occasion d’accumuler des crédits de formation continue.

Si vous n’êtes pas encore inscrit, rendez-vous sur le site Web (www.veterinairesaucanada.net). Inscrivez-vous dès aujourd’hui pour cette occasion exceptionnelle de formation continue qui est offerte dans l’Est du Canada. Au plaisir de vous rencontrer à Charlottetown!

(par Ruta Klicius, CMP, gestionnaire des congrès de l’ACMV)
Join the Community for Emerging and Zoonotic Diseases to Support Canada’s Animal Early Warning Capabilities

Joinz-vous à la Communauté des maladies émergentes et zoonotiques afin d’appuyer les capacités de dépistage précoce des animaux du Canada

Why was CEZD developed?
This virtual network was developed to support Canada's animal early-warning, preparedness and response capabilities needs regarding emerging and zoonotic diseases. Through the gathering of information, generation and distribution of timely intelligence reports, Canada is now better able to anticipate, manage, and mitigate pending disease threats on its society, economy, environment, and animal resources.

CEZD would like your participation!
All partner and stakeholder members of the animal, public and environmental health communities are encouraged to participate, be involved in the implementation of this virtual network, and benefit from its early-warning capabilities. Various community of practice participants with agricultural, public and environmental health-related qualifications and/or expertise are invited to participate as CEZD analysts in order to deliver on its multidisciplinary analytical capability.

For more information, go to the Canadian Animal Health Surveillance System (CAHSS) website (www.cahss.ca) and under the Groups tab, click Community for Emerging and Zoonotic Diseases to do the following:
- Read a summary of CEZD, its benefits and information on how to join the community.
- Download the CEZD poster that describes the purpose and process followed by the community for emerging and zoonotic disease.

CEZD is a network group within the Canadian Animal Health Surveillance System, which is an initiative of the National Farmed Animal Health and Welfare Council (NFAHWC), with broad-based collaborative support of industry and governments. CAHSS has been designed to fill the need for strengthened animal health surveillance in Canada, as identified in the NFAHWC’s report, “Surveillance in a Time of Transition in Farmed Animal Health.”

La Communauté des maladies émergentes et zoonotiques (CMEZ) est un réseau virtuel qui intègre les outils automatisés d’extraction d’information d’aujourd’hui avec la capacité analytique multidisciplinaire des humains. Ce système automatisé en temps réel collecte, collige, analyse et dissémine des renseignements portant sur les maladies infectieuses et les zoonoses émergentes provenant de sources d’information ouvertes et traditionnelles.

Pourquoi la CMEZ a-t-elle été mise sur pied?
Ce réseau virtuel a été conçu afin d’appuyer les besoins des capacités de dépistage précoce, de préparatifs et d’intervention du Canada en lien avec les maladies émergentes et les zoonoses. Par la collecte de renseignements, la production et la distribution de rapports de renseignement opportuns, le Canada est maintenant plus apte à prévoir, à gérer et à atténuer les menaces de maladies pour sa société, son économie, son environnement et les ressources animales.

La CMEZ sollicite votre participation!
Tous les partenaires et les intervenants membres des collectivités de la santé animale, publique et environnementale sont encouragés à s’engager, à participer à la mise en œuvre de ce réseau virtuel et à profiter de ses capacités de dépistage précoce. Les participants des diverses collectivités de pratique possédant des qualifications et/ou de l’expertise dans le domaine de la santé agricole, publique et environnementale sont invités à s’engager en tant qu’analystes de la CMEZ pour assurer la prestation de sa capacité d’analyse multidisciplinaire.

Pour en savoir davantage, allez sur le site Web (www.cahss.ca) du Système canadien de surveillance de la santé animale (SCSSA) (www.cahss.ca) et sous l’onglet Groupes, cliquez sur Communauté des maladies émergentes et zoonotiques afin de :
- Lire un résumé portant sur la CMEZ qui présente ses avantages et des renseignements sur la façon de vous joindre à la collectivité.
- Télécharger l’affiche de la CMEZ qui décrit le but et le processus suivis par la collectivité pour les maladies émergentes et zoonotiques.

La CMEZ est un groupe de réseau au sein du Système canadien de surveillance de la santé animale (SCSSA), une initiative du Conseil national sur la santé et le bien-être des animaux d’élevage (CNSBAE), doté d’un vaste soutien collaboratif de l’industrie et des gouvernements. Le SCSSA a été conçu pour combler le besoin d’une surveillance accrue de la santé animale au Canada tel qu’il a été identifié dans le rapport du CNSBAE, «Surveillance in a Time of Transition in Farmed Animal Health».
Article

Use of an elastic transarticular external fixator construct for immobilization of the elbow joint

Bertrand Vedrine

Abstract — Transarticular external skeletal fixation usually involves rigid bars that result in a stable but stiff joint. This study describes the technique and the outcome of an elastic transarticular external fixator (ETEF) applied to the elbow joint. Four cases of elbow luxation with collateral ligament injuries were managed with closed reduction and application of an ETEF to maintain the reduction. A triceps tendon avulsion was surgically managed before applying an ETEF. The clinical outcome was considered excellent in 2 cats, good in 2 dogs (1 elbow luxation and the avulsion of the triceps tendon), and poor in 1 dog presented for elbow luxation and a permanent neurological defect. The procedure was rapid, easy to perform, and inexpensive. All animals except the one with a neurological defect had an early return to weight bearing. This method maintains extension of the joint while permitting its motion thereby promoting rehabilitation.

Résumé — Utilisation d’un fixateur externe élastique en pontage articulaire pour immobiliser le coude. Un pontage articulaire est généralement réalisé avec des barres métalliques aboutissant à une articulation stable mais rigide. Cette étude décrit la technique et le suivi d’un pontage articulaire par fixateur externe élastique (FEE) appliqué au coude. Quatre cas de luxation du coude avec lésions ligamentaires associées ont été gérés par réduction manuelle et application d’un FEE pour maintenir la réduction. Une avulsion du tendon du triceps a été opérée avant application d’un FEE. Le résultat a été considéré excellent pour 2 chats, bon pour 2 chiens (1 luxation du coude et l’avulsion du triceps), et mauvais pour un chien présenté pour luxation du coude avec un déficit neurologique permanent. La procédure était rapide, facile à réaliser et peu onéreuse. Tous les animaux à l’exception de celui avec le déficit neurologique ont repris rapidement un appui. Le FEE maintient l’articulation en extension tout en permettant son mouvement ce qui favorise sa rééducation.

Introduction

Transarticular stabilization is designed to restrict joint movement by the placement of an external skeletal fixation device above and below a joint, connected by rigid bars. It has been developed to manage joint instability (1–3), protect tendon repair such as patellar tendon (4–6), common calcaneal tendon (7,8), triceps tendon (9,10), and juxta-articular fractures (2,5,11). Rigid transarticular external fixators (RTEFs) have been employed to restore joint alignment and stability while healing of supporting structures and articular cartilage surface takes place.

Joint immobilization, however, causes a decrease in synovial fluid production, cartilage stiffness and thickness, and range of motion (ROM). It also leads to cartilage fibrillation, cleft formation, intra-articular adhesions, periarticular contractures, the development of degenerative joint disease, a loss of muscle mass, and bone mineral content and density (1–8,11). Some of the changes present after joint immobilization appear to be permanent even if rapid remobilization after removal of the fixator helps to reverse the negative consequences of immobilization.

Controlled motion of ligamentous structures has been reported to be beneficial since intermittent joint compression serves as a pump mechanism for solute exchange in the cartilage (4). Motion has been shown to stimulate neochondrogenesis, promoting differentiation of mesenchymal cells toward a chondrogenic lineage, especially during the first few weeks of the healing process. As little as 10º of movement in a joint promotes...
preservation of articular cartilage health, so an ideal balance between motion and immobilization is required for the best outcome after surgical ligamentous repair (4).

Non-rigid transarticular external fixator (N-RTEF) has been proposed to reduce the stiffness of the immobilization and promote an early controlled motion of the joint after surgery. Hinged transarticular external fixator (HTEF) restricts motion to a single plane parallel to the joint's plane of motion (2,4). Elastic transarticular external fixator (ETEF) replaces connective rigid bars with an elastic band (3). The goals of N-RTEF are to prevent joint instability and promote healing of supportive structures while minimizing the impact of immobilization on articular homeostasis and cartilage metabolism.

The elbow is particularly prone to decreased range of motion (ROM) and development of periarticular fibrosis when immobilized for any length of time (12). Recommendations for immobilizing the joint after reduction of elbow dislocation vary from 7 d to 2 wk (13–16). Protection of an avulsed triceps tendon repair needs an immobilization of 3 to 6 wk to allow the tendon to regain sufficient tensile strength and healing at the osseo-tendinous junction (9,10,17–20).

The purpose of this study was to describe the placement of an ETEF in clinical cases and to evaluate its ability to maintain the reduction of unstable elbows, and to protect repair of an avulsed triceps tendon.

Materials and methods
Hospital records from the veterinary clinic Seinevet, Rouen-Boos, France, were searched for cases in which ETEF was used to immobilize elbow joints. Between May 2013 and December 2014, 5 animals (3 dogs, 2 cats) presented for elbow luxation (2 dogs, 2 cats) and avulsion of the triceps muscle (1 dog) were managed by application of an ETEF.

Elastic transarticular external fixator (ETEF) technique
The technique employed herein was the same as described by Schwartz and Griffon in 2008 (3). One pin was placed in the distal quarter of the humerus, proximal to the supratrochlear foramen and perpendicular to the long axis of the bone. A second pin was placed parallel to the first in the center of the olecranon, at the proximal aspect of the bone (Figure 1). When both pins were in place, the elbow was moderately extended to an angle of 140°. The pins were then clamped to rigid bars for 2 d until postoperative swelling had decreased. Then, the connective bars were replaced with tight elastic bands on the medial and lateral aspects of the elbow to allow ROM. A commercial regular elastic band was used on each side of the fixator and was twisted several times around each pin until there was enough

Figure 1. Medio-lateral radiograph of an elbow illustrating the placement of the pins in the distal humerus and olecranon (black circles).

Figure 2. Photograph (A) and radiographs in orthogonal views (B) of the ETEF after placement of the elastic bands. Blood sampling tube stoppers were used to prevent migration of the band.
localization of the lameness to the elbow. Radiographs showed

A 1-year-old female border collie, weighing 17 kg, was referred to the veterinary clinic after replacement of the rigid connective bars with elastic bands. They received anti-inflammatory drugs for 5 to 7 d. Blood sampling tube stoppers were placed over the pins before and after placement of the elastic bands to prevent migration of the bands (Figure 2).

Elbow luxation (cases 1 to 4)
Description, history, and duration of luxation at the time of consultation were recorded (Table 1). Diagnosis of elbow luxation was made upon clinical and radiographic examination (Figure 3). All the cases were managed with closed reduction. A Campbell test was carried out to evaluate collateral ligament integrity and residual instability after reduction. Stable elbows after closed reduction were excluded from the study. An ETEF was applied as described. Animals were discharged from the clinic after replacement of the rigid connective bars with elastic bands. They received anti-inflammatory drugs for 5 to 7 d. Instructions were given to owners to confine animals to a small room, dogs were allowed to have short leash walks for toileting purposes. Re-examination and removal of the ETEF were scheduled 2 wk after its application in all cases.

Triceps avulsion (case 5)
A 1-year-old female border collie, weighing 17 kg, was referred 11 d after being hit by a car. Initial consultation had allowed localization of the lameness to the elbow. Radiographs showed a triceps tendon avulsion. A computed tomography (CT) scan was made and showed a partial avulsion of the tendon (Figure 4). The triceps tendon was reattached to the olecranon using a modified three-loop pulley pattern. An ETEF was applied to protect the suture and allow the tendon to heal at the osseotendinous junction. The dog received anti-inflammatory drugs for 10 d and antimicrobial protection for 5 d. Instructions were given to confine the dog for 1 mo.

Results
Elastic transarticular external fixator (ETEF) technique
Pin diameters were chosen based on body weight: 2 mm for animals weighing < 10 kg, and 2.5 mm for the dog weighing 17 kg. The mean duration of the procedure was approximately 15 min (the elbow luxations were reduced and the surgery of the avulsed triceps was performed beforehand). No peri-operative complication was noticed when applying ETEF. Elastic tension was estimated subjectively to allow the patient to keep the elbow extended and allow good ROM (Figure 5).

Pin tract drainage or infection and pin loosening were not seen in the study. The only complication seen with the ETEF application was cutaneous irritation by the blood sampling tube stoppers (Figure 6). This complication was observed in all the cases of the study. This was considered as a minor complication and was successfully managed with local treatment in case of irritation or with stitches at the time of the ETEF removal in case of ulceration.

Elbow luxation
All the elbows were laterally luxated. Closed reduction was successfully managed in all cases. The reduced joint was assessed for collateral stability by the Campbell test. Normal range of motion is around 45° in pronation and 70° in supination in dogs; normal supination is around 110° in cats. If the collateral lateral ligament is avulsed or ruptured supination is expected to increase, if the collateral medial ligament is injured, pronation is expected to increase. In cases 1, 2, and 4 both collateral ligaments seemed to be ruptured. In case 3, only the lateral osseous fragments proximal to the olecranon. Anti-inflammatory drugs were given to the dog for 1 wk without improvement. At the time of referral, the dog carried the limb flexed without bearing weight, loss of muscle mass was already noticed compared to the contralateral forelimb. Swelling in the region of the triceps tendon and the presence of osseous fragments in the region of the tendon on radiographs already taken were indicative of a triceps tendon avulsion.

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Table 1. Description and history of the 4 cases of elbow luxation

<table>
<thead>
<tr>
<th>Case</th>
<th>Species</th>
<th>Breed</th>
<th>Gender</th>
<th>Age (y)</th>
<th>Weight (kg)</th>
<th>Origin of elbow luxation</th>
<th>Duration of lameness at the time of surgery (d)</th>
<th>Stability of the elbow after closed reduction</th>
<th>Duration of ETEF (d)</th>
<th>Range of motion at time of removal of the ETEF</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Cat</td>
<td>Common breed</td>
<td>F</td>
<td>4</td>
<td>3.5</td>
<td>Unknown</td>
<td>1</td>
<td>Mildly unstable</td>
<td>28</td>
<td>30°</td>
</tr>
<tr>
<td>2</td>
<td>Dog</td>
<td>Spitz</td>
<td>F</td>
<td>5.5</td>
<td>7</td>
<td>Dog bite</td>
<td>8</td>
<td>Highly unstable</td>
<td>15</td>
<td>25°</td>
</tr>
<tr>
<td>3</td>
<td>Cat</td>
<td>Common breed</td>
<td>M</td>
<td>0.5</td>
<td>3</td>
<td>Kicked by owner</td>
<td>6</td>
<td>Mildly unstable</td>
<td>16</td>
<td>75°</td>
</tr>
<tr>
<td>4</td>
<td>Dog</td>
<td>Jack Russell terrier</td>
<td>F</td>
<td>11</td>
<td>7.5</td>
<td>Hit by car</td>
<td>1</td>
<td>Mildly unstable</td>
<td>12</td>
<td>75°</td>
</tr>
</tbody>
</table>

F — Female; M — Male.
collateral ligament seemed to be injured. In case 2, the dog was presented several days after being bitten by another dog and had multiple cutaneous lacerations and severe injury of nerves in the limb. In case 4, the dog was presented with concomitant pelvic fractures that were surgically managed with the elbow luxation. Removal of the ETEF was initially scheduled for 2 wk after surgery. In case 1, the owner forgot the appointment and the ETEF was removed 28 d after surgery. The cat had intermittent weight-bearing with a limited ROM (30°) at this time on account of a severe ankylosis. The owner reported that the lameness had worsened during the presence of the ETEF, the cat had normal weight-bearing at the beginning of the period. Active physiotherapy was performed after removal of the fixator that allowed rapid improvement of the ROM and the lameness. The cat was examined during a consultation 5 mo later: there was no lameness, ROM was normal in extension but decreased in flexion as compared to the other forelimb (angle of flexion of 80° in the operated limb and of 30° in the contralateral limb) without clinical consequence. The clinical result was considered excellent.

Case 2 had a poor outcome on account of a permanent neurologic defect as a consequence of the dog bite (limb paralysis with loss of deep pain perception). Nearly 2 y after surgery, the dog still does not use his limb. The owner declined amputation. Case 3 was considered to have an excellent outcome. The cat walked without lameness with the ETEF and was immediately free of lameness after its removal. The cat was lost to follow-up 1 mo after removal of the ETEF. Case 4 was considered to have a good outcome. The postoperative period was difficult on account of the concomitant pelvic fractures. At the removal of the ETEF the dog was lame in the hind limbs and the operated forelimb. Control evaluation was made 6 wk after surgery and revealed weight-bearing without lameness. A mild lameness was reported after activity, but the owners had difficulties identifying the lame limb. The ROM of the elbow was 90° (140° on the other elbow) with normal extension and limited flexion.

There was no case of reluxation after removal of the ETEF in the study.

**Triceps avulsion**

Removal of the stitches and the ETEF were made 14 d after surgery. It was assumed that the partial nature of the avulsion enabled a rapid removal of the fixator with decreased risk of complete rupture of the tendon. The ROM was decreased in flexion (90° of flexion) but normal in extension (170°). The dog had weight-bearing with persistent lameness. Active physiotherapy was done by the owner and the angle of flexion decreased to 60° 1 mo after removal of the ETEF. Clinically, the dog was intermittently lame, he was pain-free, and had returned to normal activity. He was lost to further follow-up.

**Discussion**

This study describes the placement of an ETEF in clinical cases, and its ability to maintain the reduction of unstable elbows and to protect repair of an avulsed triceps tendon. To the author’s knowledge, this is the first report on clinical cases involving the use of ETEF (21).

The ETEF was successfully applied in 5 elbows. The procedure was rapid (about 15 min), easy to perform, and not expensive for the pet owners. The bilateral frame of the ETEF was well-tolerated by the animals because of its light weight and absence of friction against the thorax. All the animals except the one with a neurological defect had an early return to weight-bearing. An N-RTEF such as HTEF or ETEF has been proposed to reduce the stiffness of the immobilization and promote an early controlled motion of the joint after surgery (2–4). Post-traumatic stiffness of the elbow joint is a frequent result of rigid immobilization leading to severe ankylosis. The tendency to stiffness leads to the assumption that the strong self-healing forces of the capsule and ligament apparatus convert the initial instability of the joint after ligament rupture, into a high-grade undirected stability following immobilization. Directed...
stability, as produced by the natural ligament apparatus of the joint, on the other hand produces a guided movement of the joint in one direction. These theoretical considerations lead to the idea that the self-healing forces of the ligament apparatus under continuous guided movement of the joint will result in a stable and movable joint to allow healing of the compromised soft tissue envelope (1–8,11). Comparison between stiffness of the elbow joint at the time of removal of RTEF, HTEF, and ETEF is lacking. Three dogs (2 with elbow luxation and 1 with avulsed triceps tendon) had a ROM of 75° to 80° at the time of removal of the ETEF. The 2 other dogs with elbow luxation had ROM of only 25° to 30° on account of the length of time of the presence of the ETEF in 1 case, and the impossibility of weight-bearing with the ETEF secondary to a neurologic defect for the other. External coaptation is an alternative to transarticular external skeletal fixation in limiting elbow joint flexion. Robert-Jones bandage, light bandage, Spica splint, and orthosis are employed after reduction of elbow luxation to prevent recurrence (12–16,22), or to protect tendon repair in several joints (9,10,17–20).

Lateral elbow luxation was seen in the 4 cases described here, which is consistent with other studies that reported 92% to 100% of elbow luxations were lateral (13–16,22–24). In our study, luxations were caused by a traffic accident, dog bite, kick, and an unknown origin for the 4th case. Other reports described other causes such as falling from a height or getting

**Figure 5.** Photographs of the ETEF applied to the dog of case 4. ETEF maintains the elbow in extension because of the tension of the elastic bands (A) and allows ROM of the joint without relaxation (B).

**Figure 6.** Photograph of the medial aspect of the elbow of the dog of case 5 after removal of the ETEF showing cutaneous ulceration secondary to friction by the blood sampling tube stoppers.
the leg caught, with indirect rotational forces rather than from direct traumatic forces (13,15). Closed and open reductions have been proposed to manage elbow luxation (13–16,22,25). Closed reduction often leads to successful reduction if the luxation is recent and without severe swelling. The reduced joint is assessed for collateral stability by the Campbell test: the elbow is held in a flexed position and the carpus is rotated. If the collateral ligaments are ruptured or avulsed, the paw is expected to rotate through a greater ROM than normal (16,23,26). Some authors have reported that collateral ligament injuries occur in 18% to 100% of the cases of elbow luxation (13–15,22). All the cases in our study had collateral ligament injury. An in vitro study has shown that the canine elbow could luxate after transection of the lateral collateral ligament or after transection of both the lateral and medial collateral ligaments, and the feline elbow could only luxate after transection of both (26). Closed reduction leads to periarticular fibrosis that provides sufficient stability of the elbows even if collateral ligament injuries are present at the time of surgery. Open reduction and stabilization should be considered if the joint cannot be reduced, if gross instability is present following closed reduction, or if a fracture is associated with the luxation. Some authors consider surgery immediately after closed reduction to decrease long-term stiffness of the joint and lameness (24) but this is controversial (13–15,22). External coaptation by Robert-Jones bandage, light bandage, or Spica splint is warranted for 7 d to 2 wk to avoid post-reduction relaxation (12–16,22). Duration of bandaging varies according to the resultant stability and subjective assessment of soft tissue damage (16).

Rigid transarticular external fixators (RTEF) have not been described to immobilize the elbow after luxation. Elastic transarticular external fixators (ETEF) have been briefly mentioned in veterinary medicine (3), but no clinical reports have been published. We subjectively decided to maintain the ETEF for immobilization of 3 to 6 wk is warranted to allow the tendon to regain sufficient tensile strength and healing at the osseo-tendinous junction (9,10,17–20). We chose to remove the fixator sooner than previously recommended because the rupture was partial with limited retraction. Transarticular external skeletal fixator offers a complete immobilization of the elbow with good protection of the tendon repair (9,10). Nevertheless, it is well-known that a gradual increase in tendon activity increases healing strength over the maturation, organization, and differentiation phase (17). Therefore a regular passive ROM of the elbow after temporary removal of the connecting bars of the fixator is warranted to assist healing of the tendon. The N-RTETF (HTETF, ETEF) enables a limited active ROM during the weight-bearing phase that promotes healing of the tendon and reduces the risk of elbow ankylosis. Alternative strategies such as bandage, Spica splint (18,20) or orthosis (19) have the advantage of being less rigid than a transarticular external fixator, but need to be regularly monitored to prevent negative dermal effects of padding.

Care was required to control cutaneous irritation by the rubber stoppers. This complication was observed in all cases of the study and could be avoided by the placement of “olives” on the pins to prevent the rubber stoppers slipping and irritating the skin. Pin tract drainage or infection and pin loosening were not seen in the study on account of the rapid removal of the external fixator and the limited stiffness of the frame.

Duration of immobilization by transarticular external fixator plays a major role in ankylosis of the joint. Rigid joint immobilization can have harmful effects on connective tissue, and results in decreased ROM of the joint (1,2,4–8,11). All methods of elbow stabilization are associated with serious drawbacks; any method that prevents elbow motion delays rehabilitation and may result in stiffness. An ETEF could not prevent a reduced ROM at the time of removal of the fixator in
our study. Comparison of residual ROM between RTEF and N-RTEF (HTEF and ETEF) applied to the elbow is warranted in another study to determine effectiveness of ETEF. A study reported a mean loss in ROM of 21% for the stifle and 16% for the tarsus after removal of an HTEF, but there was no case of application of HTEF on the elbow joint in this study (2).

This study has several limitations. Our sample size is small (4 cases of elbow luxation and 1 case of triceps avulsion), this was a retrospective study, and the procedures were performed by only 1 surgeon. The results will need to be confirmed in a larger series to verify the possibility of its generalization. Further research will be needed to determine the appropriate duration of immobilization by ETEF, and the appropriate tension of the elastic band depending upon species and body weight.

In conclusion, ETEF is an alternative for elbow stabilization that maintains extension of the joint while permitting its motion thereby promoting rehabilitation. Surgeons may consider this device to manage elbow luxation and triceps avulsion to facilitate early weight-bearing.

References
Determining bovine viral diarrhea and infectious bovine rhinotracheitis infections in dairy cattle using precolostral blood

Paul Baillargeon, Juan C. Arango-Sabogal, Vincent Wellemans, Gilles Fecteau

Abstract — The objective of this study was to determine if precolostral blood samples are useful to detect apparent fetal infections with bovine viral diarrhea (BVD) and infectious bovine rhinotracheitis (IBR) viruses. A convenience sample of 317 sera from 50 Canadian herds was used in the study. Antibody level was measured using 2 commercial IBR and BVD ELISA kits. Precolostral status of sera was confirmed on 304 samples using serum gamma-glutamyl transferase activity. Postcolostral serum samples yielded a higher proportion of positive results to IBR (OR = 86; 95% CI: 17.8 to 415.7) and BVD (OR = 199.3; 95% CI: 41.7 to 952.3) than did precolostral samples. All positive precolostral serum samples (n = 7 of 304) originated from calves born to vaccinated cows. Postcolostral positive serum samples (n = 11 of 13) originated mostly (60%) from calves born to non-vaccinated cows. Precolostral serum sampling can detect apparent fetal infections in a herd.

Résumé — Utilisation du serum précolostral pour le dépistage de la diarrhée virale bovine (BVD) et rhinotracheite infectieuse bovine (IBR) dans les troupeaux laitiers. L’objectif de cette étude était d’évaluer l’utilité du prélèvement de sérum précolostral de nouveau-nés pour détecter des infections fœtales apparentes par IBR et BVD dans un troupeau. Un échantillonnage de convenance de 317 sérums, prélevés de 50 troupeaux canadiens, a été utilisé. Les niveaux d’anticorps des sérums ont été mesurés en utilisant 2 trousses ELISA (IBR et BVD). Le statut précolostral a été confirmé pour 304 échantillons par la mesure de l’activité sérique des gamma glutamyl transférasas. Une plus grande proportion de résultats positifs à IBR (RC = 86; IC 95%: 17,8 à 415,7) et BVD (RC = 199,3; IC 95 %: 41,7 à 952,3) a été observée parmi les échantillons postcolostraux que parmi les précolostraux. Tous les échantillons précolostraux positifs (n = 7/304) provenaient de veaux nés de mères vaccinées. Les échantillons postcolostraux positifs (n = 11/13) étaient majoritairement (60 %) prélevés à partir de veaux nés de mères non vaccinées. Le prélèvement de sérum précolostal peut détecter des infections fœtales apparentes dans les troupeaux.

Can Vet J 2017;58:360–364

Introduction

Over the last 30 y, bovine viral diarrhea (BVD) and infectious bovine rhinotracheitis (IBR) have been associated with epidemics causing severe losses, most often involving respiratory diseases and abortions (1–3). In Canada, a retrospective study reported that 12% of 84 aborted fetuses were positive for IBR as indicated by a fluorescent antibody technique (4). Based on the presence of at least 1 seropositive (> 1:64) unvaccinated animal, the herd-level prevalence of BVD in dairy herds in Canada has been estimated to be between 28.1% and 53.4% (5). Commercial modified live (MLV) (6,7) and killed (K) vaccines (8) are available with indications to prevent reproductive consequences of BVD or IBR infections as well as to provide fetal protection (9,10). In North America, enzyme-linked immunosorbent assay (ELISA) testing to detect antibodies as an indicator of ongoing infection in a herd is not widely used since use of K or MLV vaccine would complicate interpretation (11). One approach to detect endemic BVD virus infection involves demonstrating seroconversion in a subset of animals by testing paired acute and convalescent sera. However, seroconversion in a subset of animals is difficult to demonstrate due to the slow within-herd spread of BVD virus, making it hard to select the exposed animals that seroconvert (12). Moreover, once again, vaccination could complicate the interpretation of results from this approach (11).

Serological analysis of precolostral serum samples is an effective method to demonstrate fetal exposure to pathogens such as Neospora caninum (13–15) and BVD (9,12,16) during the last trimester of pregnancy. Some studies suggest that precolostral
serum antibody detection cannot be confounded by vaccination and would be an interesting screening method as an alternative to bulk-tank milk reverse transcriptase-polymerase chain reaction (RT-PCR) and non-vaccinated sentinel calf strategies (12,16).

Fetal infections occurring after the development of a competent immune system could lead to the birth of a normal calf with precolostral antibodies (17,18). Therefore, detecting fetal infections constitutes evidence of virus infection within the herd, as was suggested previously for BVD (12). The objective of this study was to determine if precolostral blood samples can be used to detect apparent fetal infections with BVD and IBR viruses.

Materials and methods

Origin of the samples
A convenience sample of 317 precolostral calf sera from 50 Quebec herds was used in this study. Of these, 236 samples were taken between February 2005 and March 2008 by veterinarians and dairy producers who participated on a voluntary basis. The remaining 81 samples originating from a previous study (13) were collected between August 1999 and October 2000 and were stored at $-70^\circ$C. At the time of the visit, herd information (vaccination strategy adopted in the farm and veterinarian’s perception of reproductive performance for each farm) and dam individual information (last calving date, number of lactations, date of last vaccination, and type of last vaccine administered to the dam) were recorded. Samples were collected either by a veterinarian or by a trained producer prior to observed colostrum intake. Jugular vein puncture using a vacutainer tube was used to collect blood.

Laboratory analyses
Whole blood samples were centrifuged after clot formation. A subsample of at least 2 mL of serum was stored at $-70^\circ$C. Samples were submitted to the laboratory (Biovet, Saint-Hyacinthe, Quebec). Antibody detection was achieved using the BVD virus ELISA Kit (Bio-X Diagnostics, Jemelle, Belgium) and the SVANOVIR IBR-Ab assay (Boehringer Ingelheim Svanova, Uppsala, Sweden). Samples were treated and interpreted according to the instructions of the manufacturers. A sample was considered positive for BVD if its optical density ratio was \(> 0.15\). For IBR an optical density ratio \(> 0.20\) was used as the cutoff to declare a sample positive. In order to confirm that the blood samples were collected before colostrum intake, gamma-glutamyl transferase (GGT) activity in serum was measured at the laboratory of the Faculté de médecine vétérinaire at Université de Montréal in Saint-Hyacinthe, Quebec. As suggested previously (15), a serum sample with a GGT value \(< 50\) U/L was considered to be precolostral.

Statistical analysis
Descriptive statistics were used to determine the distribution of the samples by farm, vaccination strategy, and type of vaccine administered to the dams. The difference between pre- and postcolostral samples positive for IBR and BVD was evaluated using the Fisher’s exact test. Results were considered to be statistically significant if \(P < 0.05\).

Results

Herd characteristics
A total of 346 samples from 50 herds were obtained. Herds were distributed within 9 Quebec and 1 Ontario administrative regions. All herds were dairy except for 1 beef herd. A total of 20 veterinarians submitted samples for the analysis. A mean of 6 samples per herd (95% CI: 4.5 to 9.1) was collected, ranging from 1 sample to 52 samples. The number of collected samples per herd is shown in Figure 1. Most of the samples \((n = 224)\) were collected in 2005 and 2006. Twenty-nine samples were
excluded because a GGT result was not available. On average, dams of the calves included in the study were in their second lactation (ranging from 1 to 8 lactations).

Types of vaccine

Information about the most recent vaccination of the dams was available for all samples. Samples were grouped into 3 categories according to the type of vaccine administered to the dam: “K” if an inactivated vaccine was administered \( (n = 196) \); “MLV” if a modified live virus vaccine was administered \( (n = 97) \); and “Not vaccinated” if, to the best of our knowledge, no vaccine was administered to the dam \( (n = 53) \).

Precolostral samples

Out of the 317 serum samples, 13 were considered to be postcolostral \( (GGT > 50 \text{ U/L}) \) (Table 1). Overall, more positive results for either IBR \( (OR = 86; 95\% \text{ CI: 17.8 to 415.7}) \) or BVD \( (OR = 199.3; 95\% \text{ CI: 41.7 to 952.3}) \) were obtained from the postcolostral samples than from the precolostral samples. Among the precolostral samples, 1 was positive for both IBR and BVD, 2 were positive for IBR only, and 4 were positive for BVD only. Positive samples originated from 5 herds.

All positive precolostral samples \( (n = 7) \) were collected from calves born to vaccinated dams (Table 2). Five samples were collected from calves born to cows vaccinated with a K vaccine and 2 samples were collected from calves born to dams vaccinated with an MLV vaccine within the last year. Of the 304 confirmed precolostral samples, 259 were collected from calves born to vaccinated cows: 176 cows with a K vaccine and 83 cows with an MLV vaccine (Table 2).

Positive postcolostral samples

Of the 13 samples confirmed to be postcolostral \( (GGT > 50 \text{ U/L}) \) (Table 1), 5 were positive for both IBR and BVD, 1 was positive for IBR only and 5 were positive for BVD only. These samples originated from 8 herds.

Among positive postcolostral samples \( (n = 11) \), 7 were collected from calves born to non-vaccinated cows while the remaining 4 were collected from calves born to cows vaccinated with either an MLV vaccine (3 cows) or a K vaccine (1 cow) (Table 3). There was no difference in the number of positive results for IBR between the samples of calves born from vaccinated and non-vaccinated cows (Table 3). The 2 postcolostral negative samples came from cows that received a K vaccine.

Historical reproductive herd problems

No history of reproductive problems was reported in 3 of the herds from which the positive precolostral samples for IBR or BVD originated, whereas in 2 herds, historical reproductive problems were reported. Seven of the herds from which positive non-precolostral samples were collected had no history of reproductive problems, whereas in 1 herd, historical reproductive problems were reported.

Discussion

The primary objective of this study was to determine if precolostral blood samples can be used to detect apparent fetal infections with BVD and IBR viruses as a means to demonstrate viral transmission in a herd. The number of herds, the total number of samples collected, and the number of veterinarians who submitted samples from different regions demonstrated the practicality of this monitoring tool under field conditions. Our experience with this project and with another field study (4) is that properly instructed producers can satisfactorily collect blood samples from calves before colostrum intake. A high percentage of samples were confirmed to be precolostral. Confirmation of precolostral status by GGT activity concentration provides additional confidence in this strategy.

The overall number of positive samples for IBR or BVD was lower than expected. However, postcolostral samples yielded significantly more positive results for either IBR or BVD than

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Table 1. ELISA test results for serum samples collected from newborn calves for the diagnosis of infectious bovine rhinotracheitis and bovine viral diarrhea in Canadian herds

<table>
<thead>
<tr>
<th>GGT result</th>
<th>IBR</th>
<th>BVD</th>
<th>Number of samples (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt; 50 (Precolostral; ( n = 304 ))</td>
<td>+</td>
<td>+</td>
<td>1 (0.3)</td>
</tr>
<tr>
<td>+</td>
<td>-</td>
<td>2 (0.7)</td>
<td></td>
</tr>
<tr>
<td>-</td>
<td>+</td>
<td>4 (1.3)</td>
<td></td>
</tr>
<tr>
<td>-</td>
<td>-</td>
<td>297 (97.7)</td>
<td></td>
</tr>
<tr>
<td>&gt; 50 (Postcolostral; ( n = 13 ))</td>
<td>+</td>
<td>+</td>
<td>5 (38.5)</td>
</tr>
<tr>
<td>+</td>
<td>-</td>
<td>1 (7.7)</td>
<td></td>
</tr>
<tr>
<td>-</td>
<td>+</td>
<td>5 (38.5)</td>
<td></td>
</tr>
<tr>
<td>-</td>
<td>-</td>
<td>2 (15.3)</td>
<td></td>
</tr>
</tbody>
</table>

\( ^a \) GGT — gamma-glutamyl transferase (U/L).
\( ^b \) IBR — infectious bovine rhinotracheitis.
\( ^c \) BVD — bovine viral diarrhea.

Table 2. Serum samples positive for infectious bovine rhinotracheitis and bovine viral diarrhea antibodies by type of vaccine administered to the dams for precolostral serum samples \( (GGT < 50 \text{ U/L}) \)

<table>
<thead>
<tr>
<th>Type of vaccine</th>
<th>Number of samples</th>
<th>IBR</th>
<th>BVD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Inactivated</td>
<td>176</td>
<td>3(^a) (1.7)</td>
<td>3(^a) (1.7)</td>
</tr>
<tr>
<td>Modified live virus</td>
<td>83</td>
<td>0 (0)</td>
<td>2 (2.4)</td>
</tr>
<tr>
<td>Not vaccinated</td>
<td>45</td>
<td>0 (0)</td>
<td>0 (0)</td>
</tr>
<tr>
<td>Total</td>
<td>304</td>
<td>3 (0.9)</td>
<td>5 (1.6)</td>
</tr>
</tbody>
</table>

\( ^a \) One of these 3 samples was positive for both viruses.

Table 3. Postcolostral serum samples from newborn calves that tested positive by ELISA for infectious bovine rhinotracheitis and bovine viral diarrhea by type of vaccine administered to the dams

<table>
<thead>
<tr>
<th>Type of vaccine</th>
<th>IBR</th>
<th>BVD</th>
<th>Number of samples</th>
</tr>
</thead>
<tbody>
<tr>
<td>Inactivated</td>
<td>+</td>
<td>+</td>
<td>1</td>
</tr>
<tr>
<td>Modified live virus</td>
<td>+</td>
<td>+</td>
<td>2</td>
</tr>
<tr>
<td>Modified live virus</td>
<td>-</td>
<td>+</td>
<td>1</td>
</tr>
<tr>
<td>No vaccine</td>
<td>-</td>
<td>+</td>
<td>4</td>
</tr>
<tr>
<td>No vaccine</td>
<td>+</td>
<td>+</td>
<td>2</td>
</tr>
<tr>
<td>No vaccine</td>
<td>+</td>
<td>-</td>
<td>1</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td></td>
<td>11</td>
</tr>
</tbody>
</table>

\( ^a \) IBR — infectious bovine rhinotracheitis.
\( ^b \) BVD — bovine viral diarrhea.
did precolostral samples. The GGT levels in these samples confirmed calf colostrum intake before sampling. These calves proved that antibodies against both viruses were present in the source herds; however, it is not possible to know if they were present due to vaccination or infection. More than 60% of these samples originated from calves born to non-vaccinated dams, which favors the circulating virus hypothesis.

Positive results for either IBR or BVD were observed among precolostral samples, indicating fetal exposure to the viruses. All these samples were collected from calves born from vaccinated dams. The presence of one or more seropositive calves at birth before colostrum intake provides evidence of dam’s exposure to the viruses after 125 days of gestation (17). This confirms that precolostral blood samples can be used to detect exposure to IBR and BVD viruses, as was suggested previously (12).

Newborn calves sampled before colostrum intake can be used as sentinels for IBR and BVD. In larger herds, replacement heifers may be housed in a different environment from the milking herd, making them less suitable for establishing herd status. Also, in an increasing number of herds, calves are vaccinated during the neonatal period and are no longer useful as potential sentinels. Thus, the precolostral monitoring strategy presented here is more likely to reflect viral transmission in the reproductive portion of the adult herd compared to the sampling strategies described previously (19,20).

Precolostral serological status has been proven to be an effective way of monitoring transmission of Neospora caninum (13). It appears that the strategy may similarly be valuable for monitoring BVD transmission. For example, in 1 study (9), 10 non-vaccinated pregnant heifers delivered live calves after natural exposure to 3 strains of BVD type 2a during their last trimester of pregnancy. Precolostral serology revealed that 9 of these calves were seropositive. The only seronegative calf was determined to be persistently infected (PI).

The percentage of calves with precolostral BVD virus serum antibodies may be significantly higher than the proportion of PI animals. In 1 study (12), the authors found that approximatively 8 BVD seropositive calves were born for every BVD PI calf. For this reason, a precolostral BVD virus antibody screening strategy should have a higher sensitivity than searching for PI animals to detect viral transmission.

Regarding IBR, little is known about the survival of bovine fetuses exposed to bovine herpes virus (BHV)-1 in utero. Experimental challenge during the last trimester of pregnancy in susceptible seronegative pregnant females has resulted in very high rates of abortions or stillbirths of fetuses exhibiting lesions of BHV-1 infection (18). Precolostral serology may not be as sensitive for monitoring BHV-1 as it is for BVD and Neospora infections where fetuses have a much higher chance of surviving in utero infection.

Fetal immunocompetence allows detection of infection, as demonstrated in other reports (9,13) and in our results (18/317 seropositive for IBR or BVD), and reflects viral exposure during the last trimester of pregnancy. Almost 15% of the precolostral samples were collected from calves born to non-vaccinated dams. Among them, no positive results for IBR or BVD were observed. The samples collected from calves born to dams vaccinated with the K vaccine tended to yield more positive results to both viruses. However, we observed 2 positive results to BVD among precolostral samples collected from calves born to dams vaccinated with an MLV vaccine without fetal protection. The MLV vaccines providing fetal protection against BVD and IBR became available after 2004 in Canada. A previous study also evidenced a lack of protection of calves born to dams which were given a BVD MLV vaccine (21). The authors suggested that this result may be explained by an inadequate host response to vaccination or a vaccine failure (21). The detection of seropositive calves in precolostral blood samples supports the pertinence of including this fetal protection for reproductive animals.

A completely different situation was observed in postcolostral samples in which samples collected from calves born from dams vaccinated with an MLV vaccine tended to yield more positive results to either IBR or BVD virus. Surprisingly, more positive results to both viruses were observed in postcolostral samples collected from calves born from non-vaccinated dams. We would expect that postcolostral samples from calves fed colostrum from vaccinated dams would more often be antibody positive. One explanation for this observation may be that non-vaccinated dams living in a herd with endemic infection have higher colostrum antibody titers compared with vaccinated dams.

The results of this study support the inclusion of precolostral serology for the monitoring of circulating IBR and BVD viruses in cattle herds when alternatives are not possible (e.g., vaccinated young calves) or are more cumbersome. This information could be helpful to demonstrate exposure to these disease agents and to monitor compliance with recommended vaccination programs.

Acknowledgment

The authors gratefully acknowledge Dr. Julie Paré who critically reviewed this manuscript.

References


Pregnancy per AI in Holstein heifers inseminated with sex-selected or conventional semen after estrus detection or timed-AI

Marcos G. Colazo, Reuben J. Mapletoft

Abstract — This study compared pregnancy per AI (P/AI) of heifers inseminated with sex-selected or conventional semen after estrus detection (ED) or timed-AI (TAI). Heifers in the ED group received 2 treatments with prostaglandin F2α 14 d apart and those in the TAI group received a modified 5-day Co-synch protocol plus an intravaginal progesterone releasing insert device (PRID) and were inseminated 72 h after PRID removal. Overall P/AI were 69.2% (74/107) and 64.1% (75/117) for conventional and sex-selected semen (P > 0.05). Although P/AI in ED heifers following the use of conventional semen were numerically higher (75.0% versus 63.6%), P/AI with sex-selected semen were almost identical (65.0% versus 63.2%) for ED and TAI heifers. Pregnancy losses from first pregnancy diagnosis to term did not differ between ED and TAI heifers (6.0% versus 11.3%). In summary, heifers subjected to TAI with sex-selected semen following the application of a modified 5-day Co-synch plus PRID protocol had acceptable P/AI.

Résumé — Gestation par IA chez les génisses Holstein inséminées avec du sperme déterminant le sexe ou un sperme conventionnel après la détection de l’œstrus ou l’IA à temps prédéterminé. Cette étude a comparé la gestation par IA (G/IA) des génisses inséminées avec du sperme déterminant le sexe ou du sperme conventionnel après la détection de l’œstrus (DCE) ou l’IA à temps déterminé (IATD). Les génisses dans le groupe DCE ont reçu 2 PGF à un intervalle de 14 jours et celles dans le groupe IATD ont reçu un protocole modifié 5-d Co-synch et PRID et ont été inséminées 72 heures après l’entèlement de PRID. Dans l’ensemble, le taux de G/IA était de 69,2 % (74/107) et de 64,1 % (75/117) pour le sperme conventionnel et celui déterminant le sexe (P > 0.05). Même si le taux de G/IA chez les génisses DCE après l’utilisation de sperme conventionnel était numériquement supérieur (75,0 % c. 63,6 %), le taux de G/IA avec le sperme déterminant le sexe était presque identique (65,0 % c. 63,2 %) pour les génisses DCE et IATD. La perte de gestations entre le premier diagnostic de gestation jusqu’à la parturition ne différait pas entre les génisses DCE et TAI (6,0 c. 11,3 %). En résumé, les génisses soumises à l’IATD avec du sperme déterminant le sexe après l’application d’un protocole modifié 5-d Co-synch et PRID avaient une G/IA acceptable qui confirmait notre hypothèse.

Introduction

The use of sex-selected semen to inseminate heifers might increase the profitability of the dairy herd, as it provides an opportunity to increase the proportion of calves that are heifers (1). This has 2 main advantages: a 28% reduction in the incidence of dystocia (2) and more replacements from the genetically improved group in the herd (3). However, the use of sex-selected semen results in reduced pregnancy per AI (P/AI) compared with the use of conventional semen. In this regard, Seidel et al (4) reported that among dairy farms P/AI of Holstein heifers inseminated with sex-selected semen varied from 40% to 68%, while with conventional semen the P/AI varied from 67% to 82%. Others have concluded that the fertility of sex-selected semen was compromised as P/AI remained different even when number of sperm per insemination dose was equalized between sex-selected and conventional semen (5,6). In an attempt to increase P/AI with sex-selected semen, Sá Filho et al (7) evaluated different intervals from onset of estrus to AI using the Heat Watch system (CowChips, Manalapan, New Jersey, USA) in Jersey heifers. They reported that the greatest P/AI was obtained when inseminations were done between 16.1 and 20 h after onset of estrus, which is somewhat longer than the interval recommended for conventional semen.
The implementation of timed-AI (TAI) protocols has allowed for increased use of AI in beef and dairy cattle. However, P/AI with sex-selected semen has been inconsistent in studies that evaluated estradiol and progesterone-based TAI protocols (8). As a result, sex-selected semen is often not recommended for use in dairy cattle that are subjected to TAI (3). Therefore, optimization of TAI protocols that consistently yield high P/AI in heifers inseminated with sex-selected semen would increase the adoption of these technologies.

Recently, a 5-day Co-synch TAI protocol that incorporates a progesterone releasing device resulted in 39.3% P/AI in Holstein heifers inseminated with sex-selected semen (9). Moreover, Colazo and Ambrose (10) modified this protocol by eliminating the first gonadotropin-releasing hormone (GnRH) injection in dairy heifers inseminated with conventional semen and obtained an overall conception rate of 70%. Two follow-up studies with larger numbers of Holstein \((n = 605)\) and beef \((n = 1062)\) heifers confirmed that administration of GnRH at progesterone device insertion was not necessary to achieve high P/AI with conventional semen (11,12). In our earlier study (10), we observed that more than 75% of the heifers ovulated within 24 h following insemination, which might be favorable for the use of sex-selected semen. In addition, this protocol called for heifers to be handled only 3 times, which would be more acceptable to producers. Therefore, the objective of the present study was to compare P/AI of heifers inseminated with sex-selected or conventional semen after estrus detection or TAI. We hypothesized that a modified 5-day Co-synch plus an intravaginal progesterone releasing insert device (PRID) protocol, without the first GnRH, would result in acceptable P/AI in Holstein heifers inseminated with sex-selected semen.

**Materials and methods**

This study was carried out in a large commercial dairy herd in Wetaskiwin, Alberta, Canada. All procedures were conducted in accordance with the guidelines of the Canadian Council on Animal Care (13).

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**Table 1.** Effect of synchronization treatment and type of semen on pregnancy per AI (P/AI), calving rate and pregnancy loss in Holstein heifers subjected to estrus detection and AI (ED group) or a modified 5-day Co-synch plus PRID protocol (TAI group)

<table>
<thead>
<tr>
<th></th>
<th>Conventional semen</th>
<th>Sex-selected semen</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>ED group</td>
<td>TAI group</td>
</tr>
<tr>
<td>Number</td>
<td>52</td>
<td>55</td>
</tr>
<tr>
<td>P/AI, % (n)</td>
<td>75.0 (39)</td>
<td>63.6 (35)</td>
</tr>
<tr>
<td>Calving rate, % (n)</td>
<td>71.2 (37)</td>
<td>58.2 (32)</td>
</tr>
<tr>
<td>Preg loss, % (n)</td>
<td>7.1 (3)</td>
<td>10.3 (4)</td>
</tr>
</tbody>
</table>

* Pregnancy losses from first pregnancy diagnosis (27 to 33 d after AI) to term.

Seven heifers had a non-viable embryo at first pregnancy diagnosis.

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**Animals and diets**

This study was conducted with cyclic (determined by transrectal ultrasonography) Holstein heifers between 13 and 16 mo of age. Heifers were housed in free-stalls, had unrestricted access to water, and were fed a total mixed ration once daily. The diet was designed to meet the nutritional requirements of Holstein heifers weighing 350 kg and gaining 1.0 kg/d (14). The diet (DM/kg per day) was based on barley silage (16.0), alfalfa silage (4.0), haylage grass (4.0), hay (4.0), brewer’s grain (4.0), barley grain (0.75), and a mineral and vitamin supplement. The dry matter and crude protein content of the rations were 41.6% and 14.3%, respectively.

**Experimental design**

A group of 131 cyclic Holstein heifers were given 2 treatments with 500 μg cloprostenol [prostaglandin F2α (PGF); Estroplan, Vétoquinol Canada, Lavaltrie, Quebec] 14 d apart (ED group) (Figure 1). Another group of 112 cyclic Holstein heifers received a modified 5-day Co-synch protocol which involved the insertion of an intravaginal progesterone releasing device (PRID; Vétoquinol Canada) for 5 d without GnRH treatment at the time of insertion and single treatment with PGF at PRID removal (TAI group; 10) (Figure 1). Heifers in the ED group received the second PGF treatment and those in the TAI group had the PRID removed and PGF administered on the same...
Detection of estrus was carried out 3 times/d for 30 min for 6 d after the second administration of PGF and the heifers were inseminated ~12 h after onset of estrus (ED group) or TAI 72 h after PRID removal (TAI group) with sex-selected or conventional semen from 4 sires available commercially. Heifers assigned to TAI received 100 µg GnRH (Fertiline; Vétoquinol Canada) at the time of AI. All heifers were inseminated by the same technician.

### Semen

The semen used in this study was available commercially (Alta Genetics, Balzac, Alberta). The 4 sires used in the study and type of semen (sex-selected versus conventional) were equally distributed between estrus synchronization protocols. The sperm concentrations of sex-selected and conventional semen were $2.1 \times 10^6$ and $~20 \times 10^6$ cells/dose, respectively. The overall post-thaw motility varied from 50.0% to 70.0% and the post-thaw viability from 42.0% to 65.1%.

### Ultrasonographic examinations

Transrectal ultrasonography (MicroMAXX, color Doppler scanner equipped with a multifrequency 5–10 MHz linear transducer; SonoSite, Bothell, Washington, USA) was performed and ovarian maps were drawn for each heifer, which included the diameter and location of follicles and corpora lutea as previously described by Pierson and Ginther (15). Cycling status was determined at the initiation of the study as previously described by Colazo et al (16). Ovaries were scanned at AI and every 12 h thereafter until ovulation to determine ovulation time. Heifers in the ED groups that were not inseminated were also examined 6 d after the second PGF to determine ovulation. Pregnancy status was determined by transrectal ultrasonography between 27 and 33 d after AI. Presence of a viable embryo (positive heart beat) was used as a determinant of pregnancy. Heifers diagnosed pregnant at the first examination were re-examined between 42 and 48 d after AI to confirm pregnancy. Throughout the manuscript, the term pregnancy loss (unless otherwise noted) denotes all losses, embryonic mortality determined at first examination plus pregnancy losses from 27 to 33 d after AI to term.

### Statistical analysis

All data were analyzed using SAS (Statistical Analysis System, Version 9.3 for Windows; SAS Institute, Cary, North Carolina, USA). Binomial data were analyzed using general estimating equations (GEE) in the GENMOD procedure. Model specifications included a binomial distribution, logit link function, repeated statement with subject equal to heifer, and an exchangeable correlation structure. Continuous data were analyzed by 1-way analysis of variance (ANOVA) in the General Linear Model (GLM) procedure. Bartlett’s test of equal variance was used to analyze variance, and the LSD test was used to compare means. A probability of 0.05 or less was considered statistically significant, and a probability between 0.051 and 0.1 was considered a tendency.

A power analysis (17) of previously published data on the use of sex-selected semen (4,6) suggested that fewer than 107 heifers per group would be required to demonstrate a statistically significant difference in P/Al with sex-selected versus conventional semen.

### Results

Pregnancy per AI (P/Al) did not differ between synchronization treatments nor between types of semen used to inseminate heifers (Table 1). As expected, insemination risk was greater in the TAI group compared to the ED group ($P < 0.01$; 100.0% versus 85.5%). The distribution of estrus in both groups is shown in Figure 2. Of the 19 (14.5%) heifers not seen in estrus in the ED group, 52.6% (10/19) did not ovulate within 6 d following the second PGF administration. In the TAI group, 77.7% of heifers were observed in estrus from 36 to 96 h following PRID...
In the current study, the overall P/AI with sex-selected semen in TAI heifers was 63.6% at 32 d and the calving rate was 58.2%, which supported our hypothesis that a modified 5-day Co-synch plus an intravaginal progesterone releasing insert device (PRID) protocol, without the first GnRH, would result in acceptable P/AI in Holstein heifers inseminated with sex-selected semen. In this study, P/AI was greater than that reported in previous TAI studies. In a large field study, Holstein heifers were synchronized with the 5-day Co-synch + CIDR (controlled internal drug release) with 1 injection of PGF and assigned randomly to be inseminated with conventional or sex-selected semen from 2 sires (9). Pregnancy per AI with sex-selected semen was 39.3% at 32 d and 35.9% at 60 d after TAI, while P/AI with conventional semen were 59.8% and 59.2%, respectively. Low P/AI with sex-selected semen has been also reported in studies that used estradiol and progesterone based-TAI protocols (8). In Jersey heifers that received 2 mg of estradiol benzoate (EB) and a CIDR for 8 d and were inseminated with sex-selected semen at 54 or 60 h following CIDR removal and PGF treatment (30 or 36 h after a second treatment with EB 24 h after CIDR removal), P/AI ranged from 16.2% to 31.4%, while P/AI was 46.5% with conventional semen (8). In the current study, P/AI obtained with sex-selected semen in TAI heifers was almost identical to that obtained with conventional semen, indicating that the modified 5-day Co-synch plus PRID protocol used in this study is a feasible option for attaining high P/AI in Holstein heifers inseminated with sex-selected semen.

Interestingly, P/AI obtained with sex-selected semen in estrus detected heifers was somewhat lower (86.6% of that obtained with conventional semen). Although the reason for this difference is unclear and needs to be elucidated in future studies, results are in agreement with previous studies in which estrus detection was done. In this regard, Seidel et al (4) summarized data from the insemination of 1000 heifers with sex-selected semen over several experiments; overall P/AI in heifers receiving 1 of 4 estrus synchronization methods was 90.0% of that obtained with conventional semen. In a more recent study, De Jarnette et al (6) compared P/AI in Holstein heifers from 51 dairy herds in USA that were inseminated with sex-selected or conventional semen from 8 Holstein sires. Across herds and sires, P/AI for sex-selected semen (2.1 × 10⁶, n = 2319) was 38% compared to 60% for conventional semen (10 × 10⁶, n = 2292). In these studies, P/AI in heifers inseminated with sex-selected semen following estrus detection ranged from 63% to 90% of that obtained with conventional semen. Factors other than type of semen such as herd, sire, sperm dosage and service number were identified as affecting P/AI (6). In the present study, other variables, except for sperm dosage, were not confounding factors that could have affected the outcome. Interestingly, the P/AI

<table>
<thead>
<tr>
<th>Expression of estrus</th>
<th>Conventional semen (n/n (%))</th>
<th>Sex-selected semen (n/n (%))</th>
<th>P-value</th>
<th>Estrus expression</th>
<th>Type of semen</th>
<th>Estrus expression by type of semen</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes</td>
<td>28/41 (68.3)</td>
<td>32/46 (69.6)</td>
<td>0.02</td>
<td>0.57</td>
<td>0.40</td>
<td></td>
</tr>
<tr>
<td>No</td>
<td>7/14 (50.0)</td>
<td>4/11 (36.4)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 2. Effect of estrus expression and type of semen on pregnancy per AI (P/AI) after timed-AI in Holstein heifers subjected to a modified 5-day Co-synch plus PRID protocol.
obtained in ED heifers inseminated with sex-selected semen was 65.0%, which is comparable to the P/AI usually achieved with conventional semen in well-managed commercial dairy herds.

It has been reported that inseminations with sex-selected semen in the uterine horn ipsilateral to the presumed ovulation could improve conception rate of estrus synchronized heifers (18). However, in the current study, all inseminations were performed in the uterine body by the same technician, suggesting that placement of sex-selected semen deeper into the uterine horn or ipsilateral to the ovulation site is not necessary to achieve acceptable P/AI.

In an attempt to improve P/AI with sex-selected semen, Sá Filho et al (7) evaluated different intervals from onset of estrus to AI in Jersey heifers. Estrus was detected with a HeatWatch system and heifers were inseminated from 12 to 16, 16.1 to 20, or 20.1 to 24 h after onset of estrus. Inseminations between 16.1 to 24 h after the onset of estrus resulted in greater P/AI than inseminations between 12 and 16 h, indicating that inseminations with sex-selected semen done closer to the time of ovulation should be recommended. In agreement, another study with a small number of Angus heifers subjected to GnRH-based plus CIDR TAI inseminations with sex-selected semen at 67 to 68 h after CIDR removal resulted in numerically higher pregnancy rates than inseminations done at 55 to 56 h after CIDR removal [46.6% versus 34.4% (5)].

In the present study the interval from AI to ovulation affected P/AI, especially in TAI heifers inseminated with sex-selected semen. Ovulations occurring within 12 h following TAI resulted in numerically higher P/AI, while ovulations occurring between 24 and 36 h after TAI tended to result in lower P/AI in heifers inseminated with sex-selected semen compared to conventional semen. It appears that fertility of sex-selected semen is reduced after 24 h in the female reproductive tract. Conversely, fertility seemed to be unaffected in heifers inseminated with conventional semen if ovulation occurred within 36 h following insemination. Therefore, our observations are in agreement with the suggestion that timing of AI for sex-selected semen should be delayed compared to that recommended for conventional semen. In an earlier study (10), more than 75% of the heifers subjected to the modified 5-day Co-synch plus PRID protocol ovulated within 24 h following insemination, while only 64.3% ovulated during the same interval of time in the current study.

The proportion of heifers with later ovulations would further improve P/AI following TAI with sex-selected semen. Hence, future studies should examine strategies to enhance synchrony of ovulation in heifers subjected to the modified 5-day Co-synch plus PRID protocol.

Expression of estrus in heifers subjected to the TAI protocol affected P/AI, regardless of type of semen used. Although not significant, heifers that were observed in estrus before TAI with sex-selected semen were twice as likely to become pregnant than those that were not observed in estrus. Thus, the use of estrus detection aids (e.g., patches or tail chalk) to determine which animals were in estrus might enhance P/AI with sex-selected semen used in TAI protocols. For example, sex-selected semen could be used in females determined to be in estrus before TAI, while conventional semen could be used in those not observed in estrus. Another option, if only sex-selected semen was being used, would be to delay the timing of AI in those females not observed in estrus. This strategy has been explored by Thomas et al (19) in heifers subjected to another TAI protocol and inseminated with conventional semen. Delaying insemination of heifers that had not expressed estrus before scheduled TAI by 20 h resulted in increased P/AI [from 46% to 54% (18)].

There is little published information concerning pregnancy loss in heifers following insemination with sex-selected semen. Seidel et al (20) reported that 3/11 (27.3%) and 2/11 (18.2%) heifers inseminated with X- or Y-bearing, non-frozen semen, respectively, lost their pregnancies between 1 and 2 mo post-insemination. Bodmer et al (21) compared pregnancy rate and loss in 54 heifers inseminated with either X-bearing, frozen-thawed semen or conventional semen. Pregnancy loss between first (30 to 40 d after AI) and second (70 to 90 d after AI) pregnancy diagnosis was 11.1% and 0.0% for sex-selected and conventional semen, respectively. Based on these reports, pregnancy loss in heifers following insemination with sex-selected semen would appear to be higher than with conventional semen. Although, no differences in the overall pregnancy loss between sex-selected and conventional semen were found in the present study, the majority of pregnancy losses following the use of sex-selected semen occurred early during gestation. Interestingly, all heifers in the TAI group that experienced pregnancy loss had a non-viable embryo at the time of first pregnancy diagnosis and no further pregnancy loss occurred between first (27 to 33 d

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Table 3. Effect of time of ovulation relative to timed-AI and type of semen on pregnancy per AI (P/AI) in Holstein heifers subjected to a modified 5-day Co-synch plus PRID protocol

<table>
<thead>
<tr>
<th>Time of ovulation (h)</th>
<th>N (%)</th>
<th>Conventional semen n/n (%)</th>
<th>Sex-selected semen n/n (%)</th>
<th>Overall n/n (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>20 (17.9)</td>
<td>5/11 (45.4)</td>
<td>4/9 (44.4)</td>
<td>9/20 (45.0)</td>
</tr>
<tr>
<td>12</td>
<td>27 (24.1)</td>
<td>6/9 (66.6)</td>
<td>15/18 (83.3)</td>
<td>21/27 (77.7)</td>
</tr>
<tr>
<td>24</td>
<td>25 (22.3)</td>
<td>10/13 (76.9)</td>
<td>8/12 (66.6)</td>
<td>18/25 (72.0)</td>
</tr>
<tr>
<td>36^c</td>
<td>38 (33.9)</td>
<td>14/20 (70.0)</td>
<td>9/18 (50.0)</td>
<td>23/38 (60.5)</td>
</tr>
<tr>
<td>No ovulation</td>
<td>2 (1.8)</td>
<td>0/2 (0.0)</td>
<td>—</td>
<td>0/2 (0.0)</td>
</tr>
</tbody>
</table>

^n P/AI tended to differ (P = 0.1) between sex-selected and conventional semen. 

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after AI) and second (42 to 48 d after AI) pregnancy diagnosis. All other pregnancy losses occurred in both groups between the second pregnancy diagnosis and term.

As indicated, the objective of using sex-selected semen is to obtain offspring of the preferred gender (female calves in our study) in a selected group of females. The proportion of female offspring born from heifers inseminated with sex-selected semen was 91.8%, while the proportion of female offspring in heifers inseminated with conventional semen was 52.2%. There was no effect of sire on the proportion of female calves born, which is in agreement with reports by others (3,5,20).

In conclusion, the modified 5-day Co-synch plus PRID protocol, without an injection of GnRH at PRID insertion, resulted in acceptable P/AI in Holstein heifers inseminated with sex-selected semen, which supported our stated hypothesis. Results suggest that sex-selected semen can be used with the TAI protocol used in this study to eliminate the inconvenience of estrus detection and increase the proportion of female calves born.

Acknowledgments

The research was supported by Livestock Research Branch, Alberta Agriculture and Forestry. The authors thank Mr. Darren Hipkin from Alta Genetics (Balzac, Alberta) and Vetoquinol (Lavaltrie, Québec) for their in-kind support and the de Goeij family (Breevliet Ltd; Wetaskiwin, Alberta) for their cooperation during the study.

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Hematology and biochemistry reference intervals for Ontario commercial nursing pigs close to the time of weaning


Abstract — The evaluation of pig hematology and biochemistry parameters is rarely done largely due to the costs associated with laboratory testing and labor, and the limited availability of reference intervals needed for interpretation. Within-herd and between-herd biological variation of these values also make it difficult to establish reference intervals. Regardless, baseline reference intervals are important to aid veterinarians in the interpretation of blood parameters for the diagnosis and treatment of diseased swine. The objective of this research was to provide reference intervals for hematology and biochemistry parameters of 3-week-old commercial nursing piglets in Ontario. A total of 1032 pigs lacking clinical signs of disease from 20 swine farms were sampled for hematology and iron panel evaluation, with biochemistry analysis performed on a subset of 189 randomly selected pigs. The 95% reference interval, mean, median, range, and 90% confidence intervals were calculated for each parameter.

Résumé — Intervalle de références de l’hématologie et de la biochimie pour des porcelets à l’allaitement vers le moment du sevrage dans des élevages commerciaux de l’Ontario. L’évaluation des paramètres hématologiques et biochimiques des porcs est rarement réalisée surtout en raison des coûts associés aux tests de laboratoire ainsi qu’à la main-d’œuvre et à la disponibilité limitée d’intervalles de référence requis pour l’interprétation. La variation de ces valeurs au sein de troupeaux et entre les troupeaux complique l’établissement des intervalles de référence. Néanmoins, des intervalles de référence de base sont importants pour appuyer les vétérinaires dans l’interprétation des paramètres sanguins pour le diagnostic et le traitement des porcs malades. Cette recherche avait pour objectif de fournir des intervalles de référence pour les paramètres hématologiques et biochimiques des porcelets commerciaux à l’allaitement âgés de 3 semaines en Ontario. Des échantillons ont été prélevés pour un total de 1032 porcs ne présentant pas de signes cliniques de maladie provenant de 20 fermes porcinères pour une évaluation du profil d’hématologie et du fer et une analyse biochimique a été réalisée pour un sous-groupe de 189 porcs choisis au hasard. L’intervalle de référence de 95 %, la moyenne, la médiane, l’étendue de référence et les intervalles de confiance de 90 % ont été calculés pour chaque paramètre.

Introduction

There are many important reasons for performing blood analyses in pigs. Firstly, the assessment of these parameters can be used as a component of determining the health status of a herd (1). Hematology and biochemistry reference intervals can also contribute to the early identification of disease or poor growth performance, aiding clinicians and researchers in interpreting the results of tests on blood samples (2–5). However, despite the importance of analyzing these parameters, hematology and biochemistry assessments are rarely used in the swine industry. This may be due to the dearth of information on reference intervals for commercial pigs, the costs associated with labor and laboratory testing, especially in comparison to the low economic value of an individual pig (1), or the perception that hematology and blood biochemistry will provide little useful information. Additionally, it is possible for the results to be biased by factors such as improper blood collection and handling techniques (i.e., not properly mixing the blood with the anticoagulant), which may result in poor sample quality, or the effects of animal stress or excitement from the handling and collection process (1).

Many within-herd variables can influence hematology and biochemistry parameters. These include environmental and physiological factors such as age, breed, gender, diet, and housing, as well as pathogen challenge, and stress (1,3). Between-herd differences can include the same reasons mentioned, as well as variables associated with management practices, biosecurity, and
overall health status of the herd. Hematology and biochemistry parameters from a particular animal or herd are typically compared to reference intervals that have been previously determined from a similar group of animals using similar laboratory techniques. Additionally, some previously published studies that developed reference intervals have used small sample sizes, breeds that are uncommon, or have combined data from different age categories of pig or different stages of production (6–8). However, there are limited studies that have published such reference intervals for nursing commercial piglets. Reference intervals are influenced by analytical factors such as instrumentation and technology, time or temperature of a chemical reaction, or the substrate used (5). Many laboratories have been updated with advanced automated and computerized systems to improve the overall accuracy and precision of analytical measurements. Thus, it is important to report updated reference intervals that reflect current analytical methods/automation, and advancements in genetics and pig production practices. The objective of this study was to develop reference intervals for hematology and biochemistry parameters for Ontario commercial nursing piglets close to the time of weaning at approximately 21 d of age.

**Materials and methods**

The animal care committee at the University of Guelph, following the guidelines of the Canadian Council for Animal Care, reviewed and approved this study. The blood samples were taken from pigs from 20 southern Ontario swine farms and had been used in a previous study (9). Briefly, the farms sampled varied in production type, management practice, and sow-herd size, and were representative of the variation and types of herds operating in Ontario at the time. A questionnaire was administered to each producer from the participating farms to collect reference population information including age of piglets at weaning, management practices, and the size of the sow herd. All animals used in this study were raised according to the current Canadian Code of Practice for the Care and Handling of Pigs (10). Hence, all pigs received a 200-mg IM iron injection, either gleptoferron or iron dextran, within the first 7 d of life (9). Litters were not used if they were treated with any pharmacological agents (i.e., antibiotics). Thus, all participating farms were considered to have healthy pigs without any current health challenges or disease outbreaks. Creep feed was given to suckling pigs on some of the farms; however, the number of farms and contents of the feed were not recorded. Each farm was visited 1 to 2 d before the routine weaning day, and litters were systematically selected at this time by beginning with the initial crate in the farrowing room until a maximum of 20 litters were sampled. From each litter, a small, medium, and large piglet were purposely selected to account for size variation across litters. All male piglets enrolled in this study were barrows. Pigs were excluded if they had any health concerns such as the visible presence of an abscess, hernia, thin body condition, or lameness (9).

A technician and a veterinarian took blood samples from the selected piglets by the orbital sinus bleeding technique (11,12) using a Monoject Standard Hypodermic needle 16 G × 1" (Coviden; Mansfield, Massachusetts, USA). Blood for serum biochemistry and iron profile was collected in 8.5-mL plain tubes containing no additive (BD Vacutainer; BD, Franklin Lakes, New Jersey, USA). Blood for hematology was collected in 6-mL tubes containing ethylenediamine tetraacetic acid (EDTA) (BD Vacutainer; BD). The EDTA tubes were immediately inverted 5 to 10 times after the sample was collected to mix the anticoagulant with the blood. The blood samples were immediately placed on ice packs in a cooler and transported from the farm to the laboratory.

**Hematology evaluation**

The blood samples (n = 1095) collected by Perri et al (9) were used for hematology analysis of individual piglets just prior to weaning at approximately 21 d of age. Within approximately 3 h of sampling on-farm, the whole blood samples were analyzed at the Animal Health Laboratory (AHL), University of Guelph, Guelph, Ontario. Standard hematology techniques using the ADVIA 2120/2120i Hematology system (Siemens Healthcare Diagnostics, Deerfield, Illinois, USA) were used to determine the red blood cell (RBC) count, white blood cell (WBC) count, hemoglobin (HGB), hematocrit (HCT), mean corpuscular volume (MCV), mean corpuscular hemoglobin (MCH), mean corpuscular hemoglobin concentration (MCHC), red blood cell distribution width (RDW), platelets, and mean platelet volume (MPV). Platelet counts were measured photometrically. For further details on the hematology analytical methods and automation procedures, please contact the corresponding author.

**Biochemistry evaluation**

Blood samples (n = 1095) were centrifuged at the AHL, the serum was removed and then stored at −20°C until the time of analysis. Due to the cost associated with the biochemical analysis a subset of 200 samples was randomly chosen by using a random generator in STATA 12.0 (Stata 12 Statacorp LP, College Station, Texas, USA). A total of 10 serum samples, representing 10 individual pigs, were randomly selected from each of the participating farms and were analyzed using a Roche Cobas 6000 c501 biochemistry analyzer (Roche Diagnostics USA, Indianapolis, USA), as per standard protocols at the AHL. For further details on the biochemistry analytical methods and automation, please contact the corresponding author.

**Statistical analysis**

Reference intervals were statistically evaluated using a computer program (Analyze-It Version 3.0; Analyze-It Software, Leeds, UK). This software program works within Microsoft Excel. Data were examined using non-parametric methods as recommended by the American Society for Veterinary Clinical Pathology (ASVCP). Non-parametric methods are recommended when using ≥ 120 samples for the determination of reference intervals and when the data do not follow a normal distribution (13). Five blood samples were omitted from the datasets due to small clots. Additionally, the authors decided *a priori* to exclude any pigs from the study if they were considered anemic. Anemia was defined as a pig having a HGB value ≤ 90 g/L. The decision tree indicating whether a pig should be included or excluded in the statistical analysis to define reference intervals for the hematology and biochemistry parameters is displayed in Figure 1.
After the removal of anemic pigs, 1032 pigs (from the original 1095) were used for hematology reference interval determination. From the original 1095 pigs, 200 were randomly selected for biochemical analysis. However, of these 200 pigs selected 11 were removed because they were anemic, leaving a total of 189 pigs available for biochemistry reference interval determination. Each hematology and biochemistry parameter was initially screened visually using histograms and boxplots to assess the distribution. Box plots illustrate a sample distribution using the 25th, 50th, and 75th percentiles, which are also referred to as the lower quartile (Q1), median (m or Q2), and upper quartile (Q3), respectively (14). The interquartile range (IQR) is equal to Q3 − Q1 and this range covers the central 50% of the data (14). The 95% reference intervals, mean, median, minimum, maximum, and 90% CI’s for the lower and upper reference limits were calculated for each hematology and biochemistry parameter. The statistical examination of outliers is not recommended for reference interval analysis since large values from a skewed population (non-Gaussian) may be mislabeled as an outlier(s) (15). Since nonparametric methods establish reference limits by trimming the most extreme values, outliers have less of an effect on the reference intervals than with parametric methods (13). Thus, outlier detection was not performed.

**Results**

The mean age of piglets sampled was 21.8 ± 4.2 d. The 95% reference intervals, mean, median, minimum, maximum, and 90% CI’s for the lower and upper reference limits for the hematology parameters are presented in Table 1. The 95% reference intervals, mean, median, minimum, maximum, and 90% CI’s for the lower and upper reference limits for the biochemistry parameters are displayed in Table 2.
Table 1. Hematology reference values* and reference intervals for Ontario piglets (n = 1032) sampled 1 to 2 days prior to weaningb on 20 commercial farms

<table>
<thead>
<tr>
<th>Variable</th>
<th>Mean</th>
<th>Median</th>
<th>Min–Max</th>
<th>IQR</th>
</tr>
</thead>
<tbody>
<tr>
<td>WBC (× 10^9/L)</td>
<td>11.2</td>
<td>10.1</td>
<td>4.3–53.9</td>
<td>5.0</td>
</tr>
<tr>
<td>RBC (× 10^12/L)</td>
<td>6.0</td>
<td>5.9</td>
<td>3.9–8.0</td>
<td>0.9</td>
</tr>
<tr>
<td>HGB (g/L)</td>
<td>115.0</td>
<td>115.0</td>
<td>91.0–144.0</td>
<td>15.0</td>
</tr>
<tr>
<td>HCT (L/L)</td>
<td>0.4</td>
<td>0.4</td>
<td>0.3–0.5</td>
<td>0.05</td>
</tr>
<tr>
<td>MCV (10^-12 L)</td>
<td>66.0</td>
<td>66.0</td>
<td>48.0–87.0</td>
<td>9.0</td>
</tr>
<tr>
<td>MCH (10^-12 g)</td>
<td>19.5</td>
<td>20.0</td>
<td>13.0–27.0</td>
<td>3.0</td>
</tr>
<tr>
<td>MCHC (g/L)</td>
<td>295.0</td>
<td>294.0</td>
<td>262.0–397.0</td>
<td>14.0</td>
</tr>
<tr>
<td>RDW (%)</td>
<td>18.2</td>
<td>17.4</td>
<td>10.0–31.1</td>
<td>3.6</td>
</tr>
<tr>
<td>Platelets (× 10^12/L)</td>
<td>487.0</td>
<td>474.5</td>
<td>49–14989</td>
<td>201.0</td>
</tr>
<tr>
<td>MPV</td>
<td>10.5</td>
<td>10.0</td>
<td>6.6–22.7</td>
<td>2.8</td>
</tr>
</tbody>
</table>

95% Reference interval: Min: Max
90% CI: Lower limit
90% CI: Upper limit

* Reference values were determined using Analyze-It Software (Analyse-It Version 3.0; Leeds, UK) and based on non-parametric analyses.

b Average age of piglets (1 to 2 d prior to weaning) was 21.8 ± 4.2 d.

IQR — interquartile range, which is equal to the upper quartile (Q3) minus the lower quartile (Q1) (Q3–Q1) and this range covers the central 50% of the data; CI — confidence interval; WBC — white blood cells; RBC — red blood cells; HGB — hemoglobin; HCT — hematocrit; MCV — mean corpuscular hemoglobin; MCHC — mean corpuscular hemoglobin concentration; RDW — red blood cell distribution width; MPV — mean platelet volume.

Table 2. Biochemistry reference values* and reference intervals for Ontario piglets (n = 189) sampled 1 to 2 days prior to weaningb on 20 commercial farms

<table>
<thead>
<tr>
<th>Variable</th>
<th>Mean</th>
<th>Median</th>
<th>Min–Max</th>
<th>IQR</th>
</tr>
</thead>
<tbody>
<tr>
<td>Calcium (mmol/L)</td>
<td>2.8</td>
<td>2.9</td>
<td>1.70–3.2</td>
<td>0.19</td>
</tr>
<tr>
<td>Phosphorus (mmol/L)</td>
<td>3.3</td>
<td>3.3</td>
<td>2.3–3.9</td>
<td>0.33</td>
</tr>
<tr>
<td>Magnesium (mmol/L)</td>
<td>1.2</td>
<td>1.2</td>
<td>0.9–1.5</td>
<td>0.11</td>
</tr>
<tr>
<td>Sodium (mmol/L)</td>
<td>138.3</td>
<td>140.0</td>
<td>94–150</td>
<td>6.0</td>
</tr>
<tr>
<td>Potassium (mmol/L)</td>
<td>5.0</td>
<td>5.0</td>
<td>3.6–7.2</td>
<td>0.6</td>
</tr>
<tr>
<td>Chloride (mmol/L)</td>
<td>97.2</td>
<td>98.0</td>
<td>64–106</td>
<td>4.0</td>
</tr>
<tr>
<td>Serum carbon dioxide (mmol/L)</td>
<td>25.3</td>
<td>26.0</td>
<td>18–32</td>
<td>3.0</td>
</tr>
<tr>
<td>Anion gap (mmol/L)</td>
<td>20.9</td>
<td>21.0</td>
<td>15–29</td>
<td>4.0</td>
</tr>
<tr>
<td>Na/K ratio (mmol/L)</td>
<td>27.8</td>
<td>28.0</td>
<td>18–36</td>
<td>4.0</td>
</tr>
<tr>
<td>Serum iron (μmol/L)</td>
<td>19.4</td>
<td>17.0</td>
<td>2–85</td>
<td>17.0</td>
</tr>
<tr>
<td>UIBC (μmol/L)</td>
<td>60.0</td>
<td>61.0</td>
<td>0–143</td>
<td>42.0</td>
</tr>
<tr>
<td>TIBC (μmol/L)</td>
<td>80.0</td>
<td>79.0</td>
<td>23–149</td>
<td>28.6</td>
</tr>
<tr>
<td>Prop saturation (%)</td>
<td>28.0</td>
<td>24.0</td>
<td>2–100</td>
<td>29.0</td>
</tr>
<tr>
<td>Total protein (g/L)</td>
<td>48.0</td>
<td>48.1</td>
<td>31.0–61.0</td>
<td>4.0</td>
</tr>
<tr>
<td>Albumin (g/L)</td>
<td>36.9</td>
<td>38.0</td>
<td>23–46</td>
<td>6.0</td>
</tr>
<tr>
<td>Globulin (g/L)</td>
<td>11.2</td>
<td>11.0</td>
<td>4–35</td>
<td>3.0</td>
</tr>
<tr>
<td>A/G ratio</td>
<td>3.8</td>
<td>3.5</td>
<td>0.7–10.5</td>
<td>1.8</td>
</tr>
<tr>
<td>Urea</td>
<td>2.5</td>
<td>2.5</td>
<td>0.7–9.3</td>
<td>1.2</td>
</tr>
<tr>
<td>Creatinine (μmol/L)</td>
<td>89.7</td>
<td>88.0</td>
<td>36.0–141.0</td>
<td>24.0</td>
</tr>
<tr>
<td>Glucose (mmol/L)</td>
<td>6.5</td>
<td>6.5</td>
<td>2.7–8.9</td>
<td>1.0</td>
</tr>
<tr>
<td>Cholesterol (mmol/L)</td>
<td>4.7</td>
<td>4.6</td>
<td>1.7–9.76</td>
<td>1.9</td>
</tr>
<tr>
<td>Total bilirubin (μmol/L)</td>
<td>6.0</td>
<td>5.0</td>
<td>1–22</td>
<td>3.0</td>
</tr>
<tr>
<td>Conjugated bilirubin (μmol/L)</td>
<td>2.9</td>
<td>3.0</td>
<td>0–10</td>
<td>1.0</td>
</tr>
<tr>
<td>Free bilirubin (μmol/L)</td>
<td>3.1</td>
<td>3.0</td>
<td>0–15</td>
<td>2.0</td>
</tr>
<tr>
<td>Alkaline phosphatase (U/L)</td>
<td>589.3</td>
<td>552.0</td>
<td>160–2119</td>
<td>326.7</td>
</tr>
<tr>
<td>GGTT (U/L)</td>
<td>35.0</td>
<td>35.0</td>
<td>0–75</td>
<td>20.0</td>
</tr>
<tr>
<td>AST (U/L)</td>
<td>38.3</td>
<td>35.0</td>
<td>3–130</td>
<td>14.0</td>
</tr>
<tr>
<td>CK (U/L)</td>
<td>365.0</td>
<td>302.0</td>
<td>111–4918.0</td>
<td>144.7</td>
</tr>
<tr>
<td>GLDH (U/L)</td>
<td>5.1</td>
<td>2.0</td>
<td>0–65</td>
<td>3.0</td>
</tr>
<tr>
<td>BHB (μmol/L)</td>
<td>3.2</td>
<td>0</td>
<td>0–58</td>
<td>0.0</td>
</tr>
<tr>
<td>Haptoglobin (g/L)</td>
<td>0.6</td>
<td>0.4</td>
<td>0.2–3.7</td>
<td>0.2</td>
</tr>
<tr>
<td>Calculated osmolality (mOsm/L)</td>
<td>278.0</td>
<td>278.0</td>
<td>188–297</td>
<td>11.0</td>
</tr>
</tbody>
</table>

95% Reference interval: Min: Max
90% CI: Lower limit
90% CI: Upper limit

* Reference values were determined using Analyze-It Software (Analyse-It Version 3.0; Leeds, United Kingdom) and based on non-parametric analyses.

b Average age of piglets (1 to 2 d prior to weaning) was 21.8 ± 4.2 d.

IQR — interquartile range, which is equal to the upper quartile (Q3) minus the lower quartile (Q1) (Q3–Q1) and this range covers the central 50% of the data; CI — confidence interval; UIBC — unsaturated iron-binding capacity; TIBC — total iron-binding capacity; GGT — gamma-glutamyl transferase; AST — aspartate transaminase, CK — creatine kinase; GLDH — glutamate dehydrogenase; BBHA — blood β-hydroxbutyrate.

Discussion

The establishment of hematology and biochemistry reference intervals in nursing piglets is important for veterinarians and researchers. Reference intervals can be used to interpret laboratory results in order to better understand the health status of either an individual pig or the entire herd. The interpretation of these parameters is often difficult due to the variation within individual pigs and herds, as well as between herds. There are many animal-related pre-analytical factors such as age, gender, breed, growth rate, nutritional and health status, season, physical

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activity and stress that can affect both hematology and biochemistry parameters (16).

Nursing piglets undergo rapid growth and immune system changes, which may result in variation in hematology and biochemistry parameters. It is therefore essential to develop reference intervals for this age group to aid in the diagnosis of disease and to enable timely intervention to prevent further health-challenge issues in subsequent stages of production. There are only a few published manuscripts containing reference intervals for hematology and biochemistry parameters for 3-week-old nursing piglets. Thus, contributions to the literature on reference intervals for these parameters are needed.

All pigs selected for sampling lacked any visible outward clinical signs or physical abnormalities. However, subclinical disease and/or marginal nutritional deficiencies may have been present in some of the pigs included in this study. This further highlights the importance of assessing hematology and biochemistry parameters. The decision to omit anemic pigs from the study was based on both the authors’ previous work on pig anemia and iron deficiency (9) as well as on other studies that have published accepted values for pig hemoglobin (HGB) concentration (17,18). The work conducted by Perri et al (9) established that iron deficiency and anemia are present in a proportion of Ontario pigs at weaning, despite their healthy physical appearance. Hence, anemic pigs were identified and removed from the current study in order to establish hematology and biochemistry parameters for healthy pigs. It was hypothesized that the timing of iron administration would contribute to the number of anemic pigs found in the herds. However, Perri et al (9) found no statistically significant difference in the number of anemic pigs when comparing pigs administered an iron injection at ≤ 1 d of age, 2 to 4 d, or 5 to 7 d of age.

The values reported in the current study are similar to values reported in 2 previous publications (19,20). Gong et al (19) evaluated hematology values for 368 piglets that were 20 d of age and the values were similar to the hematology values from the current study. Egeli et al (20) conducted a study on biochemistry and hematology values of pigs at 1 d, 21 d, and 35 d of age. The study compared values from pigs (n = 60) that were defined as having a normal hemoglobin concentration (HGB > 80 g/L) to pigs (n = 42) that were anemic (HGB ≤ 80 g/L). When comparing our hematology parameters to those of Egeli et al (20), the current study reports higher HGB and HCT values. The minor variation in these parameters may be due to differences in the iron supplementation protocols, such as timing of injection and dosage. Egeli et al (20) administered 180 mg of iron dextran at 1 d of age, compared to 200 mg of either iron dextran or gleptoferron at 1 to 7 d of age from the current study. Egeli et al (20) reported slightly lower reference intervals for AST, magnesium, cholesterol, and similar reference intervals for total protein and albumin compared with the current study. The larger sample size herein and different analytical methods may explain the dissimilarities in these parameters. The disparities in cholesterol and total iron may be a result of nutritional variations due to access to milk and creep feed. Also, variations in the amount of protein in milk and creep feed might also affect urea and creatinine concentrations (21).

It is inappropriate to compare hematology and biochemistry reference intervals of nursing piglets to those of other age groups because nursing pigs undergo significant physiological changes such as bone development which will lead to differences in parameters (i.e., elevated phosphorus concentration and alkaline phosphatase activity) compared to older growing pigs (22). There are also nutritional variances between pigs from different age groups, which can affect values such as phosphorus, cholesterol, total bilirubin, conjugated bilirubin, and free bilirubin (21).

A general limitation for assessing reference intervals for hematology and biochemistry parameters is the large variation in biological features found within pigs on a single farm as well as an even larger variation when comparing pigs from different farms. However, a strength of this study was the large sample size for both hematologic evaluation (n = 1032) and biochemistry evaluation (n = 189).

The results from this study fill an important gap in the literature by providing reference intervals for hematology and biochemistry parameters in nursing piglets from Ontario commercial herds. The herds selected appeared to be in good health and the pigs chosen lacked clinical signs or physical abnormalities on physical examination, thus the variation in parameters may reflect what is expected in Ontario commercial pigs at weaning. Since the nursing period is a critical stage of development for pigs, it is important to continue to assess and publish hematological and biochemical blood parameters for these animals, as well as for other stages of production, to aid veterinarians and researchers in the identification of clinical or subclinical disease or metabolic and nutritional problems.

Acknowledgments

This study was funded by the Saskatchewan Ministry of Agriculture and Food, Saskatchewan Pork Development Board, the Canadian Swine Health Board, and the Ontario Ministry of Agriculture Food and Rural Affairs-University of Guelph Research Partnership.

References

Cuttable plate fixation for small breed dogs with radius and ulna fractures: Retrospective study of 31 dogs

Gwyneth K. Watrous, Noel M.M. Moens

Abstract — This retrospective study evaluated complication rates for radius and ulna fractures in small breed dogs in which 1.5 mm to 2.7 mm cuttable bone plates were used for internal fixation. The medical records of all cases from 2004 to 2011 that were presented to our clinic were reviewed. Inclusion criteria were: dogs with body weight < 9 kg, fracture of the radius and ulna with open reduction, and internal fixation utilizing a cuttable bone plate. Thirty-four fractures in 31 dogs met the inclusion criteria. Of 25 dogs that were available for follow-up, all achieved union, minor complications occurred in 9, and major complications occurred in 8. External coaptation was responsible for complications in 8 cases and the need for coaptation needs to be investigated. Excluding minor complications, 32% of patients required at least 1 additional surgery or additional hospitalization. All but 2 of the dogs returned to full function. The 1.5 mm straight plate was successfully used in all dogs with a body weight of 0.9 to 2.6 kg.

Résumé — Fixation à l’aide d’une plaque taillable chez les chiens de petites races pour les fractures de radius et de cubitus : étude rétrospective de 31 chiens. Cette étude rétrospective a évalué les taux de complication pour les fractures de radius et de cubitus chez les chiens de petites races pour lesquels des plaques vissées taillables de 1.5 mm à 2.7 mm ont été utilisées pour la fixation interne. Les dossiers médicaux de tous les cas de 2004 à 2011 présentés à notre clinique ont été examinés. Les critères d’inclusion étaient les suivants : chiens avec un poids corporel de < 9 kg, la fracture de radius et de cubitus avec une réduction ouverte et une fixation interne utilisant une plaque vissée taillable. Trente-quatre fractures de 31 chiens ont satisfait aux critères d’inclusion. Parmi les 25 chiens qui étaient disponibles pour le suivi, on a observé une union réussie, des complications mineures se sont produites dans neuf cas et des complications majeures ont eu lieu dans huit cas. La coaptation externe a été responsable des complications dans huit cas et le besoin de coaptation doit être étudié. En excluant les complications mineures, 32 % des patients ont requis au moins une chirurgie additionnelle ou une hospitalisation additionnelle. Tous les chiens sauf deux sont retournés à une fonction complète. La plaque de 1,5 mm a été utilisée avec succès chez tous les chiens ayant un poids corporel de 0,9 à 2,6 kg.

(Traduit par Isabelle Vallières)

Introduction

Radius and ulna fractures represent the third most common fractures in dogs and account for approximately 17% of all fractures in dogs, with many of these occurring in small breeds (1). Although various techniques can be used for the treatment of radius and ulna fractures in small breed dogs, bone plating remains one of the most frequent methods of stabilization for these fractures. In a retrospective study of 22 small and miniature dogs with radial and ulna fractures treated with bone plates, 89% successfully returned to function. However, complication rates were high and reported to affect 54% of the cases with 18% considered major complications and 36% minor complications (2).

Bone size and small bone fragments are always significant challenges in miniature breeds and the surgeon must choose the most appropriate plate for each dog. Several types of plate are available for the repair of radial fractures in small and miniature dogs and the results for several of these types of plate have been described in the literature (2–4). Cut-to-length plates provide unique characteristics that make them appealing for the treatment of radial fractures in miniature breeds. They are versatile and economical; they come in multiple small sizes and generally

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offer a short hole-to-hole distance, allowing the placement of several screws in relatively short bone segments (5,6). On the other hand, their small size and high hole-to-plate ratio make them subjectively flexible and weak. Results associated with the use of these cut-to-length plates have not been reported.

It has been over 15 y since any literature has been published reviewing the complication rate and long-term outcome of radius and ulna fractures repaired by internal fixation in small breed dogs. The purpose of this retrospective study was to determine the current complication rate over an 8-year period treating small breed dogs with internal fixation for radial and ulna fractures using cut-to-length plates.

### Materials and methods

#### Inclusion criteria

The medical records of all cases from 2004 to 2011 in which a 1.5 mm, 2.0 mm, or 2.7 mm cuttable bone plate was used were reviewed and totaled 97 cases. The criteria for inclusion of cases in the study were: fracture of the radius and ulna with open reduction and internal fixation utilizing a cuttable bone plate [1.5 mm straight plate; 2.0 mm straight plate; 2.0 mm/1.5 mm Cut-To-Length Plate; formerly known as Veterinary Cuttable Plates (VCP) or 2.7 mm/2.0 mm Cut-To-Length Plate] (DePuy-Synthes, Paoli, Pennsylvania, USA) in dogs with body weight less than 9 kg.

Data pertaining to breed, gender, age, body weight, clinical history, time from injury to surgery, fracture description, previous repair attempts, duration of surgical repair, plate size and configuration, utilization of cancellous bone graft, postoperative fracture alignment, postoperative management, postoperative complications, lameness outcome, and time from fracture fixation until last follow-up radiographs were recorded. Owner compliance was not recorded.

Complications were classified into major and minor based on criteria proposed by Cook et al (7). Major complications were defined as complications that required further treatment based on current standards of care (implant failure, surgical intervention, or hospitalization for bandage complications). Minor complications were defined as complications not requiring additional surgical or medical treatment to resolve (long-term lameness, bandage complications not requiring specific treatment or hospitalization) (7).

All referring veterinarians were contacted to determine if the patient was still living at the time of the survey. A questionnaire was created and mailed to all owners for long-term follow-up, excluding those clients whose dogs were known to have died. A $10 gift card incentive was offered and mailed to every client who completed and returned the questionnaire.

#### Results

Thirty-one dogs were included in the study. Pomeranians constituted 10 of the 31 dogs; other breeds were poodle (n = 7), Yorkshire terrier (n = 4), mixed breed (n = 3), Chihuahua (n = 3), Chinese crested hairless (n = 2), Jack Russell terrier (n = 1), and Italian greyhound (n = 1). The mean (median) age at fracture repair was 14.9 mo (7.0 mo). Bilateral fractures occurred in 2 of 31 dogs and 1 dog was presented for fracture of the contralateral radius 7 mo following the first repair for a total of 34 fractures in 31 dogs. There were 14 females and 17 males. Clinical history for all cases included minimal trauma: falling (n = 12), jumping a short distance (n = 11), unknown trauma (n = 5), playing with other dogs (n = 2), or being stepped on (n = 1).

All fractures consisted of complete fracture of the radius and ulna. Of the 34 fractures that were treated initially, 20 were located in the distal diaphysis of the radius, 10 in the mid-diaphysis, 1 in the proximal diaphysis and the location was not recorded in 3 cases. All recorded fractures were either a short oblique or transverse fracture except for 3 cases: 1 case of bilateral fractures (both comminuted) which went on to experience implant failure and 1 mid-diaphyseal fracture (mild comminution) which was lost to follow-up (Table 1).

Most dogs had their fracture(s) treated within 3 d after the injury; 8 fractures were repaired between 4 to 10 d after injury. One dog had been treated unsuccessfully with a splint for 9 wk before presentation.

All fractures were repaired at our clinic. A total of 45 surgeries were performed on 31 dogs. Bilateral fractures were present in 3 dogs, 1 of which had bilateral radial fractures 7 mo apart. Implant failure requiring plate replacement occurred in 4 dogs (Table 1). Seven additional surgeries were performed to provide additional bone graft and/or to remove or replace screws during the healing process (n = 4) or to remove the plate following complete healing because of perceived ongoing complication associated with the implant (n = 3). Excluding the surgeries for bilateral fractures, 5 dogs required 2 surgeries and 3 dogs required 3 surgeries. Among the 4 dogs that suffered catastrophic implant failure, 2 were repaired using a plate other than a cuttable plate (2.0 mm DCP; DePuy-Synthes). For these 2 cases, the revision surgeries were counted as a complication but excluded from our analysis of plates.

Of the initial fracture fixation (34 fractures in 31 dogs), 21 fractures were stabilized with a 1.5 mm straight plate, 4 fractures with a 2.0 mm straight plate, 5 with a 2.0/1.5 mm VCP, and 4 with the 2.7/2.0 mm VCP. The average (median) weight of the dogs treated with each type of plate were 2.2 (2.2) kg for the 1.5 mm straight plate, 2.4 (2.8) kg for the 2.0 mm straight plate, 2.9 (2.0) kg for the 2.0/1.5 VCP, and 5.4 (4.9) kg for the 2.7/2.0 VCP. All fractures were initially repaired using a single plate. The 2 plate revision surgeries included were revised with a 1.5 mm straight plate (from a 2.0 mm straight plate) on a 0.94-kg dog and a stacked 2.0 mm straight plate (from a single 2.0 mm straight plate) on a 2.8-kg dog.

Either a cancellous or cortico-cancellous bone graft (autograft or allograft) was used in 8 of the initial 34 fractures. Three additional bone grafts were performed on 3 dogs during revision surgery (Table 1). Two of the bilateral fractures and the fracture that had been splinted for 9 wk before presentation were grafted at the time of initial surgery.

Immediately after surgery for the initial 34 fractures, 23 caudal splints were placed, including both of the bilateral fracture repairs. Caudal splints generally consisted of spoon splint, caudal splint made of fiberglass casting material, or a portion of a tongue depressor, at the discretion of the clinician. Splints
having evidence of progression of bony healing. The number of follow-up visits ranged from 2 to 15 and included 2 patients that were hospitalized for 4 d and 10 d each, to address severe bandage complications and associated wounds. Of the 25 cases with at least 27 d of follow-up, major postoperative complications were recorded in 8 patients and minor complications occurred in 9 patients (Table 1).

### Major complications

Four dogs suffered a catastrophic plate failure (9 to 58 d following initial surgical repair) (Table 1, dogs 1 to 4). Two (dogs 1 and 2) were in the group repaired with the 1.5 mm mini straight plate and had a splint or padded bandage following surgery. The dogs weighed 3.5 and 5 kg and were the largest dogs in the 1.5 mm plate group. Both were successfully repaired with a 2.0 mm DCP and were censored from the study. The 2 other

<table>
<thead>
<tr>
<th>Case number</th>
<th>Bandage placed</th>
<th>Postoperative complications</th>
<th>Fracture configuration</th>
<th>Nature of complication</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Soft padded</td>
<td>Major</td>
<td>Transverse</td>
<td>Implant failure, repaired with 2-0DCP, censored.</td>
</tr>
<tr>
<td>2</td>
<td>Splint</td>
<td>Major</td>
<td>Transverse</td>
<td>Implant failure, repaired with 2-0DCP, bandage, censored.</td>
</tr>
<tr>
<td>3</td>
<td>2 Splints</td>
<td>Major</td>
<td>Commined (2)</td>
<td>Implant failure. Bandage — pressure sores — requiring hospitalization, intermittent lameness.</td>
</tr>
<tr>
<td>4</td>
<td>Splint</td>
<td>Major</td>
<td>Oblique</td>
<td>Implant failure following screw removal, osteopenia, revised with smaller plate, healed without complications.</td>
</tr>
<tr>
<td>5</td>
<td>Splint</td>
<td>Major</td>
<td>Transverse</td>
<td>Splinted for 9 wk before referral. Osteopenia, bone grafting, screw failure, and disuse osteopenia of carpus and manus.</td>
</tr>
<tr>
<td>6</td>
<td>No</td>
<td>Major</td>
<td>Transverse</td>
<td>Implant removal due to synostosis and cold sensitivity.</td>
</tr>
<tr>
<td>8</td>
<td>Soft padded &lt; 5 d</td>
<td>Major</td>
<td>Oblique</td>
<td>Mild decrease in range of motion of carpus/elbow. Osteopenia, staged plate removal.</td>
</tr>
<tr>
<td>9</td>
<td>Splint</td>
<td>Minor</td>
<td>Transverse</td>
<td>Bandage — pressure sores. Ulnar osteopenia.</td>
</tr>
<tr>
<td>10</td>
<td>Splint</td>
<td>Minor</td>
<td>Oblique</td>
<td>Bandage — olecranon wound.</td>
</tr>
<tr>
<td>11</td>
<td>Splint</td>
<td>Minor</td>
<td>Oblique</td>
<td>Bandage, osteopenia.</td>
</tr>
<tr>
<td>12</td>
<td>Soft padded &lt; 5 d</td>
<td>Minor</td>
<td>Oblique</td>
<td>Bandage, chewing sutures.</td>
</tr>
<tr>
<td>13</td>
<td>Splint</td>
<td>Minor</td>
<td>Transverse</td>
<td>Bandage, osteopenia, lameness.</td>
</tr>
<tr>
<td>14</td>
<td>Splint</td>
<td>Minor</td>
<td>Oblique</td>
<td>Carpal swelling; non-weight-bearing lameness 8 wk after surgery, ulnar osteopenia.</td>
</tr>
<tr>
<td>15</td>
<td>Splint</td>
<td>Minor</td>
<td>Oblique</td>
<td>Valgus deformity</td>
</tr>
<tr>
<td>16</td>
<td>Splint</td>
<td>Minor</td>
<td>Oblique</td>
<td>Lameness</td>
</tr>
<tr>
<td>17</td>
<td>No</td>
<td>Minor</td>
<td>Transverse</td>
<td>Lameness</td>
</tr>
<tr>
<td>18</td>
<td>Splint</td>
<td>None</td>
<td>Transverse</td>
<td>None</td>
</tr>
<tr>
<td>19</td>
<td>2 Splints</td>
<td>None</td>
<td>Transverse/oblique (2)</td>
<td>None</td>
</tr>
<tr>
<td>20</td>
<td>2 Splints</td>
<td>None</td>
<td>Transverse (2)</td>
<td>None, contralateral radial fracture 7 mo following first fracture.</td>
</tr>
<tr>
<td>21</td>
<td>Splint</td>
<td>None</td>
<td>Oblique</td>
<td>None</td>
</tr>
<tr>
<td>22</td>
<td>Splint</td>
<td>None</td>
<td>Oblique</td>
<td>None</td>
</tr>
<tr>
<td>23</td>
<td>Splint</td>
<td>None</td>
<td>Oblique</td>
<td>None</td>
</tr>
<tr>
<td>24</td>
<td>Soft padded</td>
<td>None</td>
<td>Oblique</td>
<td>None</td>
</tr>
<tr>
<td>25</td>
<td>Soft padded &lt; 5 d</td>
<td>Lost</td>
<td>Transverse</td>
<td>NA</td>
</tr>
<tr>
<td>26</td>
<td>Soft padded &lt; 5 d</td>
<td>Lost</td>
<td>Transverse</td>
<td>NA</td>
</tr>
<tr>
<td>27</td>
<td>Soft padded &lt; 5 d</td>
<td>Lost</td>
<td>Commined</td>
<td>NA</td>
</tr>
<tr>
<td>28</td>
<td>Splint</td>
<td>Lost</td>
<td>Transverse</td>
<td>NA</td>
</tr>
<tr>
<td>29</td>
<td>Soft padded</td>
<td>Lost</td>
<td>Transverse</td>
<td>NA</td>
</tr>
<tr>
<td>30</td>
<td>No</td>
<td>Lost</td>
<td>Oblique</td>
<td>NA</td>
</tr>
<tr>
<td>31</td>
<td>Splint</td>
<td>None</td>
<td>Oblique</td>
<td>None</td>
</tr>
</tbody>
</table>

NA = not applicable.

or bandages were rechecked weekly. Three limbs had a soft padded bandage placed after surgery for an undetermined period of time (Table 1). Eight cases had either no bandage after surgery or only a soft padded bandage placed for a short time thereafter (1 to 5 d) (Table 1). Of these 8 cases, 4 were lost to follow-up immediately after surgery. One dog required bandage removal because of skin irritation and was lost to follow-up after 27 d. The other 3 were followed a minimum of 101 d after surgery and all 3 had healed fractures.

Of the 31 dogs, 6 were lost to follow-up after the initial surgery (Table 1). The remaining 25 dogs had at least 1 set of recheck radiographs with a follow-up range of 27 to 169 d. The mean (median) follow-up time was 64 (57) d. Complete fracture healing was recorded for 17 cases with the remaining 8 cases having evidence of progression of bony healing. The number of follow-up visits ranged from 2 to 15 and included 2 patients that were hospitalized for 4 d and 10 d each, to address severe bandage complications and associated wounds. Of the 25 cases with at least 27 d of follow-up, major postoperative complications were recorded in 8 patients and minor complications occurred in 9 patients (Table 1).
failures happened with the 2.0 mm straight plate. Dog 3 had a bilateral comminuted fracture with postoperative splints. One of the plates broke and the dog developed pressure sores requiring additional hospitalization. The surgery was revised with a stacked 2.0 mm straight plate and no coaptation. Bone graft was used for both the initial and revision surgeries. The fourth dog (#4) failed after a bone screw was removed because of delayed healing and progressive osteopenia. The dog was a 0.94-kg Chihuahua and the smallest dog in the series. The plate and screws were considered oversized and the surgery was revised successfully with a 1.5 mm straight plate. Bone graft and coaptation were used for both initial and revision surgeries.

Dog 5, which had been treated initially with a splint before a 2.0 mm straight plate was applied, developed a delayed union and required 2 additional surgeries, 1 for bone grafting, the other to replace failing screws. Healing was confirmed 151 d following surgery and required 15 hospital visits in total.

Three dogs (dogs 6,7,8) healed uneventfully but required the implant to be removed because of progressive osteopenia or cold sensitivity. One of these dogs was a 1-kg dog treated with a 1.5 mm straight plate and no coaptation, one was a 3-kg dog treated with a 2.0/1.5 mm VCP and no coaptation, and the third (dog 8) was a 4.6-kg dog treated with a 2.7/2.0 VCP and coaptation. This dog was also hospitalized for 4 d because of a deep olecranon ulcer. Two of these plates were removed in a single staged procedure and the third plate was removed in 2 stages.

Minor complications

Nine dogs suffered only minor complications; some dogs suffered more than 1 complication. Minor complications included: bandage complications that did not require specific treatment other than bandage change or removal (5 cases), premature suture removal by the animal (1 case), carpal swelling (1 case), valgus deformity (1 case), intermittent lameness (3 cases), and 1 non-weight bearing lameness at 8 wk.

Long-term lameness outcome among the 25 cases with follow-up was as follows: full return to function in 15, acceptable function in 5, unacceptable function with continued lameness in 2 dogs, and undocumented lameness status in 3 dogs. One of the dogs with unacceptable function was the dog which had the fracture splinted before treatment and required multiple surgeries due to delayed union (Table 1, dog 5). This dog was also diagnosed with elbow incongruity. The other dog with unacceptable function was non-weight-bearing 8 wk following fracture fixation despite bone healing on radiographs (Table 1, dog 14). This dog had mild swelling of the carpal joint; however, no further follow-up was available. Of the 3 dogs that had undocumented lameness status; 2 had mild decrease in carpal and elbow range of motion.

Twenty-nine questionnaires were mailed to owners, excluding 5 whose dogs had died. Six questionnaires were returned. All owners were satisfied with the surgery and only 1 dog had residual lameness after strenuous activity. The overall use of the limb was satisfactory for all owners. Two of the 6 patients had implants removed. The long-term complications noted from surgery included a scar from a bandage sore and a little tenderness after running too hard, resulting in favoring of the leg for a brief period with a mild lameness. A third owner reported the leg to be sensitive and become cold easily. The questionnaire answers were factored into the overall complication rate.

Discussion

Small breed dogs appear to be predisposed to radial fractures with approximately 85% of radius and ulna fractures occurring in the distal third (1,8). Morphological differences in the antebrachium of small breed dogs compared to larger breeds are believed to be responsible for this predisposition (9). Radius and ulna fractures in small breed dogs have been associated with a high complication rate and a high incidence of delayed and non-unions (2,10). One study reported up to 54% of small breed dogs treated with plate osteosynthesis developed postoperative complications (2). The complication rate is approximately 83% if the radial fractures are treated with cast fixation (2). The reasons for this high rate of complication likely include the size and shape of the bones, technical difficulties associated with the size of the bone fragments, and the paucity of soft tissues surrounding the distal antebrachium.

Our retrospective study on radius and ulna fractures in small breed dogs treated with cuttable plates showed similar trends to previous studies but a higher complication rate with 8 major and 9 minor complications in 25 cases. The overall complication rate of 68% is higher than the previously reported overall complication rate of 54% (2). However, unlike previous publications, we adopted a stringent definition of complications as suggested by Cook et al (7). Furthermore, complications associated with coaptation were also counted as if they resulted in alteration of the original postoperative plan (such as premature bandage removal), even though they may not have influenced the final outcome.

In our study, coaptation was used in 23 of the 31 cases following the initial repair of the radius and ulna. External coaptation accounted for complications in 8 cases and resulted in prolonged hospitalization in some cases. A high complication rate associated with coaptation (up to 63%) has also been observed by others following the application of bandages, splints, or casts in small animals (11–14). External coaptation has the potential for causing pressure sores, swelling, and dermatitis (13,14) and in this study, all of these were observed within the minor complication category. Extensive lesions and a deep olecranon ulcer were observed in the major complication category.

The need for external coaptation following internal stabilization is controversial. The decision to apply postoperative coaptation was made by the surgeon, based on their evaluation of the surgical repair and the implant strength. In this study, out of the 21 fractures in which the smallest 1.5 mm straight plate was used, 16 had external coaptation placed after surgery. Four minor and 2 major complications were at least partially attributed to the bandage in that group. Bandages were also used with all other types of plate and complications occurred in all groups. There are, however, too few cases of other types of plate and our ability to make comparisons between groups was limited. One would expect that postoperative coaptation would be used...
in cases deemed at risk for implant failure and that coaptation would protect against plate breakage. Surprisingly, all 4 implant failure cases had postoperative coaptation. Two of those dogs were in the 1.5 mm straight plate group. Two of those dogs had body weights of 3.5 and 5 kg, well above the average weight of the dogs in that group (2.2 kg). Although there are no published guidelines for the use of these plates, it is likely that those dogs were too heavy for the plate. All dogs which had successful fracture repair with the 1.5 mm straight plate had an average body weight of 1.9 kg (range: 0.9 to 2.6 kg) and we therefore suggest that this plate be used for dogs within that body weight range. The other 2 cases that underwent catastrophic failure were in the 2.0 mm straight plate group and both had bone graft and postoperative coaptation. The failure of 1 of the cases remains unexplained as the dog weight (2.8 kg) was in the range of the other dogs in that group and no predisposing factor could be identified other than the fact that this dog had bilateral comminuted fractures. The last case that suffered implant failure was the smallest dog of the cohort and weighed only 0.94 kg. The fracture was initially stabilized with a 2.0 mm straight plate and 2.0 mm screws. In the face of progressing osteopenia and delayed healing, concerns of overly rigid fixation prompted the removal of 2 of the central screws and precipitated the implant failure and fracture of the bone. Fixation with a smaller plate and smaller screws, a bone graft and coaptation resulted in healing of the fracture.

Eight dogs did not have external coaptation following surgery or had coaptation for 5 d or less. Four of those dogs were immediately lost to follow-up. Interestingly, none of the remaining 4 dogs for which follow-up was available experienced implant failure, suggesting that postoperative coaptation may not always be required.

Osteopenia was diagnosed in several dogs. The degree of osteopenia was subjectively considered significant in 3 cases, prompting surgical removal of all or some of the implants. Self-limiting osteopenia not requiring treatment was not counted as a complication. Concerns about osteopenia, delayed healing, or non-union in small and miniature dogs are often raised following radius and ulna fractures (2,4,10). Although the causes of osteopenia following plate fixation have been extensively debated, it is generally accepted that vascular impairment to the bone cortex plays a larger role than stress protection in the development and progression of osteopenia (8,15).

Determination of the degree of osteopenia is often subjective and the need for the removal of the implant could be questioned. In 1 dog, the plate was believed to be oversized and although stress protection cannot be totally ruled out in this dog, vascular impairment caused by the oversized plate and screws was likely to also be a contributing factor. In addition to the effect of the implant, vascular insufficiency of the distal radius has also been suggested as a cause of healing impairment in small and miniature breeds. Decreased vascular density of the intraosseous blood supply to the distal diaphyseal-metaphyseal junction of the radius has been demonstrated compared to large breeds (16). Although vascular density is not necessarily synonymous with blood flow, decreased vascular density may contribute to the decreased prognosis for fracture healing in small breed dogs and an increased frequency of delayed union and non-union compared to similar fractures in large breed dogs or compared to fractures in other bones (16).

To the best of our knowledge, true vascular insufficiency has not been demonstrated. All fractures for which follow-up was available healed and non-union was not observed in this series. Because of the retrospective nature of the study, accurate time to healing was not available.

The lack of long-term follow-up, inability to compare risk factors due to small group sizes, inability to compare time to healing with or without external coaptation, and the retrospective nature of the study present significant limitations of this study. Because of institutional policy regarding client communication, we were not allowed to contact owners of pets that had died. Furthermore, the response rate to the long-term survey was low. These factors reduced our ability to collect long-term data on several of the dogs. It is possible that these limitations have biased our results. The direction of the bias is, however, unknown.

Our study on radial and ulna fracture fixation using 1.5 mm to 2.7 mm “cut-to-length” plates demonstrated a higher overall rate of complication than previously reported in the literature for other types of plate. The high complication rate may have been, at least in part associated with the strict definition of complications used in this publication. Despite the high complication rate, the results were similar to those reported for different plates in a similar population of dogs. All fractures that we could follow achieved clinical union and we believe “cut-to-length” plates remain a good choice for fracture repair. Bandages and splints were used in most cases and were responsible for a large number of complications. The fact that all catastrophic failures occurred despite the splint raises questions about the efficacy of coaptation or the need for coaptation. Perhaps more emphasis should be placed on strict exercise restriction and external coaptation reserved only for tenuous repairs; however, owner compliance could not be assessed and may have played a role.

The retrospective nature of the study and the small number of cases that were treated without coaptation limit the strength of this conclusion and additional studies should be conducted. The 1.5 mm straight plate was successfully used in all dogs with a body weight between 0.9 and 2.6 kg. We suggest that this range is appropriate for use of this plate although plate selection and the decision to apply coaptation will remain subjective until stronger guidelines can be developed.

References

Books Available for Review
Livres disponibles pour compte rendu

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Case Report  Rapport de cas

Pneumatosis coli in a domestic ferret (Mustela putorius furo)
Cédric B. Larouche, Marion R. Desmarchelier, Swan Specchi, Isabelle Langlois

Abstract — A 4-year-old spayed female ferret was presented with acute diarrhea and partial anorexia. Pneumatosis coli and segmental enteropathy were identified by ultrasonography and radiography. Fecal culture did not identify any pathogenic bacteria. Medical management of concurrent diseases and antibiotic therapy resulted in resolution of clinical signs and pneumatosis coli.

Résumé — Pneumatose chez un furet domestique (Mustela putorius furo). Un furet femelle stérilisé âgé de 4 ans a été présenté avec une diarrhée aiguë et de l’anorexie partielle. Une pneumatose et une entéropathie segmentaire ont été identifiés par échographie et radiographie. Une culture fécale n’a pas permis de mettre en évidence une bactérie pathogène. La gestion médicale de maladies concomitantes et d’une thérapie antibiotique ont produit une résolution des signes cliniques et de pneumatose.

Ferrets are frequently affected by gastrointestinal diseases of various origins (1). Pneumatosis coli (PC) is an uncommon medical condition characterized by the presence of gas within the intestinal wall, usually in the submucosal or subserosal layer. The condition is most commonly known as pneumato-sis cystoides intestinalis or pneumatosis intestinalis when the intestines are affected. It is also reported as intestinal emphy-sema, cystic lymphopneumatosis, and abdominal or intestinal gas cysts (2). The term gastric pneumatosis is used when the stomach is affected. These conditions are considered physical or radiographic findings and reflect the presence of an underlying condition, including trauma as well as gastrointestinal, systemic, pulmonary, autoimmune, and iatrogenic diseases (3,4).

Case description
A 4-year-old, spayed female domestic ferret was presented to the Zoological Medicine Service of the Centre Hospitalier Universitaire Vétérinaire, Université de Montréal, with a 3-day history of diarrhea and partial anorexia. The animal had been adopted 5 mo before presentation. Previous medical history was unknown. The owner reported recent loss of fur on the tail and generalized pruritus.

On physical examination, the ferret was thin and mildly lethargic. Clinical findings included a 3-mm rectal prolapse, mucoid diarrhea, generalized pruritus, and hypotrichosis of the tail. The rectal mucosa was erythematous and moderately swollen. On abdominal palpation, multiple small mobile masses were identified in the mid-abdomen. The right adrenal gland was suspected to be enlarged. Blood glucose measured with a portable glucometer (AlphaTrak, Abbott Laboratories, Illinois, USA; using a canine setting) after a 3-hour fasting period was 3.4 mmol/L [reference range (RR): 4.4 to 6.5 mmol/L] (5).

Abdominal ultrasonography showed moderate to severe mesenteric lymphadenomegaly (up to 15 mm in thickness) with hypoechoic parenchyma and hyperechoic fat surrounding the lymph nodes. Segmental asymmetrical wall thickening of the jejunum was also observed. There was gas dissecting the colonic wall with parallel disposition compared to the wall layering, consistent with pneumatosis coli (Figure 1). The right adrenal gland was moderately enlarged (thickness: 6.5 mm; RR: 1.3 to 3.7 mm) (6) with heterogeneous parenchyma and hyperechoic speckles casting acoustic shadowing within it. Abdominal radiographs revealed linear radiolucency within the colonic wall, confirming the presence of pneumatosis coli (Figure 2). This section of the colon was severely dilated and mainly filled with gas and a small amount of fecal material.

Differential diagnoses for segmental enteropathy included lymphoma, bacterial enteritis, inflammatory bowel disease, eosinophilic enteritis, proliferative bowel disease, coccidiosis, and epizootic catarhal enteritis with concomitant pneumatosis coli. Presumptive diagnosis of adrenal gland disease was also
established based on hypotrichosis and ultrasonographic findings. Despite the absence of pancreatic nodules visualized on ultrasonographic examination, an insulinoma was suspected based on the cut-off value of 3.3 mmol/L and the use of the AlphaTrack with a canine setting, which can overestimate blood glucose in hypoglycemic ferrets (7,8). A blood glucose concentration value remained to be measured using a validated laboratory analyzer to confirm hypoglycemia (8).

A therapeutic plan was established based on the presumptive diagnoses and was to be modified if needed in light of forthcoming bacterial culture results. The plan included leuprolide acetate (Lupron Depot; Abbvie, Saint-Laurent, Quebec), 100 µg/kg body weight (BW), IM, q1mo, prednisolone (Pediapred; Sanofi-Aventis, Laval, Quebec), 1 mg/kg BW, PO, q12h until re-evaluation, cepalexin (Novo-Lexin; Teva Canada, Toronto, Ontario), 25 mg/kg BW, PO, q12h for 14 d, and sucralfate (Sulcrate; Aptalis Pharma Canada, Mont-St-Hilaire, Quebec), 100 mg/kg BW, PO, q12h for 30 d.

Aerobic and anaerobic bacterial cultures of the stools were submitted during the initial examination. Sensitivity testing on aerobic bacteria was performed. *Enterococcus* spp., *Enterobacteriaceae*, and *Clostridium perfringens* were identified. Fecal flotation was planned but could not be performed following a laboratory error.

Upon re-evaluation 5 wk later, diarrhea had resolved. The owner reported that the animal was more active, fur was growing back, and pruritus had resolved following the first visit. However, a decrease in general activity and a relapse of the generalized pruritus had been noted 4 d prior to the recheck examination. Treatment recommendations had been followed except for prednisolone that was discontinued by the owner after 3 wk of administration and for leuprolide acetate injection that should have been administered a week earlier. Abdominal ultrasound showed a less pronounced abdominal lymphadenomegaly and resolution of the segmental jejunal enteropathy and pneumatosis coli (Figure 2). The size of the right adrenal gland was decreased compared to the first evaluation, but the gland was still enlarged. Abdominal radiograph confirmed resolution of the pneumatosis coli. On repeated aerobic and anaerobic bacterial cultures, *Enterococcus* spp., *Enterobacteriaceae*, *C. perfringens*, and *Bacillus* spp. were identified. No parasites were observed on fecal flotation.

Considering the resolution of diarrhea, rectal prolapse, and segmental enteropathy, no antibiotic treatments were initiated despite the bacterial culture results. Further treatment with prednisolone was declined by the owner. Leuprolide acetate injections were continued as prescribed on initial presentation.

The ferret was presented for re-evaluation 10 wk after initial presentation. Hair was growing back, pruritus had

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**Figure 1.** Abdominal ultrasonography of the ferret. Longitudinal (A) and transverse (B) ultrasonographic evaluations of the colon revealed hyperechoic lines within the colonic wall (arrows) consistent with pneumatosis coli.

**Figure 2.** Abdominal radiography of the ferret. These images were acquired in right lateral recumbency on the day of presentation (A) and on first re-evaluation 5 wk later (B). Arrows show linear radiolucency within the colonic wall consistent with pneumatosis coli (A). Similar findings were absent on re-evaluation (B).
resolved, and general activity was back to normal. No gastrointestinal clinical signs were reported. The results of an ultrasonographic examination were similar to those of the first re-evaluation. Aerobic and anaerobic bacterial cultures revealed *Lactobacillus* spp., *C. perfringens*, and an unidentified coliform bacterium.

**Discussion**

Pneumatosis cystoides intestinalis is uncommon in veterinary medicine. It is occasionally seen in swine (9). It has been previously described in a gnotobiotic pigs inoculated with an enteropathogenic *Escherichia coli* (9), in a single rabbit doe (*Oryctolagus cuniculus*) (2), and in horse neonates (10). There have been several reports of pneumatosis coli in dogs (11–14). Gastric pneumatosis has been described in a red ruffed lemur (*Varecia variegata rubra*) with non-specific gastrointestinal signs (15), in 4 black and white ruffed lemur (*Varecia variegata variegata*) associated with eosinophilic gastritis (16), in a Bengal slow loris (*Nycticebus coucang bengalensis*) with a hepatocellular carcinoma and an esophageal leiomyosarcoma (17), in dogs with gastric dilatation-volvulus syndrome (18), and in a domestic cat following gastrointestinal surgery (19). To the authors’ knowledge, this is the first report of pneumatosis coli in a domestic ferret.

Three mechanisms have been described concerning the origin of pneumatosis cystoides intestinalis in humans: gas translocation from the lumen to the intestinal wall, intrusion of gas-producing bacteria within the intestinal wall, and intrusion of gas from lung alveolar rupture, tracking through the mediastinum to the retroperitoneum and mesentery (3,4). Alteration of the intestinal mucosal or immune barrier integrity eases the transfer of gas or bacteria into the mural compartment, potentially leading to pneumatosis cystoides intestinalis. Increased intraluminal pressure can also lead to the passage of gas through the mucosal barrier, even in the absence of mucosal or immune compromise, though a combination of both situations is common. A theory called “counterperfusion supersaturation” has been proposed, hypothesizing that the increased intraluminal hydrogen tension in patients affected by some bacteria exceeds the blood nitrogen tension, leading to the diffusion of hydrogen toward the submucosal vessels (20). It has also been proposed that fluctuations in intra-abdominal pressure in patients affected by pulmonary diseases could lead to the formation of pneumatosis cystoides intestinalis instead of alveolar rupture and gas movement through the mediastinum (21).

A wide variety of underlying conditions have been reported in humans affected by pneumatosis cystoides intestinalis. Although many mechanical or traumatic causes have been described, multiple inflammatory, autoimmune, infectious, pulmonary, iatrogenic, and oncologic conditions have been associated with pneumatosis cystoides intestinalis (3.4). Approximately 15% of human cases are idiopathic, while 85% are considered secondary (3). Humans with this condition are most commonly asymptomatic, but clinical signs can include abdominal pain, diarrhea, nausea/vomiting, hematochezia, melena, constipation, tenesmus, and excessive mucus or gas production (16,22). Complications directly associated with pneumatosis cystoides intestinalis occur in 16.3% of cases according to a study in human medicine (22). They are usually the result of gastrointestinal obstruction by intestinal wall dilatation (22).

The exact cause of pneumatosis coli was not determined in this case, but multiple etiologies are possible. Ulcerative colitis, as well as *Clostridium* spp. infections, have been reported as possible causes for pneumatosis cystoides intestinalis in humans (3,4). In this patient, *Enterococcus* spp., *C. perfringens*, and Enterobacteriaceae were identified on initial presentation. These bacteria were still present on the first re-evaluation despite resolution of gastrointestinal signs and pneumatosis coli. These findings were expected considering the weak efficacy of cephalixin against most of these bacteria and the time lapse between the end of the treatment and the re-evaluation. *C. perfringens*, as well as several Enterobacteriaceae, have been previously described as part of the fecal microbiota of healthy ferrets (23). Their role in this case is probably minimal considering their continued presence after the resolution of clinical signs. However, no distinction was made among the different bacteria of the family Enterobacteriaceae and some of them could have been susceptible to cephalixin. Determination of toxin status via enzyme-linked immunosorbent assay (ELISA) would have been required to link the presence of *C. perfringens* with the diarrhea (24). Infection by another bacterium, not identified on routine aerobic and anaerobic bacteriology, remains possible. Bacterial enteritis was unlikely to be the primary cause of pneumatosis coli in this patient. However, the use of antibiotics may have contributed to reduction of bacterial overgrowth, leading to resolution of pneumatosis coli (25). Cephalixin, though uncommonly prescribed in cases of diarrhea in ferrets, was used while we awaited the results of bacterial culture. The ferret’s poor general condition and several client-associated constraints led to the choice of this antibiotic. The treatments were not modified when bacterial culture results were available due to the improvement in the animal’s condition and refusal of the owner to try another medication. As inflammatory bowel disease and eosinophilic enteritis were part of the differential diagnoses, prednisolone could have played a role in the resolution of pneumatosis coli as well.

Insulinoma was highly suspected in this ferret because of the low blood glucose (3.4 mmol/L) following a 3-hour fast. The AlphaTrak with a canine setting has been shown to be the portable glucometer with the best agreement to a validated laboratory analyzer for the evaluation of ferrets’ blood glucose, although results can be overestimated (9,26). Hypoglycemia is usually defined as a blood glucose value of < 3.3 mmol/L, although different reference ranges have been described in ferrets (5). Thus, hypoglycemia was likely but not confirmed and evaluation by a validated laboratory analyzer was recommended, but declined by the owner.

In this case, pneumatosis coli was diagnosed using both ultrasonography and radiography. The condition is characterized by linear, curvilinear or cystic-shaped radiolucency within the colonic wall on radiography (27). Barium enema can occasionally be helpful for the diagnosis of pneumatosis coli, though the condition can be confused with intestinal polyposis (4). The diagnosis can also be made using ultrasonography by identifying bright echoes casting acoustic shadowing within the
colonic wall (28). Computed tomography is now considered the most sensitive diagnostic technique in the identification of pneumatosis coli, allowing the distinction of gas in the bowel wall from intraluminal gas (3). Histopathological examination of gas cysts usually reveals granulomatous inflammation characterized by eosinophils, lymphocytes, multinucleated giant cells, macrophages, and plasma cells (4,16). Endoscopy has been used in human medicine to confirm the presence of pneumatosis cystoides intestinalis, but the distinction between gas cysts and other structures is often impossible without aspiration (4).

Treatment of pneumatosis coli relies mainly on resolution of the primary condition responsible for the accumulation of submucosal gas. It has been suggested that oxygen therapy by facemask, head tent, hyperbaric means, or mechanical ventilation to maintain an arterial oxygen partial pressure higher than 300 mmHg was effective in treating pneumatosis cystoides intestinalis (3). It is uncertain whether this therapy acts by direct effect on anaerobic bacteria or by diffusion of oxygen into the bowel wall, increasing the gas partial pressure and thus forcing the accumulated gas into the intestinal lumen. Radiographic criteria supportive of a surgical intervention in human include the presence of pneumoperitoneum or portal venous gas (29). Other criteria include blood pH < 7.3, bicarbonate level < 20 mEq/L, lactate level > 2 mmol/L, amylase level > 200 U/L, and disseminated intravascular coagulation (3). Complete blood cell count and biochemistry were not performed in this ferret because of budget limitations and the absence of criteria supportive of a surgical intervention.

In conclusion, radiography and ultrasonography were useful in establishing a diagnosis when pneumatosis cystoides intestinalis was suspected in a ferret. The exact cause of pneumatosis coli was not identified in this ferret, but a multifactorial enteropathy is deemed likely.

References
Complete longitudinal patellar fracture in a cat: A rare case

Gregory D. Herndon

Abstract — Longitudinal patellar fractures in cats are extremely rare with only 1 other report of a comminuted longitudinal fracture for which pins and wires were placed in the patella for stabilization. This report describes the surgery and outcome of a strictly longitudinal patellar fracture in a cat.

Résumé — Fracture patellaire longitudinale complètement chez un chat : un cas rare. Les fractures patellaires longitudinales chez les chats sont extrêmement rares et seulement un autre rapport de fracture longitudinale fragmentée a été publié pour lequel des broches et fils ont été placés dans la rotule afin de la stabiliser. Ce rapport décrit la chirurgie et les résultats d’une fracture patellaire strictement longitudinale chez un chat.

Fractures of the long bones make up a significant portion of an orthopedic caseload; however, patellar fractures are an uncommon occurrence in veterinary surgery. The incidence that has been reported in the veterinary literature is as low as 0.1% in dogs and only 0.25% of fractures in small animals (1,2). Most patellar fractures seen in veterinary practice are transverse in configuration thus leading to a strong tensile force across the fracture line due to the quadriceps mechanism of the knee. It is this tensile force that leads to a high complication rate with patellar fractures, including implant failure, re-fracture of the patella, implant looseness, and delayed or non-union of the patella. Although there are reports of comminuted fractures of the patella in cats, the literature is sparse on longitudinal patellar fractures. This report describes the presentation, surgical fixation, and 8-month postoperative outcome of a longitudinal patellar fracture in a cat.

Case description

A 2-year-old spayed female ocelot cat was referred to our hospital because of a 3-week history of right hind limb lameness and traumatic lateral patellar luxation after falling from a third story window. Conservative management, consisting of rest, was not associated with significant improvement. Upon examination, the cat exhibited a moderate lameness of the right hind limb. Orthopedic examination findings included pain on palpation of the right stifle and lateral patellar luxation that could not be reduced through a full range of motion. No cranial cruciate associated instability was noted on examination. A cranial-caudal radiograph from the referring veterinarian demonstrated a lateral patellar luxation; however, the patella was not of a normal size or shape and there was a radiopaque structure still in the trochlear groove (Figure 1A). Additional radiographs were acquired and confirmed the presence of a closed, laterally displaced, mid-body longitudinal fracture of the right patella with a small non-displaced chip fracture on the distal aspect of the patella (Figure 1B). Based on the degree of clinical lameness, failure of conservative treatment, the presence of a laterally luxated portion of the patella, and pain on manipulation of the stifle joint, surgical correction was recommended to repair the patellar fracture and restore normal function to the limb.

Pre-operative hematological and biochemical evaluations revealed no significant anomalies. The cat was premedicated with a standard protocol of ketamine (Vetalar; Vétoquinol, Lavaltrie, Quebec), 3 mg/kg body weight (BW), IM, hydromorphone (Sandoz Canada, Boucherville, Quebec), 0.1 mg/kg BW, IM, and dexmedetomidine hydrochloride (Dexdomitor; Zoetis, Kirkland, Quebec), 0.005 mg/kg BW, IM. Anesthesia was induced with alfaxalone (Alfaxan; Central Sales, Bramton, Ontario), 0.5 mg/kg BW, IV, and maintained with isoflurane (PPC Vet Isoflurane; Fresenius Kabi Canada, Richmond Hill, Ontario). Once induced, an epidural injection of bupivacaine (Marcaine; Hospira, St. Laurent, Quebec), 0.5 mg/kg BW, IV, and maintained with isoflurane (PPC Vet Isoflurane; Fresenius Kabi Canada, Richmond Hill, Ontario). Once induced, an epidural injection of bupivacaine (Marcaine; Hospira, St. Laurent, Quebec), 0.5 mg/kg BW, and preservative-free morphine (Morphine LP Epidurale; Sandoz Canada), 0.1 mg/kg BW, was used to help control pain during anesthesia and after surgery.

A lateral parapatellar skin incision was made over the right stifle. After subcutaneous dissection, the laterally luxated patellar fragment and the medial patellar fragment located in the trochlear groove were identified. The patellar tendon was examined and was noted to be partially torn in the same plane as the...
fracture (Figure 2). A medial arthrotomy was then performed to examine the articular surface of the medial fragment. The articular cartilage was normal in appearance. The cruciate ligaments and menisci were examined at this time and found to be normal. A lateral desmotomy was performed to facilitate reduction of the lateral patella fragment. Once the lateral fragment was reduced, its cartilage was examined and found to be normal. There was a significant amount of fibrous tissue present on both fracture surfaces, which was debrided using a #15 surgical blade and a Freer elevator (Johnson & Johnson, Markham, Ontario). Once the fibrous tissue was removed and the fracture ends were clearly identified, the fracture was reduced.

Initial stabilization was attempted using an encircling suture with 20-lb test leader line. Although adequate reduction was achieved there was significant instability noted in the patella when it was placed through a range of motion. Due to the instability the suture was removed and an alternative fixation was used. At the midpoint of the patella, a 0.054-inch K-wire was inserted through the medial fragment in a lateral to medial direction; the fracture was reduced using pointed reduction forceps to maintain reduction while placing the pin. The pin was then inserted into the lateral fragment. A 22-gauge encircling cerclage wire was placed around the pin ends and tightened to facilitate compression of the fracture. The pin ends were then cut, leaving approximately 2-mm ends (Figure 3). The articular surface of the patella and the fracture reduction were visualized by externally rotating the patella from the medial arthrotomy site. The reduction was found to be adequate and there was no evidence of the pin penetrating the articular surface (Figure 4). The distal fragment was visualized and found to be non-displaced and no attempt at stabilization was made. Once the repair had been completed the stifle was placed through a range of motion and no crepitus or instability was noted. The lateral desmotomy was closed with 2 simple interrupted sutures using 2-0 Polidioxanone (PDS; CDMV, St. Hyacinthe, Quebec), leaving most of the lateral desmotomy open to prevent lateral luxation after surgery. Two simple interrupted sutures using 3-0 PDS were placed to repair the tear in the patella tendon. The medial joint capsule was closed using 2-0 PDS in a vest over pants and simple interrupted pattern. A medial fabellopalatellar suture using #2 Polypropylene (Prolene; CDMV) was placed to further stabilize the patella and prevent lateral luxation from occurring after surgery. The subcutaneous closure was completed using 3-0 Monocryl in a simple continuous pattern, and the skin was closed with 4-0 Nylon in a simple continuous pattern.

Postoperative radiographs were taken and revealed a mild medial patella subluxation, likely secondary to the medial fabellopalatellar suture and the vest over pants sutures. The cat was returned to the operating room and the medial fabellopalatellar suture and the vest over pants sutures were removed. The medial arthrotomy was then closed with 2-0 PDS in a simple continuous pattern. The remaining subcutaneous and skin closure was performed as stated previously. Radiographs were repeated and the patella was properly positioned (Figure 5). Recovery was uneventful and the cat was discharged 3 d after surgery on the following medications: buprenorphine (Vetergesic multidose; Champion Alstoe, Whitby, Ontario), 0.01 mg/kg BW, PO, q8h for 7 d, meloxicam (Metacam; Boehringer Ingelheim Canada, Burlington, Ontario), 0.1 mg/kg BW, PO, q24h for 5 d, and amoxicillin/clavulanate (Clavamox; Zoetis), 13.75 mg/kg BW, q12h for 7 d.

The cat was returned to his referring veterinarian after 2 wk for suture removal and was clinically doing well at that time. The cat was returned to our hospital 8 wk after surgery. The owner reported that there was no evidence of lameness noted when the cat walked, ran, or jumped. During gait analysis the cat was placed in a closed examination room and observed at a walk for 5 min with no obvious lameness noted. Upon palpation of the right stifle, no pain was detected nor elicited through a
normal range of motion. Radiographs were taken under sedation (Figure 6). Alignment and reduction were adequate and there was no evidence of loosening or migration of the implants. The patella exhibited signs of healing, as the fracture line was becoming less distinct. The non-displaced fracture distally was healed at this time. Mild stifle effusion was noted but this was an improvement compared to the postoperative radiographs. The owner was instructed to continue exercise restriction for another 2 wk and slowly increase activity to normal over another 4 wk. Communication with the owner 8 mo after surgery revealed that the cat was doing well with no obvious lameness noted at a walk. The owner mentioned, however, that when the cat sat, the right limb seemed to be slightly externally rotated.

Discussion

Patellar fractures are uncommon in dogs and cats. The majority of patellar fractures have been reported in the dog, with only a small number of cases reported in the cat (7 articles with a total of 87 fractures involving the patella; 3–9). Most patellar fractures in the cat are described as transverse in configuration and typically are not associated with trauma. These fractures appear to be associated with stress as opposed to direct trauma as is typically seen in dogs (3). Since the majority of patellar fractures in cats, regardless of the cause, appear to be transverse, the literature on longitudinal patellar fractures in cats is sparse. There are only 6 patellar fractures in cats reported in the literature that were considered to be longitudinal or to have a longitudinal component (4–6). Of these 6 cases, 5 had one side of the fracture that was too small for repair using an implant and was either removed at the time of surgery or was stabilized with an encircling suture. The remaining case was described as a comminuted longitudinal fracture that was stabilized with multiple pins and cerclage wires (6). The outcome of these fractures has been good to excellent, which is not surprising since many of them involved removing the fragment and preventing patella luxation from occurring. The outcome of the single case that was repaired with pins and cerclage wires was good with the only complication being a recurrent patellar luxation (6); however, it was unclear if this complication required a second surgery for correction.

When presented with a patellar fracture in a cat, determining the best method of treatment can be difficult. In a review of the literature, one article compared the outcome of transverse patellar fractures repaired surgically versus those treated nonsurgically. Of 9 transverse patellar fractures that were evaluated, 6 were treated surgically and 3 were treated non-surgically. The outcome was good with a return to normal activity whether surgery was performed or not (7). However, none of these cases involved luxation of a patellar fragment, which typically results in chronic lameness and, when present, surgery should be considered. Although only a few cases of longitudinal patellar fractures have been reported, complications seemed to be infrequent and included a persistent mild lameness in 1 case, intermittent lameness in cold weather in 1 case, and 2 recurrences of a patella luxation in another case (6). It is interesting to note, when we consider that only one other case in the literature involved internal fixation of a longitudinal patellar fracture in a cat, that neither of these cases suffered complications typically seen with transverse patella fractures such as implant failure or re-fracture of the patella. The most likely explanation for the difference in outcomes for surgical repair between longitudinal and transverse fractures probably lies in the differences between the forces that act on these fractures.

The extensor mechanism of the stifle is composed of the vastus muscle group (lateralis, medialis, and intermedius) and rectus femoris, which form the quadriceps tendon that attaches to the patella, which in turn attaches to the patellar tendon. The contraction of the vastus muscle group and rectus femoris leads to the exertion of a tensile force through the patella and patellar tendon leading to extension of the stifle. When a transverse fracture of the patella is present, this tensile force will lead to distraction between the 2 fracture fragments. The internal fixation used in cases of patellar fractures has historically been pin and tension band wires. All cases in which implants are placed, especially in areas of high motion, are susceptible to cyclical forces that can lead to loosening and even failure of the implants (3). In a longitudinal patellar fracture, the forces acting on the implants are likely diminished because the forces acting...
on the fracture line are parallel rather than perpendicular as in a transverse fracture. The anatomic structures that would provide tensile forces in a longitudinal patellar fracture would come from the parapatellar ligaments, which were transected in this case during the medial and lateral arthrotomy. Since the patellar fragment was luxated laterally, most of the tensile force would have come from the lateral aspect of the stifle due to the contracture of the soft tissues. Therefore, the lateral arthrotomy was left open to reduce lateral tensile forces from acting on the repair. By reducing the tensile forces acting on the 2 fracture fragments, the amount of stress and strain on the implant should lead to a reduction in the cyclical forces acting on the implants. This decrease in stress and strain on a longitudinal fracture should lead to a more stable fixation and a decrease in complications such as implant failure. The main force to then overcome in stabilizing this type of patellar fracture would be shear. In this case, the fracture was adequately reduced using pin and cerclage wire, which provided sufficient stability to overcome shear force.

In conclusion, cats that suffer a longitudinal patellar fracture and have a concurrent patellar luxation of 1 of the fragments should be considered surgical candidates. Surgical repair of a longitudinal fracture will likely have a better outcome with fewer complications than occur with a transverse fracture due to the difference in configuration of the fracture and how the anatomic forces act upon that fracture. This is only the second report of a successful internal fixation of a patellar fracture with a longitudinal configuration. Although both cases had a good outcome, the case presented here was not associated with any complications 8 mo after surgery. More such cases are needed before we can definitively comment on prognosis and outcome of these cases.

Acknowledgments

The author thanks Dr. Bertrand Lussier and Dr. Carolyn Grimes for their help and advice on preparation of this manuscript.

References

Case Report  Rapport de cas

Primary intranasal melanoma with brain invasion in a dog

Julie Lemetayer, Ahmad Al-Dissi, Kim Tryon, Valerie MacDonald-Dickinson

Abstract — A 6-year-old castrated male boxer dog with right-sided dark purulent nasal discharge and acute bilateral blindness was diagnosed on magnetic resonance imaging (MRI) and then on necropsy with primary nasal malignant melanoma that extended into the brain, as well as concurrent ocular melanosis. There was no evidence of metastasis in other organs.

Résumé — Un cas de mélanome primitif des fosses nasales avec invasion cérébrale chez un chien. Un boxer mâle castré de 6 ans a été présenté pour écoulement nasal purulent et de couleur foncée à droite et perte de vision bilatérale aiguë. Un mélanome malin nasal primaire qui s’étendait dans le cerveau, ainsi qu’une mélanose oculaire, ont été diagnostiqués par imagerie à résonnance magnétique (IRM) puis nécropsie. Il n’y avait pas d’évidence de métastases dans les autres organes.

In human and veterinary medicine, melanoma is one of the few neoplasms for which location is an important prognostic indicator. While oral melanoma, the most common form of melanoma in dogs, and melanoma of the digit, foot pad, and mucocutaneous junction are usually aggressive malignant tumors with high potential for local invasiveness and metastasis, 95% of the haired-skin melanomas and most intraocular melanocytic tumors are benign (1).

In humans, sinonasal melanoma is invariably malignant and aggressive (2–7). Contrary to its human counterpart for which sinonasal melanoma is more common than oral melanoma, primary malignant intranasal melanoma has been rarely reported in dogs, and only 2 cases are fully described (8,9). The tumor was limited to the nasal vestibule in 1 case based only on surgical findings and to 1 nasal cavity in a second case based on magnetic resonance imaging (MRI) of the head. There was no metastasis based on repeated thoracic radiographs for both cases and lymph node aspirations for the second case (8,9).

Ocular melanosis, on the other hand, is a benign lesion of the melanocytic system that is known to occur mainly in cairn terriers, although similar lesions have been described in boxers and Labrador retrievers (10).

To the authors’ knowledge, this is the first case of primary nasal melanoma with brain invasion and concurrent ocular melanosis in a dog. Clinical presentation was interesting as the dog presented for both signs of nasal and neurological diseases.

Case description

A 6-year-old castrated male boxer dog was referred to the Western College of Veterinary Medicine, Saskatoon, Saskatchewan because of a 3-week history of unilateral nasal discharge from the right nostril, progressive lethargy, and blindness over 2 d. The nasal discharge was dark brown/purple and purulent but became hemorrhagic on the day of presentation. No pain was detected on palpation of the nose or retropulsion of the eyes, and submandibular lymph nodes were normal in texture and size. A neurological examination showed bilateral absence of menace response and marked bilateral mydriasis with poor direct and consensual pupillary light reflexes. The remainder of the neurological and physical examinations was normal. An ophthalmological examination showed very myelinated and prominent optic nerves that were interpreted as possible individual variation. The marked mydriasis prevented a good evaluation of the irises. An electoretinogram was found to be normal. The origin of the blindness was therefore suspected to involve the proximal portion of the visual pathway, from the optic nerves to the lateral geniculate nuclei, and more likely the optic chiasma.

Complete blood cell count, serum biochemistry, and urinalysis were unremarkable. Thoracic radiographs and abdominal ultrasound were performed to look for metastasis since a nasal...
tumor was the most likely diagnosis. Findings were mild and non-specific. A mild bronchial pattern and possible mild sternal lymphadenomegaly were seen on abdominal ultrasound examination. A magnetic resonance image of the brain showed a large (8 × 4 × 2.5 cm) contrast-enhanced mass of mixed intensity that filled the entire right nasal passage and extended into the left nasal passage and caudally through the cribiform plate into the olfactory and likely the frontal lobes of the rostral right brain (Figures 1A, B). The nasal mass was isointense to hyperintense on T2 sequences, isointense and moderately hyperintense on T1 sequences, and enhanced on the post-contrast T1 sequences. There was also a focal lesion in the left frontal lobe, immediately rostral to and displacing the left lateral ventricle, as well as bilateral symmetrical lateral ventriculomegaly. This lesion was hyperintense on T2 sequences, hypointense on T1 sequences, did not contrast enhance and was considered to be a fluid-filled lesion. The right frontal sinus was fluid-filled, likely secondary to the obstruction from the mass. Differential diagnoses for the mass included primary neoplasia and less likely fungal infection. Due to the poor prognosis, the dog was euthanized and a postmortem examination was conducted.

Grossly, a black firm mass measuring 8 × 4 × 2.5 cm filled the right nasal cavity, destroyed the cribiform plate and extended into the cranium. The ventral and rostral aspect of the right frontal lobe of the brain contained a solitary, round, dark grey, soft mass which replaced the olfactory bulb area (Figures 2A, B). A focal round area was found on the spleen. Microscopically, expanding and infiltrating the submucosa, destroying the nasal bone and multifocally elevating or ulcerating the nasal mucosa, there was an unencapsulated, poorly demarcated, highly infiltrative, and densely cellular neoplastic mass that was composed of cells arranged in interlacing bundles, whors and dense clusters and that was supported by a fine fibrovascular stroma. Neoplastic cells were pleomorphic, ranging from round to polygonal to spindloid, with variably distinct cell borders and a variable amount of eosinophilic cytoplasm, often obscured by dark brown melanin pigment. Nuclei were round to oval to spindloid with moderately stippled chromatin, and had 1 to 3 distinct nucleoli. There was marked anisocytosis and anisokaryosis, and mitotic figures ranged from 3 to 10 per high power field (40×). Areas of nasal bone invasion and necrosis were also seen. Similar neoplastic cells were seen infiltrating and effacing the brain (Figures 2C, D, E). These tumor cells infiltrated the olfactory nerve fibers and the olfactory bulb of the brain but did not infiltrate the optic chiasm. There was no evidence of metastasis in any of the other organs examined including draining lymph nodes and the spleen. Based on gross and histological findings a diagnosis of malignant melanoma was made and was confirmed by immunohistochemistry. Tumor cells were positive for Melan A (Figure 2F) and S100, two melanoma associated antigens.

In both eyes, the iris was diffusely infiltrated by a dense population of highly pigmented round cells which obscured the iris architecture and extended into the filtration angle, ciliary body, choroid and around the optic disc. A bleached section revealed the cells to be round to polygonal with indistinct cell borders. Nuclei were polygonal to spindle and no mitotic figures were seen (Figures 2G, H).

**Discussion**

We describe a case of primary nasal melanoma with brain infiltration, along with ocular melanosis, in a boxer dog. To the authors’ knowledge, this is the first description of these 2 lesions.
Figure 2. A – Cross section of the head. A dark black nasal mass was found occupying most of the nasal cavity and extending into the cranium. B – Brain, ventral view. Solitary, round, dark black, soft mass replaced the olfactory bulb area. Inset: Dorsal view: the mass extended dorsally. C – Nose: A large neoplastic mass replaced the nasal epithelium and underlying bone. Hematoxylin and eosin stain (H&E), 100×. D – Closely packed neoplastic cells invaded the brain. (H&E), 400×. E – Round to polygonal neoplastic cells, some of them containing intracytoplasmic dark brown pigment. (H&E), 400×. F – Positive immunohistochemistry for melan A. Brown pigment is present within the cytoplasm of tumor cells. ABC diaminobenzidine method, hematoxylin counterstain; 200×. Inset: Omission control. G – A bleached histology section of the eye displaying melanocytes occupying the iris and ciliary body. 20×. Inset: The iris is expanded by many round to polygonal cells with variably distinct cell borders and moderate to abundant amount of cytoplasm. Nuclei were mostly polygonal, rarely had prominent nucleoli with no mitotic figures. H – A large population of melanocytes expanding the iris and ciliary body. (H&E), 20×. Inset: Pigmented melanocytes with expanding iris stroma. H&E.
combined in a dog and the first description of brain invasion by a primary nasal melanoma. Nasal melanoma in dogs has only been described twice previously (8,9).

Extensive local invasiveness and infiltration of surrounding tissues is a characteristic common to all types of malignant melanoma and is attributed to submucosal lymphatic spread of the disease (2). The case of primary nasal malignant melanoma presented herein had a very aggressive local behavior, as seen by the extensive bone and brain invasion.

In contrast to this case, the 2 previously described cases of malignant nasal melanoma had a longer duration of clinical disease and did not progress to brain invasion. In the first report, malignant melanoma was diagnosed within the ventral left nasal vestibule of a 14-year-old intact male miniature schnauzer 1 mo after the mass was treated with topical hydrocortisone. The tumor extended to the upper lip caudally and ventrally. Three months after complete surgical excision, there were no clinical signs of tumor recurrence and no evidence of metastasis in repeated thoracic radiographs (8). The second case occurred in a 10-year-old, spayed female, Newfoundland-cross dog which was presented to the referring veterinarian for intermittent left epistaxis and sneezing of 6 to 8 months’ duration (9). Magnetic resonance imaging of the head revealed a mass in the middle portion of the left nasal cavity which was locally destructive and histologically diagnosed as epithelioid melanoma. The tumor was cytoreduced surgically via a rhinotomy followed by radiation therapy. Complete resection was not possible because of the tumor location. Clinical signs improved after surgery; however, the dog was presented for a gingival mass on the right side of the oral cavity, which was contralateral to the location of the original mass. A second MRI showed no evidence of a nasal mass. The gingival mass was diagnosed as malignant melanoma and was treated with radiation 3 mo later. No evidence of metastasis was found on repeated radiographs and submandibular lymph node aspirations, and the dog was still alive after 12 mo (9).

Sinonasal melanoma occurs rarely in humans, representing approximately 4% to 8% of malignant tumors of the nasal cavity and paranasal sinuses (5). Comparable to other forms of malignant melanoma, sinonasal melanoma in humans is characterized by extensive local invasion. Humans with primary nasal melanoma usually present with one-sided nasal obstruction and/or epistaxis (4,11). Due to the non-specific nature of the symptoms experienced by humans with sinonasal melanoma, delay in diagnosis is frequent, patients having symptoms for months to years before diagnosis (5,11). Therefore the tumor is often advanced at the time of diagnosis. However, brain invasion is very rarely reported (4,7).

Studies in humans have reported high rates of local recurrence of primary nasal melanoma after surgical removal (31% to 85%); low rates of invasion of regional lymph nodes (10% to 30%); high rates of distant metastasis (25% to 50%), which occurs late in the disease process; and often poor 3- and 5-year survival rates (19% to 62.5%) (2,3,6). Since these tumors are invariably aggressive in humans, the classification of mucosal melanoma of the head and neck (70% of which are sinonasal melanoma) by the American Joint Committee on Cancer does not include stages T1 and T2 (5). The tumor is classified stage T3 when it only invades the mucosa and stage T4 for deeper invasion, with 2 sub-stages a and b for moderately advanced disease and very advanced disease, such as brain invasion, respectively. The absence of distant metastasis in this case based on necropsy and in the 2 previously described reports based on repeated thoracic radiographs, and submandibular lymph node aspirations in 1 of the 2 cases, could suggest that nasal malignant melanoma in dogs, unlike humans, is a locally invasive tumor with lower metastatic potential, but a higher number of cases would be necessary to investigate this hypothesis.

The tumor is suspected to originate from melanocytes within the nasal mucosa and less likely within meninges or brain. It has been previously thought that melanocytes were not present within the nasal mucosa, thus, malignant nasal melanomas in humans were suspected to arise after squamous metaplasia of nasal epithelium (12). Later studies in humans have confirmed the presence of nasal melanocytes within the nasal mucosa.

The clinical course of this tumor with epistaxis preceding the development of neurological signs as well as the presence of a larger mass within the nasal cavity are consistent with a nasal origin (12). Although studies confirming the presence of melanocytes within the nasal mucosa in dogs are lacking, the clinical presentation in this case and the absence of squamous metaplasia within the nasal mucosa suggests their existence within the canine nasal mucosa.

The origin of the blindness in this dog was suspected to be due to swelling and compression around the optic chiasm, as opposed to an infiltration by the tumor as the tumor was not seen microscopically.

Interestingly, this dog presented with another lesion involving the melanocytic system. Ocular melanosis, a non-neoplastic condition in which pigmented cells proliferate in several tissues of the eyes, occurs mainly in cairn terriers, less commonly in other breeds, and is thought to be inherited (13). Diffuse over-pigmentation of the uvea is typically seen histologically resulting from an increase in the number and size of round and heavily pigmented cells. Two cell types are present within the lesion, i.e., melanocytes and melanophages. Melanocytes are thought to predominate in the cairn terrier while melanophages are thought to be predominant in other breeds (13). A few cases of ocular melanosis to be a variant of melanocyctoma while others make a distinction between the 2 lesions (13). Melanocyctomas typically form a regional mass (i.e., are not diffuse), and contain heavily pigmented round and spindle cells. This is unlike most cases of ocular melanosis in which only a single population of round and heavily pigmented cells is present diffusely. In this case, only a single population of round and heavily pigmented cells was seen histologically in both eyes which is consistent with a diagnosis of ocular melanosis. It is possible that the lesions in both eyes represent a site of distant metastasis; however, this possibility is less likely given the organized nature of this lesion, the benign cellular morphology and the lack of local invasion or mitotic figures.

Gross and histological findings were consistent with malignant melanoma in this case, but because malignant melanoma can be amelanotic and highly pleomorphic, the histological diagnosis may need to be confirmed by immunohistochemistry. Tests for Melan-A, an antigen present on the surface of
melanocytes; PNL2, an antigen of melanocytes and granulocytes; and tyrosinase-related proteins 1 and 2 were found to be highly sensitive and 100% specific in a study evaluating canine oral amelanotic melanocytic neoplasms (14). S-100, a calcium-binding protein that is widely distributed in the central and peripheral nervous systems, as well as in other cells including melanocytes, is considered a less reliable marker because tests for this protein are less specific but sensitive. Melan A and the S-100 proteins were used in our case, both showing positive staining. The dog in this report had poor short- and long-term prognoses, regardless of the type of tumor diagnosis; therefore, nasal biopsies and treatments were declined by the owners, and the diagnosis of primary nasal malignant melanoma was made on postmortem examination.

Available treatments for malignant melanomas in dogs include wide surgical resection, radiation therapy, and adjunctive systemic therapies such as melanoma vaccine and various chemotherapy protocols (15–19). Wide surgical excision remains the treatment of choice if complete resection is feasible (15,16,19). External beam radiotherapy can also be used for local tumor control, despite older data which suggested that melanoma was radioresistant (2,8,19). However, given the high metastatic rate of malignant melanoma, systemic therapy is often added. No consensus has been established on the optimal systemic management of mucosal malignant melanoma in dogs and humans (15,16).

Studies investigating the chemotherapeutic agents carboplatin, cisplatin, both in association with piroxicam, melphalan, lomustine, dacarbazine, doxorubicin, or temozolomide showed response in a small subset of dogs with malignant oral melanoma; and the combination of adjunctive systemic therapies to surgery and/or radiation does not seem to improve the survival time compared to loco-regional control alone (16,20–25). However, type II errors were possible in these studies due to the small number of dogs studied.

Various immunotherapy strategies have been developed, some of them showing promising results, but the development of these products is expensive, time-consuming, and difficult to reproduce or commercialize (15). The development and commercialization of a vaccine containing xenogeneic plasmid DNA encoding human tyrosinase represents a leap forward, but its efficacy has recently been questioned (17). Despite initial outcomes. World J Clin Oncol 2011;2:344–347.

References


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**Book Reviews**

**Comptes rendus de livres**

**Mosby’s Comprehensive Review for Veterinary Technicians, 4th edition**


*Mosby’s Comprehensive Review for Veterinary Technicians* was one of the most useful tools I had to help me review for the Veterinary Technician National Examination (VTNE). This book is packed with an incredible amount of information including many aspects of the skills and subjects I studied in school, as well as new information that allowed me to expand my knowledge. The information is provided in a layout that made it easy to find specific topics and areas of interest. This helped me to quickly find and review certain subjects I was struggling to remember or understand while studying for the VTNE. It is well-written and easy to understand, which is important for anyone having difficulty understanding certain concepts. Another benefit of this book, is that it provides review questions for each topic, and a complete review test at the end. I believe that this book would be a great tool for any veterinary technician, whether they are using it to study for exams at school, the VTNE, or even just as a book to look to from time to time for review while in practice.

*Reviewed by Shannon Wheatley, RVT, Ottawa, Ontario.*

**Review Questions and Answers for Veterinary Technicians, 4th edition**


*Intended as a companion to Mosby’s Comprehensive Review for Veterinary Technicians, 4th edition, this book provides a large selection of review questions and answers for veterinary technicians who are preparing to write the Veterinary Technician National Examination (VTNE), or any other exam. There is a wide variety of questions covering every aspect of registered veterinary technician (RVT) skills, from emergency triage to large animal care, as well as pharmacy and anatomy. I found this book incredibly useful as a tool to not only review all the skills and important information I learned in school, but also a source of new information that I did not cover in my studies. When studying for the VTNE, the book allowed me to improve my method of studying by taking the quizzes provided and getting an idea of which sections I needed to study more to better prepare for the exam. This is something that I would have found helpful to have in school as well as after school and I would recommend it to any new veterinary technician looking for another tool to help them progress to becoming an RVT.*

*Reviewed by Shannon Wheatley, RVT, Ottawa, Ontario.*
Brief Communication Communication brève

Prevalence and risk factors for *Coxiella burnetii* seropositivity in small ruminant veterinarians and veterinary students in Ontario, Canada

Shannon L. Meadows, Andria Jones-Bitton, Scott A. McEwen, Jocelyn Jansen, Samir N. Patel, Catherine Filejski, Paula Menzies

Abstract — *Coxiella burnetii* is a zoonotic pathogen that causes Q fever in humans. Serological and questionnaire data on *C. burnetii* were obtained from 32 small ruminant veterinarians and veterinary students in Ontario, Canada, in February 2012. Overall, 59% of participants were seropositive; advanced stage of career and increased age were associated with seropositivity.

Résumé — Prévalence et facteurs de risques pour la séropositivité à *Coxiella burnetii* chez les vétérinaires des petits ruminants et les étudiants en médecine vétérinaire en Ontario, au Canada. *Coxiella burnetii* est un agent pathogène zoonotique qui cause la fièvre Q chez les humains. Des données sérologiques et provenant de réponses à un questionnaire portant sur *C. burnetii* ont été obtenues auprès de 32 vétérinaires et étudiants en médecine vétérinaire en Ontario, au Canada, en février 2012. Globalement, 59 % des participants étaient séropositifs; un stade de carrière avancé et un âge supérieur étaient associés à la séropositivité.

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modelling was used in place of standard asymptotic logistic regression, as the former is ideal for analyzing small, skewed, or sparse datasets (6). Associations were considered significant at confidence level of \( \alpha < 0.05 \). If a covariate predicted seropositivity perfectly, an estimate of the coefficient was calculated using a median unbiased estimates procedure to give a reasonable estimate of the covariate of interest (6). The dataset was considered too small for the development of a multivariable model.

At the time of sampling, 5 participants indicated in the questionnaire that they suspected they had had Q fever at some point in the past. Two of these individuals sought medical attention but had negative serological tests for *C. burnetii* at that time. The reported symptoms attributed to Q fever by the 5 individuals were: fever \( (n = 5) \), headache and muscle ache \( (n = 3) \), fatigue \( (n = 2) \), cough \( (n = 1) \), and sore throat \( (n = 1) \). All 5 of these individuals were seropositive for *C. burnetii* at the time of sampling for the current study. None of the 14 female participants were pregnant at the time of sampling. Of the 4 women who reported having been pregnant in the previous 2 y, all tested seropositive; none reported an adverse pregnancy outcome.

Serosurvey results indicated that 59.4% \([19/32, 95\% \text{ confidence interval (CI): } 40.6\% \text{ to } 76.3\%]\) of participating veterinarians and veterinary students were seropositive to *C. burnetii*. Practicing veterinarians had a seroprevalence of 76.2% \([16/21, 95\% \text{ CI: } 52.8\% \text{ to } 91.8\%]\) compared to 50.0% \([2/4, 95\% \text{ CI: } 6.8\% \text{ to } 93.2\%]\) in veterinarians not active in clinical practice at the time of sampling, and 14.3% \([17, 95\% \text{ CI: } 0.3\% \text{ to } 57.9\%]\) in veterinary students. Table 1 demonstrates the distribution of phase I and phase II antibodies to *C. burnetii* antigens among the study population; 9.4% \([3/32]\) and 50.0% \([16/32]\) were considered to have recent and past exposures, respectively.

The exact logistic univariable analysis identified 2 covariates significantly associated with seropositivity. Being a veterinary student had a sparing effect, as students had 0.06 times \([95\% \text{ CI: } 0.001 \text{ to } 0.65]\) the odds of seropositivity compared to practicing veterinarians; the odds of seropositivity among veterinarians not active in clinical practice were not significantly different from the odds for either practicing veterinarians or veterinary students. In addition, participants aged 30 to 39 y and 40 to 49 y had 15 times \([95\% \text{ CI: } 1.01 \text{ to } 1059.64]\) and 13 times \([95\% \text{ CI: } 1.26 \text{ to } +\text{Infinity}]\) the odds of seropositivity, respectively, compared to those aged 18 to 29 y.

This is the first investigation examining *C. burnetii* seropositivity among veterinarians and veterinary students in the province of Ontario, and the second in Canada (2). The seroprevalence \([59.4\%, 19/32]\) indicates that exposure to *C. burnetii* was common. *Coxiella burnetii* has been identified as an occupational hazard for veterinarians and veterinary students elsewhere \((3,7,8)\). For the present research, an IFA IgG titer cut-off of \( \geq 1:16 \) was used, as this is the cut point recommended by manufacturers, and the low cut-point maximizes case capture of those who have been previously exposed to *C. burnetii* \((6)\). Although an IFA titer cut-point analysis using past *C. burnetii* exposure as the outcome has not been published, manufacturers reported a high specificity \((100\%)\) using the cut-off of \( \geq 1:16 \) \((5)\). Due to the high specificity, false positives are not anticipated, though cross-reactivity to non-specific antibodies cannot be excluded \((9)\).

Within our study group, there was an increased risk of *C. burnetii* seropositivity among practicing veterinarians compared to veterinary students. While veterinary students perform similar activities as veterinarians, particularly in upper years of study \((7)\), they typically do not have as much opportunity for exposure to potentially infected animals as do veterinarians. Other risk factors for seropositivity previously identified and consistent with dose-response relationships between degree of animal exposure and human seropositivity include age, number of hours with animal contact per week, number of years graduated as a veterinarian, and number of years lived on a farm \((3,7,8)\). Young participants \(\text{(aged 18 to 29 y)}\) had decreased odds of seropositivity compared to those who were 30 to 39 y and 40 to 49 y; however, all 7 of the participating veterinary students, and 3 of the practicing veterinarians, were between 18 and 29 y.

### Table 1. Number of individuals (percentage of total samples) with specific serum titers for immunoglobulin G to Phase I and Phase II *Coxiella burnetii* antigens, among 32 small ruminant veterinarians and veterinary students as determined by the immunofluorescence assay (Focus Diagnostics) (February 24, 2012, Ontario, Canada)

<table>
<thead>
<tr>
<th>Phase I</th>
<th>NR</th>
<th>1:16</th>
<th>1:32</th>
<th>1:64</th>
<th>1:128</th>
<th>( \geq 1:256 )</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Phase II</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>NR</td>
<td>13</td>
<td>2 (6.3)</td>
<td>1 (3.1)</td>
<td>1 (3.1)</td>
<td>0 (0)</td>
<td>0 (0)</td>
<td>17 (53.1)</td>
</tr>
<tr>
<td>1:16</td>
<td>1 (3.1)</td>
<td>0 (0)</td>
<td>1 (3.1)</td>
<td>0 (0)</td>
<td>0 (0)</td>
<td>0 (0)</td>
<td>2 (6.2)</td>
</tr>
<tr>
<td>1:32</td>
<td>0 (0)</td>
<td>0 (0)</td>
<td>2 (6.3)</td>
<td>3 (9.4)</td>
<td>2 (6.3)</td>
<td>0 (0)</td>
<td>7 (22.0)</td>
</tr>
<tr>
<td>1:64</td>
<td>0 (0)</td>
<td>0 (0)</td>
<td>0 (0)</td>
<td>2 (6.3)</td>
<td>0 (0)</td>
<td>0 (0)</td>
<td>2 (6.3)</td>
</tr>
<tr>
<td>1:128</td>
<td>0 (0)</td>
<td>0 (0)</td>
<td>2 (6.3)</td>
<td>0 (0)</td>
<td>2 (6.3)</td>
<td>0 (0)</td>
<td>4 (12.6)</td>
</tr>
<tr>
<td>( \geq 1:256 )</td>
<td>0 (0)</td>
<td>0 (0)</td>
<td>0 (0)</td>
<td>0 (0)</td>
<td>0 (0)</td>
<td>0 (0)</td>
<td>0 (0)</td>
</tr>
<tr>
<td>Total</td>
<td>14</td>
<td>2 (6.3)</td>
<td>6 (18.8)</td>
<td>6 (18.8)</td>
<td>4 (12.6)</td>
<td>0 (0)</td>
<td>32 (100.0)</td>
</tr>
</tbody>
</table>

With the exception of non-reactive titers, titers above the dashed line are suggestive of a chronic infection and those below, suggestive of an acute infection.

NR — Not reactive.

40.6% \([13/32]\) Unexposed (phase I and phase II IgG not reactive).

9.4% \([3/32]\) Titors suggestive of recent exposure (phase II titer > phase I titer).

50.0% \([16/32]\) Titors suggestive of past exposure (phase I titer \( \geq \) phase II titer).
of age. When students were excluded from the analysis, age was no longer associated with seropositivity. Age may therefore be an explanatory antecedent of position (practicing veterinarian/student) (6), since age can largely explain the participants’ stage of career. Due to the small sample size of our dataset, we were unable to determine whether age confounded the relationship between stage of career and seropositivity.

We hypothesized that the percent of a veterinarian’s practice dedicated to sheep, goats, or to a lesser extent cattle, would have had an association with seropositivity, as up to 1/3 dedicated to sheep, goats, or to a lesser extent cattle, would have had an association with seropositivity, as up to 1 × 10⁹ organisms may be shed in the sheep/goat placenta (10) and these animal species have been linked to human cases of Q fever (1); however, this study failed to demonstrate any relationship. The potential animal source of C. burnetii exposure among seropositive veterinarians and veterinary students remains unclear. While sheep and goats have high seroprevalences in Ontario (11,12), C. burnetii could have been transmitted to participants from cows, cats, or other animals.

By the nature of their occupations, small ruminant veterinarians and veterinary students may be exposed to C. burnetii frequently throughout their career. The animal Q fever vaccine (Coxevac; CEVA Animal Health, Libourne, France) is now available for use in Ontario in sheep and goats. However, since veterinarians potentially have contact with animals on many farms, use of the vaccine in sheep and goats may not infer veterinarian protection unless use was widespread. Therefore, vaccinating unexposed veterinary students and veterinarians, particularly those at high risk of developing chronic Q fever (e.g., those with pre-existing heart disease), with a human C. burnetii vaccine (Q-Vax; CSL Biotherapies, Melbourne, Australia), merits future consideration. The Q-Vax vaccine is currently used in Australia, and research has demonstrated that it induces a long-lived immune response to C. burnetii (13).

Several limitations of the study should be noted. While 1/3 of all SRVO members were sampled for this study, the sample size was nevertheless small. The exact logistic regression models served to limit the bias of the coefficients and P-values obtained from small sample sizes (6); however, our sample size, and an expected proportion C. burnetii exposure of 59% (as observed here), means the statistical power is low (calculated at 16.5%). Larger sample sizes may be required to further elucidate the relationship between risk factors and veterinarian seropositivity in Ontario, and to increase the precision of identified associations. This study may also have been subject to selection bias. Our sampling frame of SRVO members is not an exhaustive list of all veterinarians and veterinary students who work with small ruminants in Ontario. As previously noted, SRVO is a voluntary organization and is involved in the continuing education of veterinarians in the health and welfare of small ruminants. The SRVO members may therefore be more engaged in learning about small ruminants and consider small ruminants as a more important part of their caseload or anticipated caseload, than non-members. In addition, research has identified a number of other barriers to participation in continuing education events among veterinarians including: ownership of a solo practice, stage of career, and family demands (14). These factors may have influenced attendance at the AGM, and thus, subsequent participation. Most participants had not been tested for C. burnetii exposure before participating in our study and most did not suspect that they have had Q fever.

Overall, Coxiella burnetii seropositivity was common among SRVO members, particularly among veterinarians, presumably due to their contact with infectious animals. Veterinarians should be alert to the signs and symptoms of Q fever, and should ask their physician for the appropriate tests should these signs and symptoms appear. Hygiene and biosecurity practices, while not statistically associated with seropositivity here, are encouraged for their utility in preventing occupational exposure to not only C. burnetii, but also several other zoonotic disease agents (8).

Acknowledgments

The authors thank: the Ontario Ministry of Agriculture, Food and Rural Affairs-University of Guelph Agreement through the Animal Health Strategic Investment fund (AHSI) managed by the Animal Health Laboratory of the University of Guelph; the Ontario Ministry of Health and Long-Term Care; the Natural Sciences and Engineering Research Council of Canada; and Public Health Ontario. The authors also acknowledge the cooperation of the SRVO and the small ruminant veterinarians and veterinary student members who participated in this study.

References

A female, domestic, short-haired, adult calico cat of unknown age was presented to Norwich Veterinary Service for a spay surgery on May 17, 2016. The cat primarily lived outdoors in the owner’s barn, and so a detailed history could not be obtained. The owner noted that the cat had previously given birth to 3 healthy litters each of 3 to 4 kittens, but she was unsure whether the cat was currently pregnant. Approximately 3 to 4 mo earlier, the cat had been stepped on by a cow, but continued to be ambulatory and appeared to be healthy afterwards. The owner was not sure if the cat had been pregnant at the time of the incident. During the preoperative examination, it was not possible to determine pregnancy by palpation and no abnormalities were discovered.

Upon incising into the abdominal cavity, a moderate amount of serosanguinous fluid was found. Gauze was used to soak up most of the fluid and the surgery was continued. After ligation of the left ovarian pedicle, an attempt was made to visualize the right ovarian pedicle and numerous abnormalities were found. First, the right uterine horn was found to have ruptured into 2 sections with a 3-cm gap filled with hemorrhagic tissue (Figure 1). Second, there was an adhesion between the gap and body wall with 3 to 4 circular, soft, fat-like nodules of approximately 1 cm diameter contained within. The adhesion was vascularized and may have attached to a portion of the small intestines, but it was difficult to confirm without more invasive manipulation. The adhesion was ligated and the surgery was continued. Interestingly, the uterus itself was not distended and beyond the abnormalities listed, appeared normal. The right ovarian pedicle and uterine body were then ligated as per standard spay protocols.

Prior to closing, the abdomen was thoroughly searched and 2 dead fetuses were found wrapped in well-vascularized omentum in the cranial abdomen (Figure 2). Additionally, there was evidence of blood supply between the spleen and fetuses. Ligations of 3 large omental vessels and 1 splenic vessel were made to remove the fetuses. The fetuses were each approximately 10 cm from crown to rump, had fine hair covering most of the body, and their limbs were bent in abnormal angles. The lighter-colored fetus was especially abnormal, with the caudal half of the body rotated nearly 180°, and a 3-cm crater-like lesion in...
the abdominal area with an absence of abdominal organs. The patient's omentum also contained a yellow/tan, amorphous, soft-tissue mass that was 3 to 4 cm in diameter with a ridged surface. None of the fetuses were found with placenta. Additionally, fine dark hairs were found throughout the abdomen. The abdomen was lavaged with sterile saline and 5 mL of a penicillin solution (penicillin G; Fresenius Kabi, Richmond Hill, Ontario) reconstituted to 100 mg/mL before closing the surgical site. The patient was kept in hospital for 3 d and placed on clavulanic acid and amoxicillin tablets (Clavaseptin; Vétoquinol, Lavaltrie, Quebec), 62.5 mg, PO, q12h, for the duration of the cat's stay. At 3 d post-surgery, ventral-dorsal and right lateral abdominal radiographs were taken. A medially displaced healing fracture was identified in the midsection of the wing of the left ilium. No additional fetuses or other abdominal abnormalities were observed on radiographs. Despite this fracture, the patient showed no gait abnormalities at admittance and after surgery. Since the surgery, the patient has returned to the owner's barn and has had no complications.

Discussion

Ectopic pregnancies are defined as pregnancies that occur outside of the uterus. They are traditionally classified as either abdominal or tubal pregnancies, depending on the site of implantation. There have been no cases of tubal pregnancies in non-primate animals, possibly because of factors inhibiting implantation in the uterine tube and/or lack of maternal recognition of pregnancy (1). However, abdominal pregnancies in cats and other domestic animals have been reported in the literature, albeit uncommonly.

Abdominal pregnancies can be categorized into 2 forms: primary and secondary. Primary abdominal ectopic pregnancies occur when a fertilized oocyte is expelled into the abdomen and implants itself on an abdominal organ such as the omentum or spleen. These have been theorized to occur if a fertilized ovum was present during a spay surgery and excessive handling during surgery allowed the ovum to escape into the abdomen (2). In order to diagnose a primary abdominal ectopic pregnancy, histology is required to show extrauterine placentation onto an abdominal organ. To date, there have been no reports documenting this phenomenon with sufficient histological evidence. Secondary abdominal ectopic pregnancies occur if the oocyte matures into a fetus while it is still in the uterus, then is expelled into the abdominal cavity due to uterine wall rupture and continues its development there. In the available case reports, the diagnosis of these have been based on a history of trauma, evidence of uterine trauma, and gross findings of mum-mified fetuses in the abdomen (3,4). However, for a confirmed diagnosis, there must be evidence of continued development or viability while in the abdomen (5). In humans, evidence of development in secondary abdominal pregnancy often takes the form of life-threatening hemorrhage caused by the developing fetus. This hemorrhage results from the increase in fetal size within a substitute organ which has a relatively low expansion potential compared to the uterus (6). In cats, although clinical signs are reported in some cases of secondary ectopic pregnancies, none of the case reports have associated intra-abdominal hemorrhage (3–5,7). A possible explanation for this lack of development may be that there is a difference in placental invasion, which describes the degree of fetal trophoblast contact and infiltration into maternal tissues. While humans have the most invasive type, called hemochorial placentation, cats have endotheiochorial placentation, which has only a slight degree of maternal tissue invasion. Thus, from a comparative anatomy perspective, cats are less likely to have ectopic pregnancies due to a difference in their placentation (5,8).

Unfortunately, this case also lacks the histological evidence needed to definitively diagnose an abdominal ectopic pregnancy. Therefore, an ectopic fetus may be a more appropriate diagnosis. Since an ectopic fetus is characterized by its abnormal location, the only requirement for diagnosis is locating the fetus. Since there is lack of evidence to support fetal implantation onto the omental tissues in this patient, the tentative diagnosis is ectopic fetuses. A macroscopic inspection of the fetuses and

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**Figure 2.** Ectopic fetuses ex-situ. The fetuses were 10 cm from crown to rump, fully-haired, and had abnormal body and limb positions. A yellow/tan amorphous mass of approximately 3 to 4 cm with undulating margins was found beside the black and white-haired fetus. Additionally, the black and white-haired fetus’ abdomen had a crater-like lesion and contained no abdominal contents.
analysis of the history provides evidence for this diagnosis. Gross inspection of the yellow/tan amorphous mass found in the omentum suggested that it could have been intestinal contents undergoing autolysis. It is possible that the sudden increase in intra-abdominal pressure during the traumatic incident not only caused a uterine rupture, but also directly damaged the fetuses themselves leading to expulsion of one of the fetus’ abdominal contents. Moreover, the fine hairs tracked throughout the abdomen may have been due to the traumatic passage of the fetus from the uterus to the cranial abdomen. These observations all support a diagnosis of ectopic fetuses secondary to trauma.

There has been a wide variety of clinical signs associated with ectopic fetuses. Some reports have described non-specific signs such as fever and vomiting, while others have found the ectopic fetuses incidentally during routine spay surgery or abdominal radiographs (3–5,7). It is unknown if ectopic fetuses directly cause clinical signs due to obstruction, or if initial rupture of the uterus itself causes peritonitis due to release of bacteria from the uterine microflora (3). In this case, the patient was presented with no clinical signs yet had a moderate amount of fluid upon opening its abdomen. It is possible that the ruptured uterine horn remained open to the abdomen, and thus during every estrus cycle, the normal fluid accumulation in the uterus was deposited in the abdomen. Whether this may eventually cause clinical signs is unknown, but given that the patient has had no clinical signs 3 to 4 mo after the incident and the recovery itself was uneventful, it is highly likely that the ectopic fetuses were incidental.

Based on the gross findings, history of the patient, and literature analysis, this patient had an ectopic fetus secondary to abdominal trauma. It is also likely that previous cases diagnosed as secondary abdominal ectopic pregnancies may also be in fact, ectopic fetuses secondary to trauma. However, there are no experimental studies attempting to replicate secondary abdominal ectopic pregnancies in cats or other domestic animals. Non-primate animal models of tubal ectopic pregnancies have been made with some success (9), but currently there are no models of secondary abdominal ectopic pregnancies in domestic animals. This case adds to the database of ectopic fetuses and further illustrates their incidental nature.

Acknowledgments

I thank Dr. Kathi Kirby for her guidance and support throughout the management of this case and Drs. Cowbrough and Barnes for hosting me during my externship. Special thanks are due to the Norwich Veterinary Services staff for their continued support during my veterinary education.

References

The creation of the Department of Population Medicine at the Ontario Veterinary College

Kevin Woodger, Elizabeth Stone, Cate Dewey

In 1987 the Ontario Veterinary College (OVC), University of Guelph, inaugurated the Department of Population Medicine, beginning a new era in the College’s approach to veterinary medical education, research and health care. The creation of the Department was the product of wider changes in the nature of livestock agriculture, the growing importance of population level health management in veterinary practice in Canada and elsewhere, and strong support from within the College. Population level preventive medicine became increasingly important over the second half of the 20th century as the intensification of livestock production combined with tightening profit margins for producers made the prevention of disease and increased productivity vital to the success of livestock agriculture. Outbreaks of new production limiting diseases among livestock populations can wreak havoc on agricultural economies and cause substantial financial losses for producers. Within OVC a number of influential faculty members, including Drs. Wayne Martin, Bob Curtis, Alan Meek, Bob Friendship, Ken Leslie, Bill Mitchell, and Dean Ole Nielsen helped lay the foundation for, and/or were the driving forces behind the creation of the Department. Their work helped put OVC in a leadership position in terms of the growth of population medicine in North America. Several of these faculty members were interviewed and their thoughts have been incorporated into this paper.

As a consequence of these developments OVC reconsidered its approach to livestock animal medicine and created the Department of Population Medicine to systematically teach and perform research and extension work in farm animal health management and welfare, epidemiology, public health, food protection, and theriogenology.

The intensification of livestock production, especially from the 1960s onwards, meant that food animal veterinarians needed to re-orient their practices to serve the new focus on herd health, which emphasized preventive medicine as an effective response to tight profit margins for producers. Producers were forced to increase productivity to keep pace with the increasing costs of agricultural production, as the intensification of agriculture led to increased costs of farm machinery and land, due in part also to rapid urbanization and the spread of human populations over agricultural lands in places such as Ontario. Such tight profit margins meant that veterinarians needed to provide services that would be economically beneficial to producers as they changed their focus from individual animals to the herd as a whole (1). Many veterinarians recognized the financial constraints facing large-scale livestock producers and throughout the 1960s and 1970s began to advocate herd health management as a way to provide cost-effective veterinary services to livestock producers.

Beginning in the early 1960s, the Ontario Veterinary College, with the assistance of the Livestock Branch of the Ontario Department of Agriculture, began a Specific Pathogen-Free (SPF) pig program to “create a nucleus of high quality pure-bred certified herds from which other secondary herds can be established easily and economically” (2). These pigs were seen as potentially able to “break the cycle of infection at the moment of birth.” While there were high start-up costs, long-term savings would accrue from decreased drug costs and mortality rates compared to conventional herds (3). Specific Pathogen-Free researcher M.K. Abelseth noted that “the practicing veterinarian should be closely associated with the SPF programme” (4). Veterinarians provided farmers with advice on topics such as sanitation and nutrition, and by 1964 it was reported that veterinarians with SPF herd clients “have co-operated to the fullest extent in endeavoring to keep the herd health status at a high level” (3).

In 1974 Dr. O.M. Radostits (a faculty member at the OVC in the early 1960s before moving to the Western College of Veterinary Medicine at the University of Saskatchewan in 1964) noted that the modern livestock producer is “business oriented and applies the principles of agricultural economics to his everyday task of allocating resources to achieve optimum returns.” He argued that the high cost of raising stock such as cattle and pigs meant that “progressive” producers would increasingly demand high quality herd health services from their veterinarians. In addition, Canadian and American veterinary colleges, which traditionally focused on individual animals, would need to teach herd level medicine to meet this new demand (5).

A mid-1970s report in Ontario recommended a similar approach. William A. Stewart, the Ontario Minister of Agriculture and Food, commissioned Dr. E.H. Botterell to...
study the state of livestock animal health management. The Botterell Report (6) concluded that “the food animal industry and veterinary medicine are entering the era of Maintenance of Health Programs in support of intensive production of food-producing farm animals (herd health).” Botterell found that the intensive production of livestock animals was making “new and heavy demands” for preventive medicine programs and for services to help producers manage such things as nutrition, fertility, and humane housing (5). While Botterell found that the emergency, or “fire-engine” approach to veterinary farm practice was well taken care of in Ontario, due in large part to the long hours worked by livestock veterinarians, “relatively little has been achieved in the direction of a comprehensive system of Maintenance of Health Programs for food producing animals” (6).

The result of this was “substantial economic loss due to disease in livestock and poultry” (6). The Ontario Ministry of Agriculture and Food estimated that animal diseases cost the Ontario economy over $100 million in 1973. These losses could be reduced through health management and preventive veterinary medicine programs. For example, veterinarians could assist swine producers in managing or preventing or reducing potentially devastating outbreaks of diarrhea due to Escherichia coli, especially among newborn pigs. One way of doing this was through an E. coli vaccine developed by OVC faculty member Dr. Michael R. Wilson in the early 1970s (7). This vaccine remains in use and its administration has become standard practice for all sows prior to farrowing.

Herd health was a lesson that Martin, one of the founders of population medicine at OVC, learned in the 1970s from pioneering veterinary epidemiologist Dr. Calvin Schwabe at the University of California Davis (UCD). Schwabe argued that “preventive veterinary medicine of the future will largely be a form of on-going on-farm research, based upon surveillance” (Interview with Wayne Martin by Kevin Woodger and Cate Dewey, March 2, 2015). Often referred to as the “father of veterinary epidemiology,” Dr. Schwabe founded the UCD Department of Epidemiology and Preventive Medicine (the first of its kind in any veterinary school) in the late 1960s and (Interview with Alan Meek by KW, March 2, 2015). The 1976 Botterell Report, faculty advocates such as Curtis and Cote, Martin’s experiences at UCD, and the growing OVC herd health program led to discussions at OVC about creating a department focused on population level medicine. Dr. Bill Mitchell, a faculty member in the Department of Veterinary Microbiology and Immunology (VMI) was also influential. Throughout the 1960s and 1970s Mitchell taught a Public Health course in the Doctor of Veterinary Medicine (DVM) program, which incorporated aspects of applied epidemiology. He also stressed to his colleagues in VMI that “there was more to understanding and controlling disease than the microbe,” and was an advocate for the use of epidemiology in public health and in government efforts at controlling diseases such as bovine tuberculosis and brucellosis (Interview with Wayne Martin by Kevin Woodger and Cate Dewey, March 2, 2015). Furthermore, Mitchell helped convince Schwabe to take on Wayne Martin as a PhD student in 1970 and he was instrumental in supporting the hiring of both Martin and Alan Meek (after he completed a PhD in epidemiology at the University of Melbourne) into VMI in the mid-1970s, changing the “face” of OVC, as Wayne Martin put it (Interview with Wayne Martin by Kevin Woodger and Cate Dewey, March 2, 2015).

By the 1980s, OVC had 4 departments; Biomedical Sciences, Pathology, Clinical Studies and VMI. In the summer of 1981, the OVC Dean, Dr. D.C. Maplesden, appointed a committee of OVC faculty, which was chaired by Dr. Gordon Ball, Associate Dean of the Ontario Agricultural College, with a membership of Curtis, Meek, W.H. Harris, and J.O.D. Slocombe, to
investigate what the College should do in the area of preventive medicine. Settling on the term health management rather than preventive medicine, the committee sought to “assess the needs of the profession and society in general in the area of health management,” and to “recommend how these needs might be best fulfilled by OVC in its responsibilities for teaching, research and extension” (14). The committee defined health management as a concern for the health of animal populations and with the development of programs to maintain health in order to optimize production efficiency and produce high quality animal food products under humane conditions (14).

Over the course of its investigation, the Committee decided that the creation of a Department of Health Management would be the best way to generate producer awareness of the importance of preventive medicine, and to facilitate teaching, research, and extension work in health management. They envisioned faculty joining the new department from relevant areas across the College, including reproduction and swine, ruminant, and poultry medicine (from Clinical Studies) as well as epidemiology and public health (from VMI). They also called for computer scientists and biometricians, as it was perceived that the new department would need to manipulate large volumes of data concerning the health of client herds. It was recognized that information management on herd health was becoming increasingly important. This was reflected in the Committee’s recommendations for the potential department’s teaching program which would include an emphasis on epidemiology and the statistical analysis of the wealth of information (including nutrition, genetics, and housing) needed to determine the cause of disease outbreaks and production concerns among animal populations (14).

Data generation and collection would also be key to the department’s research program. The Committee noted that the general absence of health management programs in Ontario resulted in a dearth of data on which OVC researchers could base technical health management advice. They noted that production diseases were increasingly prominent and that veterinary services should be tailored to treating and controlling these. With that in mind, the Committee outlined a research program for the department that would center around “the interrelationships between the various components and levels of livestock production including husbandry/management, production, producer objectives and disease” (14).

According to Martin, the findings of the Committee on Health Management supported the general desire amongst faculty to act on the recommendations of the Botterell Report and “do things differently” (Interview with Wayne Martin by Kevin Woodger and Cate Dewey, March 2, 2015). Dr. Friendship, who was at that time a faculty member specializing in swine diseases in the Department of Clinical Studies, recalled in an interview that the proposed department was “sort of the dominant talk in the coffee room.” He had seen the proposed department as a way to secure the place of food animals in the College in the face of the growing popularity of small animal medicine (Interview with Bob Friendship by KW, March 2, 2015). Even with this support, the motion to create the department failed. Martin notes that the failure of the Department of Health Management motion came as a surprise to most of his colleagues, although not to him because he had voted against the creation of the department. Despite the growing calls for a more herd-oriented approach to livestock medicine, Martin believed that the concept of herd health management was too narrow, with the connotation that public health and zoonoses would not be incorporated into the department’s work (Interview with Wayne Martin by Kevin Woodger and Cate Dewey, March 2, 2015). Martin would take a leading role in advocating for a broader definition of population medicine during the years between the vote on a Department of Health Management and a vote on the founding of the Department of Population Medicine.

Both Martin and Friendship agree that there was a good deal of misunderstanding within OVC about the concept of health management, especially among individual animal-oriented faculty members. Friendship recalls that within Clinical Studies, many of the proponents of individual animal medicine did not understand that it “was ridiculous to bring a cow or a pig into the clinic and have the students do a big workup on it the way you would a pet.” In the context of intensive livestock operations, “if you’re going to bring the animal in to diagnose the situation you would take them straight to the postmortem room and try to make a diagnosis as quickly as you can because there’s another thousand of them out in the barn that are dying of the same thing” (Interview with Bob Friendship by KW, March 2, 2015).

After the 1982 vote that rejected the creation of a Department of Health Management, conversations and initiatives continued to advance population level health management. Particularly important was creation of a coursework Master of Science program in epidemiology by Martin, with the assistance of Meek, within VMI in 1982. The program was designed to “prepare students for participation in the organization of animal disease control programs at the farm and provincial and federal government levels” (15). Over the next several years, this program would become internationally renowned and was matched only by Dr. Calvin Schwabe’s veterinary epidemiology program at UCD. Martin’s program attracted some of the best students from OVC and around the world to study epidemiology. The success of Martin’s graduate program in epidemiology was a key factor in convincing OVC faculty to support population medicine in 1987. For a list of all epidemiology-focused graduate students between 1979 and 1998 (including those from VMI in the coursework MSc in epidemiology and those who were
### Table 1. Epidemiology-focused Graduate Students, 1979–1998

<table>
<thead>
<tr>
<th>Name</th>
<th>Year</th>
<th>Degree</th>
<th>Position/Institution or Agency</th>
<th>Country</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hollis Erb</td>
<td>1979</td>
<td>PhD</td>
<td>Professor/Cornell University</td>
<td>USA</td>
</tr>
<tr>
<td>Ian Dohoo</td>
<td>1982</td>
<td>PhD</td>
<td>Professor/University of Prince Edward Island</td>
<td>Canada</td>
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<tr>
<td>Scott McEwen</td>
<td>1985</td>
<td>DVS</td>
<td>Professor/University of Guelph</td>
<td>Canada</td>
</tr>
<tr>
<td>David Walmer-Toews</td>
<td>1985</td>
<td>PhD</td>
<td>Professor/University of Guelph</td>
<td>Canada</td>
</tr>
<tr>
<td>Nonie Smart</td>
<td>1987</td>
<td>MSc</td>
<td>Senior Scientist/Canada Food Inspection Agency</td>
<td>Canada</td>
</tr>
<tr>
<td>Kenneth Bateman</td>
<td>1988</td>
<td>MSc</td>
<td>Professor/University of Guelph</td>
<td>Canada</td>
</tr>
<tr>
<td>Brenda Bonnett</td>
<td>1988</td>
<td>PhD</td>
<td>CEO, International Partnership for Dogs</td>
<td>Canada</td>
</tr>
<tr>
<td>Neil Anderson</td>
<td>1989</td>
<td>MSc</td>
<td>Lead Veterinarian, Bovine Health and Welfare, OMAFRA</td>
<td>Canada</td>
</tr>
<tr>
<td>Helen Drolia</td>
<td>1989</td>
<td>MSc</td>
<td>Veterinary Practitioner/Greece</td>
<td>Greece</td>
</tr>
<tr>
<td>Gary Hallbert</td>
<td>1989</td>
<td>MSc</td>
<td>Analyst and Scientific Advisor/CFIA</td>
<td>Canada</td>
</tr>
<tr>
<td>David Sandals</td>
<td>1989</td>
<td>MSc</td>
<td>Professor/University of Guelph</td>
<td>Canada</td>
</tr>
<tr>
<td>David Alves</td>
<td>1990</td>
<td>PhD</td>
<td>Deputy Chief Veterinarian of Ontario/OMAFRA</td>
<td>Canada</td>
</tr>
<tr>
<td>John McDermott</td>
<td>1990</td>
<td>PhD</td>
<td>Director/CGIAR Research Program on Agriculture for Nutrition and Health, International Food Policy Research Institute</td>
<td>USA</td>
</tr>
<tr>
<td>W. Bruce McNabb</td>
<td>1990</td>
<td>PhD</td>
<td>Senior Scientist/Animal Health and Welfare Branch, OMAFRA</td>
<td>Canada</td>
</tr>
<tr>
<td>Jonathan Morgan</td>
<td>1990</td>
<td>MSc</td>
<td>Manager/CFIA</td>
<td>Canada</td>
</tr>
<tr>
<td>Cord Heuer</td>
<td>1991</td>
<td>MSc</td>
<td>Professor/EpiCentre, Massey University</td>
<td>New Zealand</td>
</tr>
<tr>
<td>Jeff Wilson</td>
<td>1991</td>
<td>PhD</td>
<td>President/Novometrix Research Inc</td>
<td>Canada</td>
</tr>
<tr>
<td>Cate Dewey</td>
<td>1992</td>
<td>PhD</td>
<td>Professor and Department Chair/University of Guelph</td>
<td>Canada</td>
</tr>
<tr>
<td>Gordon Doig</td>
<td>1992</td>
<td>MSc</td>
<td>Senior Lecturer/University of Sydney</td>
<td>Australia</td>
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<tr>
<td>Pilar Donado-Godoy</td>
<td>1992</td>
<td>MSc</td>
<td>Scientist/COPOICA, CBB</td>
<td>Colombia</td>
</tr>
<tr>
<td>Armin Elbers</td>
<td>1992</td>
<td>MSc</td>
<td>Senior Scientist/Central Veterinary Institute</td>
<td>Netherlands</td>
</tr>
<tr>
<td>George Gitau</td>
<td>1992</td>
<td>MSc</td>
<td>Professor/University of Nairobi</td>
<td>Kenya</td>
</tr>
<tr>
<td>Carol Mulder</td>
<td>1992</td>
<td>MSc</td>
<td>Provincial Lead, Quality Improvement Decision Support Program, AFHTO</td>
<td>Canada</td>
</tr>
<tr>
<td>Carl Ribble</td>
<td>1992</td>
<td>PhD</td>
<td>Professor/University of Calgary</td>
<td>Canada</td>
</tr>
<tr>
<td>Dominique Baronet</td>
<td>1993</td>
<td>MSc</td>
<td>Director of Development &amp; Regulations, MAPAQ</td>
<td>Canada</td>
</tr>
<tr>
<td>John Deen</td>
<td>1993</td>
<td>PhD</td>
<td>Professor/University of Minnesota</td>
<td>USA</td>
</tr>
<tr>
<td>Andrea Ellis</td>
<td>1993</td>
<td>MSc</td>
<td>Scientist/CFEZID, PHAC</td>
<td>Canada</td>
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<tr>
<td>Patrick Hearne</td>
<td>1993</td>
<td>MSc</td>
<td>Co-owner, Hearn Veterinary Services</td>
<td>Canada</td>
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<tr>
<td>George Hillis</td>
<td>1993</td>
<td>MSc</td>
<td>Veterinarian/East Oshawa Animal Hospital</td>
<td>Canada</td>
</tr>
<tr>
<td>Julia Keenliside</td>
<td>1993</td>
<td>MSc</td>
<td>Epidemiologist/Alberta Agriculture and Rural Development</td>
<td>Canada</td>
</tr>
<tr>
<td>John Griffin</td>
<td>1994</td>
<td>MSc</td>
<td>SSVI/Department of Agriculture and Food</td>
<td>Ireland</td>
</tr>
<tr>
<td>Mutsumu Kodohira</td>
<td>1994</td>
<td>PhD</td>
<td>Professor/Ohihiro University of Agriculture and Veterinary Medicine</td>
<td>Japan</td>
</tr>
<tr>
<td>Ronny Mudigdo</td>
<td>1994</td>
<td>MSc</td>
<td>Director for Animal Diseases Investigation Center Maros</td>
<td>Indonesia</td>
</tr>
<tr>
<td>Frank Pollar</td>
<td>1994</td>
<td>PhD</td>
<td>Senior Epidemiologist/CFEZID, PHAC</td>
<td>Canada</td>
</tr>
<tr>
<td>Bambang Sumiarto</td>
<td>1994</td>
<td>MSc</td>
<td>Professor/Gadjah Mada University</td>
<td>Indonesia</td>
</tr>
<tr>
<td>André Busato</td>
<td>1995</td>
<td>MSc</td>
<td>Professor/University of Bern</td>
<td>Switzerland</td>
</tr>
<tr>
<td>Abdelhamid Elfadil</td>
<td>1995</td>
<td>PhD</td>
<td>Professor/Sudan University of Science and Technology</td>
<td>Sudan</td>
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<tr>
<td>George Gunn</td>
<td>1995</td>
<td>MSc</td>
<td>Professor/Scotland’s Rural College</td>
<td>Scotland</td>
</tr>
<tr>
<td>Jack Halip</td>
<td>1995</td>
<td>MSc</td>
<td>President/Professional Animal Behavior Associates Inc.</td>
<td>Canada</td>
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<tr>
<td>David Kelton</td>
<td>1995</td>
<td>PhD</td>
<td>Professor/University of Guelph</td>
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<tr>
<td>Dean Middleton</td>
<td>1995</td>
<td>MSc</td>
<td>Senior Public Health Epidemiologist/Public Health Ontario</td>
<td>Canada</td>
</tr>
<tr>
<td>Parminder Raina</td>
<td>1995</td>
<td>PhD</td>
<td>Professor/McMaster University</td>
<td>Canada</td>
</tr>
<tr>
<td>Sonja Sakiska</td>
<td>1995</td>
<td>MSc</td>
<td>CEO/British Columbia Centre for Aquatic Health Sciences</td>
<td>Canada</td>
</tr>
<tr>
<td>Nathaniel Tablante</td>
<td>1995</td>
<td>MSc</td>
<td>Professor/University of Maryland</td>
<td>USA</td>
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<tr>
<td>Paul Valle</td>
<td>1995</td>
<td>MSc</td>
<td>Professor/Norwegian School of Veterinary Science</td>
<td>Norway</td>
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<tr>
<td>Cindy Adams</td>
<td>1996</td>
<td>PhD</td>
<td>Professor/University of Calgary</td>
<td>Canada</td>
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<tr>
<td>Peter Buck</td>
<td>1996</td>
<td>MSc</td>
<td>Senior Public Health Epidemiologist, PHAC</td>
<td>Canada</td>
</tr>
<tr>
<td>Hugo Dunlop</td>
<td>1996</td>
<td>PhD</td>
<td>Veterinarian, Chris Richards Associates Swine Veterinary Consultants</td>
<td>Australia</td>
</tr>
<tr>
<td>Muhamad Sopian Johar</td>
<td>1996</td>
<td>MSc</td>
<td>Epidemiologist/Ministry of Agriculture</td>
<td>Malaysia</td>
</tr>
<tr>
<td>George Nasinyama</td>
<td>1996</td>
<td>PhD</td>
<td>Deputy Vice-Chancellor, Research Innovation and Extension/IKU</td>
<td>Uganda</td>
</tr>
<tr>
<td>Rita Nespeca</td>
<td>1996</td>
<td>MSc</td>
<td>Associate Director Data Management/ProNAI Therapeutics</td>
<td>Canada</td>
</tr>
<tr>
<td>Christine Power</td>
<td>1996</td>
<td>MSc</td>
<td>Professor/Institute of Child Health, University College London</td>
<td>England</td>
</tr>
<tr>
<td>Asif Saezuddin</td>
<td>1996</td>
<td>PhD</td>
<td>Rector/Trilogi University</td>
<td>Indonesia</td>
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<tr>
<td>Jan M. Sargeant</td>
<td>1996</td>
<td>PhD</td>
<td>Director, Centre for Public Health &amp; Zoonoses, University of Guelph</td>
<td>Canada</td>
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<tr>
<td>Nathalie Bruneau</td>
<td>1997</td>
<td>PhD</td>
<td>National Manager Aquatic Surveillance &amp; Epidemiology, CFIA</td>
<td>Canada</td>
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<tr>
<td>Abdunasser Dayhun</td>
<td>1997</td>
<td>MSc</td>
<td>Professor/University of Tripoli</td>
<td>Libya</td>
</tr>
<tr>
<td>Almabrouk Fares</td>
<td>1997</td>
<td>MSc</td>
<td>Professor/University of Tripoli</td>
<td>Libya</td>
</tr>
<tr>
<td>Carolyn Hewson</td>
<td>1997</td>
<td>PhD</td>
<td>Professor/University of Prince Edward Island</td>
<td>Canada</td>
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</tbody>
</table>
graduate students in the Department of Population Medicine during its first 10 years of operation) see Table 1.

In addition, a number of Clinical Studies faculty, such as Leslie, Curtis, and Friendship, were demonstrating how epidemiology could be integrated into health management. They worked to convince veterinarians, veterinary students, and producers of the value of this approach. For example, Leslie, often alongside Curtis, carried out research evaluating the efficacy of treatments and determining the sensitivity and specificity of diagnostic tests and measuring production parameters in dairy cattle.

They were joined by Martin and Meck from VMI, who had become increasingly assertive in their opinion that a more formalized approach to population medicine was necessary. Despite the freedom to pursue their own research, the epidemiologists were more likely to work with food animal faculty members in Clinical Studies, such as Leslie and Curtis, than the microbiologists, virologists, and immunologists of their own department (8). As Friendship recalled, the food animal faculty and epidemiologists increasingly recognized the complementarity of their work. Food animal clinicians noted that proper feeding, ventilation, and proper sanitation and hygiene practices could prevent many of the diseases found in their patients. They began to see many livestock diseases as “multi-vectoral” and multi-factorial and opened up space for epidemiologists to “do their very structured studies and prove [what] the risk factor for [a] disease was,” and demonstrate “the value of epidemiology to point out what…the clinicians were observing in the field, that the two went rather well together” (Interview with Bob Friendship by KW, March 2, 2015).

In 1982 and 1983, faculty responsible for swine health in Clinical Studies, including Drs. Bob Friendship and Mike Wilson, carried out a large “Wintario” study to examine swine herd productivity in Ontario and provide a pool of data from which other producers and veterinarians could draw to compare their own herds’ productivity. Reporting in 1986, the study provided an early demonstration of the value and importance of many of the tools and methods on which the Department of Population Medicine would later rely. The researchers noted that “records of productivity are essential for efficient (or cost effective) health management” (16). They found that “in the absence of clinical disease, and where suboptimal productivity is the problem, productivity data and corresponding reference values are effective means for identifying problem areas” (16). The researchers undertook weekly and biweekly farm visits in order to collect the data recorded by participating producers. The study also provides an early example of the use and importance of computer technology, including the use of computerized production records, in health management work. The researchers typed the data collected on the farm into a “hand-held, programmed data logger and transmitted through a modem (via telephone) to a central microcomputer,” for statistical analysis (16). The researchers concluded that “a wide range in swine productivity…exists between Ontario farms,” with “a significant number of pork producers…operating at a level far below their productivity potential” (16). However, they also found that there was “great potential…in the industry for increasing the efficiency of farms,” especially if producers made wider use of existing health management techniques (16).

In 1986, noting the increasing collaborations between the epidemiologists and the food animal faculty, the newly appointed Dean, Dr. Ole Neilsen, supported by the Dean’s Council, appointed a steering committee co-chaired by population medicine advocates Martin and Leslie, to investigate the creation of a Department of Population Medicine. The committee believed that “clinical veterinary medicine can be divided…into two broad streams; one that is primarily oriented to individual patients and one to populations” (17). They found

Table 1. Epidemiology-focused Graduate Students, 1979–1998 (continued)

<table>
<thead>
<tr>
<th>Name</th>
<th>Year¹</th>
<th>Degree¹</th>
<th>Position/Institution or Agency¹</th>
<th>Country</th>
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<tr>
<td>Innes</td>
<td>1997</td>
<td>MSc</td>
<td>Manager, Veterinary Science and Policy, OMAFRA</td>
<td>Canada</td>
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<tr>
<td>Michel</td>
<td>1997</td>
<td>PhD</td>
<td>Chief Science Officer, PHAC</td>
<td>Canada</td>
</tr>
<tr>
<td>Poland</td>
<td>1997</td>
<td>MSc</td>
<td>Professional Development Veterinarian/Hill’s Canada</td>
<td>Canada</td>
</tr>
<tr>
<td>Ramanoom</td>
<td>1997</td>
<td>MSc</td>
<td>Senior Lecturer/Universiti Putra Malaysia</td>
<td>Malaysia</td>
</tr>
<tr>
<td>VanLeeuwen</td>
<td>1997</td>
<td>PhD</td>
<td>Professor/University of Prince Edward Island</td>
<td>Canada</td>
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<tr>
<td>Boerlin</td>
<td>1998</td>
<td>MSc</td>
<td>Professor/University of Guelph</td>
<td>Canada</td>
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<tr>
<td>Mallia</td>
<td>1998</td>
<td>PhD</td>
<td>Professor/Institute of Agriculture, University of Malta</td>
<td>Malta</td>
</tr>
<tr>
<td>O’Callaghan</td>
<td>1998</td>
<td>PhD</td>
<td>Sr. Investigator/Canadian Clinical Trials Group; Professor, Queen’s University</td>
<td>Canada</td>
</tr>
<tr>
<td>Morgan Scott</td>
<td>1998</td>
<td>PhD</td>
<td>Professor/Texas A&amp;M University</td>
<td>USA</td>
</tr>
<tr>
<td>Teare</td>
<td>1998</td>
<td>PhD</td>
<td>Saskatchewan’s Health Quality Council</td>
<td>Canada</td>
</tr>
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¹ Year degree was awarded.
² Highest degree received from Department of Population Medicine.
³ Current position or last position before retirement based on publicly available information.
⁴ OMAFRA — Ontario Ministry of Agriculture, Food and Rural Affairs.
⁵ CFIA — Canadian Food Inspection Agency.
⁶ CGIAR — Consultative Group on International Agricultural Research.
⁷ CORPOICA, CBB — Corporación Colombiana de Investigación Agropecuaria, Centro de Biotecnología y Bioindustria.
⁸ AFHRP — Association of Family Health Teams of Ontario.
⁹ MAPAQ — Le ministère de l’Agriculture, des Pêcheries et de l’Alimentation du Québec.
¹⁰ CFZID — Centre for Foodborne, Environmental and Zoonotic Infectious Diseases.
¹¹ PHAC — Public Health Agency of Canada.
¹² RIU — Kampala International University.
that at OVC individual patient medicine “has flourished” (17). Population medicine, however, had been slower to develop due to the relatively recent recognition of the importance of veterinary epidemiology, particularly to “modern food animal production and regulatory medicine” (17). Whereas the previously proposed Department of Health Management carried the implication of having a focus strictly limited to livestock, from the beginning, Martin, Leslie, and the committee sought to outline a department with a broader scope. For example, they extended the benefits of veterinary epidemiology to wildlife, laboratory animals, environmental toxicology and public health (17).

The committee used a definition of population medicine that incorporated health management, but also the broader concept championed by Martin. They defined population medicine as the “study of the frequency, distribution, and cost of disease, and the interrelationships between and among disease, management, environment and productivity” (18). Reflecting the importance of health management, the definition incorporated “directed action (i.e., applied prevention and control strategies) for the management of health and control of disease in animal populations” (18). By contrast, the earlier health management approach focused more on preventive medicine, with less consideration given to the relationships between disease and the other factors outlined by the committee (14).

As outlined by Martin, Leslie, and the rest of the committee, the proposed Department of Population Medicine’s main responsibility would be the collection of “data on the distribution, causes, and costs of disease (including abnormal behavior) in animal populations and to develop control strategies based on that knowledge.” They foresaw a department that would emphasize the key roles played by environment, population structure, animal behavior and animal husbandry and management in determining health and disease. To do this, the department would take epidemiology as a key discipline (18). The committee envisioned a department that would “bring together those who are, or desire to be, involved in a population-based, quantitative, holistic approach to studies of health and disease” (18).

An OVC faculty vote on the creation of a new Department of Population Medicine was taken in the spring of 1987, with faculty members voting in favor of the new department, and Martin was appointed as the first Department Chair (14). Faculty involved in the Department’s founding, such as Martin, Meek, and Friendship, now generally agree that the proposals and debates that preceded and surrounded the initial proposal for a Department of Health Management helped lay the groundwork for the approved Department of Population Medicine and convinced faculty of the need for a new approach to food animal medicine (Interview with Wayne Martin by Kevin Woodger and Cate Dewey, March 2, 2015).

While there was some caution on the part of the wider Canadian veterinary profession to not lose sight of the individual animal in favor of the herd, population medicine was cited as a necessity given the reality of the intensive livestock economy (19,20). For example, Martin and Drs. John McDermott, and David Alves argued that there was a lack of expertise in herd health within the Canadian veterinary profession. They noted that when dealing with livestock at the population level, “the risk of disease or treatment success, for an individual in a herd, isn’t independent of risks for the other animals in the herd.” Management decisions, such as vaccination programs must be made based on how it will benefit the herd as a whole. Furthermore, such decisions can only be made after comparing data from similar herds so treated. They noted, however, that “our track record as a profession, in scientifically testing these herd level decisions, is rather poor” (21).

The Department of Population Medicine initially had 23 faculty, 16 staff, and 23 graduate students. It was divided into 5 primary research areas: farm animal health management, epidemiology and biometrics, public health and food protection, theriogenology (reproduction), and ethology (animal behavior) (22). Some individuals questioned the inclusion of the theriogenologists because of their focus on individual animals. However, their efforts to improve production efficiency by improving reproduction efficiency “without compromising the welfare of the animal,” fit with the Department’s overall goals (14,22).

Health management was a core discipline of the new department (as enshrined in the department’s mission statement), and most faculty who joined at the beginning worked in health management. The farm animal health management section worked with dairy and beef cattle, sheep, goats, and pigs, divided into separate subsections for ruminants and swine. The College’s poultry specialists chose not to join the department, in part because of the importance of pathology to the poultry industry (14). However 2 poultry epidemiologists later joined Population Medicine, Dr. Jean Pierre Vaillancourt, from 1990 to 1996, and then Dr. Michele Guerin from 2007 to the present. The farm animal health management section was tasked with carrying out teaching as well as the practical work of health management and disease prevention, examining the factors that affected farm animal health, and devising tools to control them.

In general, the health management group was responsible for teaching, including the health management areas of the DVM curriculum. This consisted of lectures, laboratories, and practical exercises in herd health and population medicine. There was also a 2-week clinical rotation in ruminant field service plus a 1-week clinical rotation in swine field service for all final year veterinary students (23). According to Leslie, the group’s extension education work, which included faculty talks to breeders’ and producers’ associations, helped fulfill the Department’s “responsibility to the large animal community in Ontario.” Furthermore, as with dairy, the swine area emphasized the importance of economics in the DVM curriculum so that upon entering practice, veterinarians could “make a valuable contribution to swine producers” (Interview with Kerry Lissemore by KW, March 2, 2015). Through the department’s DVM teaching, generations of veterinarians have graduated into health management practice, making a huge impact on the health, welfare, and productivity of livestock on Canadian farms.

Epidemiology was primarily concerned with the “study of the distribution and determinants of health and disease in animal populations,” using the quantitative tools of biometrics (22). Computer technologies were key to the epidemiology
and biometrics group. Computers and epidemiology were seen as essential for the Department to be able to collect, manage, manipulate, and interpret herd health data in support of faculty research and producer-clients. Computers were also seen as important veterinary student teaching tools, as they helped students learn “how to evaluate a herd on a population basis and how to interpret data as a first step in making proper recommendations about health management to their clients” (18). This included setting goals in collaboration with clients and measuring whether they achieved the targets. This was done before and during each herd health visit. In 1989 Kerry Lissemore explained that computers had greatly enhanced veterinarians’ ability to monitor herd health. He noted that as a key part of herd health and the “continual assessment of deviations of actual herd performance from targets of performance,” computers have “reduced the labour required by the veterinarian, and the farmer in the repetitive tasks related to data preparation and analysis” (24).

The research emphasis within the new department was firmly on the population level. For example, researchers including Drs. Cate Dewey, Martin, Wilson, and Friendship examined computerized swine records from 1987 to 1991. Recognizing that litter size “is an important production parameter in swine herds,” they examined 66 525 computerized individual sow-level records from 112 Ontario swine farms in order to analyze “the relationships between sow-level management factors and litter size” (25). In 1991 Drs. McDermott, Alves, Neil Anderson (OMAF) and Martin published a study examining the productivity of Ontario cow-calf herds, using a sample of 180 separate breeding herds. One of their aims was to provide farmers, veterinarians, and agricultural extension personnel with data with which they could “compare a specific herd’s health and productivity to productivity measures and disease rates of other herds kept under the same conditions” (26).

Through its research and extension work, such as Leslie’s internationally recognized Dairy Health Management Certificate program, the Department of Population Medicine quickly established itself as a leader in the field of population health and epidemiology. The creation of the Department of Population Medicine allowed OVC to effectively respond to the needs of the intensive livestock agriculture economy and train veterinarians to provide services that would be of maximum benefit to producers. By 2012, OVC faculty and students were conducting over 800 farm visits for health management and teaching purposes per year, impacting 1.3 million livestock animals and were providing continuous health management services to more than 70 Ontario farms, accounting for over 55 000 animals. A 2014 study of the economic impact of OVC concluded that the College, “as one of the largest and most well respected programs of its kind in the world, is an essential link in the development and maintenance of health management standards and protocols in an ever-evolving landscape” (27). As the Dean’s Council concluded in 1989, “the creation of [the] new department of Population Medicine was a critically important step that has brought the Institution to the cutting edge in the population-based veterinary health disciplines” (28).

References

15. Annual Report of the University of Guelph, 1982. RE1 UOG A0086, University of Guelph Archival and Special Collections.
17. Ontario Veterinary College Inter-Departmental Memorandum, Proposed Department of Population Medicine, 11 November 1986, CAV Barker Museum of Canadian Veterinary History, University of Guelph.
18. A Proposal for a Department of Population Medicine in the Ontario Veterinary College. CAV Barker Museum of Canadian Veterinary History, University of Guelph.
1. E) A majority of feline mammary masses are malignancies; therefore, a “wait and see” attitude would clearly not be appropriate. With feline mammary masses it is typically recommended to remove the entire mammary chain, and with this cat having bilateral involvement, this procedure would be the best choice. Lumpectomy and mammectomy are procedures to be used on occasion in canine patients, but not typically in cats. The response of mammary tumors to chemotherapeutic agents has been frustratingly poor, and cisplatin administration is contraindicated in cats as it can cause fatal pulmonary edema.

E) La majorité des masses mammaires des chats sont malignes et une attitude «d'attendre avant d’agir» n’est clairement pas appropriée. Avec les masses mammaires félines, il est fortement recommandé de faire l’ablation des chaînes mammaires au complet et, chez cette chatte qui a une atteinte bilatérale, cette intervention est le meilleur choix. La lumpectomie et la mastectomie sont des chirurgies qui peuvent être réalisées à l’occasion chez la chienne mais non chez la chatte. La réponse des tumeurs mammaires à la chimiothérapie est mauvaise de façon frustrante et l’administration de cisplatine est contre-indiquée chez la chatte puisqu’elle peut causer de l’œdème pulmonaire fatal.

2. B) This dog could have hyperadrenocorticism based on these results. Further testing is necessary. Elevation of the UCCR may be caused by hyperadrenocorticism, but may also be elevated as a result of stress or other nonadrenal illness. The clinical signs and elevated UCCR do not suggest hypoadrenocorticism.


3. D) Dark chocolate is more toxic than milk chocolate, and even small quantities of chocolate can be quite toxic. Treatment is usually necessary because clinical signs are severe.

D) Le chocolat noir est plus toxique que le chocolat au lait et même de petites quantités peuvent être vraiment toxiques. Un traitement est habituellement nécessaire parce que les signes cliniques sont sévères.

4. B) Pyrrolizidine-alkaloid-containing plants can cause severe hepatic dysfunction in horses, and exposures are generally chronic. Wilted maple leaves can cause a hemolytic anemia, zinc and copper can cause hemolytic changes (though horses are very resistant to the toxic effects of copper), and lead toxicosis in horses typically causes more neurological changes.

B) Les alcaloïdes de type pyrrolidizine des plantes peuvent causer des dysfonctions hépatiques sévères chez le cheval et les expositions sont généralement chroniques. Les feuilles d’érable fanées peuvent causer une anémie hémolytique; le zinc et le cuivre peuvent causer des changements hémolytiques (bien que les chevaux soient très résistants aux effets toxiques du cuivre) et la toxicose au plomb chez les chevaux cause de façon caractéristique plus de changements neurologiques.

5. D) These symptoms are common with sole abscesses. Infection begins at compromised white line, and proceeds under the sole horn, into the corium, or under the wall horn (as in this case). Abscesses of this type will rupture at the coronary band directly proximal to the site of initial infection. Abscesses that track under the sole will rupture at the heel, or axial wall. Sole ulcers are present at the heel-sole junction, away from the white line. Foot rot and hairy heel wart are diseases of the skin, and the symptoms of laminitis are numerous and non-specific, but inconsistent with focal coronary band swelling.

D) Ces symptômes sont communs lors d’abcès de la sole. L’infection commence à la ligne blanche et se poursuit sous la corne de la sole jusqu’au corium ou sous la corne de muraille (comme c’est le cas ici). Les abcès de ce type vont éclater à la bande coronaire directement proximalement au site de l’infection initiale. Les abcès qui ont un trajet fistulaire sous la sole vont s’ouvrir au talon ou à la paroi axiale. Les ulcères de la sole sont présents à la jonction talon-sole, loin de la ligne blanche. Le piétin et la dermatite digitale sont des maladies de la peau et les symptômes de fourbure sont nombreux et non spécifiques, mais incompatibles avec une enflure de la bande.

Answers to Quiz Corner
Les réponses du test éclair

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Answers to Quiz Corner
Les réponses du test éclair
The Art of Private Veterinary Practice
L’art de la pratique vétérinaire privée

Cold-call communication

Myrna Milani

When Dr. Bogart arrives home more than an hour later than she told her family to expect her, it is difficult to tell who is more upset: the veterinarian or her family. Her daughter is annoyed that her carefully prepared casserole is overbaked. Her son complains because he could have stayed longer at his friend’s home working on a school project. Her partner gives her “the look” that translates, “Another unscheduled phone call or walk-in?”

Because quality communication skill plays such an important role in successful practice, veterinarians who master it soon become aware of the costs of this skill as well as its benefits. During her scheduled office hours, Dr. Bogart has minimal trouble taking time to talk to clients she knows will a) concisely describe the animal’s problem, b) carefully listen to her recommendations, and c) reliably implement them. Although she sometimes may feel put out by such calls when these negatively impact her other activities, for the most part she can justify any inconvenience because these people are good clients.

It is the rambling, unscheduled calls that wear Dr. Bogart down. While her family becomes increasingly irritated by her tardiness, she finds herself on an emotional roller coaster as she listens to Ms. Gabrieli talk about her 19-year-old cat, Fidelio. The veterinarian fully understands that her geriatric client is terrified of losing her only companion even as Ms. Gabrieli faces failing health herself. But Dr. Bogart also knows that Fidelio’s many complex and overlapping problems make it impossible to give his owner the kind of definitive answers she wants in response to her random phone calls. Furthermore, she knows that Ms. Gabrieli knows this because they have discussed this many times — providing the client’s memory remains reliable. Although the woman seems lucid enough when she calls, the practitioner cannot rule out the possibility that her client’s memory might not be as good as it used to be.

Unsolicited or cold-calls from clients like Ms. Gabrieli can be stressful for practitioners because they may elicit all kinds of conflicting emotions. Dr. Bogart appreciates that her client loves Fidelio and cannot bear the thought that he could die. She also recognizes that Ms. Gabrieli is very lonely. Consequently, the veterinarian does not feel that she can refuse to take the client’s calls. But at the same time, Dr. Bogart knows that doing this reinforces the client’s behavior. It also means taking time away from other clients and patients, as well as sometimes denying herself the necessary restorative benefits of interactions with family and friends.

In situations like this, repeatedly asking the client to set up specific phone appointments often does not work because doing so does not address the client’s loneliness. Compare this to Dr. Bogart asking Ms. Gabrieli to keep a journal of Fidelio’s daily activities. This includes how often and how much he eats and drinks, what he eats, how often he uses the litter box, details about his urine and stool, his sleep patterns, how much interest he shows in his surroundings, including his interest in play. At that time, the practitioner also sets up a specific time for Ms. Gabrieli to call “so that we can go over what you’ve discovered and make any changes necessary to help Fidelio.”

Although playing a more active role in her animal’s health hopefully will add more meaning to the client’s life, this is not mere busywork to keep the client from bothering the veterinarian. It also guarantees that when the practitioner talks to the client, the client will be able to provide more meaningful information about the animal.

Cold-calls from long-standing clients like Ms. Gabrieli can stress even the most patient and saintly practitioner. At their worst, they may drive frustrated veterinarians to make comments to the client that they later regret. Or they may take out their frustration on colleagues, staff, or family members after-the-fact. But be that as it may, at least the veterinarian has the consolation of knowing that these clients genuinely care about their animals and want to do their best to help them, regardless how little that may be.

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

Cold-call: Calling or visiting a prospect (who may not know the visitor/caller) without a prior appointment.

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“True,” admits Dr. Bogart. “Even if Ms. Gabrieli’s current willingness to keep a journal and call at specific times to discuss Fidelio wanes over time, it’s impossible to deny how much he means to her. Plus once I know this approach has merit, I can adjust her ‘assignments’ to keep her busy and me better informed.”

Another group of cold-callers create even greater communications challenges for practitioners. Unlike the Ms. Gabrielis of the world, these people are not clients, never have been clients, and often vanish as soon as they get the service they want from the veterinarian. Like most practitioners, Dr. Bogart would not refuse to see an animal experiencing a true emergency, regardless how demanding or inconsiderate the owner might be. But when someone she does not know calls or drops in and expects her to immediately provide some non-emergency service strictly for that person’s own convenience, she flounders.

“’No matter how I look at it, I consider it a no-win situation for me,” she acknowledges. “Before I even open my mouth I have to dissipate all kinds of negative emotions and assume a reasonably professional demeanor. I also know that, if I give these people what they want, I can’t rationalize denying that same service to them or others in the future. That makes me feel even more abused. But even if I never see them again, I worry that they may tell others in the area that I refused to help them and their animals. That could hurt my business. Regardless what I do, I never feel like I’m in control of the situation.”

Whereas Dr. Bogart inevitably gives in to the unknown callers’ demands even if she hates herself for doing so afterward, her colleague, Dr. Yanover, takes a more impulsive approach. How he responds depends on his mood and what he is doing when the call occurs. If he is in a good mood and has time, he treats a cold-caller the same way he would one of his regular clients. But if he is in a bad mood for any reason, e.g., facing a packed schedule or in dire need of some sleep after a series of legitimate night emergencies, these people will feel the full force of his anger.

Obviously neither of these responses is optimal. Allowing strangers to treat her like a doormat eventually will take its toll on Dr. Bogart as well as her family. Whereas her established relationship with clients like Ms. Gabrieli enables her to rationalize giving in to their demands, she feels no such allegiance to unknown cold-callers. Consequently, each such interaction leaves her feeling frustrated and angry for hours afterward. And although Dr. Yanover’s venting may make him feel better, his staff members and others around during his angry outbursts or those who hear about them may wonder if he treats animals the same way.

In these situations, preparation pays big dividends. Preparing a basic response to unknown cold-callers and then practicing it to the point that it flows naturally when these situations arise places the veterinarian in a position of authority from the beginning. In this scenario, Dr. Bogart’s first response to a request for immediate non-emergency care is to thank the person for their interest in the clinic. Then without giving the other the time to respond, she continues with, “’We work on an appointment-only basis to ensure that all of our patients and clients get the best care. Because this isn’t an emergency, may I set up an appointment for you and your dog so the staff and I can give you the benefit of our full attention?’

In addition to enabling the practitioner to respond in a professional manner, the essence of a carefully crafted response can be repeated as many times as necessary for the cold-caller to get the message. Admittedly there may be those self-absorbed individuals who become angry and frustrated when they cannot manipulate the practitioner. But because the practitioner truthfully defines ensuring optimal care for the animal as the reason for the policy, it is easier for her to stand firm and politely terminate the conversation.

In The Temple of Glas, 15th century monk John Lydgate wrote, “You can please some of the people all of the time, you can please all of the people some of the time, but you can’t please all of the people all of the time.” Accepting this reality will enable practitioners bedeviled by known and unknown cold-callers to prepare strategies that, at best, will re-educate and, at worst, discourage these people in a professional manner. This will enable those in private practice to sustain quality patient and client care, as well as their own well-being.
What Can’t Be Taught
Ce qui ne s’enseigne pas

Dr. Marc Philippot

A fter graduating from veterinary school, I moved back to my home province of Manitoba to begin, I hoped, my career as a mixed animal practitioner. Now as I sit in my office, trying to write this article, I have to remind the reader and myself that I graduated 16 years ago. What possibly can I offer to new grads in advice about my first year, or years, in practice? Can I even remember that long ago? Sure, I had some difficult cases then, like now: a horse with immune-mediated thrombocytopenia, the first outbreaks of West Nile virus in Manitoba, the BSE crisis in cattle, an iguana with a fractured mandible and certainly being fooled by a sick golden retriever with Addison’s disease; just to name a few.

As well, I certainly cannot forget my other life choices during this time. Falling in love, getting married, having kids. There is also agreeing to buy my first mixed animal practice in my home town, a month prior to BSE. I convinced myself that things would be okay. I had dairy farms and the PMU industry in the area to fall back on. LOL! But 10 years later, I was back at it, buying another mixed animal practice and its satellite clinic to complement my first business.

But why stop there — how about volunteering with local community groups or becoming president of the Manitoba Veterinary Medical Association.

So, the advice I give today, comes more from these past 16 years, instead of my first year. Recognize value — the value you give to your clients, the value your employees or coworkers or employer bring to the team, the value of time with loved ones.

We as employers often hear about or discuss value. If clients feel that they got more out of you, compared to what they paid for, they got value. I believe this to be true; I’ve seen it and I preach it. If you charge a client $50 for something, make them feel they got $100 worth. One way to achieve this, in my opinion, is through good communication. Do not feel you have to educate clients; far too many times the client smiles and nods and walks away. You feel good, but they left confused. Therefore, don’t educate, communicate! Through communication, both sides are talking, asking questions and getting to the point. Clients do value this time, and remember, you still have to sound knowledgeable.

The same goes to your staff and/or coworkers. If you cannot communicate effectively with them, nothing gets done right. You end up with upset people, and worse, a toxic environment. Don’t forget to say hello or goodbye — you never know if that’s the last time you’ll see them. We lost an employee a few years ago. She was driving to work and died in an automobile accident. You just never know. Give praise where praise is due. Even for the little things. Thank you or great job can go a long way.

My wife has three plaques with quotes above the toilet, I read them every day. Her favorite is… “Life is not measured by the number of breaths we take, but by the moments that take our breath away.” Now, I don’t care what generation you may belong to. All I know is that I was raised to work hard, be kind and respectful, and do the job right the first time. Therefore I like to think I work hard, and in our career, that sometimes involves long hours. So, I do the task at hand; however, this may sacrifice family time. If it was not for my wife, I probably would miss even more things. I see my younger colleagues trying to enjoy life and value their time with their loved ones. I see my older colleagues wondering what the younger ones are doing (and I admit, I question them too). Maybe its envy. But as I write this, I remember a conference I was at recently and overheard an older colleague say to another that he was a terrible father, always working, never seeing his kids grow up and that he hoped to be a better grandfather. Now I hope his kids don’t feel that way, many of us had parents who worked a lot. But if this is how we as a profession feel, then value your time with your loved ones. Don’t forget to try and take that time when available with them and make some memories. Work does not always allow me to be there with my family, they understand that and they appreciate that I try.

So there you have it, something that was not taught to me at school, at least not directly. Someone once said… “Try not to become a man of success, but rather try to become a man of value.” Something to live by…
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