B ill 27

NOVA SCOTIA VETERINARY MEDICAL ASSOCIATION
Registrar's Office
15 Cobequid Road, Lower Sackville, NS B4C 2M9
Phone: (902) 865-1876 Fax: (902) 865-2001
E-mail: **nsvma@ns.sympatico.ca**

September 24, 2018

Dear Chair, and committee members,

My name is Dr Melissa Burgoyne. I am a small animal veterinarian and clinic owner in Lower Sackville, Nova Scotia. I am currently serving my 6th year as a member of the NSVMA Council and currently, I am the past president on the Nova Scotia Veterinary Medical Association Council. I am writing today to express our support of Bill 27 and what it represents to support and advocate for those that cannot do so for themselves.

As veterinarians, we all went into veterinary medicine because we want to help animals, prevent and alleviate suffering. We want to reassure the public that veterinarians are humane professionals who are committed to doing what is best for animals, rather than being motivated by financial reasons.

We have Dr. Martell-Moran's paper (see attached) related to declawing, which shows that there are significant and negative effects on behavior, as well as chronic pain. His conclusions indicate that feline declaw which is the removal of the distal phalanx, not just the nail, is associated with a significant increase in the odds of adverse behaviors such as biting, aggression, inappropriate elimination and back pain. The CVMA, AAFP, AVMA and Cat Healthy all oppose this procedure. The Cat Fancier's Association decried it 6 years ago.

As for the other medically unnecessary cosmetic surgeries, I offer the following based on the Mills article. In the middle ages, tail docking was performed to lessen the risk of injury to tails in hunting and fishing dogs. Recent studies show that less than 1% of working dogs and 0.53 % of non-working dogs actually experience tail injuries. This is an intensely painful procedure done without analgesia or anesthetic. Self-mutilation at the surgical site for up to 1 year post operatively has been documented as well as possible neurologic pain development at the amputation site. Eighty percent of humans experience phantom pain post limb amputation; therefore, we must assume that neuropathic pain occurs in dogs as well. The need for social communication is also relevant with longer tails, because dogs rely on body language and shorter tails have been shown to lead to negative interactions with other dogs. Overall this concludes that tail docking is an unnecessary procedure.

The historical reason to remove dewclaws was to prevent injury of accidental tearing. The forelimb dewclaws are typically attached by bone whereas the hind dewclaws can be attached by skin or bone. To date no research has been done to prove or disprove injury reports but with any surgical procedure there is always the potential for acute and chronic pain. In my practice we do not commonly see dewclaws injuries, more so nail injuries and the prevalence is just as high for no dewclaw digits as it is for dewclaws and rarely require surgical intervention.

Historically, ear cropping was done to prevent ear damage during hunting and fishing. There is no evidence to support claims that ear cropping actually reduces injury in working dogs. The acute pain that is evident is significant. This procedure is actually no longer taught in veterinary schools as it is deemed unethical and unnecessary.

On behalf of the NSVMA, I am here to support Bill 27 and the enforcement officers who require more authority to hold those accountable for the unnecessary suffering of animals. The NSVMA has banned these procedures under our Code of Ethics as we want to be the leaders in animal welfare and alleviate undue suffering at the hand of humans.

Thank you for your time today.

Sincerely

Dr Melissa Burgoyne
NSVMA past president
Small animal veterinarian/owner

Original Article

Journal of Feline Medicine and Surgery
1–9

DOI: 10.1177/1098612X17705044
journals.sagepub.com/home/jfms
This paper was handled and processed by the American Editorial Office (AAFP) for publication in *JFMS*
SAGE

Pain and adverse behavior in declawed cats

Nicole K Martell-Moran[1], Mauricio Solano[2] and Hugh GG Townsend[3]

Abstract

Objectives The aim of this study was to assess the impact of onychectomy (declawing) upon subsequent development of back pain and unwanted behavior in cohorts of treated and control cats housed in two different locations.

Methods This was a retrospective cohort study. In total, there was 137 declawed and 137 non-declawed cats, of which 176 were owned cats (88 declawed, 88 non-declawed) and 98 were shelter cats (49 declawed and 49 non-declawed). All cats were physically examined for signs of pain and barbering. The previous 2 years of medical history were reviewed for documented unwanted behavior such as inappropriate elimination and biting with minimal provocation and aggression. All declawed cats were radiographed for distal limb abnormalities, including P3 (third phalanx) bone fragments. The associations of declaw surgery with the outcomes of interest were examined using χ^2 analysis, two sample *t*-tests and manual, backwards, stepwise logistic regression.

Results Significant increases in the odds of back pain (odds ratio [OR] 2.9), periuria/perichezia (OR 7.2), biting (OR 4.5) and barbering (OR 3.06) occurred in declawed compared with control cats. Of the 137 declawed cats, 86 (63%) showed radiographic evidence of residual P3 fragments. The odds of back pain (OR 2.66), periuria/perichezia (OR 2.52) and aggression (OR 8.9) were significantly increased in declawed cats with retained P3 fragments compared with those declawed cats without. Optimal surgical technique, with removal of P3 in its entirety, was associated with fewer adverse outcomes and lower odds of these outcomes, but operated animals remained at increased odds of biting (OR 3.0) and undesirable habits of elimination (OR 4.0) compared with non-surgical controls.

Conclusions and relevance Declawing cats increases the risk of unwanted behaviors and may increase risk for developing back pain. Evidence of inadequate surgical technique was common in the study population. Among declawed cats, retained P3 fragments further increased the risk of developing back pain and adverse behaviors. The use of optimal surgical technique does not eliminate the risk of adverse behavior subsequent to onychectomy.

Accepted: 23 March 2017

Introduction

The onychectomy procedure (declawing) is performed across the USA and Canada to eliminate the possibility of property destruction and scratches. Medical indications for the procedure include removal of nail bed neoplasms and paronchia. Some believe that declawing will stop the spread of zoonotic diseases to immunocompromised cat owners.[1–3] To avoid disease transmission from scratches, the Centers for Disease Control and Prevention recommend flea prevention, keeping cats indoors, away from strays and avoiding rough play with cats. However, declawing is not a recommended part of their strategy.[4] The documented increased biting behavior of declawed cats can lead to more severe disease in people than cat scratches.[5] In one study of cat-inflicted wounds presented to an emergency room, none of the cat scratches resulted in infection, whereas 20% of bite puncture wounds became infected, with several requiring

[1]Feline Medical Center, Houston, TX, USA
[2]Cummings Veterinary Medical Center at Tufts University, North Grafton, MA, USA
[3]Department of Large Animal Clinical Sciences, Western College of Veterinary Medicine, University of Saskatchewan, Saskatoon, Saskatchewan, Canada

Corresponding author:
Nicole Martell-Moran DVM, MPH, Feline Medical Center, Houston, TX, USA
Email: nkmartell@live.com

hospitalization.[6] Cat-bite infection rates on hands can be as high as 30–50%.[7]

There are several surgical techniques reported for removing the claw, including scalpel and laser disarticulation of the distal phalanx and use of guillotine nail clippers to cut a portion of the distal phalanx, leaving the articular base with the deep digital flexor tendon attached.[8–10] There have been studies addressing postoperative morbidity in declawed cats related to the development of lameness, reluctance to ambulate, chewing at the digits, paw swelling, nail regrowth, postoperative bleeding, infection and persistent pain, among others.[5,8–13] The procedure remains a common practice in North America, although eight cities in California have banned the procedure from veterinary practice.[14]

Most veterinary associations do not recommend declaw surgery without first attempting to train the cat. The American Animal Hospital Association states that it is opposed to the procedure except as a last resort and if the cat's adoptability is in jeopardy.[15] The American Association of Feline Practitioners' declawing position statement conveys the AAFP's strong belief that it is the obligation of veterinarians to provide cat owners with alternatives to declawing; also stressing the importance of informed client consent and acknowledging the possibility of negative side effects to the cat.[16] The American Veterinary Medical Association (AVMA) opposes declawing wild and exotic cats for non-medical reasons,[17] but states that declawing domestic cats is warranted after training methods have failed.[18]

The AVMA position statement also states that leaving a segment of the distal phalanx with flexor tendon attached may be desirable, citing a study from 1979.[18] The AVMA's Literature Review on the Welfare Implications of Declawing of Domestic Cats, published in 2016, also states that veterinarians may choose to retain a part of the distal phalanx to improve function of the foot.[19] However, the standard of care in the past decade for performing an onychectomy, as determined by Diplomates of the American College of Veterinary Surgeons, is to disarticulate the distal phalanx from P2, to sever the deep digital flexor tendon and to remove the entire P3 (third phalanx).[1,20–23] Anatomically, the nail is a modified layer of the epidermis that encases the unguicular hood and unguicular process. It has two distinct portions: the cornified claw sheath, which surrounds the unguicular hood, and the horn, which encases the unguicular process. The nail grows from the root of the cornified claw sheath. If a portion of the articular base of P3 is left behind during a declaw, there will be no new nail growth as the articular base of P3 is not attached to the cornified claw sheath.[24] One study linked the presence of P3 bone remnants to claw regrowth,[8] but not to the amount of P3 remaining or to other pathological or behavioral findings such as back pain, biting or inappropriate elimination.

The long-term impact of declawing cats and the effect it may have on weightbearing adjustments, chronic pain and other musculoskeletal diseases is unknown. Pain identification and management in cats has evolved significantly over the past decade. Cats manifest pain in a wide variety of forms, including, but not limited to, inappropriate elimination, flinching, increased body tension, excessive licking or chewing of fur (barbering) and other abnormal behaviors.[25–27] Musculoskeletal pain is the most overlooked cause of pain in cats given that they instinctively attempt to hide it, leading to owners' and veterinarians' inability to identify it.[25,26] Studies in human amputee patients have shown various sequelae, including back pain.[28,29]

In a PubMed search in June 2016 using the keywords 'declaw or onychectomy', no studies incorporating a modern pain assessment tool, with or without controls and aimed at revealing the presence of pain in declawed cats years after onychectomy, were found. One study identified a lack of a sensitive pain assessment tool in published declaw studies reviewed.[30] There is also a lack of published research in declawed cats with respect to the prevalence of long-term disease, other than nail regrowth, associated with P3 bone remnants. This is an important consideration given that an estimated 25% of the US domestic cat population is declawed.[11]

The purposes of this study were: (1) to determine if there was an association between the surgical procedure of declawing a cat and biting behavior, aggression, inappropriate elimination, back pain and barbering; (2) to determine the prevalence of P3 fragments remaining after declaw surgery; and (3) to determine if P3 fragments were associated with back pain, increased biting behavior, aggression, inappropriate elimination or barbering compared with declawed cats without P3 fragments.

Materials and methods

Sample population

The study population was comprised of a convenience sample of two cohorts of animals: declawed and non-declawed cats. The animals were sourced from two locations: owned cats presented to a veterinary clinic and relinquished cats housed in an animal shelter. Declawed owned cats were selected in sequential order of appointments in the veterinary clinic, no matter what the presenting reason, including wellness or diagnostic examinations, grooming, dentistry or received for boarding. Non-declawed owned cats were also selected sequentially by appointment until all of the declawed cats were age matched by year. Declawed cats from the shelter were included sequentially during routine examinations after relinquishment. Non-declawed cats from the shelter were chosen in sequential order of cages in the building based on age, by year, to match the declawed cats already represented in the study. The cages within the shelter were not divided by illness, reason for relinquishment or temperament. All cats in this study were spayed or neutered. Quarantined, unsocialized, primarily outdoor or feral cats were not included.

Each cat was physically examined, its age recorded and the last 2 years of history were assessed with respect to the method of declaw, and the presence of the outcomes of interest. In addition, radiographs were taken of the declawed limbs. All physical examinations and medical record assessments were performed by one of the authors (NM). Inclusion of the shelter cats in this study was approved by the medical manager and chief operating officer. All protocols were executed under the internal guidelines set forth for the ethical use of animals by the shelter.

Radiographic evaluation

With the owner's verbal permission, a single lateral and occasionally a dorsopalmar digital radiograph of the declawed limbs was obtained. The animals were not sedated unless this was required for other reasons. In a minority of cases, all four limbs were included in a single projection. To achieve unimpeded views of the surgery site, a very slight supination of the manus at the level of the carpus or raising the end of the paw slightly away from the detector was performed.

The owners, clinic staff and shelter staff were aware that the radiographs were part of a study; however, they were not aware of the study hypothesis. All radiographs were examined by a diplomate of the American College of Veterinary Radiology (MS) who was aware of the study hypothesis but unaware of the history and physical findings for each cat radiographically examined. Both front and all four limb declawed cats were included in this study; however, any cats with a previous history of orthopedic trauma, such as fracture, were excluded. Each radiograph was assessed for presence of P3 bone, interdigital osteoarthritis and visible signs of remodeling of the second phalanx. Digital radiographs, taken in the medical digital format (DICOM), were converted into a lossy electronic image format (JPEG) and saved for evaluation by one of the authors (MS). All declawed digits were placed into one of four categories: (1) all of P3 removed; (2) <25% of the articular base of P3 remaining; (3) 25–50% of P3 remaining; or (4) only the distal end of the ungual process removed (Figure 1). All findings were recorded in a Microsoft Excel spreadsheet.

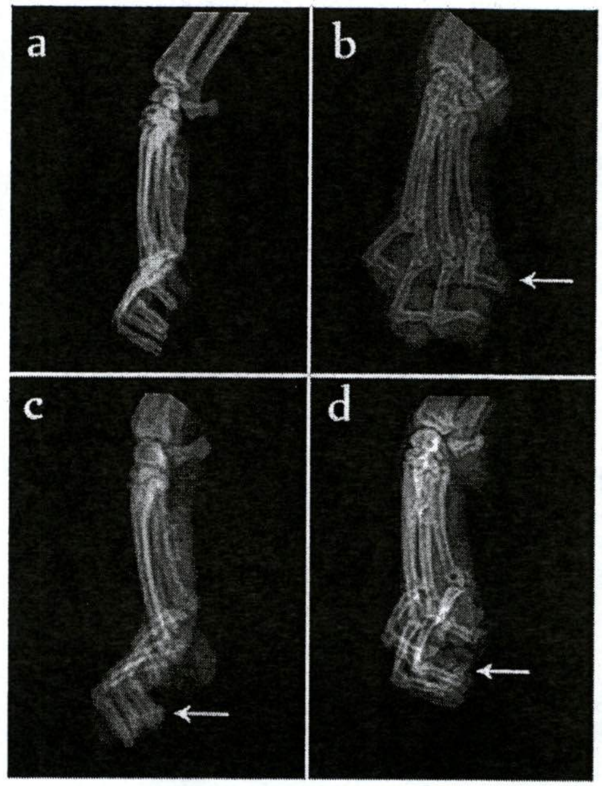

Figure 1 Four radiographic projections of the manus of four subjects in the study. The arrows indicate fragments left behind after onychectomy. The entire P3 has been removed in projection (a); <25% of the distal phalanx remains in (b); while >25% percent remains in (c); and only the tip of the distal phalanx has been removed (d)

Health and behavioral outcomes

Each cat was evaluated for pain using the 'signs of pain' table from the 2007 AAHA/AAFP Pain Management Guidelines for Dogs and Cats.[25] Palpation of the back was accomplished by applying moderate, even pressure with the thumb and middle finger over the transverse processes and musculature from the first thoracic vertebra to the first three caudal vertebrae. Cats showing a reaction such as flinching, exaggerated arching ventrally or tucking of the hips, hissing, or attempting to bite or flee during muscle and vertebral palpation were deemed painful only when loss of normal behavior or expression of abnormal behaviors could also be identified via the aforementioned guidelines. Those cats that reacted questionably to palpation were deemed non-painful. Those cats that reacted negatively to palpation but did not show loss of normal behavior or expression of abnormal behaviors were classified as non-painful. Any cat with known previous trauma (eg, fracture) or congenital or developmental condition (eg, hip dysplasia) was excluded from the study.

Biting history was determined through the presence of pre-existing alerts entered into the medical record by handling technicians or groomers indicating that the cat was prone to biting, a verbal warning in the examination room from the owner that the cat will bite or a recorded consultation with a veterinarian about biting behavior. Medical record alerts with regard to biting were added to the medical record by non-veterinary staff when touching, handling or light restraint (eg, petting, moving their position, lifting, and holding for nail trims or vaccinations) provoked attempts to bite.

A cat was listed as aggressive if a documented incident occurred during a veterinary visit or the owner reported unprovoked attacks by the cat when at home. Cats in a shelter setting were determined to be aggressive based on a history of attacking the owners, their children or shelter staff, or when a veterinarian documented that the cat had lunged at any person without provocation.

Inappropriate elimination behavior was determined by one or more episodes documented in the medical history in the previous 2 years, with or without a documented medical cause and included both periuria (inappropriate urination) and perichezia (inappropriate defecation). Inappropriate elimination in shelter cats was based on the listed reason for surrender being inappropriate elimination, or documented episodes of not using the litterbox while in a cage or free-roaming room. Cats with known urinary tract disease were not excluded from this study.

In this study, a cat was included in the barbering category when there was no evidence of a primary skin condition causing the hair loss and the behavior. Not all barbering cats were subjected to a full range of diagnostic procedures to rule out primary skin disease (ie, skin scrapings, food trials, blood tests). However, all cats included in the study were required to be current on topical monthly veterinary-obtained flea prevention. Any cat with visible evidence of fleas, a primary skin condition or potential for secondary endocrine cause (ie, hyperthyroidism) was excluded from the study.

Statistical methods

The two cohorts in the primary study were assembled after the outcomes of interest had occurred and therefore this was classified and analyzed as a retrospective cohort study. The cats were sourced from two locations, owned cats admitted to a veterinary practice and relinquished animals in an animal shelter. During the design phase of the study, age was assumed to be an important confounder in the relationship between onychectomy and the outcomes of interest. Therefore, at both locations, declawed cats and their controls were matched by year of age. The data related to all animals in the two cohorts were analyzed using χ^2 analysis and logistic regression (Statistix version 10). Initially, the univariate association of declaw surgery and animal location with each of the outcomes of interest (back pain, periuria/perichezia, biting, aggression and barbering) was assessed using χ^2 analysis. Subsequently, the combined association of declaw surgery and location, along with their interaction term (declaw surgery*location), was assessed using manual, backwards, stepwise, logistic regression. With this approach, each model was developed by starting with all three variables in the model and then manually removing them from the model based on the magnitude of their *P* values (highest *P* values removed first). Variables with *P* values <0.05 were considered significant and retained in the final models. In those instances where both declaw status and animal location were associated with one of the outcomes, confounding was deemed to be present if there was a 10% difference between the crude and adjusted odds ratios (ORs).

Primary analysis of the study data suggested that retention of P3 fragments in declawed cats may have had an impact upon the occurrence of adverse outcomes and that optimal surgical technique could be associated with fewer adverse outcomes. As a consequence, further analysis of the study data related to all 274 cats was undertaken by first assigning all study animals to one of three mutually exclusive cohorts – not declawed; declaw surgery leaving no P3 fragments; and declaw surgery resulting in retained P3 fragments – and then subsequently comparing the odds of adverse outcomes among the cohorts. Indicator variables were created for the three surgical outcomes so that declawed cats with and without P3 fragments could be compared with their non-surgical controls. The combined association of surgical status and animal location with each of the outcomes of interest was then assessed using manual, backwards, stepwise, logistic regression. Initially, both indicator variables for the declawed animals, along with their location, were entered into the models and then manually backed out based on the magnitude of their *P* values. Both indicator variables were retained in the final models if either attained a *P* value of <0.05. Similarly, animal location was retained in the final model when the *P* value was <0.05. Potential confounding and interaction were assessed as described above.

In order to determine if declawed cats with retained P3 fragments were at greater risk of experiencing adverse outcomes than those having the entire P3 excised, a secondary analysis that included only the 137 declawed cats was performed. As with the previous analyses, the potential effect of surgical status and animal location was assessed using manual, backwards, stepwise, logistic regression. Age was also included as a potential risk factor in this analysis. Variables were retained in the final models when their *P* value was <0.05. Confounding and interaction were assessed.

Results

Among the 274 cats in the study, 137 had been declawed and 137 had not. There were 88 declawed and 88 non-declawed owned cats, examined at a veterinary clinic, and 49 declawed and 49 non-declawed cats examined in a shelter setting. The mean $\pm$ SD age of the cats was 8.0 $\pm$ 4.1 years (range 1–17 years).

Table 1 Summary of clinical outcomes in 274 declawed and non-declawed cats located at two different sites

		Shelter		Home	
		Declawed (n = 49)	Control (n = 49)	Declawed (n = 88)	Control (n = 88)
Back pain	Yes	22	7	17	10
	No	27	42	71	78
Periuria/perichezia	Yes	25	5	31	7
	No	24	44	57	81
Biting	Yes	13	1	20	8
	No	36	48	68	80
Aggression	Yes	3	1	11	4
	No	46	48	77	84
Barbering	Yes	8	3	6	2
	No	41	46	82	86

Table 2 Multivariate models of factors significantly associated with back pain and adverse behavior in 274 declawed and non-declawed cats

	Factor	OR	95% CI	*P* value
Back pain	Declawed	2.90	1.53–5.48	0.001
	Location	2.41	1.31–4.44	0.005
Periuria/perichezia	Declawed	7.20	3.64–14.26	<0.001
Biting	Declawed	4.51	2.07–9.84	<0.001
Aggression	Declawed	3.00	1.05–8.59	0.04
Barbering	Declawed	3.06	1.06–8.80	0.04
	Location	2.07	1.04–7.03	0.04

OR = odds ratio; CI = confidence interval

Radiographic assessment

Raising the end of the paw slightly away from the detector was more effective than the supination method in eliminating superimposition of the digits (Figure 1). Dorsopalmar or dorsoplantar views were of little value, as the normal flexed position of the second phalanx placed it at a 90° angle in relation to the detector and this often obscured the surgery site.

Among the 137 declawed cats, 86 (63%) showed radiographic evidence of residual P3 fragments. Of these, 31 (36%) had P3 fragments measuring <25% of the bones, 29 (34%) had fragments equivalent in size to 25–50% of the P3, and 26 (30%) showed evidence of having had only the ungual process removed. Four cats with externally visible nail regrowth had only the distal end of the ungual process removed when declawed. Thirty-three of the 137 (24%) cats were declawed on all four limbs. Although the technique used for all cats was unknown and could not be assessed statistically, all three methods (scalpel blade, guillotine and laser) were represented in the cats with retained P3 fragments (data not shown). Eleven cats also had radiographic evidence of P2 bone remodeling.

Health and behavioral outcomes

A summary of the data relative to the two age-matched cohorts, declawed and non-declawed cats, is presented in Table 1 and the final multivariate models developed during the primary analysis of the data are presented in Table 2. This analysis included all 274 animals in the study and shows that subsequent to onychectomy, the odds of back pain (OR 2.90), periuria/perichezia (OR 7.20), biting (OR 4.51), aggression (OR 3.00) and barbering (OR 3.06) were significantly increased in the 137 declawed cats as compared with their 137 non-declawed controls. In addition, there was a combined but independent association of being located at the shelter with both back pain (OR 2.41) and barbering (OR 2.70). No evidence of confounding or interaction was detected.

The results of the analysis of the data related to all 274 animals that was aimed at determining the impact of retained P3 fragments upon the occurrence of adverse outcomes are summarized in Table 3. Comparison of the two declaw cohorts (86 declawed cats with fragments and 51 without) with their 137 non-declawed controls showed that those with retained P3 fragments were at greater odds of back pain (OR 3.9), inappropriate elimination (OR 9.9), biting (OR 5.5), aggression (OR 4.7) and/

Table 3 Multivariate models of the association of P3 fragment retention with the occurrence of back pain and adverse behavior in 274 declawed and non-declawed cats

	Factor	OR	95% CI	*P* value
Back pain	Not declawed	Referent		
	P3 fragments: no	1.54	0.63–3.75	0.34
	P3 fragments: yes	3.94	1.99–7.84	<0.001
	Location	2.45	1.32–4.56	0.005
Periuria/perichezia	Not declawed	Referent		
	P3 fragments: no	3.94	1.68–9.26	0.002
	P3 fragments: yes	9.94	4.80–20.58	<0.001
Biting	Not declawed	Referent		
	P3 fragments: no	3.05	1.14–8.17	0.03
	P3 fragments: yes	5.51	2.42–12.54	<0.001
Aggression	Not declawed	Referent		
	P3 fragments: no	0.53	0.06–4.56	0.56
	P3 fragments: yes	4.7	1.61–13.71	0.005
Barbering	Not declawed	Referent		
	P3 fragments: no	1.67	0.38–7.31	0.5
	P3 fragments: yes	3.95	1.31–11.92	0.015
	Location	2.72	1.04–7.10	0.04

OR = odds ratio; CI = confidence interval

or barbering (OR 4.0), whereas declawed cats without P3 fragments were only at increased odds of biting (OR 3.1) and inappropriate habits of elimination (OR 3.9).

A summary of the data related to the impact of retained P3 fragments in the 137 declawed cats is presented in Table 4, and the final multivariate models are presented in Table 5. This secondary analysis revealed an increase in the combined odds of back pain (OR 2.7) and location in the animal shelter (OR 3.6) among declawed cats with P3 fragments compared with those without. Also, declawed cats with P3 fragments were at increased odds of demonstrating periuria/perichezia (OR 2.5) and aggression (OR 8.9) compared with those without retained P3 fragments. The age of the animal was not related to any of the outcomes (P >0.4). Neither confounding nor significant interaction were detected in this analysis

Discussion

Although illegal in most other developed countries, declawing is a common practice in Canada and the USA. There is little published information regarding the long-term health effects of declawing in the cat. The current study shows a clear association between declawing and the presence of deleterious side effects after the typical postoperative period in a comparatively large sample population.

The primary analysis of the cohort data comparing declawed cats and a non-declawed control group shows that the odds of the highly undesirable habits of elimination, periuria and/or perichezia were much greater in declawed cats than their controls. In addition, declaw surgery was associated with a significant increase in the odds of back pain, biting, aggression and barbering. Although the causal relationship between declaw surgery and adverse outcomes has not been determined, plausible explanations do exist. Many cats express pain with a behavioral change such as biting, aggression or inappropriate elimination.[25] Clinically, we have observed that pain arising from the lower back is associated with inappropriate elimination. Similarly, if the source of pain is declawed phalanges, the act of walking on or digging in a gravel-type substrate may result in pain and aversion to use of the litter box. Many cats that eliminate outside of the litter box choose a soft substrate such as carpet, clothing or a location next to the litter box like a mat. With respect to aggression, following claw removal, a cat's only defense when upset or fearful is biting. When touched, a painful, fearful or stressed declawed cat may react by attempting to bite as it has few or no claws to scratch with. During the physical examination of the cats in this study, many biting attempts occurred when cats were lifted, creating an arched back; when they were touched or petted caudal to the middle thoracic vertebrae; or in anticipation of pain when a handler was reaching to touch the lower back or tail.

The removal of a cat's distal phalanges forces it to bear weight on the soft cartilaginous ends of the middle phalanges (P2) that were previously encapsulated within joint spaces. In this study, 11 declawed cats showed radiographic evidence of remodeling of the P2 bone. The significance of bone remodeling is unknown and was not explored in this study. There is currently no study that addresses the anatomic and pathologic changes affecting the P2 bone and cartilage that may incur over the declawed cat's lifetime. The potential for effects on the rest of the musculoskeletal system such as weightbearing among

Table 4 Summary of clinical outcome in 137 declawed cats at two locations

		Shelter		Home	
		P3 fragments (n = 31)	No P3 fragments (n = 18)	P3 fragments (n = 55)	No P3 fragments (n = 33)
Back pain	Yes	16	6	14	3
	No	15	12	41	30
Periuria/perichezia	Yes	18	7	24	7
	No	13	11	31	26
Biting	Yes	9	4	15	5
	No	22	14	40	28
Aggression	Yes	3	0	10	1
	No	28	18	45	32
Barbering	Yes	8	0	3	3
	No	23	18	52	30

other joints, arthritic changes, chronic pain elsewhere in the body or changes in bone density needs focused research. Based on the present study, a minority of cats showed remodeling of the middle phalanx. It remains unknown if the P2 remodeling was the result of damage to P2 during surgery or a mechanical pathophysiological sequela of P3 removal. Subjectively, none of the cats exhibited osteopenia and only one showed degenerative joint disease of an interphalangeal joint. However, radiographic changes in the cat do not always correlate with clinical signs. Full radiographic evaluation of more proximal joints was not included in this study.

The presence of P3 fragments in 63% of declawed cats is excessive and surprising. It reflects the use of poor or inappropriate surgical techniques, leading to increased odds of adverse outcomes in declawed cats. The primary analysis of the data related to all 274 cats in the study shows that declawed cats with P3 fragment retention are at greater odds of experiencing biting and inappropriate habits of elimination as compared with declawed cats without P3 fragment retention. To further explore the impact of P3 retention, a secondary analysis, limited to the 137 declawed cats, showed that cats with retained P3 fragments were at increased odds of back pain, periuria and/or perichezia and aggressive behavior when compared with declawed cats without fragments.

Table 5 Multivariate models of factors significantly associated with back pain and adverse behavior in 137 declawed cats with and without P3 fragments

	Factor	OR	95% CI	*P* value
Back pain	P3 fragments	2.66	1.1–6.41	0.03
	Location	3.56	1.6–7.86	0.002
Periuria/ perichezia	P3 fragments	2.52	1.2–5.32	0.02
Aggression	P3 fragments	8.9	1.15–69.13	0.03

OR = odds ratio; CI = confidence interval

The high incidence of P3 fragment retention detected in this study and its impact on long-term, adverse surgical outcomes, including back pain, were important findings and were related to performing digital radiography and standardized pain assessments on study cats. Discussions with animal owners during this study suggest that P3 fragment detection without the aid of radiographs is rare, even when claw regrowth occurs. The owners of all four cats with claw regrowth were unaware that new externally visible nail growth was present. Only one of all 137 declawed cats in this study was initially examined owing to an owner's concern that their cat showed signs of pain (eg, attempted to bite when petted caudal to the cervical vertebrae and reluctant to jump).

P3 fragment retention following declaw surgery may be the result of a variety of deficiencies in surgical technique. When using a blade, there are several portions of P3 that could be inadvertently left behind. The articular facet of the articular base of the distal interphalangeal joint is softer than the rest of the P3 and could easily be incised with a sharp scalpel blade, especially in kittens. The same is true for the flexor tubercle of the articular base of P3. When the claw is being retracted to cut the P3 away from the paw pad, the tubercle could be accidentally incised and left behind. If the entire portion of the articular facet is left behind, there is potential for a portion of the root of the cornified claw sheet to remain and for nail regrowth to occur.

Observational studies are subject to a variety of biases that should be addressed during the design, execution, analysis and interpretation of the research. Of particular concern in this retrospective study are the potential biases related to lack of blinding, diagnostic suspicion bias, and potential bias related to uncertainty of the time sequence of risk factors and the outcomes of interest. Wherever practical during the design and conduct of this study, attempts were made, through blinding of the investigators and control of confounding, to remove bias from the study. At the time of the interpretation of the radiographs, the radiologist was unaware of the clinical signs or behaviors exhibited by the animals. Owners, shelter and clinic staff were not informed regarding the study hypothesis or the outcomes of interest. During the clinical examination of the animals, the 'signs of pain' table from the 2007 AAHA/AAFP Pain Management Guidelines for Dogs and Cats was employed in an effort to increase the sensitivity and specificity of the diagnosis of back pain.[25] However, the corresponding author (NM) was aware of the clinical status of the animals during the clinical examinations and while extracting information from the medical records. Also, owing to the retrospective design of the study, it was not always possible to be certain that the development of back pain or adverse behavior was preceded by the surgery. Despite these concerns, we believe that owing to the magnitude of the ORs reported in this study, the consistency of results with previous reports and the biological plausibility of our findings that this study provides strong evidence that declaw surgery is associated with adverse outcomes. Although there may be some inaccuracies in the estimates of the ORs, we do not believe that these will have been sufficient to negate or reverse our findings. All of the outcomes for this study were decided upon during the design of the study, and not after the data had been collected. Rather than discovering one or two weak associations, the ORs related to all hypotheses were substantial and statistically significant.

The association of retained P3 fragments with the occurrence of back pain has not been previously reported. Although the ORs related to back pain were among the lowest in the study, they were too high to be the result of biased data. The presence of back pain is neither a reported nor a plausible reason for recommending onychectomy and we do not believe it reasonable to conclude that biased clinical assessment can account for the magnitude of the OR related to this outcome; that is, that the investigator was 2.9 times more likely to diagnose back pain in a declawed cat than in a non-surgical control. With regard to the consistency and plausibility of our findings, pain and inappropriate behaviors have been reported as adverse outcomes following declaw surgery. Importantly, none of the adverse behaviors, including aggression (unprovoked attacks), have been reported in the published literature as reasons for having cats declawed. If cats prone to unprovoked attacks, a highly undesirable trait, were three times more likely to be declawed than other cats, this sequence of events would almost certainly have been reported. Finally, the greater impact of poor vs optimal surgical technique on the odds of back pain and adverse behavior is plausible and further supports our conclusion that declaw surgery is related to the development of adverse outcomes for cats.

The significant but independent increases in the odds of back pain and barbering observed among animals housed in the shelter compared with owned cats were unexpected. In fact, the prevalence of all adverse outcomes were numerically increased in approximately equal proportions in both declawed and non-declawed cats in the shelter compared with the home environment. A potential explanation for this finding may be related to increased frequency and expertise in observing and recording or reporting these outcomes by shelter staff compared with owners. Whatever the explanation, it is important to note that inclusion of the location term in the models did not result in significant interaction or confounding and, therefore, the ORs relative to the impact of onychectomy were similar across the two locations.

Conclusions

This study found that declaw surgery in cats was associated with a significant increase in the odds of developing adverse behaviors, including biting, barbering, aggression and inappropriate elimination, as well as signs of back pain. There was a high prevalence of P3 fragments in declawed animals in this study and this was associated with an increase in all adverse outcomes in these animals compared with the non-surgical controls. As well, declawed cats with retained P3 fragments had higher odds of back pain, inappropriate elimination and aggression when compared with declawed cats without retained fragments. Although cats receiving optimal surgical technique had fewer adverse outcomes and lower odds of these outcomes being present, these animals were still at increased odds of biting and undesirable habits of elimination as compared with non-surgical controls. We propose that persistent pain and discomfort subsequent to declaw surgery is an important risk factor for the development of behavioral changes such as biting, aggression, barbering and inappropriate elimination. These are common reasons for the relinquishment of cats to shelters. In view of these findings, the ongoing practice of declawing cats in North America should be further questioned.

Conflict of interest The authors declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

Funding This study was funded by the authors.

References

1 Mison MB, Bohart GH, Walshaw R, et al. **Use of carbon dioxide laser for onychectomy in cats.** *J Am Vet Med Assoc* 2002; 221: 651–653.

2 Atwood-Harvey D. **Death or declaw: dealing with moral ambiguity in a veterinary hospital.** *Soc Anim* 2003; 13: 315–342.

3 Beaver BV. **Feline communicative behavior.** In: Beaver BV (ed). Feline behavior: a guide for veterinrians. 2nd ed. Philadelphia, PA: WB Saunders, 2003, pp 118–126.

4 Centers for Disease Control and Prevention. **Healthy pets healthy people.** http://www.cdc.gov/healthypets/pets/cats.html (accessed December 1, 2014).

5 Yeon SC, Flanders JA, Scarlett JM, et al. **Attitudes of owners regarding tendonectomy and onychectomy in cats.** *J Am Vet Med Assoc* 2001; 218: 43–47.

6 Dire DJ. **Cat bite wounds: risk factors for infection.** *Ann Emerg Med* 1991; 20: 973–979.

7 Kwo S, Agarwal JP and Meletiou S. **Current treatment of cat bites to the hand and wrist.** *J Hand Surg* 2011; 36: 152–153.

8 Clark K, Bailey T, Rist P, et al. **Comparison of 3 methods of onychectomy.** *Can Vet J* 2014; 55: 255–262.

9 Martinez SA, Hauptman J and Walshaw R. **Comparing two techniques for onychectomy in cats and two adhesives for wound closure.** *Vet Med* 1993; 88: 516–525.

10 Holmberg DL and Brisson BA. **A prospective comparison of postoperative morbidity associated with the use of scalpel blades and lasers for onychectomy in cats.** *Can Vet J* 2006; 47: 162–163.

11 Patronek GJ. **Assessment of claims of short- and long-term complications associated with onychectomy in cats.** *J Am Vet Med Assoc* 2001; 219: 932–937.

12 Gaynor JS. **Chronic pain syndrome of feline onychectomy.** http://www.cliniciansbrief.com/sites/default/files/sites/cliniciansbrief.com/files/4.1.pdf (2005, accessed April 5, 2017).

13 Morgan M and Houpt KA. **Feline behavior problems: the influence of declawing.** *Anthrozoos* 1989; 3: 50–53.

14 American Veterinary Medical Association. **State laws governing elective surgical procedures.** https://www.avma.org/Advocacy/StateAndLocal/Pages/sr-elective-procedures.aspx (2014, accessed April 19, 2015).

15 American Animal Hospital Association. **Declawing.** https://www.aahanet.org/Library/Declawing.aspx (accessed November 15, 2015).

16 Suska N, Beekman G, Monroe P, et al. **AAFP position statement: declawing.** *J Feline Med Surg* 2015; 17: 829–830.

17 American Veterinary Medical Association. **Declawing captive exotic and wild indigenous cats.** https://www.avma.org/KB/Policies/Pages/Declawing-Captive-Exotic-and-Wild-Indigenous-Cats.aspx (accessed April 19, 2015).

18 American Veterinary Medical Association. **Declawing of domestic cats.** https://www.avma.org/KB/Policies/Pages/Declawing-of-Domestic-Cats.aspx (accessed April 19, 2015).

19 American Veterinary Medical Association. **Literature review on the welfare implications of declawing of domestic cats.** https://www.avma.org/KB/Resources/LiteratureReviews/Documents/declawing_bgnd.pdf. (2016, accessed August 24, 2016).

20 Curcio K, Bidwell LA, Bohart G, et al. **Evaluation of signs of postoperative pain and complications after forelimb onychectomy in cats receiving buprenorphine alone or with bupivacaine administered as a four-point regional nerve block.** *J Am Vet Med Assoc* 2006; 228: 65–68.

21 Carroll GL, Howe LB and Peterson KD. **Analgesic efficacy of preoperative administration of meloxicam or butorphanol in onychectomized cats.** *J Am Vet Med Assoc* 2005; 226: 913–919.

22 Fox MW. **Questions ethics of onychectomy in cats (author's response).** *J Am Vet Med Assoc* 2006; 228: 503–504.

23 Robinson DA, Romans CW, Gordon-Evans WJ, et al. **Evaluation of short-term limb function following unilateral carbon dioxide laser or scalpel onychectomy in cats.** *J Am Vet Med Assoc* 2007; 230: 353–358.

24 Homberger DG, Ham K, Ogunbakin T, et al. **The structure of the cornified claw sheath in the domesticated cat (*Felis catus*): implications for the claw-shedding mechanism and the evolution of cornified digital end organs.** *J Anat* 2009; 214: 620–643.

25 Hellyer P, Rodan I, Brunt J, et al. **AAHA/AAFP pain management guidelines for dogs and cats.** *J Feline Med Surg* 2007; 9: 466–480.

26 McKune C and Robertson S. **Analgesia.** In: Little S (ed). The cat clinical medicine and management. St Louis, MO: Elsevier Saunders, 2012, pp 90–111.

27 Ciribassi J. **Understanding behavior: feline hyperesthesia syndrome.** *Comp Cont Educ Pract* 2009; 31: 116.

28 Ehde DM, Czerniecki JM, Smith DG, et al. **Chronic phantom sensations, phantom pain, residual limb pain, and other regional pain after lower limb amputation.** *Arch Phys Med Rehab* 2000; 81: 1039–1044.

29 Ehde DM, Smith DG, Czerniecki JM, et al. **Back pain as a secondary disability in persons with lower limb amputations.** *Arch Phys Med Rehab* 2001; 82: 731–734.

30 Wilson DV and Pascoe PJ. **Pain and analgesia following onychectomy in cats: a systematic review.** *Vet Anaesth Analg* 2016; 43: 5–17.

Reference Point

A review of medically unnecessary surgeries in dogs and cats

Katelyn E. Mills BSc

Marina A. G. von Keyserlingk PhD

Lee Niel PhD

From the Animal Welfare Program, Faculty of Land and Food Systems, University of British Columbia, Vancouver, BC V6T 1Z6, Canada (Mills, von Keyserlingk); and the Department of Population Medicine, Ontario Veterinary College, University of Guelph, Guelph, ON N1G 2W1, Canada (Niel).

Address correspondence to Dr. Niel (lee.niel@uoguelph.ca).

In ancient Rome, during the First Century CE, Lucius Columella wrote that it was proper to remove the tails of puppies to prevent their growth to an "abominable length" and to prevent madness, which is presumed to refer to rabies.[1] Although the idea that this procedure could protect dogs against rabies has long since been abandoned, tail docking is still commonly performed, both because of a belief that it reduces the incidence of injuries and because of the resulting perceived improvements in aesthetics. However, the effectiveness of this procedure in preventing injuries has been questioned, and the idea of performing this and other surgical procedures on animals solely for cosmetic reasons has been heavily criticized in many parts of the world.[2] In fact, some countries have passed legislation restricting these types of surgeries. While anecdotal reports suggest that certain cosmetic procedures such as ear cropping are in decline in North America, to our knowledge there are no reliable estimates on the numbers of these procedures performed annually.

Most surgical procedures performed on dogs and cats in North America are performed for therapeutic, diagnostic, or preventive purposes; that is, they are medically necessary. In contrast, procedures that are not necessary for maintaining health or that are not beneficial to the animal can be classified as MUSs. This would include procedures performed mainly to alter the appearance of animals (eg, ear cropping and tail docking in dogs), procedures performed solely to prevent behaviors that are destructive or annoying (eg, devocalization and defanging in dogs and onychectomy in cats), and procedures of dubious or minimal benefit (eg, dewclaw removal in dogs). Note that elective neutering of healthy dogs and cats has historically been performed to prevent or reduce the risk of future health problems (eg, pyometra, mammary gland neoplasia, and reproductive tract–related neoplasia) and to prevent unplanned breeding, which benefits the population as a whole by reducing the number of unwanted animals.[3] Thus, for the purposes of the present review, we did not classify elective neutering of dogs and cats as an MUS, even though there is evidence that elective neutering, while decreasing the risk of certain health issues in dogs, may increase the risk of others.[4]

ABBREVIATIONS

CVMA Canadian Veterinary Medical Association
MUS Medically unnecessary surgery

MUSs Commonly Performed on Dogs and Cats

Tail docking

Tail docking (caudectomy) is the surgical removal of the distal portion of the tail. In the Middle Ages, tail docking was performed on hunting and fighting dogs to lessen the risk of injury to the tail[5] and is still commonly performed on dogs of various hunting, working, and terrier breeds. Tail docking is most often done within the first week after birth. Typically, a scissors or scalpel is used to remove the distal portion of the tail, with 1 or more sutures used to close the resulting wound. Alternatively, an elasticized band is placed around the tail, causing loss of tissue circulation and eventual death and sloughing of the tail.[6] According to 1 study,[6] tail docking is often carried out by dog breeders without the use of anesthetics or analgesics. Even when tail docking is performed by veterinarians, anesthetics or analgesics may not be used, with 1 study[6] finding that only 10% of veterinarians used anesthetics or analgesics in conjunction with tail docking. Given that the use of anesthetics and analgesics in veterinary practice has increased in general since that study was published,[7] it is possible that the percentage of veterinarians using pain management techniques in conjunction with tail docking has also increased. However, good estimates are not available.

Tail docking is sometimes performed in adult dogs because of tail injury, neoplasia, or self-trauma and in these instances would be considered a medically necessary surgery. Note that treatments other than tail docking have been described for dogs with self-trauma of the tail, including behavioral modification and pharmacologic treatment.[8] However, the efficacy of these alternative treatments has not been examined.

One argument in favor of tail docking is that these breeds require docking to avoid future tail injury.[2] To test this theory, Diesel et al[9] completed a case-control study of tail injuries in working and nonworking dogs with and without docked tails. Tail injuries that were reported included fractures, dislocations, lacerations, contusions, self-trauma, and neoplasia. The weighted risk of tail injuries in working dogs (0.29%) was significantly higher than the risk in nonworking dogs (0.19%), and the risk for dogs with docked tails (0.03%) was significantly lower than the risk for dogs without docked tails (0.23%). However, the overall tail injury rate was quite low, and the authors estimated that 500 dogs would need to have their tails docked to prevent 1 tail injury.[9] A separate study[10] reported similar results, with a tail injury risk of 0.90% for working breeds and 0.53% for nonworking breeds, and an estimate that 232 dogs would need to have their tails docked to prevent 1 tail injury severe enough to require treatment by a veterinarian. Recently, Lederer et al[11] examined owner reports of tail injuries in docked and undocked hunting dogs during the shooting season in Scotland and found that rates of injuries were higher in undocked spaniels and undocked dogs of the hunt, point, and retrieve breeds. The authors also found that the number of injuries reported for both docked and undocked hunting dogs was higher than previously reported for working and nonworking dogs. For example, 54.7% of undocked spaniels and 20.8% of docked spaniels reportedly had at least 1 injury during the shooting season. However, only 4.4% of dogs with a tail injury required veterinary treatment, suggesting that the risk of serious injury was much lower than the overall injury estimate. These results indicate that there may be some minor benefits to tail docking but likely only in particular breeds of dogs that are participating in hunting activities.

Notably, a number of dog breeds, including the Pembroke Welsh Corgi and Australian Shepherd, have a naturally occurring mutation in the T-box transcription factor *T* gene (C189G) that results in a short-tail phenotype.[12] In addition, a few breeds with naturally occurring short tails do not have this mutation, suggesting that there are other yet-to-be-discovered genetic factors affecting tail phenotype. Recently, selective breeding by outcrossing to a Pembroke Welsh Corgi with the natural bobtail gene resulted in the birth of Boxers with naturally short tails.[13] Thus, it may be possible for breeds that traditionally have undergone tail docking to develop family lines with naturally short tails. Note, however, that there have been anecdotal reports that breeding for a bobtail appearance has resulted in health concerns related to deformed tails and spinal cord defects. Unfortunately, no scientific literature is available on this topic, and the extent of this problem is currently unknown.

Individuals disagree as to whether there is pain associated with tail docking. When asked about the degree of pain associated with tail docking in puppies, 82% of dog breeders sampled in Australia indicated "none" or "mild."[6] In contrast, the majority of veterinarians (76%) reported the associated pain to be "significant" or "severe." In a study[14] of 50 puppies (Doberman Pinschers, Rottweilers, and Bouviers des Flandres) that underwent tail docking at 3 to 5 days of age, all puppies vocalized intensely at the time of tail amputation, indicating that the procedure was indeed painful. The authors also reported that the puppies settled down relatively quickly after the procedure, suggesting that the pain did not last long; however, puppies were only monitored until they settled, which took approximately 3 minutes, and further pain behaviors may have occurred at later time points. Despite the seemingly short duration of pain, some opponents of tail docking have argued that any pain is unjust if it is unnecessary.[15]

Whether tail docking can result in chronic pain in dogs has not been extensively studied. Gross and Carr[16] described 5 Cocker Spaniels and a Miniature Poodle that had extensive self-trauma at the surgical site for several months up to 1 year after tail amputation and reported that application of mild pressure to the affected tail areas elicited a severe pain response. The pain in these dogs was attributed to neuroma development. Young female cattle that have undergone tail docking show increased agitation following application of hot or cold packs to the tail stub, suggesting that hypersensitive nerve bundles may be present,[17] and up to 80% of human amputees report experiencing phantom pain following limb amputation.[18] Thus, there is a potential for neuropathic pain in dogs following tail docking, although whether or how frequently this occurs is unknown.

Tail docking may also have detrimental effects on social communication in dogs,[19] as research suggests that social communication in dogs is largely reliant on body language, with the tail playing an important role. For example, Leaver and Reimchen[19] examined behavioral responses to dogs with different tail lengths by placing a remotely controlled life-sized dog replica in a park. They assessed responses to tails that were short or long and to tails that were wagging or still. Large dogs showed more caution approaching the replica dog when it had a short tail than when it had a long tail, and the authors speculated that this was a consequence of failure by the replica dog to signal. Also, large dogs approached the replica dog with a long, still tail less frequently than they approached the replica dog with a long, wagging tail but approached replica dogs with short, wagging tails and short, still tails with about equal frequency. In contrast, small dogs showed greater caution than large dogs, regardless of tail length or motion, likely because of the height difference and the small dogs' inability to view the tail. Results of this study indicated that social communication in dogs relies on proper observation of tail signaling, suggesting that tail docking may impair social communication in dogs.

Collectively, the available evidence suggests that tail docking is unnecessary as a routine procedure to prevent injury, particularly in nonworking companion dogs; that it causes short-term pain and has the potential to cause long-term neuropathic pain in some animals; and that it impairs social communication, which could lead to increased negative interactions with other dogs.

Ear cropping

In dogs, ear cropping involves reshaping the appearance of the external ear, usually by removing up to half of the caudal portion of the pinna (auricula). Following removal of the pinna, the ears are taped and splinted to facilitate healing in the desired shape. This procedure is typically performed when puppies are between 9 and 12 weeks old, after they have received their initial vaccinations.[20] Most often, dogs are anesthetized during the procedure and may or may not be given analgesics afterward.

Historically, ear cropping was performed to prevent ear damage during hunting or fighting, and some proponents of ear cropping continue to suggest that cropping is necessary to prevent accidental tearing of pendulous ears, particularly in hunting dogs. However, there is no evidence to support these claims, and many working breeds, such as spaniels and retrievers, have naturally pendulous ears. It has also been suggested that ear cropping reduces the risk of ear infection, as a result of less trapping of moisture and debris in the ear canal.[21] While there is some evidence to suggest that dogs with pendulous ears have a higher risk of otitis externa, compared with dogs with erect ears, it appears that specific breeds tend to have a higher predisposition than others regardless of ear conformation.[22,23] For example, 1 study found that otitis externa is more common in Cocker Spaniels, Poodles, and German Shepherd Dogs,[24] and another found a higher prevalence in Golden Retrievers and West Highland White Terriers.[23] None of these breeds traditionally have their ears cropped, and their natural ear position varies between hanging and erect. At least 1 textbook on veterinary surgery[25] no longer includes detailed information on ear cropping in dogs because of ethical concerns associated with the procedure, with the authors indicating their support for the AVMA position statement against this procedure.

To the best of our knowledge, there are no published studies on whether ear cropping results in acute or chronic pain in dogs, although given the length of the resulting wound, it is clear that the procedure results in some level of acute pain. However, information is lacking on common anesthetic and analgesic practices for dogs undergoing ear cropping. In addition, we are not aware of any studies on whether alterations in ear conformation influence communication with humans or other dogs.

Importantly, ear cropping is no longer taught at colleges of veterinary medicine in the United States. Thus, veterinarians performing this procedure in the future will largely be self-taught,[26] particularly as veterinarians experienced with this procedure retire. Some veterinarians have justified performing this procedure because of concerns that serious complications and animal welfare issues will arise if the procedure is done by unqualified individuals who are not veterinarians and do not have access to appropriate facilities, anesthetics, and analgesics.[26]

Dewclaw removal

In dogs, the dewclaws represent the vestigial first digits of the forelimbs and, occasionally, hind limbs.[27] Some breeds, such as the Great Pyrenees, Bauceron, and Norwegian Lundehund, have double dewclaws on each of the hind limbs.[28] Dewclaw removal is typically performed within the first few days after birth, usually without anesthesia or analgesia,[29] but it may also be performed later in life (eg, when the dog is spayed or neutered).[30] Sedation and local anesthesia are recommended when performing this procedure on young puppies, and general anesthesia is recommended for older animals.[31]

The main argument in support of dewclaw removal is that it prevents injuries associated with accidental tearing of the dewclaws.[29] While the forelimb dewclaws are typically attached by bone, the hind limb dewclaws are often attached only by skin, which, some have suggested, makes them prone to catching and tearing. Furthermore, because there is no wear of the associated nail, regular trimming is required to reduce the chances of the nail being caught. However, to date, no research is available to determine the actual incidence of dewclaw tearing, so the true scope of this problem is unknown.

To our knowledge, the impact of dewclaw removal on the welfare of dogs has not been researched. As with any surgery, there is the potential for acute and chronic pain, but the severity of the pain is unknown.

Declawing

Declawing (onychectomy) is an elective surgical procedure that involves removal of the claws through amputation of all or part of the distal phalanx. Several variations of the procedure have been described, including removal of the entire distal phalanx with a scalpel or surgical laser and removal of all or most of the distal phalanx with a nail clipper.[32] Removal of the distal phalanx with a surgical laser appears to be the quickest procedure and is associated with lower levels of postoperative stress and pain than removal with a scalpel.[33] However, it has also been associated with a higher number of postoperative complications in the days following the procedure.[33] Transection of the tendons of the deep flexor muscle (ie, tendonectomy) is sometimes performed as an alternative to onychectomy, as it prevents extension of the claws and results in fewer signs of pain.[34] Both onychectomy and tendonectomy should be performed only by veterinarians with appropriate anesthesia and postoperative analgesia.

Declawing is usually performed to prevent scratching-related injuries to people and damage to property. Recent surveys[35,36] of veterinarians indicate that aggression and property destruction due to scratching are frequent behavior problems reported by cat owners. Scratching of people and other animals is undesirable because of the potential for injury and infection, particularly in people who are immunocompromised. In some cases, this scratching may be intentional and related to aggression, but in others it is unintentional during play and handling. There appears to be a relatively high prevalence of aggression in owned cats, with recent research suggesting 36% of cats display aggression toward their owners[37] and almost 50% of cats display aggression toward either familiar or unfamiliar people.[38] However, although declawing will prevent scratching-related injuries, it is unlikely to resolve the problem of aggression in general owing to the potential for cats to bite as an alternative to scratching. More research is needed to identify means to prevent aggression-related behaviors by cats toward their owners.

Scratching items in the environment is a normal behavior that serves a number of functions for cats, including territorial marking and nail conditioning.[39] Farm cats have been reported to scratch between 1 and 6 times a day. Scratching behavior is driven almost entirely by the presence of conspecifics[39] but is still present in cats housed singly in homes. Although it is a normal behavior, environmental scratching is generally deemed to be undesirable by owners because it can lead to property damage. While recent estimates of the prevalence of environmental scratching are unavailable, 2 older studies[40,41] suggest that 15% to 25% of cats show inappropriate scratching of property, with one of these studies[40] indicating that scratching might increase the risk of cat relinquishment. Although declawing is 1 method of preventing scratching damage, there are alternative methods that do not involve surgery. For example, owners can provide appropriate outlets for scratching and trim their cats' nails regularly. Therefore, when this procedure is requested, every effort should be made to educate and assist owners of cats to pursue possible alternatives that could alleviate the need for surgery.

The National Council for Pet Population has estimated that approximately 14.4 million of the 59 million cats in the United States are declawed.[42] Similarly, a recent study[43] reported that 20% of cats admitted in the Raleigh, NC, area had undergone declawing or, more specifically, onychectomy. Interestingly, the percentage of cats that are declawed has apparently not changed in the past decade despite the growing controversy surrounding the procedure.[43] In a survey conducted by Yeon et al,[34] cats reportedly continued to make scratching movements following declawing, but 91% of owners surveyed had an overall positive attitude about the procedure, whether onychectomy or tendonectomy.

Various studies[44-47] have demonstrated that onychectomy causes postoperative pain in cats. For example, Carroll et al[44] examined postoperative pain in cats receiving either butorphanol or no analgesia following onychectomy and found that in comparison to control cats, butorphanol-treated cats had higher analgesia scores during the first 24 hours after surgery. Furthermore, according to owner reports, butorphanol-treated cats were more likely to eat and act normally and to have lower lameness scores during the first day after discharge. Cloutier et al[45] found that even when cats were treated with butorphanol before surgery, they had evidence of postoperative pain, as determined by comparison with control cats that underwent a sham procedure. Both of these studies involved removal of the distal phalanx with a scalpel or clipper, but recent studies assessing the effect of laser removal suggest that this procedure also results in postoperative pain, although to a lesser degree than that associated with other methods. Clark et al[46] found that cats that underwent laser onychectomy were less reluctant to jump after surgery than were cats in which onychectomy was performed with a scalpel or clipper. Similarly, Holmberg and Brisson[47] compared pain scores during the 10 days following onychectomy with either a scalpel or a laser and found that both groups had elevated pain scores during the first 9 days but that the mean score over the first 7 days was higher for the scalpel group, compared with the laser group. Finally, Robinson et al[33] assessed limb function by measuring ground reaction forces following laser or scalpel onychectomy and found that forces were reduced in both groups following surgery, but the reduction was greater in the scalpel group.

Researchers have also studied the pain associated with tendonectomy versus onychectomy, but differences between the procedures are unclear. While 1 study[48] found that tendonectomy resulted in lower pain scores, compared with onychectomy, during the first 24 hours after surgery, another study[45] found no differences in pain scores when comparing the 2 procedures. Jankowski et al[48] reported differences in postoperative complications associated with the 2 procedures. Of 18 cats that underwent onychectomy, 1 had severe postoperative pain and another had long-term lameness. Of 20 cats that underwent tendonectomy, 1 had long-term lameness, but owners of 6 cats expressed dissatisfaction with the procedure because of continued scratching and issues with claw growth and trimming.

Although both onychectomy and tendonectomy have the potential to cause acute postoperative pain, it is likely that a multimodal analgesic approach will provide adequate pain control. Although a review of all studies assessing efficacy of analgesic regimens for control of postoperative pain following onychectomy and tendonectomy is beyond the scope of the current discussion, we encourage future research to determine which analgesic regimes are commonly used in current veterinary practice and whether they are sufficient.

A number of studies have assessed short-term and long-term postoperative complication rates following onychectomy. Short-term postoperative complications following onychectomy include pain and associated lameness, hemorrhage, swelling, infection, and changes in behavior.[48,49] Pollari and Bonnett[50] examined the risk of postoperative complications when onychectomy was performed alone or in combination with other surgeries and reported that cats that underwent onychectomy in combination with ovariohysterectomy or castration were more likely to have postoperative complications than were cats that underwent either procedure alone. This was particularly concerning because 53% of cats underwent both procedures.

One common long-term complication of onychectomy is claw regrowth, with rates reportedly ranging from 3.4% to 15.4%, depending on the study and the method of claw removal.[46,48,49] One study[46] found that claw regrowth was more common with use of a nail clipper than with use of a scalpel or laser (15.4% vs 6.5% and 3.4%). Other long-term complications include persistent lameness and signs of chronic pain.[46,48,49] Clark et al[46] reported the highest rates of pain-related complications, with up to 23% of cats having ongoing lameness and 42.3% of cats showing signs of pain on paw palpation. Owners have also reported long-term behavioral changes in cats following onychectomy such as house soiling and an increased resistance to allowing the paws to be handled or an increased incidence or severity of biting, compared with behavior before the procedure.[51]

Alternatives to declawing include regular nail trimming and use of artificial nail caps to minimize property damage and provision of appropriate scratching surfaces such as scratching posts and substrates.[52] A study[53] of 128 Italian cat owners found that sexually intact male cats were more likely to scratch other surfaces when a scratching post was absent from the environment, and Cozzi et al[39] reported that a feline interdigital semiochemical, a cat pheromone replacement made of fatty acids, can be used to control excess behavioral scratching through placement of this substance on a desired scratching location. Behavior modification methods may also decrease environmental scratching. Given clear evidence of pain and postoperative complications with declawing, this procedure should be considered as a last resort after all other behavior modifying measures have been attempted and when the only other alternative is relinquishment or euthanasia.

Devocalization

In dogs, devocalization (ventriculocordectomy) involves complete or partial removal of the vocal folds to prevent vocalization or reduce the intensity of vocalizations that are produced. The procedure can be done through an oral approach or by means of a laryngotomy. Anecdotally, the oral approach appears to be more commonly used in clinical practice, although laryngotomy is the recommended approach.[54] Devocalization procedures vary in effectiveness, with great variation among breeds.[54] In particularly excitable dogs, increased airflow through the larynx following devocalization can result in the ability to bark to some degree.[54] As a result, some owners administer tranquilizers after surgery.[54]

Excessive barking is seen as an undesirable behavior by owners and others affected by the barking and reportedly increases the risk of relinquishment.[55,56] One study[56] found that excessive barking accounts for 11.3% of reported undesirable behaviors in dogs. Alternatives to devocalization are typically aimed at addressing the underlying cause of the undesirable barking. Common causes of undersirable barking include general anxiety, separation anxiety, and compulsive disorders,[57] and treatment by means of behavior modification with or without adjunctive medication should be attempted first. One study[58] found that positive reinforcement training was effective at reducing barking in response to someone knocking at the door, and dogs that are exercised more frequently are found to bark less than dogs that are not exercised.[59] While there appears to be general agreement within the veterinary behavior community that positive reinforcement is the most appropriate training method for dogs, barking is often treated through the use of methods that incorporate positive punishment. Both electric shock and citronella spray collars have been found to reduce the incidence of certain types of barking.[60,61] However, the effectiveness of citronella spray collars is decreased when the collar is worn continuously, and a rebound effect (increased barking) is frequently observed after the collar is removed.[60] In addition, there are concerns that electric shock and citronella spray collars may cause fear and pain in dogs. One study[61] found no difference in serum cortisol concentrations between dogs wearing electric shock or citronella spray collars and control dogs. However, another study[62] found behavioral signs of fear and stress in dogs in response to use of an electric shock collar, including lowered posture, vocalizations, oral behaviors, and aggression toward the handler.[62] In addition, when used improperly, electric shock collars can lead to burns and infections. Finally, in dogs with excessive barking, devocalization only removes the manifestation of the problem (ie, the dog is no longer being able to bark) and does not address the underlying behavioral problem, which may be negatively affecting the dog's quality of life. Thus, in dogs with excessive barking, the underlying cause should be identified and addressed before devocalization is considered.

A potential long-term complication of devocalization in dogs is formation of a laryngeal web that obstructs airflow[63] and may require corrective surgery.[31] Laryngeal web formation occurs more commonly after devocalization through an oral approach, with clinical signs developing between 3 months and 3 years after surgery in 1 report.[63]

Defanging

Defanging involves removal or reduction of the canine teeth and can be performed in either puppies or adult dogs. Although this procedure should only be performed with appropriate dental techniques, it is, in some cases, performed by cutting or breaking the teeth near the gingival margin and may or may not involve adequate anesthesia and analgesia.[64]

Defanging was originally developed to decrease the danger captive wild animals posed to humans, and similar justifications have been presented by advocates of this procedure in companion animals.[65] Although aggression can be a serious concern in certain dogs, this procedure is not fully effective at reducing the risks of biting injuries. Appropriate treatment of aggression should involve risk management and treatment to reduce the behavior problem. Although research has not been conducted on pain and behavioral effects of defanging in companion animals, this procedure is considered unnecessary when trying to prevent human-animal conflicts with exotic carnivores and similar results can be predicted for companion animals.[65]

Legislation Related to MUSs

Some of the earliest legislation restricting MUSs in dogs and cats was passed in the European Union in 1987, when the European Convention for the Protection of Pet Animals was implemented. This treaty prohibits any "surgical operation for the purpose of modifying [the] appearance of a pet animal or for other non-curative purposes,"[66] which would include tail docking, ear cropping, devocalization, declawing, and defanging. Veterinarians can make exceptions to these prohibitions if the procedure is considered necessary for curative reasons or the benefit of a particular animal, or to prevent reproduction.[66] However, regardless of the reason, all surgical operations must be carried out by a veterinarian and under anesthesia if the animal is believed to be in, or have the possibility of being in, severe pain.[66] Although this convention was initially ratified by 4 member states in 1992, it is noteworthy that as of 2014 some members of the EU had yet to ratify it. In some of the countries that have not yet ratified the convention, alternative legislation restricts at least some of these procedures. For example, in the United Kingdom and the Netherlands, ear cropping, tail docking, and declawing are restricted. In addition, some countries, such as France, have ratified the convention but excluded tail docking from the list of prohibited procedures.[67]

Many additional countries have incorporated MUSs into their animal welfare legislation, but recommendations vary by country. For example, declawing, ear cropping, and tail docking are restricted in Australia and Israel; declawing, devocalization, and ear cropping are restricted in New Zealand; and tail docking and ear cropping are restricted in Brazil. We are not aware of legislation in any countries that restricts surgical removal of the dewclaws in dogs.

Current Status in North America

Both the CVMA and AVMA have a number of position statements regarding MUSs. For instance, the AVMA position statement on tail docking and ear cropping states that it "opposes ear cropping and tail docking of dogs when done solely for cosmetic purposes."[68] The AVMA has also produced comprehensive literature reviews and fact sheets to support these position statements. The CVMA has taken a stronger stance by indicating that the organization "opposes the alteration of any animal by surgical or other invasive methods for cosmetic or competitive purposes," which includes tail docking and ear cropping in dogs as well as cosmetic dentistry, tattooing, and piercing.[69] Although these position statements are decidedly against MUSs, they are ultimately only suggestions because these organizations have no enforcement capabilities. Indeed, veterinarians practicing in Canada and the United States are still able to perform these procedures at their own discretion, with a few exceptions. In addition, anecdotal reports suggest that some procedures, most notably tail docking, are performed by breeders without the assistance of a veterinarian. It has been suggested that some veterinarians elect to continue tail docking puppies in fear that failure to do so will result in less qualified people, such as breeders, undertaking the procedure without access to proper medical facilities and appropriate analgesics.[2] This concern is supported by a study[6] that found 51% of the breeders that were surveyed were performing the procedure on their own.

The CVMA position statement on cosmetic alterations also states that the association "strongly encourage breed associations to change the breed standards" in the hopes that the number of dogs that are ear cropped and tail docked will decrease.[69] Breed standards in Canada and the United States have changed to allow showing of dogs that have not undergone ear cropping or tail docking. This is likely to have reduced the number of dogs undergoing these procedures, but relevant figures are not available. Although the Canadian Kennel Club and American Kennel Club do not encourage these procedures, they also do not specifically discourage them. The American Kennel Club, for instance, states that it endorses "acceptable practices integral to defining and preserving breed character and enhancing good health."[70]

The CVMA and AVMA also have position statements against MUSs used primarily for behavioral modification, including declawing, devocalization, and removal or reduction of the teeth.[52,69,71,72] For example, the CVMA position statement on onychectomy of domestic cats states that the association "strongly discourages onychectomy of domestic cats for routine purposes" as it "prevents cats from expressing normal behaviors and causes pain."[52] The AVMA position statement echoes this message and encourages client education and other preventive measures be taken before declawing is considered. Similar suggestions for attempts at behavioral modification to prevent the problem behavior are included in the devocalization position statements of both the CVMA and AVMA. However, for each of these position statements there is little guidance as to what attempts at alternative strategies are sufficient to justify the need for these procedures. Thus, owners with a lower tolerance for behavioral problems may elect to pursue them without first attempting alternative strategies.[42] Notably, pursuing alternative strategies to correct behavior problems related to scratching, aggression, and barking can involve substantial time, expertise, and expense, and owners may not be willing to invest their resources in alternative strategies when a surgical option is available. Some have argued that if these procedures were unavailable, such owners might opt for relinquishment or euthanasia. However, many veterinary clinics offer declawing of kittens in conjunction with spaying or neutering as a preventive measure when scratching behavior is not yet a concern. Thus, further discussion among stakeholders to determine how best to balance these ethical tradeoffs with an aim toward reducing the number of these procedures being performed is needed.

The role of national veterinary organizations such as the CVMA and AVMA in reducing the number of MUSs that are performed should not be underestimated. In some cases, their position statements have been incorporated into regulations initiated by provincial or state regulatory bodies to restrict veterinarians from performing these surgeries. For instance, restrictions on veterinarians performing ear cropping and, in some cases, tail docking have been incorporated into the bylaws of veterinary organizations in 6 Canadian provinces (British Columbia, Manitoba, Saskatchewan, Newfoundland and Labrador, New Brunswick, and Prince Edward Island).[73] However, these restrictions do not apply to nonveterinarians who may be performing tail docking and dewclaw removal outside of a clinic environment. Newfoundland and Labrador is the only Canadian province that has incorporated MUSs into formal legislation. In this province, the Animal Health and Protection Act was passed in 2010, banning ear cropping in dogs for the purposes of conforming to breed standards.[74] Additionally, this province has bylaws that prohibit docking of tails in all animals except when medically necessary.

A number of similar bylaws have been created in some states within the United States, many of which are based in principle on the AVMA guidelines. Fourteen states restrict tail docking in some species; however, only Maryland and Pennsylvania restrict tail docking of dogs.[75] In Pennsylvania, this restriction is for unqualified persons performing the procedure after 5 days of age, but veterinarians can perform the surgery regardless of age.[75] Legislation restricting ear cropping of dogs is the most common in the United States, with 9 states having restrictions. In the case of Washington State, ear cropping is permitted when in line with good husbandry practices.[75] After the CVMA released a position statement in 2009 that "discourages devocalization of dogs unless it is the only alternative to euthanasia," and the AVMA released a similar statement 4 years later, a law was passed in Massachusetts that banned this procedure.[76] Devocalization is also prohibited in 4 other US states, unless medically necessary. In addition to state-level restrictions, municipalities have in some cases implemented bylaws restricting MUSs in animals. For example, declawing is banned in a number of municipalities throughout California.

While veterinary organizations in North America have been clear about discouraging various MUSs through the publication of position statements, their role to date has been relatively passive. In contrast, the Australian Veterinary Association actively called for a ban on tail docking in dogs starting in 2008,[77] which was in part responsible for passage of national legislation banning this procedure. This legislation ensures that no persons in Australia, including nonveterinarians, can perform this procedure. We would suggest that there may be value in veterinarians in Canada and the United States taking a similar stance in suggesting formal legislation as a method of reducing the number of MUSs in dogs and cats.

Public Attitudes Toward MUSs in Dogs and Cats

Community consensus regarding right and wrong governs the actions of society, which then forms policies and laws.[78] Challenges arise when there is disagreement among stakeholders, preventing a consensus from being reached. This is the case for many MUSs, in that stakeholders differ in what they consider to be acceptable. Given the distributed authority governing companion animal welfare regulations and legislation in Canada and the United States, it is not surprising that leadership comes in large part from the CVMA and AVMA, in combination with the Canadian and American kennel clubs and specific breed associations. Equally disconcerting is that despite the American Kennel Club stating that unaltered dogs will not be disqualified when entered into competitions,[79] many owners believe that failure to comply with traditional breed standards will reduce their dogs' chances of winning. Some organizations have argued that banning these procedures is a violation of an individual's rights. For example, the United Kingdom–based Council of Docked Breeds campaigns to protect the owner's right to choose tail docking as an option, arguing that legislating these practices removes a person's freedom of choice.[80]

Social distance is defined as the emotional, psychological, and physical distance between one individual and another, typically 2 humans.[81] In the past few decades, the social distance between humans and companion animals has decreased drastically. This likely accounts for the change in attitudes regarding what is acceptable versus unacceptable in relation to animal treatment, with the effect that practices that were once seen as being acceptable are now questioned.[81] In some cases, language choice can be used to influence stakeholders and evoke emotion, a strategy commonly used by animal rights advocates, who employ words such as oppression, suffering, and cruelty to appeal to human emotion.[82] In other cases, euphemisms can be used to increase social distance and decrease empathy. Both the CVMA and AVMA have acknowledged these potential concerns in their position statements regarding declawing and devocalization by stating that owners must be educated with regards to the potential alternatives, the details of the procedure to be performed, and the potential risks. However, there are no data available to determine how often these conversations between veterinarians and owners occur or what effect they have on the owner's willingness to proceed with the procedure. Further research in this area is critical to accurately gauge current societal views on MUSs in dogs and cats.

Conclusions

We strongly believe that in a clinical setting, surgical procedures should be performed on animals only if they have or can be expected to have clear benefits for the animal or the population as a whole. At a minimum, the procedures discussed in the present review all cause some degree of acute pain and are associated with some risk of infection or other adverse effects. Society's attitudes toward dogs and cats have changed over time, likely because of decreased social distance, with the result that attitudes toward certain procedures that were once considered acceptable are now being reconsidered. In many countries, discussions among broad ranges of stakeholders have resulted in legislation banning surgical procedures that are considered elective or unnecessary.

People are willing to acknowledge that animals experience pain but do not always appear to be willing to take appropriate action to treat or prevent that pain.[83] This appears to be true in the case of the procedures discussed in the present review, which are known to be painful but are still commonly performed.[84] We recommend the following strategies for enacting change in Canada and the United States with regards to MUSs in dogs and cats. First, further research and education are needed on effective methods for preventing or treating the underlying behavior problems that traditionally have resulted in declawing, devocalization, and defanging. Second, further research on public attitudes toward MUSs is needed; specifically, understanding the beliefs and values held by the public must be a priority, as only then will it be possible to encourage policy and legislation that accurately reflect the views of current society. Third, veterinarians should take a leadership role in educating both owners and the broader public on the important topic of MUSs in dogs and cats.

References

1. Columella LJML. *L Junius Moderatus Columella of husbandry. In twelve books: and his book concerning trees. Translated into English, with several illustrations from Pliny, Cato, Varro, Palladius, and other ancient and modern authors.* London: A. Miller, 1745;335.
2. Bennett P, Perini E. Tail docking in dogs: can attitude change be achieved? *Vet J* 2003;81:277-282.
3. Root Kustritz MV. Effects of surgical sterilization on canine and feline health and on society. *Reprod Domest Anim* 2012;47:214-222.
4. Hart B, Hart L, Thigpen A, et al. Long-term health effects of neutering dogs: comparison of Labrador Retrievers with Golden Retrievers. *PLoS ONE* 2014;9:e102241.
5. Broughton A. Cropping and docking: a discussion of the controversy and role of law in preventing unnecessary cosmetic surgery in dogs. Available at: www.animallaw.info/article/cropping-and-docking-discussion-controversy-and-role-law-preventing-unnecessary-cosmetic. Accessed Nov 28, 2014.
6. Noonan GJ, Rand JS, Blackshaw JK, et al. Tail docking in dogs: a sample of attitudes of veterinarians and dog breeders in Queensland. *Aust Vet J* 1996;73:86-88.
7. Weber GH, Morton JM, Keates H. Postoperative pain and perioperative analgesic administration in dogs: practices, attitudes and beliefs of Queensland veterinarians. *Vet J* 2012;90:186-193.
8. Landsberg G, Hunthausen W, Ackerman L. *Behavior problems of the dog & cat.* 3rd ed. St Louis: Saunders Elsevier, 2012.
9. Diesel G, Pfeiffer D, Crispin S, et al. Risk factors for tail injuries in dogs in Great Britain. *Vet Rec* 2010;166:812-817.
10. Cameron N, Lederer R, Bennett D, et al. The prevalence of tail injuries in working and non-working breed dogs visiting veterinary practices in Scotland. *Vet Rec* 2014;174:450.
11. Lederer R, Bennett D, Parkin T. Survey of tail injuries sustained by working gun dogs and terriers in Scotland. *Vet Rec* 2014;174:451.
12. Hytonen MK, Grall A, Hedan B, et al. Ancestral t-box mutation is present in many, but not all, short-tailed dog breeds. *J Hered* 2009;100:236-240.
13. Cattanach B. Bobtail Boxers. Available at: bobtailboxers.com/the-cross-corgi-ex-boxer. Accessed Mar 15, 2015.
14. Noonan GJ, Rand JS, Blackshaw JK, et al. Behavioural observations of puppies undergoing tail docking. *Appl Anim Behav Sci* 1996;49:335-342.
15. Wansbrough R. Cosmetic tail docking of dogs. *Aust Vet J* 1996;74:59-63.
16. Gross T, Carr S. Amputation neuroma of docked tails in dogs. *Vet Pathol* 1990;27:61-62.
17. Eicher SD, Cheng HW, Sorrells AD, et al. Short communication: behavioral and physiological indicators of sensitivity of chronic pain following tail docking. *J Dairy Sci* 2006;89:3047-3051.
18. Jensen T, Nikolajsen L. Phantom pain and other phenomena after amputation. In: Wall P, Melzack R, eds. *Textbook of pain.* 4th ed. Edinburgh: Churchill Livingstone, 1999;799-814.
19. Leaver S, Reimchen T. Behavioural responses of *Canis familiaris* to different tail lengths of a remotely-controlled life-size dog replica. *Behaviour* 2008;145:377-390.
20. Henderson R, Horne R. The pinna. In: Slatter D, ed. *Small animal surgery.* 2nd ed. Philadelphia: Saunders Elsevier Science, 1993;1545-1559.
21. Rosser E. Causes of otitis externa. *Vet Clin North Am Small Anim Pract* 2004;34:459-468.
22. Hayes HM Jr, Pickle LW, Wilson GP. Effects of ear type and weather on the hospital prevalence of canine otitis externa. *Res Vet Sci* 1987;42:294-298.
23. Lehner G, Sauter Louis C, Mueller R. Reproducibility of ear cytology in dogs with otitis externa. *Vet Rec* 2010;167:23-26.
24. Fernandez G, Barboza G, Villabos A. Isolation and identification of microorganisms present in 53 dogs suffering from otitis externa. *Rev Cient* 2006;16:23-30.
25. Henderson R, Horne R. The pinna. In: Slatter D, ed. *Textbook of small animal surgery.* Vol 1. 3rd ed. Philadelphia: Saunders Elsevier Science, 2003;1737-1746.
26. Crook A. Cosmetic surgery in North America and Latin America, in *Proceedings*. World Small Animal Veterinary Association World Congress 2001; 54-55.
27. Ciucci P, Lucchini V, Boitani L, et al. Dewclaws in wolves as evidence of admixed ancestry with dogs. *Can J Zool* 2003;81:2077-2081.
28. Park K, Kang J, Park S, et al. Linkage of the locus for canine dewclaw to chromosome 16. *Genomics* 2004;83:216-224.
29. Savant-Harris M. Removal of dew claws. In: *Canine reproduc-*

tion and whelping: a dog breeder's guide. Wenatchee, Wash: Dogwise Publishing, 2005.
30. Becker M. Does our puppy need his dewclaws? Available at: www.vetstreet.com/dr-marty-becker/does-our-puppy-need-his-dewclaws. Accessed Nov 28, 2014.
31. Hedlund CS. Surgery of the integumentary system. In: Fossum T, ed. *Small animal surgery.* 3rd ed. St Louis: Mosby, 2007;254–255.
32. Hedlund CS. Surgery of the integumentary system. In: Fossum T, ed. *Small animal surgery.* 4th ed. St Louis: Mosby, 2011;251–259.
33. Robinson DA, Romans CW, Gordon-Evans WJ, et al. Evaluation of short-term limb function following unilateral carbon dioxide laser or scalpel onychectomy in cats. *J Am Vet Med Assoc* 2007;230:353–358.
34. Yeon SC, Flanders JA, Scarlett JM, et al. Attitudes of owners regarding tendonectomy and onychectomy in cats. *J Am Vet Med Assoc* 2001;218:43–47.
35. Fatjo J, Ruiz-de-la-Torre J, Manteca X. The epidemiology of behavioural problems in dogs and cats: a survey of veterinary practitioners. *Anim Welf* 2006;15:179–185.
36. de Souza-Dantas L, Soares G, D'Almeida J, et al. Epidemiology of domestic cat behavioural and welfare issues: a survey of Brazilian referral animal hospitals in 2009. *Int J Appl Res Vet Med* 2009;7:130–137.
37. Strickler B, Shull E. An owner survey of toys, activities, and behavior problems in indoor cats. *J Vet Behav* 2014;9:207–214.
38. Ramos D, Mills DS. Human directed aggression in Brazilian domestic cats: owner reported prevalence, contexts and risk factors. *J Feline Med Surg* 2009;11:835–841.
39. Cozzi A, Leucelle CL, Monneret P, et al. Induction of scratching behaviour in cats: efficacy of synthetic feline interdigital semiochemical. *J Feline Med Surg* 2013;15:872–878.
40. Patronek GJ, Glickman LT, Beck AM. Risk factors for relinquishment of cats to an animal shelter. *J Am Vet Med Assoc* 1996;209:582–588.
41. Heidenberger E. Housing conditions and behavioural problems of indoor cats as assessed by their owners. *Appl Anim Behav Sci* 1997;52:345–364.
42. Patronek GJ. Assessment of claims of short and long term complications associated with onychectomy in cats. *J Am Vet Med Assoc* 2001;219:932–937.
43. Lockhart LE, Motsinger-Reif AA, Simpson WM, et al. Prevalence of onychectomy in cats presented for veterinary care near Raleigh, NC and educational attitudes toward the procedure. *Vet Anaesth Analg* 2014;41:48–53.
44. Carroll GL, Howe LB, Slater MR, et al. Evaluation of analgesia provided by postoperative administration of butorphanol to cats undergoing onychectomy. *J Am Vet Med Assoc* 1998;213:246–250.
45. Cloutier S, Newberry R, Cambridge A, et al. Behavioural signs of postoperative pain in cats following onychectomy of tenectomy surgery. *Appl Anim Behav Sci* 2005;92:325–335.
46. Clark K, Bailey T, Rist P, et al. Comparison of 3 methods of onychectomy. *Can Vet J* 2014;55:255–262.
47. Holmberg D, Brisson B. A prospective comparison of postoperative morbidity associated with the use of scalpel blades and lasers for onychectomy in cats. *Can Vet J* 2006;27:162–163.
48. Jankowski AJ, Brown DC, Duval J, et al. Comparison of effects of elective tenectomy or onychectomy in cats. *J Am Vet Med Assoc* 1998;213:370–373.
49. Tobias KS. Feline onychectomy at a teaching institution: a retrospective study of 163 cases. *Vet Surg* 1994;23:274–280.
50. Pollari FL, Bonnett BN. Evaluation of postoperative complications following elective surgeries of dogs and cats in private practices using computer records. *Can Vet J* 1996;37:672–678.
51. Landsberg G. Cat owners' attitudes towards declawing. *Anthrozoos* 1991;4:192–197.
52. CVMA website. Onychectomy (declaw) of the domestic felid. Available at: www.canadianveterinarians.net/documents/onychectomy-of-the-domestic-felid. Accessed Nov 28, 2014.
53. Mengoli M, Mariti C, Cozzi A, et al. Scratching behaviour and its features: a questionnaire-based study in an Italian sample of domestic cats. *J Feline Med Surg* 2013;15:886–892.
54. Monnet E. *Small animal soft tissue surgery.* John Wiley & Sons, Inc, 2013.
55. New J Jr, Salman M, King M, et al. Characteristics of shelter-relinquished animals and their owners compared with animals and their owners in US pet-owning households. *J Appl Anim Welf Sci* 2000;3:179–201.
56. Wells DL, Hepper PG. Prevalence of behaviour problems reported by owners of dogs purchased from an animal rescue shelter. *Appl Anim Behav Sci* 2000;69:55–65.
57. Stafford K. Training methods. In: Stafford K, ed. *The welfare of dogs.* Dordecht, the Netherlands: Springer, 2007.
58. Yin S, Fernandez E, Pagan S, et al. Efficacy of a remote-controlled, positive-reinforcement, dog-training system for modifying problem behaviors exhibited when people arrive at the door. *Appl Anim Behav Sci* 2008;113:123–138.
59. Flint E, Minot E, Stevenson M, et al. Barking in home alone suburban dogs (*Canis familiaris*) in New Zealand. *J Vet Behav* 2013;8:302–305.
60. Wells D. The effectiveness of a citronella spray collar in reducing certain forms of barking in dogs. *Appl Anim Behav Sci* 2001;73:299–309.
61. Steiss J, Schaffer C, Ahmad H, et al. Evaluation of plasma cortisol levels and behavior in dogs wearing bark control collars. *Appl Anim Behav Sci* 2007;106:96–106.
62. Schilder M, van der Borg J. Training dogs with help of the shock collar: short and long term behavioural effects. *Appl Anim Behav Sci* 2004;85:319–334.
63. Mehl ML, Kyles AE, Pypendop BH, et al. Outcome of laryngeal web resection with mucosal apposition for treatment of airway obstruction in dogs: 15 cases (1992–2006). *J Am Vet Med Assoc* 2008;233:738–742.
64. CVMA. Cutting canine teeth in adult dogs, and deciduous teeth in puppies. Available at: www.canadianveterinarians.net/documents/cutting-canine-teeth-in-dogs-and%20deciduous%20teeth-in-puppies. Accessed Mar 3, 2014.
65. United States Department of Agriculture. Animal welfare: policy#3: veterinary care. Available at: www.aphis.usda.gov/animal_welfare/policy.php?policy=3. Accessed Mar 6, 2014.
66. Council of Europe. European convention for the protection of pet animals. Available at: conventions.coe.int/Treaty/en/Treaties/Html/125.htm. Accessed Nov 28, 2014.
67. Lefebvre D, Lips D, Giffroy JM. The European convention for the protection of pet animals and tail docking in dogs. *Rev Sci Tech* 2007;26:619–628.
68. AVMA. Ear cropping and tail docking of dogs. Available at: www.avma.org/KB/Policies/Pages/Ear-Cropping-and-Tail-Docking-of-Dogs.aspx. Accessed Dec 15, 2014.
69. CVMA. Cosmetic alterations. Available at: www.canadianveterinarians.net/documents/cosmetic-alteration. Accessed Nov 28, 2014.
70. American Kennel Club. Canine legislation position statement. Available at: images.akc.org/pdf/canine_legislation/position_statements/Ear_Cropping_Tail_Docking_and_Dewclaw_Removal.pdf. Accessed Nov 28, 2014.
71. AVMA. Welfare implications of canine devocalization. Available at: https://www.avma.org/KB/Resources/LiteratureReviews/Documents/Backgrounder-Canine%20Devocalization-Final.pdf. Accessed Dec 1, 2015.
72. CVMA. Devocalization of dogs. Available at: www.canadianveterinarians.net/documents/devocalization-of-dogs#.UxT7yvmwKyI. Accessed Mar 3, 2014.
73. The College of Veterinarians of Ontario. Medically unnecessary veterinary surgery ("Cosmetic surgery"). Available at: www.cvo.org/CVO/media/College-of-Veterinarians-of-Ontario/Resources%20and%20Publications/Position%20Statements%20and%20Guidelines/MUVSCosmeticSurgery.pdf. Accessed Nov 27, 2014.
74. Newfoundland and Labrador. Animal health and protection act. Available at: www.assembly.nl.ca/legislation/sr/statutes/a09-1.htm#76_. Accessed May 15, 2015.
75. AVMA. State law governing elective surgical procedures. Available at: www.avma.org/Advocacy/StateAndLocal/Pages/sr-elective-procedures.aspx. Accessed Nov 27, 2014.
76. The Commonwealth of Massachusetts. An act prohibiting devocalization of dogs and cats. Available at: malegislature.gov/Laws/SessionLaws/Acts/2010/Chapter82. Accessed May 15, 2015.
77. Australian Veterinary Association. Surgical alteration to the natural state of animals. Available at: www.ava.com.au/policy/31-surgical-alteration-natural-state-animals. Accessed May 15, 2015.
78. Rollin B. Animal production and the new social ethic for animals, in *Proceedings.* Food Anim Well-Being Conf Workshop 1993;3–13.

79. American Kennel Club. Frequently asked conformation questions. Available at: www.akc.org/events/conformation/faqs.cfm. Accessed Feb 25, 2014.
80. Council of Docked Breeds. Available at: www.cdb.org/. Accessed Mar 6, 2014.
81. Atwood-Harvey D. Death or declaw: dealing with moral ambiguity in a veterinary hospital. *Soc Anim* 2005;13:315–342.
82. Croney C. Words matter: implications of semantics and imagery in framing animal-welfare issues. *J Vet Med Educ* 2010;37:101–106.
83. Weary D, Niel L, Flower F, et al. Identifying and preventing pain in animals. *Appl Anim Behav Sci* 2006;100:64–76.
84. Robertson SA, Lascelles BD. Long-term pain in cats: how much do we know about this important welfare issue? *J Feline Med Surg* 2010;12:188–199.

Correction: Compendium of Veterinary Standard Precautions for Zoonotic Disease Prevention in Veterinary Personnel

In the report "Compendium of Veterinary Standard Precautions for Zoonotic Disease Prevention in Veterinary Personnel" (*J Am Vet Med Assoc* 2015;247:1252–1277), several paragraphs at the end of Appendix 4 (Model infection control plan for veterinary practices, 2015) were mistakenly omitted. The final sections of the appendix should read as follows:

OCCUPATIONAL HEALTH

Infection control and employee health management: The following personnel are responsible for development and maintenance of the practice's infection control policies, record keeping, and management of workplace exposure and injury incidents.
Staff responsible: ______________________________

Record keeping: Current emergency contact information will be maintained for each employee. Records will be maintained on vaccinations, rabies virus antibody titers, and exposure and injury incidents. Changes in health status (eg, pregnancy) that may affect work duties should be reported to and recorded by the office manager so that accommodations may be made.

Pre-exposure rabies vaccination: All staff with animal contact must be vaccinated against rabies, followed by periodic titer checks and rabies vaccine boosters, in accordance with the recommendations of the Advisory Committee on Immunization Practices.

Tetanus vaccination: Tetanus immunizations must be up-to-date. Report and record puncture wounds, animal bites, and other animal-related trauma. Consult a health-care provider regarding the need for a tetanus booster.

Influenza vaccination: Veterinary personnel are encouraged to receive the current seasonal influenza vaccine. The CDC website and healthcare consultation will be used for guidance (www.cdc.gov).

Documenting and reporting exposure incidents: Report incidents that result in injury or potential exposure to an infectious agent to: ____________________ Information will be collected for each exposure incident using OSHA forms 301, 300, and 300A. Incident reporting includes documenting the date, time, location, person(s) injured or exposed, vaccination status of injured person(s), other persons present, description of the incident, whether health-care providers and public health authorities were consulted, the status of any animals involved (eg, vaccination history, clinical condition, and diagnostic information), first aid provided, and plans for follow-up.

Staff training and education: Infection control and hazard awareness training and education will be documented in the employee health record.

Pregnant and immunocompromised personnel: Pregnant and immunocompromised employees are at increased risk from zoonotic diseases. If you are concerned that your work responsibilities may put you at increased risk, inform: ________________ so that preventive measures may be taken (such as increased use of PPE) and other accommodations may be made. Consultation between the supervising veterinarian and a health-care provider may be needed.

ADDITIONAL INFORMATION

The following information is attached to the infection control plan:

- Emergency services telephone numbers—fire, police, sheriff, animal control, poison control, etc
- Reportable or notifiable veterinary diseases and where to report
- State department of agriculture or board of animal health contact information and regulations
- State and local public health contacts for consultation on zoonotic diseases
- Public health laboratory services and contact information
- Environmental Protection Agency–registered disinfectants
- Occupational Safety and Health Administration regulations
- Animal waste disposal and biohazard regulations
- Rabies regulations
- Animal control and exotic animal regulations and contacts
- Other useful resources

Note that a modifiable electronic version of the model infection control plan is available on the National Association of State Public Heath Veterinarians website (www.nasphv.org).