

## Postoperative use of analgesics in dogs and cats by Canadian veterinarians

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### Abstract

Four hundred and seventeen Canadian veterinarians were surveyed to determine their postoperative use of analgesics in dogs and cats following 6 surgical procedures, and to determine their opinions toward pain perception and perceived complications associated with the postoperative use of potent opioid analgesics. Three hundred and seventeen (76%) returned the questionnaire. The percentage of animals receiving analgesics postoperatively ranged from 84% of dogs and 70% of cats following orthopedic surgery to 10% of dogs and 9% of cats following castration. In general, with the exception of orthopedic surgery, roughly equal percentages of dogs and cats received postoperative analgesics. Opioids were used almost exclusively to provide postoperative analgesia, with butorphanol the most commonly administered drug to both dogs and cats. Analgesics were usually administered either once or twice postoperatively. With regard to the administration of potent opioid agonists, the 3 major concerns included respiratory depression, bradycardia, and sedation in dogs, and excitement, respiratory depression, and bradycardia in cats. Seventy-seven percent of veterinarians considered their knowledge of issues related to the recognition and control of postoperative pain to be inadequate. Experience in practice is currently the major source of knowledge, with undergraduate veterinary school and research articles in journals ranked as the least important sources. Lectures or seminars delivered at the regional level were the preferred format for continuing education.

### Résumé

**Utilisation postopératoire des analgésiques chez le chien et le chat par les vétérinaires canadiens**

Quatre cent dix-sept vétérinaires canadiens ont été soumis à une enquête pour déterminer leur utilisation

postopératoire des analgésiques chez le chien et le chat à la suite de 6 types de chirurgies et pour connaître leur opinion sur la perception de la douleur et sur les complications associées à l'utilisation postopératoire de puissants analgésiques opioïdes. Trois cent dix-sept (76 %) d'entre eux ont retourné le questionnaire. Le pourcentage d'animaux recevant des analgésiques en période postopératoire variait de 84 % chez les chiens et 70 % chez les chat ayant subi une chirurgie orthopédique à 10 % chez les chiens et 9 % chez les chats ayant subi une castration. En générale, à l'exception de la chirurgie orthopédique, un pourcentage à peu près égal de chiens et de chats recevait des analgésiques en période postopératoire. L'analgésie postopératoire était procurée de façon presque exclusive par les opioïdes dont le butorphanol qui était le médicament le plus fréquemment utilisé à la fois chez le chien et chez le chat. Les analgésiques étaient habituellement utilisés une fois ou deux fois après la chirurgie. Avec l'utilisation de puissants agonistes opioïdes, les trois principaux sujets de préoccupation comprenaient la dépression respiratoire, la bradycardie et la sédation chez le chien et l'excitation, la dépression respiratoire et la bradycardie chez le chat.

Soixante-dix-sept pour-cent des vétérinaires considéraient que leurs connaissances reliées à la perception et au contrôle de la douleur postopératoire étaient insuffisantes. L'habitude de l'exercice de la profession est actuellement la meilleure source de connaissance, alors que les études de premier cycle dans les écoles vétérinaires et les articles scientifiques dans les journaux se classent comme les sources les moins importantes. Les cours ou les séminaires donnés au niveau régional constituaient la façon préférée de participer à l'éducation continue.

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### Introduction

The recognition and relief of pain in animals is a subject of interest to the veterinary profession, general public, and research community. However, there is no information available regarding the frequency of administration or types of analgesic agents administered to dogs and cats in the postoperative period in private veterinary practices in Canada.

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Pain is a very complex physiological and psychological entity, made all the more difficult to treat in animals, because they cannot verbalize the extent of their discomfort, or the adequacy of the treatment. Indeed, no objective method for the assessment of the degree of pain experienced by dogs and cats in the postoperative period has yet been developed and validated. Considering this, it is reasonable to assume that the level of treatment of postoperative pain will depend largely upon the attitude of veterinarians toward how much pain dogs and cats likely experience postoperatively, concerns about complications resulting from the administration of analgesic agents, and an adequate knowledge base related to the recognition and control of postoperative pain.

The present study was conducted to determine the extent of postoperative use of analgesic agents in dogs and cats in Canadian veterinary practices following 6 categories of surgical procedure. In addition, veterinarians were asked for their opinions regarding the amount of pain caused by these procedures, the validity of certain perceived disadvantages of using potent opioid agonists in the postoperative period, the adequacy of their knowledge of pain recognition and control, as well as their recommendations for continuing education in this area.

This paper describes the postoperative use of analgesics. A second paper will describe the factors influencing that use (1). Apart from serving to focus the interest and attention of veterinarians on this issue, the information obtained will be used to guide future research and continuing education in this area. It will also provide the opportunity, through repeat surveys, to assess the impact of continuing education and research on the adequacy of treatment of postoperative pain.

## Materials and methods

A mailed questionnaire was used to collect the data. Veterinarians listed as involved in mixed or small animal practice in provincial registries were eligible for inclusion. All such veterinarians (276) practising in Atlantic Canada and a random sample of 141 veterinarians from the remaining provinces were surveyed. The number of veterinarians included in the random sample from non-Atlantic provinces was based upon the total number of veterinarians licensed to practice in each province. Assuming a 70% return rate, the size of the sample from the non-Atlantic provinces was selected to produce estimates of the frequency of use of analgesics that are within 10 percentage points of the true value, 19 times out of 20.

The questionnaire was composed of 4 parts. Part 1 collected demographic information about the veterinarians surveyed. Part 2 was composed of a separate chart for dogs and cats that collected data regarding frequency of analgesic use, drugs used, dose, route of administration, usual number of doses given, and interval (hours) between doses following 6 different categories of surgery. Five categories were the same for both dogs and cats; namely, orthopedic surgery requiring internal fixation, abdominal surgery other than ovariohysterectomy, ovariohysterectomy, castration, and dental surgery, such as major tooth extraction or endodontics. The 6th category

for cats was onychectomy; for dogs, it was repair of ruptured cruciate ligaments. Part 2 also required the veterinarian to rate how severe the pain would be in the first 12 h after each of the 6 surgical procedures by circling the appropriate number on a scale of 1 to 10, where 1 = no pain at all, and 10 = the worst pain imaginable. Part 3 included statements regarding the risks or disadvantages that may be perceived as outweighing the benefits derived from the use of potent opioid agonists, such as morphine and oxymorphone. Veterinarians ranked these from 1 to 10, where 1 = disagree completely, and 10 = agree completely. Finally, Part 4 required veterinarians to rank 6 different sources of knowledge obtained on the subject of postoperative pain control and 6 different forums for continuing education on the subject (1 = most important, 6 = least important). They were also asked whether they thought their knowledge in this area was adequate or inadequate and whether or not they had attended continuing education on the subject within the last 12 mo. A complete copy of the questionnaire is available upon request.

We obtained comments on the content of the questionnaire from faculty at the Atlantic Veterinary College, as well as an international group of specialists in veterinary anesthesia. Following appropriate revisions, the questionnaire was pretested by practitioners in Prince Edward Island. Their comments on length, clarity, and content were incorporated in a 2nd revision before the questionnaire was distributed. Two mailings of the questionnaire and a covering letter were separated by 3 wk and followed by telephone contact 3 wk after the 2nd mailing, if the questionnaire had not been returned.

All data were entered and stored in a microcomputer database management program (dBase IV, Borland, Scotts Valley, California, USA). Data were validated by computing descriptive statistics, including minimum and maximum values, of all variables, and by manually checking a random sample of records. Statistical analyses included descriptive statistics, chi-square tests, and Wilcoxon signed rank tests. All statistical analyses were carried out using Statistix (Analytical Software, Tallahassee, Florida, USA) and differences between groups were considered significant if  $P < 0.05$ .

We simplified the analyses by classifying all respondents as either an analgesic user or nonuser, based on the proportion of animals to which they administered postoperative analgesics following abdominal surgery (other than ovariohysterectomies). If veterinarians reported giving analgesics to 50% or more of either dogs or cats after abdominal surgery, they were classified as analgesic users. If they administered analgesics to less than 50% of dogs and cats, they were classified as nonusers. For the purposes of data analysis, practice type was defined as mainly small animal [greater than 75% of time spent in the treatment of dogs and/or cats] or mixed practice.

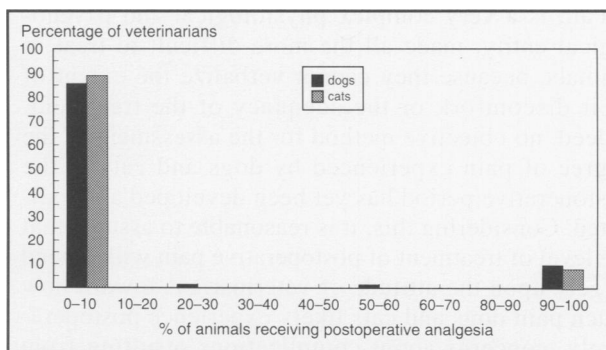
## Results

Of the 317 questionnaires returned (76% response rate), 275 were used in subsequent analyses, the remainder were rejected because respondents did not treat dogs or cats. The demographics of the veterinarians surveyed are included in Table 1.

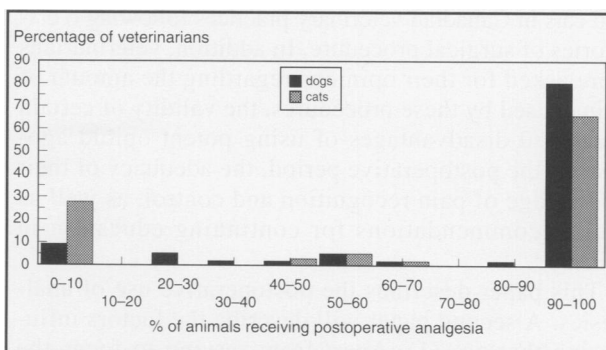
**Table 1. Demographic characteristics of 275 veterinarians responding to a survey of postoperative analgesic use**

Characteristic	Distribution
sex	52% male; 48% female
age	59% under 40 y of age
years since graduation	48% graduated within the past 10 y
practice type	84% in predominantly small animal practice <sup>a</sup>
animal health technologist use	68% employ at least 1 AHT <sup>b</sup>
practice size	67% practice with 1 to 3 veterinarians
region	65% Atlantic Canada 8% Quebec 14% Ontario 13% Western Canada
school of graduation	21% Atlantic Veterinary College 12% Faculté de médecine vétérinaire 50% Ontario Veterinary College 10% Western College of Veterinary Medicine 7% United States or European

<sup>a</sup>Predominantly small animal practice is defined as 75% or more of a veterinarian's time spent treating dogs and/or cats  
<sup>b</sup>Animal health technologist



**Figure 1.** Distribution of veterinarians according to the percentage of animals in which they use postoperative analgesia following castration surgery.



**Figure 2.** Distribution of veterinarians according to the percentage of animals in which they use postoperative analgesia following orthopedic surgery.

We classified 49.5% of veterinarians as analgesic users, with the regional values being 43% and 63% for Atlantic Canada and the rest of Canada, respectively. Table 2 includes the percentage of animals given analgesics following the 6 surgical procedures, and the number of surgeries performed each month for each procedure. Frequencies of administration to dogs and cats for the same surgeries were compared with a chi-square statistic. Analgesic use following onychectomy and cruciate surgery were not compared.

The veterinarians responding exhibited a bimodal distribution of analgesic use. For all surgeries surveyed, veterinarians tended to use analgesics postoperatively in all of their patients or none of their patients. The percentages of veterinarians administering analgesics following castration and orthopedic surgery requiring internal fixation are reported in Figures 1 and 2.

Opioids are the analgesics of choice, with butorphanol being the most commonly used in both dogs and cats, followed by meperidine. Either morphine or oxymorphone is the next most frequently used, with the order varying according to the surgical procedure and species. The percentage of veterinarians who reported doing orthopedic surgery requiring internal fixation and using these 4 most common drugs is contained in Table 3.

The vast majority of veterinarians administer the 4 major analgesics either once or twice postoperatively for all of the surgeries surveyed. Figure 3 illustrates the

frequency of postoperative administration of butorphanol following orthopedic surgery requiring internal fixation. Those veterinarians responding that they administer analgesics once or twice postoperatively are classified in the histogram as administering analgesics 1.5 times postoperatively. None of the veterinarians surveyed administered butorphanol more than 3 times to cats following orthopedic surgery, while 3% administered it 4 times to dogs.

The dose of butorphanol administered following orthopedic surgery ranged from 0.03 to 3.0 mg/kg body weight (BW) in dogs, with a median dose of 0.25 mg/kg. In cats, the dose ranged from 0.02 to 1.0 mg/kg BW, with a median dose of 0.20 mg/kg. If multiple injections were given, the median interval between doses for butorphanol following orthopedic surgery was 4 h in both dogs and cats.

Concerns associated with the perceived risks or disadvantages associated with the postoperative use of potent opioid agonists are summarized in Table 4. The 3 issues that were perceived to pose the greatest risk in dogs were respiratory depression, bradycardia, and sedation. In cats, the 3 major risks were perceived as excitement, respiratory depression, and bradycardia. The mean score exceeds 5 only for risk of excitement in cats. However, 63.5% of veterinarians scored at least one concern above 5 for dogs, and 69.8% scored one concern above 5 for cats. In addition, the range of rankings assigned to each concern for each of the 2 species extends the full width of the available scale from 1 to 10.

**Table 2. Percentage of animals receiving postoperative analgesics following selected surgical procedures carried out by 275 Canadian veterinarians**

Surgery	Dogs		Cats	
	Number of surgeries per month	% Receiving postop. analgesics	Number of surgeries per month	% Receiving postop. analgesics
orthopedic	249	83.9 <sup>a</sup>	179	70.1 <sup>a</sup>
cruciate or onychectomy <sup>b</sup>	181	76.2	1931	47.7
abdominal (non OHE <sup>c</sup> )	566	38.2	447	43.9
OHE	4390	12.6 <sup>a</sup>	4196	16.6 <sup>a</sup>
castration	3840	10.5	4079	9.3
dentistry	1474	32.2	1089	33.8

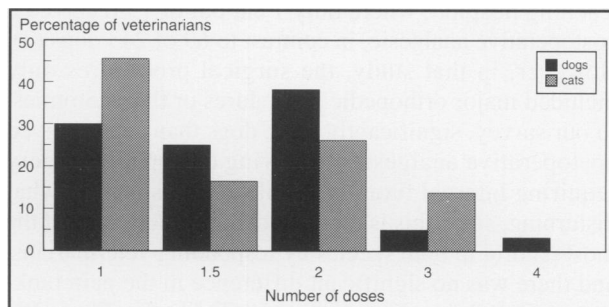
<sup>a</sup>Difference between dogs and cats significantly different ( $P < 0.05$ )

<sup>b</sup>Cruciate surgeries in dogs and onychectomy surgeries in cats (proportions receiving postoperative analgesia not compared statistically)

<sup>c</sup>Ovariohysterectomy

**Table 3. Most commonly used analgesic agents following orthopedic surgery: Percentage of veterinarians using each drug in dogs and cats postoperatively**

Analgesic	Dogs	Cats
butorphanol	40.6	41.7
meperidine	26.3	16.1
oxymorphone	11.9	6.3
morphine	9.4	7.6
no analgesic	8.1	24.3
other	3.7	4.0



**Figure 3.** Distribution of veterinarians according to the average number of doses of butorphanol they administer following orthopedic surgery.

The average pain rankings following the 6 surgical procedures are presented in Table 5. Rankings for dogs and cats were compared using the Wilcoxon signed rank test. In all cases, most veterinarians ranked pain identically in the 2 species. The percentage of veterinarians assigning equivalent rankings ranged from 63% for castrations up to 87% for orthopedic surgeries. However, for those veterinarians who did rank the species differently, the scores assigned to dogs were generally higher, resulting in a significant difference on the Wilcoxon signed rank test.

Seventy-seven percent of veterinarians considered their knowledge of issues related to the recognition and control of postoperative pain to be inadequate. Adequacy of knowledge was not influenced by attending continuing education within the previous 12 mo (75% and 78% for those attending and not attending, respectively). Experience gained while in practice was ranked as the most important source of knowledge for recognition and control of postoperative pain (mean rank of 1.9), while journal articles and undergraduate veterinary school were ranked as least important (mean rank of 3.5 for both). Lectures or seminars delivered at the regional level were the preferred continuing education format (mean rank of 2.3), while lectures or

seminars delivered at the national level and research articles in journals were the least preferred (mean rank of 4.7 for both).

## Discussion

The 76% overall response rate for this survey indicates the high level of interest within the veterinary profession regarding the recognition and control of pain in animals. We believe that it provides a very positive and constructive environment for the development and implementation of effective pain management in animals.

In our survey population, approximately equal numbers of veterinarians were analgesic users or nonusers, whereas in another citation of analgesic use in North American veterinary practices, where analgesic users were defined as veterinarians who reported using any postsurgical analgesia, 56.5% of veterinarians surveyed were analgesic users (2). However, since the sample in our study was heavily weighted towards veterinarians in Atlantic Canada and the use of analgesics was higher in the rest of Canada, our data probably underestimate the overall use of analgesics in the country.

It is encouraging that following the majority of surgical procedures surveyed, there was no species discrimination

**Table 4. Ranking<sup>a</sup> of the concerns associated with the use of potent opioid agonists in the postoperative period in dogs and cats**

Concern	Dogs		Cats	
	Mean	s <sup>b</sup>	Mean	s <sup>b</sup>
sedation (dog)	3.7	2.2		
excitement (cat)			5.3	2.7
respiratory depression	4.4	2.2	4.7	2.4
bradycardia	4.2	2.2	4.4	2.3
cost of drugs	2.7	2.1	2.7	2.2
record keeping	3.1	2.7	3.1	2.7
human abuse potential	3.4	2.8	3.5	2.9
damage to surgery site	3.3	2.3	3.5	2.6

<sup>a</sup>Ranking done on a scale where: 1 = disagree completely that the risk outweighs the benefits, 10 = agree completely that the risk outweighs the benefits

<sup>b</sup>Standard deviation

with regard to the postoperative administration of analgesics, which was in contrast to the results of a retrospective study of analgesic use in a veterinary teaching hospital, where only 1 cat out of 15 received a postoperative analgesic, in contrast to 69 of 243 dogs (3). However, in that study, the surgical procedures only included major orthopedic procedures or thoracotomies. In our survey, significantly more dogs than cats received postoperative analgesics following orthopedic surgery requiring internal fixation (Table 2). This is somewhat disturbing, since this is the surgical procedure ranked the most painful in both species by responding veterinarians, and there was no significant difference in the pain ranking assigned for dogs and cats (Table 5). Thus, the reluctance to administer analgesics to cats following this most painful surgery is difficult to explain. Finally, the significantly larger proportion of cats receiving analgesics following ovariohysterectomy is very strongly influenced by a single practitioner who reported performing a very large number of ovariohysterectomies in cats each month, and who administered analgesics postoperatively to all cats.

Simply reporting the frequency of analgesic use postoperatively is not adequate. It is also necessary to attempt to determine whether the therapies used were appropriate. This presents a significant challenge, since there is very little information available in the veterinary literature comparing analgesic efficacy of drugs, routes of administration, doses, dose intervals, or duration of analgesic administration. Research has begun to give us some answers to these questions, but at present, it is only a beginning, and many more well-designed clinical trials with analgesic agents are required.

Our survey identified butorphanol as the most commonly administered drug postoperatively. While this drug does appear to provide adequate analgesia in the postoperative period for soft tissue surgery, it has been shown to be significantly less effective than oxymorphone following orthopedic surgery (4). This may be due to the fact that butorphanol is a mixed agonist-antagonist, and it is generally accepted that a ceiling analgesic effect is reached that will not be surpassed by additional drug administration, thus limiting the usefulness

of the drug in animals with moderate to severe pain (5,6). Oxymorphone, like morphine, is a potent mu agonist, and its analgesic effect increases with increasing dose. Consequently, these 2 drugs are more suitable for moderate to severe pain associated with surgery (5). However, oxymorphone and morphine were only used by 21.3% of veterinarians following orthopedic surgery in dogs, and by 13.9% of veterinarians following orthopedic surgery in cats. Meperidine, the second most widely used postoperative analgesic, has a short duration of action, which, combined with variable effectiveness, makes it a poor choice as a small animal analgesic (7). Since, in this survey, the majority of animals received analgesics only once or twice postoperatively following orthopedic surgery, it is unlikely that this drug provided adequate analgesia under these conditions. Thus, although 83.9% of dogs and 70.1% of cats received analgesics following orthopedic surgery, the drugs most commonly used were not the most effective available. Since this survey was done, a nonsteroidal anti-inflammatory drug, ketoprofen, has been licensed, and this may have changed the pattern of drug selection.

The reluctance to use potent mu agonists as analgesics may be explained by concerns associated with the administration of these drugs in the postoperative period. The majority of veterinarians had at least one concern in which the risk outweighed the benefit. We believe that this, combined with the wide range of opinions about the risk of side effects, identifies a need for research to define the side effects associated with the administration of potent mu agonists to animals in the postoperative period, so that the profession has more reliable information than extrapolation from human studies to assist in decision making. Concerns about the risk of excitement in cats may well be limiting the use of these analgesics. This is regrettable, since these analgesics are effective and do not cause excitement in this species when appropriate doses are used (8).

Adequate doses and appropriate intervals between doses are also required for effective analgesia. A 100-fold range in dose was reported for the use of butorphanol in dogs following orthopedic surgery, with a 50-fold range reported in cats. While there is some variation in the literature regarding recommended dosages, a dose range of 0.1–0.4 mg/kg BW for butorphanol in both species seems to be a reasonable recommendation (9). While the median dose for both species falls within this range, use of low range doses of 0.02 to 0.03 mg/kg BW in cats and dogs, respectively, does indicate that ineffective doses are being used by some veterinarians. The higher doses reported, up to 3.0 mg/kg BW in dogs, are unlikely to provide increased analgesic efficacy, as discussed above, and may increase the risk of complications. In addition, only slightly over 10% of animals receive more than 2 doses of postoperative analgesic following orthopedic surgery, which is considered to be the most painful by most veterinarians. No clinically based studies on animals are available to assess whether this is adequate. Extrapolation from the human experience combined with clinical observation suggests that pain relief is required for at least 12 to 48 h following surgical procedures (5,6), although this has not been objectively determined in animals.

**Table 5. Pain rankings<sup>a</sup> by veterinarians following selected surgical procedures**

Surgery	Dogs		Cats	
	Mean	s <sup>b</sup>	Mean	s <sup>b</sup>
orthopedic <sup>c</sup>	8.18	1.45	8.03	1.59
cruciate	7.06	1.70	N/A	N/A
declaw	N/A	N/A	6.58	2.01
abdominal (non-ovariohysterectomy) <sup>c</sup>	5.46	1.55	5.33	1.57
ovariohysterectomy <sup>c</sup>	4.20	1.54	4.05	1.63
castration <sup>c</sup>	3.38	1.40	2.91	1.40
dentistry <sup>c</sup>	5.07	2.05	4.89	2.10

<sup>a</sup>Ranking done on a scale where: 1 = no pain at all in the first 12 hours following surgery, 10 = the worst pain imaginable

<sup>b</sup>Standard deviation

<sup>c</sup>Difference between dogs and cats significant ( $P < 0.05$ ) based on Wilcoxon signed rank test

There is a need for the development and assessment of effective and safe analgesic agents and formulations that will provide analgesia during the 12 to 15 h when clinics are closed and staff are not present to administer repeated injections or monitor continuous infusion. Although epidural administration of opioid and local anesthetic agents has been recommended as an effective means of providing analgesia for 6 to 24 h (10,11), only 1 veterinarian surveyed used epidural administration of analgesics postoperatively. In addition, studies are required to evaluate the efficacy of oral analgesics, both in hospital and the home environment, when analgesia is required for several days postoperatively.

Finally, the question arises as to the adequacy of dose intervals in situations where analgesics are administered more than once. It is not possible to determine from this survey whether analgesics were readministered when the animal was assessed to be in pain, or whether analgesics were readministered at fixed intervals. It is likely that effective pain control can be achieved with lower total dosages of analgesics, if drugs are administered at regular intervals before signs of pain are present (6). However, although dose intervals are contained in standard veterinary texts, these are based on tradition and clinical judgement, rather than clinical trials. Concern regarding the perceived risks associated with the administration of opioids may well preclude the administration of opioids at regular intervals from being common practice, when there are no objective guidelines available. Continuous morphine or oxymorphone infusions are used effectively in the teaching hospital setting, where adequate nursing care is available for both medical and surgical cases at relatively high doses on a mg/kg BW basis, with very few complications (5). However, none of the veterinarians surveyed use this method of opioid administration. In addition, there are no validated pain scales available to guide the assessment of postoperative pain in animals, and as a result, veterinarians are guided largely by their attitudes toward pain (1). This undoubtedly contributes to the extreme variability of case management identified in this study. Continued work to develop validated guidelines for pain assessment in animals, incorporating the physiological and behavioral responses are required before effective, standardized control of pain can be achieved.

Over three-quarters of the veterinarians responding to the survey did not consider their knowledge of issues related to the recognition and control of postoperative pain to be adequate. It is disturbing that undergraduate veterinary school was ranked as the least important source of information. This certainly appears to have identified an area of deficiency in the undergraduate curriculum in Canadian veterinary schools. Attendance at continuing education within the past 12 mo did not influence whether respondents thought their knowledge was adequate or not. This may reflect inappropriate content in continuing education to date, or it may be a very accurate evaluation of the present state of knowledge regarding clinical recognition and treatment of pain in animals. It is encouraging, however, that veterinarians have expressed an active interest in the subject through the excellent response to this survey. This, combined with clinically based research into this very challenging area, provides a sound basis for continued improvements in pain management in animals in Canada in the future.

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