

Special Report

Survey of anesthesia techniques and concerns in private veterinary practice

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As knowledge, technology, and expertise in the veterinary profession have expanded, the types of cases referred to academic referral-based teaching institutions have become more complicated and complex. Diagnostic and surgical procedures have become more sophisticated and, in many instances, more lengthy. Therefore, the anesthesia caseload at most veterinary college teaching hospitals has also become increasingly challenging, complicated, and time-consuming. At the same time, the number of live-animal laboratory exercises used for teaching anesthesia techniques to veterinary students has declined. At the Colorado State University (CSU) College of Veterinary Medicine and Biomedical Sciences, there are no longer any live-animal laboratory exercises intended specifically for teaching anesthesiology. Instead, all hands-on anesthesia training is performed during the third and fourth years, by use of client-owned animals that are referred to the CSU Veterinary Teaching Hospital's anesthesia service for clinical, diagnostic, or surgical procedures.

One concern related to these trends is that the anesthesia training offered to veterinary students may not be applicable to the types of animals and procedures requiring anesthesia at most private veterinary practices. Many of the animals anesthetized at veterinary college hospitals have chronic illnesses or conditions that may affect their responses to anesthetic drugs, whereas many private practices deal mainly with young healthy animals undergoing elective procedures such as ovariohysterectomy and castration. Most animals at veterinary college hospitals are hospitalized for at least 1 night after anesthesia and often for multiple nights before and after anesthesia, because of their underlying problems or the need for pain management and critical care. In contrast, many animals anesthetized in private practices may arrive the morning of surgery and be released a few hours afterward. The array of drugs and equipment at most veterinary college hospitals is typically much greater and more varied than in most private practices, which often use a relatively standardized anesthesia drug protocol and limited or no monitoring equipment.

In order to gain a better understanding of the anesthetic techniques of veterinarians in private clinics, a questionnaire was mailed to most of the veterinarians in Colorado. Information received was intended to be used by the anesthesiology faculty for making improvements in the practical training of veterinary students to better prepare them for private practice.

Materials and Methods

A questionnaire to investigate anesthesia techniques and concerns in private veterinary practice was mailed to all 1,083 members of the Colorado Veterinary Medical Association in late 1998. The survey was approved by the CSU Human Research Committee. A cover letter included with the survey explained that the survey was initiated by 2 faculty anesthesiologists (PWH, AEW) from the CSU College of Veterinary Medicine and Biomedical Sciences in order to assess current anesthetic practices used by veterinarians in private practice. The information gained was to be used to help direct anesthesiology instruction for veterinary students in the professional veterinary medical curriculum and graduate veterinarians in continuing education programs. The cover letter also assured participants that their answers would remain anonymous. To gather individual responses and opinions from those associated with multiple-veterinarian clinics, each veterinarian was encouraged to complete a separate questionnaire. A stamped addressed envelope was provided for returning the questionnaires.

The questionnaire consisted of 24 questions that typically required either a checkmark for 1 of several categorical answers or a numeric answer. A few questions invited written answers or comments. Questions 1 through 5 asked for demographic information about the type and size of practice, the experience of the veterinarian, and the types of procedures performed that would generally require anesthesia. Questions 6, 7, and 14 through 18 asked about use of specific drugs or types of drugs. Questions 8 through 11 asked about preanesthetic patient evaluation and use of IV catheters, fluids, and endotracheal intubation. Questions 12 and 13 were about equipment and monitoring techniques. Questions 19 through 23 asked about client concerns regarding anesthesia and pain management and the use of analgesics. Question 24 asked for comments regarding the training of veterinary students in anesthesiology.

A database program was used to create a database layout and enter the data from the survey. The program was also used to total the number of responses for questions with categorical answers and search written answers and comments for common elements. A statistical program was used to compute numeric results. Statistical analysis of results was not performed.

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Results

Three hundred forty-seven questionnaires were returned (response rate, 32%). Of these, 14 were incomplete or otherwise unsuitable for inclusion in the analysis, which was therefore based on 333 questionnaires (31% of total mailed).

Numbers for categorical questions represent the number of times a particular answer or category was recorded for all 333 questionnaires. For questions with > 1 possible answer, the total number of responses commonly exceeded 333, which was expected. For questions with mutually exclusive answers, the total for all responses was commonly < 333, because not all respondents answered all questions.

Regarding the size of practices represented in the survey, mean number of veterinarians per practice was 2.9 (range, 1 to 18). Regarding experience of the veterinarians, mean number of years in practice since graduating from veterinary college was 15.2 (range, 0.5 to 45 years). Respondents were located mainly in cities with populations > 100,000 (101 veterinarians) or in suburban areas (94 veterinarians). Other veterinarians practiced in rural (predominantly farming) areas (49 veterinarians) or in cities with populations of 50,000 to 100,000 (34 veterinarians), < 10,000 (28), or 10,000 to 49,999 (20).

Veterinarians listed the predominant animal species seen in their practices as follows: small animal (dogs and cats, 300 veterinarians), horses (65), food animals (38), and birds (27). In addition, under the category "other," the following species were mentioned as predominant: ferrets (7 veterinarians), exotic species (7), pocket pets (6), rabbits (5), rodents (5), reptiles (5), cats only (3), llamas (2), alpacas (2), elk (2), swine (1), and wildlife (1).

The questionnaire asked each veterinarian to indicate approximately how many of certain procedures he or she personally performed per month (Table 1). Veterinarians indicated the anesthetic drugs they used in their practice as follows: acepromazine (312 veterinarians), xylazine hydrochloride (180), medetomidine (171), detomidine (109), butorphanol (293), morphine (105), fentanyl citrate (102); oxymorphone hydrochloride (72); meperidine hydrochloride (25); buprenorphine hydrochloride (23); guaifenesin (36); diazepam (303); ketamine hydrochloride (318); propofol (126); tiletamine-zolazepam^a (118); thiopental sodium (102); lidocaine (286); bupivacaine hydrochloride (73); and **nonsteroidal anti-inflammatory drugs (NSAID, 262)**. One hundred nineteen veterinarians reported that they used naloxone hydrochloride,

Table 1—Mean No. of procedures performed each month in various species by individual veterinarians in Colorado

Procedure	Dog	Cat	Horse	Other
Castration	11.6	11.9	2.6	10.4
Ovariohysterectomy	12.6	11.8	0.6	2.4
Dentistry	13.5	9.5	0	1.4
Onychectomy (cats)	0	5.3	0	0
Stifle joint surgery	1.6	0.3	0.3	0
Fracture repair	1.3	0.9	0.2	0.6
Laparotomy	1.6	1.2	1.3	5.2
Radiography under anesthesia	7.2	3.2	0	2.0

whereas 196 reported that they did not use this drug; 254 veterinarians reported that they used a α -2 antagonist (yohimbine, tolazoline hydrochloride, atipamezole), whereas 75 veterinarians reported that they did not use such drugs. For maintenance of anesthesia, 314 veterinarians reported that they used "gas anesthesia," 18 reported "with injectable drugs," and 24 used either method, depending on the situation. Of the 42 veterinarians who used injectable drugs to maintain anesthesia, 12 were in small-animal practice, 8 were in equine practice, 1 was in food-animal practice, and 21 were in mixed-animal practice. Veterinarians who indicated they used gas anesthesia indicated that they used isoflurane (293 veterinarians), halothane (45), nitrous oxide (8), methoxyflurane (7), sevoflurane (5), or desflurane (0). Drugs and fluids used to treat perioperative complications in anesthetized animals were: atropine (320 veterinarians), glycopyrrolate (108), lidocaine (285), doxapram hydrochloride (178), epinephrine (315), dopamine (155), dobutamine (58), ephedrine (37), blood (83), plasma (60), packed erythrocytes (24), synthetic hemoglobin^b (54), hetastarch (55), dextran (41), and naloxone (146).

Regarding whether they routinely placed an IV catheter before inducing general anesthesia, 206 veterinarians reported "no," whereas 77 reported "yes." Regarding whether fluids were routinely administered IV during anesthesia, 212 veterinarians reported "no," whereas 67 reported "yes." Many of those who did not give a "yes" or "no" answer to the latter 2 questions instead described specific situations in which they would place an IV catheter, administer fluids IV, or both. Regarding whether they routinely intubated the following species after induction of general anesthesia, the number of "yes" versus "no" responses, respectively, for each species were: dog, 292 versus 16; cat, 236 versus 73; horse, 26 versus 65; cattle, 4 versus 50; sheep, 4 versus 50; goats, 7 versus 48; ferrets, 91 versus 99; rabbits, 20 versus 171; and birds, 41 versus 56.

Regarding preanesthetic workup, veterinarians were asked if they required or strongly suggested any of several procedures or tests before inducing general anesthesia (Table 2). The types of equipment used for anesthesia and monitoring were reported as follows: anesthesia machine with circle breathing system (287 veterinarians), anesthesia machine with nonrebreath-

Table 2—Procedures or tests required by Colorado veterinarians (No. of veterinarians [%]) before induction of general anesthesia in animals of various age groups

Test	Animal age (years)		
	< 5	5-10	> 10
History	323 (97)	316 (95)	320 (96)
Physical examination	325 (98)	320 (96)	322 (97)
PCV and TP	119 (36)	196 (59)	211 (63)
CBC	60 (18)	183 (55)	234 (70)
BUN	105 (32)	209 (63)	216 (65)
Glucose	77 (23)	185 (56)	197 (59)
Biochemistry panel	56 (17)	205 (62)	278 (83)
Urinalysis	11 (3)	77 (23)	130 (39)
Thoracic radiographs	2 (0.6)	14 (4)	63 (19)
ECG	11 (3)	28 (8)	66 (20)

TP = Total protein.

ing system (246), respiratory monitor (163), ECG (137), esophageal stethoscope (127), pulse oximeter (111), Doppler ultrasonic blood pressure monitor (67), oxygen demand valve (53), direct arterial blood pressure transducer (40), capnometer (23), oscillometric blood pressure monitor (22), temperature probe (19), and mechanical ventilator (16). When asked what they monitored under general anesthesia, 327 veterinarians checked "respiratory rate and/or pattern," 326 checked "physical signs (eye signs, jaw tone)," and 294 checked "pulse rate and/or quality."

To the question, "What percentage of your clients express concern about the risks of anesthesia?," 112 veterinarians indicated < 25%, 123 indicated 25 to 50%, 67 indicated 51 to 75%, and 29 indicated > 75%. To a similar question that asked what percentage of clients express concern about postoperative pain in their animals, 140 veterinarians answered < 25%, 114 answered 25 to 50%, 55 answered 51 to 75%, and 18 answered > 75%. When asked whether they or their staff emphasize the importance of postoperative pain management to their clients, 247 veterinarians answered "yes," whereas 82 answered "no."

The subject of pain management elicited a variety of comments. At 1 extreme, an individual commented that some pain is helpful in keeping an animal from moving too much and ruining a surgical repair. Another individual believed that pain management is overemphasized, and not all animals need analgesics, especially if going home with the owner after surgery. A third individual stated that veterinary students need to realize the risk of keeping controlled drugs in their practice where there are lay personnel who may steal or abuse them. Interestingly, another veterinarian commented that his or her biggest problem was that older veterinarians often did not believe that pain management is important. However, at least 9 veterinarians stated that pain management and the basic theories of pain and analgesia need to be taught and emphasized more. Four respondents recommended teaching epidural or spinal analgesia techniques, and another suggested acupuncture training.

Regarding clinical implementation of postoperative pain management, veterinarians were asked whether they routinely administered analgesics after surgery for specific species and procedures (Table 3).

Table 3—Summary of answers (No. of respondents) to the question "Do you routinely administer postoperative analgesics following any of the procedures indicated below? If yes, please indicate analgesic used."

Procedure	No	Yes	Analgesic				Other
			B	C	M	K	
Dog castration	183	98	53	23	12	7	25
Dog spay	161	130	66	37	18	8	26
Cat castration	230	62	41	4	2	7	8
Cat spay	190	104	77	5	4	10	17
Cat onychectomy	88	205	141	5	10	16	29

B = Butorphanol. C = Carprofen. M = Morphine. K = Ketoprofen.
 Other = Drugs cited ≤ 5 times/procedure (aspirin, flunixin, etodolac,^d buprenorphine, meperidine, oxymorphone, fentanyl, fentanyl patch, codeine and acetaminophen, medetomidine, corticosteroids, diazepam, and acepromazine [also bupivacaine and lidocaine for cat onychectomy]).

When asked specifically, in a separate question, if they used a NSAID for management of pain after surgery, 180 veterinarians answered "yes," whereas 140 answered "no." Of those who answered "yes," the NSAID they cited included carprofen (159 veterinarians), phenylbutazone (29), flunixin (26), aspirin (25), and ketoprofen (24).

The final question was open-ended: "Are there any comments regarding the training of veterinary students in the area of anesthesia that you would like to share?" Most survey respondents did not answer this question, presumably either because they had no advice to give or because composing such a reply would be too time-consuming. Of those who did write comments, 12 stated that they thought CSU veterinary graduates were well-prepared to anesthetize animals when they entered private practice, that CSU was providing good training in anesthesiology, or both. Four respondents stated that they thought veterinary students need more "hands-on" practice during their education, and another suggested that students need more clinical experience. One respondent stated that students should be taught to perform endotracheal intubation without the use of a laryngoscope. There were several comments about the need to teach veterinary students how to perform some procedures more quickly by use of injectable rather than inhalation anesthetics. However, there were conflicting opinions regarding methods used to teach students about anesthetic drugs. Several practitioners recommended that students be allowed to use only 1 or a few drugs in order to become familiar with the effects of those drugs, yet approximately the same number of practitioners believed that students should be exposed to as many different drugs and methods as possible, so they would learn that there is more than 1 method to anesthetize an animal. Three veterinarians recommended that students should be taught to consider each individual animal's requirements when selecting drugs and drug dosages, and another cautioned that dosages listed on drug bottle labels may not be appropriate. The economics of anesthesia were a concern of 6 respondents who recommended that students should be made more aware of the cost of drugs and monitoring equipment. More training in monitoring anesthetized animals, with an emphasis on physical signs of anesthetic depth, was suggested by 8 respondents. There were individual comments regarding the importance of being able to monitor an anesthetized animal while performing surgery, the tendency to become complacent or lax about monitoring until something goes wrong, and the fact that even though a technician may be monitoring a patient during surgery, ultimate responsibility for the animal's well-being is with the veterinarian. One veterinarian commented that blood pressure monitoring needs to be emphasized more, because most practitioners do not measure blood pressure.

Discussion

The response rate for this survey (32%) seemed quite good, considering how busy most veterinarians are. Because those who did respond were presumably interested in helping the veterinary college, it is possi-

ble that results of the survey were skewed toward more progressive or academic ideas and do not represent the full array of anesthetic techniques used at all veterinary practices in the state.

Veterinarians in group practices were more numerous than solo practitioners, and the respondents were fairly experienced, having been in practice for mean duration of > 15 years. Most worked in large cities or suburbs, which reflects a trend of the general population. Most were small-animal practitioners.

It was not surprising that ketamine was the most widely used anesthetic drug. Although ketamine is approved for use only in cats and nonhuman primates, it is actually used in almost every species, including laboratory rodents, horses, cattle, and zoo and wildlife species.¹ Ketamine is considered to be a relatively safe anesthetic, as it generally causes minimal cardiovascular and respiratory depression and may actually stimulate cardiovascular function via its sympathomimetic effects.¹ Another advantage is that ketamine may be administered IM as well as IV, making it practical for use in animals in which venous access is limited. Additionally, at the time of this survey, ketamine was not a scheduled substance in the United States, although it subsequently became so in 1999.

The apparent popularity of butorphanol was more surprising. Butorphanol is not as efficacious for treatment of moderate to severe pain as are pure μ -agonist opioids such as morphine; its duration of analgesia is shorter than morphine and it is more expensive than morphine.² However, butorphanol is marketed as a veterinary product, is less susceptible to abuse than are the μ -agonist opioids, and was not a scheduled drug in the United States until 1997, by which time many of these experienced practitioners were already accustomed to using butorphanol in their patients.

Propofol, which has become extremely popular for human out-patient anesthesia because of its rapid and smooth recoveries, was used by more veterinarians in this survey than was thiopental, an older drug with cardiovascular effects and induction qualities comparable to propofol.³ For many veterinarians who anesthetize patients for short procedures, the rapid recovery from the effects of propofol is a distinct advantage. Although propofol is more expensive than thiopental, propofol has the additional advantages of not being irritating if injected into perivascular tissues and not being a scheduled drug.

Results of our survey indicate that acepromazine is still 1 of the most commonly used drugs in veterinary practice, despite the advent of newer reversible sedatives such as the α_2 agonists xylazine, medetomidine, and detomidine. Although acepromazine may cause vasodilation that may contribute to perianesthetic hypotension, its other cardiovascular effects are minimal.⁴ Results of 3 studies of perianesthetic morbidity and mortality in animals (2 studies of small animals and 1 study of horses) suggest that use of acepromazine is associated with reduced risk of anesthetic death, possibly as a result of its antiarrhythmic activity.^{5,7} In contrast, xylazine has been associated with increased risk of perianesthetic mortality in cats and dogs.^{5,6}

It was interesting that more veterinarians have reason to use a α_2 antagonist drug such as yohimbine, tolazoline, or atipamezole than to use an opioid antagonist such as naloxone. This may reflect greater use of α_2 agonists, compared with opioids, for instance, to facilitate radiologic procedures. Another consideration is that α_2 agonists are potent sedatives and therefore more likely to require reversal than are opioids.

The majority of all practitioners surveyed (95%) used inhalation anesthesia for maintenance. Isoflurane is by far the most popular inhalation anesthetic and was cited in 84% of responses. Low blood solubility of isoflurane leads to rapid inductions and recoveries, which makes it especially useful in busy practice situations and for out-patient procedures. It is not as arrhythmogenic as is halothane,⁸ and presently is less expensive than sevoflurane, a drug with many similar characteristics to isoflurane.

The question regarding drugs used to treat perioperative complications did not specify any particular type of complication. Of the drugs listed, respondents cited epinephrine most commonly. Epinephrine is inexpensive and is the drug of choice for many cardiac arrest situations, although it is not generally used for lesser complications, such as hypotension, because of its arrhythmogenic properties.⁹ Unfortunately, anesthetic-induced complications such as hypotension, which may serve as warnings of impending cardiac arrest, may not be recognized because few veterinarians specifically monitor for such complications.^{10,11} Most veterinarians in our survey also kept lidocaine, which in addition to having local anesthetic properties is useful in the treatment of ventricular arrhythmias. More than half of the responding veterinarians also kept doxapram, which is used primarily as a respiratory stimulant. It was surprising to find that nearly half of the veterinarians kept dopamine, an inotropic drug that in some species specifically augments renal perfusion.¹² Dobutamine, which is probably a more efficacious inotrope than dopamine,¹³ is somewhat more expensive, which may explain why fewer veterinarians kept it in their practices. Because dopamine and dobutamine must be administered IV as constant rate infusions, they are not practical for use in animals that do not have an IV catheter in place. Ephedrine is an inotropic drug that is inexpensive and practical, because it may be administered IV as a bolus.¹⁴ However, it is not always effective at maintaining improved blood pressure in anesthetized animals.¹⁴ Only 20 to 25% of veterinarians kept blood products in their practices, probably because of infrequent need and the limited shelf life of stored blood products. Only 16% of veterinarians kept a commercially produced hemoglobin-based oxygen-carrying fluid,^b which has a long shelf life but is relatively new and possibly still unfamiliar to older veterinarians. Although 146 veterinarians reported that they kept naloxone available in their practices, only 119 reported that they actually use it. It is possible that those who have not used naloxone rarely use opioid agonists or have not yet encountered a situation in which antagonism of an opioid was indicated.

More than 60% of veterinarians surveyed reported

they do not routinely place an IV catheter before inducing general anesthesia. This may be because most of the animals they anesthetize are young and healthy, and the procedures are short. Many veterinarians mentioned that they do use IV catheters in older animals, those undergoing longer surgeries, or any patient considered to be critically ill. The same pattern of replies and exceptions was evident regarding the question concerning IV administration of fluids: > 60% of respondents reported that they do not routinely administer fluids IV during anesthesia, but many reported using fluids in older sicker animals or animals that underwent long surgeries.

Almost all respondents indicated that they routinely intubated the trachea of dogs and cats, although cats were somewhat less likely to be intubated (76% intubated) than were dogs (95% intubated). The reason for this difference was not investigated in the survey, but some procedures performed on cats, such as castration and onychectomy, are of such short duration that only injectable anesthetics are used, and intubation is not considered necessary. In addition, many people find tracheal intubation of cats to be more difficult than intubation of dogs and may avoid intubating cats unless it is considered essential. Slightly less than half (48%) of the veterinarians who anesthetized ferrets routinely used intubation. Because of their size, ferrets are often even more difficult to intubate than are cats and require very small endotracheal tubes, which some practitioners may not have. Therefore, many veterinarians choose to induce and maintain anesthesia in ferrets by use of a mask. The tracheas of birds are not difficult to intubate, but only 42% of veterinarians reported they routinely intubated birds, likely because anesthesia in birds is commonly induced and maintained by mask and because most birds require extremely small endotracheal tubes. For other species, endotracheal intubation was even less likely to be routine, which may be because most procedures in those species are of short duration and are performed by use of injectable anesthetics (as in horses and ruminants) or because of the difficulty of intubation in certain species (eg, rabbits). Although ruminants are at risk of regurgitation and subsequent aspiration of food material if not intubated during general anesthesia, our clinical impression is that regurgitation is less likely to occur during light anesthesia of short duration such as with use of xylazine or ketamine.

Regarding procedures and tests required before induction of general anesthesia, nearly all responding veterinarians (> 95%) indicated that they consider a history and physical examination to be mandatory procedures, regardless of the age of animal (Table 2). This is not surprising, because those procedures are inexpensive and require minimal equipment but provide a great deal of information that may be pertinent to anesthesia. Some state veterinary practice acts mandate that a preanesthetic physical examination be performed within 12 hours before surgery.^c Although our survey did not address the issue, it is possible that the few veterinarians who did not consider a preanesthetic history or physical examination to be mandatory are those dealing with wildlife, feral animals, or extremely

aggressive animals that would not tolerate examination without first being anesthetized. The remaining procedures and tests were more likely to be required or strongly suggested for older animals; for instance, serum biochemical analysis was required by only 17% of veterinarians before anesthetizing an animal that was < 5 years old but was required by 62% of veterinarians for animals that were 5 to 10 years old and was required by 83% of veterinarians for animals that were > 10 years old. This is expected, because aged animals are more likely to have biochemical evidence of dysfunction of the liver, kidneys, or other organs.

A large majority of veterinarians had anesthesia machines (circle breathing system, 86%; nonbreathing system, 74%). Most of the veterinarians who did not own an anesthesia machine were equine or food-animal practitioners who used only injectable anesthetics. Two small-animal practitioners who did not have anesthesia machines had been in practice for 33 and 38 years, which suggests that they became accustomed to performing anesthesia with injectable drugs during the period before inhaled anesthetics were widely available and simply continued to do so.

Respiration of anesthetized animals seemed to be cause for a great deal of concern among practitioners. More veterinarians reported that they monitored "respiratory rate and/or pattern" (98%) than "pulse rate or quality" (88%). The same concern was reflected in the number of veterinarians who indicated they used a respiratory monitor (49%), which was by far the most commonly cited piece of monitoring equipment. Because many anesthetic drugs depress respiration or cause apnea, this concern was not surprising. Additionally, the American Animal Hospital Association requires that its accredited hospitals use some method of respiratory monitoring during anesthesia.¹⁵ Despite the apparent concern about respiratory insufficiency in anesthetized animals, only 7% of veterinarians surveyed had a capnometer, perhaps because capnometry is still relatively new to veterinary anesthesia, and the instruments are relatively expensive. Pulse oximetry is another relatively new technique, but 33% of responding veterinarians were using it at the time of this survey. Pulse oximeters, although generally smaller and less expensive than capnometers, provide much useful information, not only concerning arterial hemoglobin saturation with oxygen but also pulse rate and, indirectly, peripheral perfusion.

It was disappointing to find that only a small proportion of veterinarians had the equipment to monitor arterial blood pressure during anesthesia, either by noninvasive Doppler ultrasound technique (20%), noninvasive oscillometric monitor (7%), or direct arterial catheterization (12%). Hypotension is 1 of the most common complications that develops during anesthesia.^{11,16} Hypotension may lead to other problems, such as inadequate renal perfusion or cardiac complications. Although most veterinarians (88%) reported that they monitored pulse rate and quality, pulse quality is not a reliable indicator of mean arterial blood pressure and perfusion.¹⁷ The electrocardiogram and esophageal stethoscope were used by more veterinarians (41 and 38%, respectively) than were

blood pressure monitors, but those techniques are not early predictors of cardiovascular insufficiency.¹⁸ Fortunately, it is likely that many of the animals anesthetized in private veterinary practices are young and generally healthy and are undergoing short procedures such as castration or ovariohysterectomy. Although intra-anesthetic hypotension may develop in any animal, it reportedly is more likely to be a problem in animals that are more sick, hypoproteinemic, or undergoing 3 or more procedures.¹⁶

A fairly large number of veterinarians indicated that their clients expressed concern regarding the risks of anesthesia: 20% of veterinarians reported that "50 to 75%" of their clients expressed concern, and another 9% of veterinarians reported that "more than 75%" of their clients expressed concern about anesthesia. Client fears about the danger of anesthesia may emanate from their own personal experience with anesthesia, previous anesthetic-related death or complications in a pet, or hearsay from friends or breeders. Somewhat fewer veterinarians reported that their clients expressed concern about postoperative pain in their animals: 17% reported that "50 to 75%" of their clients expressed concern about pain, and another 5% said that "more than 75%" of their clients expressed concern about pain. Nevertheless, 75% of responding veterinarians indicated that they or their staff emphasized the importance of postoperative pain management to their clients. This is an encouraging sign that veterinarians in private practice are aware of the importance of pain management, an area of practice that traditionally has been underemphasized not only in veterinary medicine but in human medicine as well.¹⁹ However, in contrast, clinical implementation of postoperative pain management was less common, at least for common surgical procedures such as castration or ovariohysterectomy in dogs and cats; only 21 to 45% of veterinarians said they routinely administered analgesics after those procedures (Table 3). Onychectomy of cats, however, was 1 procedure for which a majority of veterinarians (70%) said they routinely administered analgesics. Although it appears that most veterinarians believe that reduction of animal pain is important, they may not agree about which procedures induce postoperative pain, or possibly they may not recognize signs of pain when they develop.²⁰ Carprofen, a relatively new NSAID, has apparently achieved widespread popularity since its introduction, having been used by far more veterinarians in our survey (48%) than any other NSAID.

Results of the survey reported here suggest that most animals that are anesthetized in private veterinary practices in Colorado undergo neutering or dentistry, as opposed to more complicated procedures performed in a university veterinary hospital setting. Veterinary students exposed to a complex caseload during their education may be less prepared for the practical and economic realities of routine private practice. Ketamine and isoflurane are 2 of the most com-

monly used anesthetic drugs. Perioperative IV administration of fluids, blood pressure monitoring, and postoperative pain management are not consistently provided, suggesting that there is room for improvement in the standard of anesthetic care provided by private veterinary practices.

^aTelazol, Fort Dodge Laboratories, Fort Dodge, Iowa.

^bOxyglobin, Biopure Corp, Cambridge, Mass.

^cCal Code Reg 16, §2032.4(1).

^dEtoGestic, Fort Dodge Animal Health, Overland Park, Kan.

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