ANAVMA
Anesthesia Monitoring With Capnography

Capnography is an essential tool for monitoring anesthetized and critical care veterinary patients, according to Heidi Reuss-Lamky, LVT, VTS (Anesthesia & Analgesia), from Oakland Veterinary Referral Services in Bloomfield Hills, Michigan. Presenting at the 2017 American Veterinary Medical Association Convention in Indianapolis, Indiana, Reuss-Lamky discussed the ways in which capnography provides important feedback about the severity of a patient’s condition and how patients respond to treatment.

Capnography refers to the measurement of CO2 in a patient’s exhaled breath, she said. The measurements are displayed as a capnogram, which is a graphic representation of (continued on page 10)

AVMA
Behavioral Problems in Senior Dogs

Senior dogs represent a special class of behavioral patients for veterinarians, according to Marsha Reich, DVM, DACVB, from Maryland-Virginia Veterinary Behavior Consulting in Silver Spring, Maryland. Presenting at the American Veterinary Medical Association Convention in Indianapolis, Indiana, Dr. Reich discussed the proper approach to evaluating behavioral problems in older dogs.

She explained that behavioral problems in seniors can be sorted into 3 categories: true primary behavioral changes, behavioral problems that arise secondary to a medical issue, and problems related to cognitive decline. (continued on page 14)

GENETICS
To Clone or Not to Clone

The looks the same, smells the same, and has most of the same habits—and I never taught any of them to her.” Those are the words of the family of Nubia, the first puppy to be cloned in the United States.

“People are making a big mistake if they think they’re going to get their old pet back.” Those are the words of an Ivy League animal ethics professor who has serious concerns about the ethics of cloning. Clearly the topic of pet cloning is a controversial one.

As America’s love for its pets deepens (continued on page 27)

IVECCS
Disclosing Medical Errors

Amitting mistakes is a tough pill for just about anyone to swallow. It leaves you feeling vulnerable, defenseless, and unprotected from the reaction of the person you faulted. Nevertheless, we all want to be informed of errors, especially when it comes to health care.

One study in human medicine reported that 98% of patients want some type of acknowledgment when even minor medical errors are made.1 But only 30% of physicians share medical errors openly with their patients.1 (continued on page 13)
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CHOOSING QUALITY OVER QUANTITY

“Every time there is a season…
A time to be born, and a time to die…”

This passage, from the Book of Ecclesiastes (3:1-8), is one of the most quoted from the Bible and speaks volumes in veterinary medicine today. The death of our beloved pets is an unavoidable and brutal fact of life.

Our feature article in this issue—the first of a 2-part series on feline euthanasia—acknowledges that euthanasia is an ever-present moral and ethical dilemma facing veterinarians and support staff in private practice, an emotional upheaval for the pet owner, and a significant source of moral stress and compassion fatigue for everyone involved. Conflicting demands confront the owner, veterinarian, and professional health care team at the end of a cat’s life.

One of the causes of moral stress for the health care team is when a client requests continued care for his or her pet when the veterinarian knows that care will prolong the animal’s suffering. Pets are on solid footing as family members and not simply property, and these requests have, unfortunately, become relatively common in veterinary medicine.

LETTER TO THE EDITOR

DEAR EDITOR:

I am very concerned that you are helping to spread bad medical information in the veterinary community through your recent article, “The Benefits of Chiropractic Care” (August 2017). Chiropractic for animals is one of the ways pseudo-medicine is making its way into veterinary school curricula. The author attempts to explain the history of chiropractic while avoiding the reality: The entire theory of chiropractic is based on the idea that all disease is based on “vertebral subluxation.” The problem is that vertebral subluxation is not a real diagnosis; in over 100 years of existence, the “science” of chiropractic has never been able to demonstrate it. Multiple chiropractors examining the same patient can’t even agree on which part of the spine the “subluxation” lies. The belief that it exists leads to the idea that it affects an entire range of medical conditions that have nothing at all to do with vertebrae or spinal nerves.

Many veterinary chiropractors claim to treat a huge range of medical conditions while at the same time denying the efficacy of vaccinations and pharmaceuticals. They promote homeopathy, in which a substance is diluted to the point that not even one molecule of it is detectable, but the water “retains the memory” of the active ingredient. This is also pseudoscience and has been called out as such by many medical and veterinary associations around the world. Even Dr. Peyton’s use of Chinese herbs should be viewed critically, since the production of those herbs is entirely unregulated and has been demonstrated to be rife with fake ingredients and outright lies.

As is typical of articles that glowingly describe chiropractic, this one is full of anecdotes and light on evidence. The latest Cochrane review of chiropractic clearly demonstrates that chiropractic shows no benefit at all for anything other than back pain, and even those results can be achieved by a good physical therapist or massage therapist. Just because pet owners ask for it, and it’s gaining in popularity, does not mean it has any medical validity.

Deborah Cottrell, DVM
West End Animal Hospital
Newbury, FL

AUTHOR RESPONSE

Veterinary medicine has a long history of incorporating therapeutic modalities first developed for humans, and chiropractic is no different. Is chiropractic appropriate for all conditions? Of course not—it is not treatment. But it does the profession a disservice to dismiss chiropractic out-of-hand. Anecdotal evidence and studies in humans show that chiropractic is effective for a variety of issues, and understandably more and more veterinarians are looking into it for their patients. Rather than ignoring chiropractic, veterinarians should demand greater study into its effectiveness on their patients. Only then can its usefulness be fully determined.

—Don Vaughan
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Have a comment about one of our articles? Email Maureen McKinney at mmckinney@americanveterinarian.com.
Promising New Treatment for Ehrlichiosis-Associated Pancytopenia

By JoAnna Pendergrass, DVM

Canine monocytic ehrlichiosis (CME) is caused by the rickettsial bacterium *Ehrlichia canis*, which is transmitted to the host by the tick *Rhipicephalus sanguineus*. Distributed worldwide and affecting multiple body systems, CME has 3 clinical phases—acute, subclinical, and chronic. Bone marrow aplasia is a common and fatal sequela of chronic CME. It can cause bleeding and superinfections due to thrombocytopenia and neutropenia, respectively, making disease management challenging. Despite these serious complications, which can lead to a poor prognosis for these patients, it remains unclear why myelosuppression occurs with CME; possible reasons include immune dysfunction and *E. canis* strain.

A recent report described the case of a dog with chronic CME-associated nonregenerative pancytopenia that made a remarkable recovery after treatment with high-dose filgrastim.

**CASE PRESENTATION**

An 8-year-old male mixed-breed dog weighing about 6 kg presented with a 1-month history of hyporexia, adynamia, and a weight loss of approximately 1 kg, the authors wrote. Physical examination findings, including tachycardia, abdominal petechiae, and lethargy, indicated poor condition. Complete blood count results revealed severe leucopenia, thrombocytopenia, and anemia. No blood chemistry abnormalities were present. A direct immunofluorescence assay was positive for *E. canis*. The dog tested negative for *Anaplasm* and *Babesia* spp.

Initial treatment involved doxycycline and imidocarb dipropionate to kill *E. canis*. The anemia was treated with erythropoietin, iron, and folate. The authors noted that off-label human erythropoietin use is common for treating canine diseases; however, it has limited usefulness in chronic conditions because of anti-erythropoietin antibody development. The iron and folate corrected the iron deficiency that can occur with CME-associated bone marrow aplasia.

Following initial treatment, the dog improved slightly because of increased erythrocyte production, but leukocyte and platelet deficiencies remained. Petechiae, epistaxis, and gingival bleeding worsened.

The dog then received a short course of high-dose filgrastim (50 µg/kg SC q48h) and prednisolone. Filgrastim can reportedly treat canine neutropenia due to toxins and bone marrow transplantation. For CME, prolonged therapeutic filgrastim doses have shown some clinical success, justifying the short course and high dose described in this case report. The prednisolone treated the dog’s thrombocytopenia, which, in CME, can result from splenic sequestration and platelet destruction. Prednisolone use can be controversial due to the risk of exacerbating immunosuppression. In this case, though, the dog’s worsening bleeding problems justified prednisolone treatment.

After filgrastim and prednisolone treatment, the dog’s adynamia initially worsened, potentially due to bone pain associated with high-dose filgrastim; the hyporexia also worsened. Two weeks post filgrastim, the dog had fewer bleeding problems, more energy, and a better appetite. Neutrophil and platelet counts steadily improved, with the dog making a full recovery 2 months after diagnosis.

Should We Let Sleeping Dogs Lie in the Bedroom?

By Maureen McKinney

Dogs are part of 40 million American households today, with 63% of those households considering their pooches part of the family. In some homes, the dog is a welcome addition to the bedroom; in others, the boudoir is off limits to 4-legged family members—at least at bedtime. That’s because many people believe their own sleep will suffer with a dog in the mix.

Mayo Clinic researchers set out to determine once and for all whether sleeping with a dog or having a dog in the bedroom is beneficial or detrimental to their owner’s sleep.

“Most people assume having pets in the bedroom is a disruption,” says Lois Krahn, MD, a sleep medicine specialist at the Center for Sleep Medicine on Mayo Clinic’s Arizona campus and one of the study’s authors. “We found that many people actually find comfort and a sense of security from sleeping with their pets.”

From August through December 2015, the researchers evaluated the sleep of 40 healthy adults (88% of whom were women) without sleep disorders and their dogs occupying the same bedroom to determine whether this arrangement was conducive to sleep. Both dogs and owners were fitted with sleep trackers to monitor their snooze patterns for 7 nights.

The findings? People who slept with a dog in their bedroom did get a good night’s sleep—as long as Fido stayed off the bed. This finding held true regardless of the dog’s size. However, participants whose dogs slept in the bed with them experienced disrupted sleep.

The researchers noted that the study’s small sample size may have affected the results and suggest larger follow-up studies to confirm their findings. In addition, all the study dogs were older than 5 months, and the authors noted that results may have been different if the study included younger dogs.

“The relationship between people and their pets has changed over time, which is likely why many people in fact do sleep with their pets in the bedroom,” says Dr. Krahn. “Today, many pet owners are away from their pets for much of the day, so they want to maximize their time with them when they are home. Having them in the bedroom at night is an easy way to do that. And, now, pet owners can find comfort knowing it won’t negatively impact their sleep.”


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Early-Age Spay/Neuter Saves Lives

By Nicola M. Parry, BVSc, MRCVS, MSc, DACVP, ELS

Early-age gonadectomy (EAG) has been shown to be safe and is an effective way of saving lives,” says Carol A. Fellenstein, DVM, a mobile shelter surgery clinic staff at Purdue University College of Veterinary Medicine’s Pet Exotic Service in West Lafayette, Indiana. Presenting at the 2017 Purdue Veterinary Conference, Dr. Fellenstein described how early-age spay/neuter programs represent an essential component of a community-wide animal care strategy that only veterinarians can provide.

Overall, studies comparing outcomes associated with EAG and traditional-age gonadectomy (TAG) have shown that EAG is generally safe for both cats and dogs and leads to few long-term deleterious effects. The 1 exception may be the development of urinary incontinence in female dogs undergoing EAG, Dr. Fellenstein said. But when the risk of urinary incontinence in EAG female dogs is weighed against all other risks facing animals in shelters, it may be considered less significant.

Waiting until animals reach puberty before spaying or neutering them places an unnecessary burden on shelters, and this result in millions of animals being euthanized. “The veterinarian’s role in a comprehensive community program is to reduce the strain on shelters,” she stressed.

However, she noted the need for veterinarians to consider the following factors when operating on pediatric patients, stressing that, “physiologically, they are not just little versions of adult animals.”

Pediatric animals have a reduced ability to compensate for blood loss compared with their adult counterparts, so even a small amount of blood loss can result in a clinically significant anemia.

Oxygen consumption and respiratory rate in puppies and kittens are higher than those in adults, so young animal need 2 to 3 times higher oxygen flow rates during surgery.

The lack of body fat in pediatric patients increases their susceptibility to hypothermia.

Because of their immature livers, pediatric animals produce less albumin and have reduced glycogen stores. Lower albumin levels result in lower blood protein levels and thus a higher availability of unbound drug in circulation, making the patient more sensitive to the drug. Therefore, veterinarians should reduce drug doses for pediatric patients by at least 25% of calculated adult doses. Reduced glycogen stores also leave pediatric patients more susceptible to hypoglycemia, so a fasting period of 3 to 4 hours is enough, she noted. Dr. Fellenstein shared that her general rule of thumb when it comes to spaying/neutering in a young animal is “2 pounds or 2 months.”

Overall, EAG is beneficial for both animals and veterinarians, she said. It is less physiologically stressful for the animals—they recover within about an hour of surgery and typically do not need overnight hospitalization. EAG is also associated with fewer complications, especially because pediatric animals typically do not bleed as much during the procedure. Spaying before the first heat cycle also has a strong protective effect against the development of mammary carcinoma. Adoption rates are higher for spayed/neutered animals, she said, leaving them less likely to die in the shelter. And they are also less likely than intact animals to return to the shelter because of behavioral problems.

EAG is easier to perform and has fewer complications, so veterinarians can perform the procedure more quickly, she noted. These surgeries are also less expensive in younger animals because they require fewer materials and less staff assistance. Importantly, EAG helps to prevent accidental litters.

Therefore, “although EAG has not yet reached full acceptance in the veterinary community, 90% of vets do recommend it before adoption,” concluded Dr. Fellenstein.

How Does Your Dog Measure Up? New Growth Charts Could Provide the Answer

By JoAnna Pendergrass, DVM

In veterinary medicine, “there is limited information and little current guidance available on what constitutes optimal growth in dogs,” wrote the authors of a recent study on canine growth standards. The diversity of dog breeds and highly variable growth patterns of those breeds have made the development of a single canine growth standard a challenge.

The study described how the authors successfully developed evidence-based growth standards for male and female dogs based on size. Such standards, they said, “could form the basis of a clinical tool to enable trained veterinary professionals to monitor growth objectively during early life.”

For their retrospective study, the authors collected age and body weight data, dating back to 1994, from over 6 million dogs that had visited Banfield pet hospitals throughout the United States. Study dogs were purebred, younger than age 3, with a normal body condition score (BCS) and confirmed body weight and neuter status, and were seen for routine preventive care or received a “healthy” diagnosis.

BCS data from 2010 onward reflected use of the 5-category BCS scale, which was adopted in 2010. However, because most of the study’s data used the original 3-category scale (thin, normal, heavy), all 5-category measurements were converted to the 3-category scale. In a multistage process, the authors developed over 100 growth curves based on neuter status, breed, and adult size. The curves covered 12 weeks to 2 years of age.

Neutering is a known risk factor for weight gain, particularly when performed during the growth phase. The authors observed an upward growth trajectory with early neutering (<37 weeks) and a downward growth trajectory with later neutering (>37 weeks).

“Whether such shifts are the cause or the effect of age of neutering is not known,” the authors stated, warranting further study. The authors then created and compared breed- and size-specific growth curves for males and females. For the size-specific growth curves, the authors initially grouped breeds into 5 size categories: toy, small, medium, large, and giant. However, because some breeds had growth patterns inconsistent with their size category, the authors created a sixth size category, renamed the categories I through VI, and readjusted the per-category weight ranges. Growth patterns varied widely for category VI, which contained great Danes, mastiffs, and Rottweilers, making it unfeasible to create a growth curve for this category.

The authors observed overall agreement between the breed-specific curves and corresponding size-specific curves I through V, suggesting that size-based curves are useful for individual breeds and potentially mixed breeds. Breed-based curves, the authors noted, are too complex to be clinically useful.

Further study will be needed to validate this study’s growth standards and create a growth standard for dogs with adult weights exceeding 40 kg. In addition, these standards objectively monitor early-life growth, identify potential growth disturbances, and promote long-term health.

The Sneezes Have It: How African Wild Dogs Rally Pack Movement

By JoAnna Pendergrass, DVM

Consensus is necessary for certain benefits of group living, including defense of resources, protection, and deciding when to move. In animals, once a certain threshold of individuals (quorum) makes a particular signal, a collective decision is made to leave. For African wild dogs and other dominant-led social groups, dominant individuals disproportionately influence group decision making.

Researchers have determined that African wild dogs sneeze to rally pack movement. After studying 5 packs of African wild dogs in Botswana for 1 year, the researchers observed that rising from rest, opening the mouth, and folding back the ears were used to initiate rallies.

Video recordings of behaviors were analyzed from the beginning to end of each rally. Researchers counted the number of sneezes per rally event, including the per-minute frequency of sneezes before and after rallies. Specific social interactions were also analyzed: (1) parallel runs: running flank to flank; (2) mob: at least 3 dogs gathered within 3 feet of one another. Because dominance under the dominant pair is not easily identifiable in African wild dog packs, the quorum needed for group movement is a group consensus could not be determined. "Furthermore, the researchers observed sneezing in relaxed states and a lack of startle behavior when sneezing occurred.

Whether sneezing was a true voting mechanism or simply a physiologic response occurring after a group consensus could not be determined. “Further research is required to confirm causality,” the researchers wrote.
Anesthesia Monitoring With Capnography

Capnographic monitoring of the pulmonary and cardiovascular systems can provide invaluable information during anesthetic events.

By Nicola M. Parry, BVSc, MRCVS, MSc, DACVP, ELS

(continued from front cover)

exhaled CO₂ as each breath is taken over time. Reuss-Lamky highlighted the critical role of this tool in anesthetic monitoring by discussing findings from a key study from the human medical literature of more than 1000 anesthetic-related malpractice claims.¹ Anesthesiologist reviewers analyzed the cases and concluded that “using capnography and pulse oximetry together could have prevented 93% of the anesthetic mishaps,” she said.

**KEY ASPECTS OF PHYSIOLOGY**

According to Reuss-Lamky, 3 physiologic processes are essential for capnography use and interpretation: metabolism, circulation, and ventilation. Gas exchange occurs in alveolar capillary beds in the lung, she said. CO₂ is produced in the body as a byproduct of tissue metabolism, transported to the lungs via perfusion, and then removed via alveolar ventilation. The exhaled CO₂ is also known as end-tidal CO₂ (ETCO₂) and represents the concentration of CO₂ in the lung alveoli that emptied last.

She explained that CO₂ is transported in the body predominantly in 3 forms: 60% to 70% as bicarbonate ions, 20% to 30% bound to proteins, and 5% to 10% dissolved in arterial plasma. Blood-gas analysis measures the CO₂ that is dissolved in plasma, said Reuss-Lamky, and this is known as the arterial partial pressure of CO₂ (PaCO₂). She noted that, in a healthy patient, ETCO₂ (normally 35-45 mm Hg) typically correlates with PaCO₂ (Table) and is approximately 2 to 5 mm Hg lower. Because this gradient is considered clinically insignificant, she added that ETCO₂, PaCO₂, and alveolar CO₂ (PACO₂) levels are considered approximately equal.

Ideally, alveolar ventilation is matched to alveolar perfusion. Under normal conditions in the lung, the ratio of pulmonary ventilation to perfusion is close to 1. However, ventilation-perfusion mismatching may occur in some conditions, leading to abnormal ETCO₂ levels (Table).

**WHY USE CAPNOGRAPHY?**

Capnography offers many benefits, said Reuss-Lamky. It allows noninvasive assessment of the patient’s systemic metabolism, pulmonary perfusion, and cardiac output.

Because ETCO₂, PaCO₂, and PACO₂ levels are considered approximately equal, monitoring ETCO₂ levels can help clinicians to detect trends or sudden changes in a patient’s PaCO₂. Various clinical conditions, even anesthetic mishaps, may increase the gradient between ETCO₂ and PaCO₂, such that it becomes clinically significant, she said.

ETCO₂ analysis can help evaluate a patient’s acid-base status, respiratory patterns, and adequacy of ventilation in a variety of clinical situations, said Reuss-Lamky. These include during anesthesia when anesthetic drugs and inhalants can reduce tidal volumes significantly, or during long-term ventilatory assistance, such as when a mechanical ventilator is used. Capnography can also help clinicians promptly identify airway mishaps, she added. One example comprises cases in which the endotracheal tube is placed in the esophagus instead of the trachea.

By monitoring ETCO₂ using capnography, Reuss-Lamky explained that clinicians can identify and promptly respond to such conditions. For example, ETCO₂ levels greater than 45 mm Hg in a patient indicate inadequate ventilation (Table), she said, requiring clinicians to provide ventilatory assistance via manual or mechanical means. Hypoventilation may occur in such conditions as pneumothorax or lung disease, she added.

Using capnography also helps maintain a stable plane of anesthesia. This can be especially useful in obese animals, during prolonged surgical procedures (>90 minutes), or when neuromuscular blocking agents are used. A sudden decrease in ETCO₂ can also be an early and reliable indicator of impending cardiovascular collapse or cardiac arrest, she said.

### Table. Effect of CO₂ on Oxygenation and Ventilation

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<thead>
<tr>
<th>PaCO₂ (ETCO₂)</th>
<th>CONDITION IN THE BLOOD</th>
<th>STATE OF VENTILATION</th>
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<td>Hypercapnia</td>
<td>Hypoventilation</td>
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<tr>
<td>35–45 mm Hg</td>
<td>Eucapnia</td>
<td>Normal</td>
</tr>
<tr>
<td>&lt;35 mm Hg</td>
<td>Hypocapnia</td>
<td>Hyperventilation</td>
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</table>

ETCO₂ = end-tidal CO₂; PaCO₂ = arterial partial pressure of CO₂.

**TYPES OF CAPNOGRAPHY**

Two types of capnographs are available, said Reuss-Lamky: mainstream and sidestream devices.

**Mainstream Devices**

Mainstream, or nondiverting, devices analyze the respiratory gases locally (at the interface between the endotracheal tube and breathing circuit) and provide instant (<100 ms) results. Samples of the patient’s exhaled gases are obtained from the anesthetic circuit using an adapter that attaches to the end of the endotracheal tube. This adapter should be attached at the point of the patient’s nose to avoid excessive dead space and prevent rebreathing of CO₂, said Reuss-Lamky.

Mainstream technology is subject to fewer problems secondary to secretions or moisture compared with sidestream devices, involves fewer disposable supplies, and does not require scavenging of sampled waste anesthetic gases, she said. However, mainstream monitors have several disadvantages. Because of their weight and location, they are prone to accidental disconnection, leaks, and damage, and they may cause kinking of the endotracheal tube.

**Sidestream Devices**

Sidestream, or diverting, devices extract a sample of respiratory gases via tubing into a measurement chamber for analysis and
can also be used in patients that are not intubated. These monitors use small, lightweight sensing tees attached at the interface between the endotracheal tube and breathing system. They are also useful for remote monitoring (such as during magnetic resonance imaging).

Sidestream devices, however, have some disadvantages. In small patients, high fresh gas flow rates may produce falsely low ETCO₂ readings and waveform changes as a result of sample dilution. Sidestream monitors also have a 2- to 3-second delay in response time and require periodic calibration and replacement of disposable supplies (such as sensing tees). Sampling tubes may become occluded due to buildup of respiratory moisture. This technology also requires scavenging of sampled waste anesthetic gases.

THE CAPNOGRAM
The waveform of the capnogram represents the changes in a patient’s ETCO₂ levels over time, said Reuss-Lamky. The upward slope and the top of the waveform represent the exhalation phase, and the downward slope and the bottom of the waveform represent the inhalation phase.

In a normal capnogram (Figure 1) the baseline of the waveform should reach a zero level because the patient should not be inhaling CO₂, the expiratory upstroke of the wave should be steep, the expiratory plateau should be relatively flat, and the inspiratory downstroke should be an almost vertical drop to baseline. The highest point of the plateau represents the actual ETCO₂ value. The shape of the capnogram waveform can help clinicians identify problems with the patient’s ventilation, perfusion, or metabolism.

SOME COMMON ABNORMAL CAPNOGRAMS
ETCO₂ Level Abnormalities
Increased ETCO₂ levels (>45 mm Hg) may occur as a result of hypoventilation (Figure 2). This may be due to problems such as airway obstruction, pneumothorax, lung disease, or acutely increased metabolism (eg, in malignant hyperthermia). Decreased ETCO₂ levels (<35 mm Hg) may occur as a result of hyperventilation (Figure 3). This may be due to problems such as airway occlusion, endotracheal tube dislodgement, or cardiac arrest.

Other Abnormalities
If the baseline does not return to zero during inspiration, this indicates that the patient is rebreathing exhaled CO₂ (Figure 4). Possible causes include an exhausted soda lime absorber or faulty valves in the breathing circuit.

A ripple effect at the end of the expiratory phase represents cardiogenic oscillations as the heart contracts and relaxes against the diaphragm when the lungs are nearly deflated (Figure 5). Cardiogenic oscillations may be seen at low respiratory rates and are considered physiologically insignificant.

A weak inhalation phase showing decreasing ETCO₂ with loss of the expiratory plateau indicates an endotracheal tube cuff leak or deflated cuff.

CONCLUSION
Capnography represents a valuable tool to help clinicians evaluate and monitor anesthetized veterinary patients. By familiarizing themselves with the waveform of the normal capnogram, clinicians can learn to recognize abnormal waveforms and thus identify underlying clinical situations or technical problems that may affect a patient during anesthesia.


Figure 1. Normal Capnogram
Figure 2. Hypoventilation
Figure 3. Hyperventilation
Figure 4. Rebreathing of CO₂
Figure 5. Cardiogenic Oscillations
Figure 6. Airway Obstruction
Conference Coverage

Tackling the Obesity Issue

With pet obesity reaching epidemic proportions, how can veterinarians guide owners toward making healthier decisions for their pets?

By Maureen McKinney

(continued from front cover)

Obesity can be attributed to intrinsic and extrinsic factors. Breed, age, genetics, neuter status, gender, and the presence of certain diseases can play a role. The bigger problem seems to lie in pet owners’ knowledge (or lack thereof) and choices, including insufficient exercise and overfeeding, misconceptions about what qualifies a pet as overweight, and a changing attitude toward their pets.

Regardless of the cause, increased weight has insidious consequences for the health of the nation’s pets. Excess weight stresses every major system in the body, potentially leading to respiratory compromise, hypertension, diabetes, osteoarthritis, liver disease, and an increased risk for cancer, among many other expensive and potentially life-threatening conditions.

It may not be easy to broach the subject of excess weight in a patient—especially if the client is overweight as well. Nevertheless, to keep patients as healthy as possible, the conversation must be had.

BROACHING THE SUBJECT

Many veterinary teams are reluctant to discuss weight issues with pet owners because they don’t want to offend, upset, or anger their clients. Thus, many teams simply ignore the problem. American Veterinarian spoke with Deborah Linder, DVM, MS, DACVN, at the 2017 Central Veterinary Conference in Virginia Beach, Virginia, to get her take on how to broach the subject of weight loss with clients and how she helps her patients shed pounds.

Her advice for pinpointing the best approach is to build trust and rapport with clients, and gain an understanding of their motivation (or lack thereof).

Dr. Linder, who heads the Tufts Obesity Clinic for Animals in North Grafton, Massachusetts, said she tries to build trust and rapport quickly by asking clients open-ended questions, such as “Describe your pet’s day” or “How have things changed?” If the pet has started to gain weight, she might ask, “What is your pet doing now that he or she might not have been doing before?” The answers to these questions give her a good idea about that owner’s readiness to change, which gives her a better sense of what approach to take.

Behavioral modification research in human medicine offers insights about when and how to intervene. Dr. Linder noted that a readiness-to-change scale can help. “This type of scale helps to identify clients who have no interest in changing their behavior, those who are thinking about it and maybe have started making changes, and people who are already making changes but need troubleshooting help,” she said. “Your approach with the client who isn’t interested is very different from your approach with the client who is already trying and just needs some help.”

For the people who aren’t interested, Dr. Linder is likely to provide them with some information and then revisit the subject at another time. Sometimes, especially if a pet is really obese, it’s not the first time the client has been told that his or her pet is overweight,” she said. “And it almost works in reverse: Not starting an argument may actually pique their interest.” Instead, Dr. Linder may mention some interesting data about a relevant study. “I might say, ‘Oh, there is this really cool study where pets that were kept trim lived 2 years longer on average than pets that were overweight. I just provide interesting information and move on.”

Some owners can be very emotional about the topic. “They’ll say, ‘I can understand that losing weight for my pet would be good, but I’ve gone through it, I know its miserable, and I don’t want that for my pet,’” Dr. Linder said. “Then we know where the concern is and why the client might be against it.”

What does Dr. Linder say to those clients? “I tell them about a study that showed that overweight pets are actually in pain and have loss of vitality, but when they lose the weight, it gets better,” she said. “That’s a really neat study because we can actually say that quality life is poor. So, if someone says that a fat pet is a happy pet, we have evidence to say otherwise.”

WEIGHT LOSS STRATEGIES

Beyond the physical strategies for helping a pet lose weight, Dr. Linder also recommends psychological strategies. “This is where I get creative,” she said, “although the psychology is more with the owner than the pet.” Studies have shown that many of the same tactics people use to lose weight will work for helping pets lose weight. One simple strategy that Dr. Linder recommends is to have the owner use a smaller scoops and a smaller bowl. “Owners will actually feed their pets less food if the materials they use are smaller,” she said.

Dr. Linder finds that most clients whose pets have weight issues use food to create an emotional bond with their pet. “The obesity is just something that happens because the food is how they show their love to their pet,” she noted. So, she talks with owners about other ways to show love that don’t add calories, such as belly rubs and toys. “We do a lot of substitution, a lot of compromise,” Dr. Linder said. “I think that preserves the bond they have and keeps the pet healthier.”

Just as for people, real and sustained weight loss in pets will not occur based simply on changes in eating habits. Consistent weight loss requires increased energy expenditure, in the form of exercise, and decreased caloric intake. For clients who are motivated to help their pet lose weight, a customized weight loss plan, which should be reassessed over time and modified as needed, is ideal.

With regard to how quickly a pet should lose weight, Dr. Linder defers to the 2014 American Animal Hospital Association (AAHA) Weight Management Guidelines for Dogs and Cats, which she helped create. “Based on the different studies we compiled and analyzed, AAHA recommends about 1% to 2% weight loss per week,” she said. For cats, that can be anywhere from 0.5% to 2% of their body weight.

Most studies indicate that pets that lose 3% or more of their body weight per week are much more likely to have rebound weight gain and to lose muscle rather than fat. “If the pet is just losing weight consistently, I am over the moon,” said Dr. Linder. “My clients tend to prefer the gradual approach, and I say that is fine with me as long as we aren’t going back up.”

References available at AmericanVeterinarian.com.
Disclosing Medical Errors

Veterinarians need to be comfortable speaking out about errors to clients, team members, and themselves.

By Kerry Lengyel

(continued from front cover)

At the 2017 International Veterinary Emergency and Critical Care Symposium in Nashville, Linda Fineman, DVM, DACVIM (Oncology), explained that although fewer studies have been published regarding medical errors in veterinary medicine, there are many reasons to believe the statistics are similar.

“Many of us have been trained in a culture where we are expected to be infallible and to make an error is a source of shame, despite the growing awareness that expecting error-free practice is unrealistic,” said Dr. Fineman, who is the director of veterinary talent and knowledge strategy at Ethos Veterinary Health in Woburn, Massachusetts.

What action is considered a medical error? It’s based on the idea that another veterinary professional would have recognized the care decisions and actions a person made to be in error at the time they were being made. “If a veterinarian does something that either does or does not cause harm but it’s not within the standard of care within that community, that’s an error,” Dr. Fineman said. “I want to emphasize that not all errors do cause harm.”

By being open with clients about medical errors, you and your veterinary practice will benefit in numerous ways. Disclosing medical errors in the proper manner allows you and your practice to:

• Reduce the risk of board complaints and lawsuits
• Reach fair settlements if the client decides to sue
• Develop clarity about what happened
• Reduce the risk of board complaints and lawsuits

Despite knowing that clients want to understand what happened, veterinarians still find it difficult to disclose errors. There’s a huge mismatch between this knowledge and what usually ends up happening after an error occurs, Dr. Fineman said.

APPLYING THE TEAM MODEL

Veterinarians often respond by mentioning the adverse event but not the fact that the event happened as a result of an error. Instead of shying away from disclosing medical errors, veterinarians should educate themselves on the TEAM module for disclosure, which involves Truth, Empathy, Apologizing, and Managing the situation.

Be Truthful

Acknowledge that an error occurred. Be upfront and open and don’t put up any walls between yourself and the client. “As you’re telling the truth, share the basics and then stop and ask the client how he or she is feeling,” Dr. Fineman suggested.

Empathize

Address the client’s thoughts, feelings, and needs. Show that you understand how difficult this situation must be for the client. “I think empathy is absolutely critical,” Dr. Fineman said. “By using empathy and reflective listening, what we’re showing that client is that we hear, acknowledge, and understand the issues they’re having, and that it’s OK for them to have emotions and negativity about the bad experience they had.”

Apologize

Give the client an apology of responsibility—“I’m sorry I made this error”—not an apology of sympathy—“I’m sorry this happened to you.” Apologies need to include an explanation of what happened, said Dr. Fineman, “and also a fair offer for how you will make it right.”

Manage Through to Resolution

Fair reparations, whether financial or otherwise, need to be made. Ask the client what more you can do for him or her. If the client would rather have the pet transferred to another hospital or practice, be comfortable in setting that up. “Be accountable and make arrangements for reparations,” Dr. Fineman said. “For example, waive the fees that are appropriate to waive. If the patient is hospitalized for 3 days because you gave him pneumonia, the client better not be paying for that.”

BEFORE DISCLOSURE

Prior to having the difficult disclosure conversation, make sure that 4 things are accomplished: (1) take care of the patient’s immediate needs, (2) take care of yourself and your staff, (3) develop clarity about what happened, and (4) think about what you are going to say to the client.

Self-awareness of your emotional state is ultimately the key to getting through this difficult conversation. After becoming aware that a medical error occurred, you will most likely be overwhelmed with myriad emotions. Take some time to manage your own reactions before you try to help your client manage his or her reaction.

“The idea that if you make a mistake you are to blame and should feel ashamed—that’s not healthy,” Dr. Fineman said. “We have to speak about errors. We have to own them and admit to them out loud. We have to say, ‘I made this mistake, and here’s what happened.’ Gather your team around you and say, ‘Let’s work together to figure out how we can build in double checks.’”

THE BOTTOM LINE

Not disclosing medical errors to your clients will cause more harm than good for you and your practice in the long run. According to that same human study, nondisclosure leads to feelings of anger (90%), bitterness (80%), betrayal (55%), and humiliation (40%) in patients.

Errors and mistakes are a part of life, and it is our professional responsibility to be open with our clients, our staff, and ourselves about them.

Behavioral Problems in Senior Dogs

Improving quality of life for older dogs with behavioral problems entails first identifying the root cause of the problem and then taking a multimodal approach to treatment.

By Nicola M. Parry, BVSc, MRCVS, MSc, DACVP, ELS

(continued from front cover)

TRUE PRIMARY BEHAVIORAL PROBLEMS

In senior dogs, primary behavioral problems are similar to those seen in younger animals and may include problems such as separation anxiety, aggression, and phobias. However, according to Dr. Reich, except for problems that existed at a younger age, true primary behavioral diagnoses occur less frequently than behavioral problems secondary to a medical condition. “A new behavioral problem in a senior dog is usually a result of a medical problem,” she said.

BEHAVIORAL PROBLEMS SECONDARY TO A MEDICAL PROBLEM

Because a change in behavior is frequently the first indication of an underlying medical problem, Dr. Reich emphasized the importance of reviewing all medical records relating to the dog’s clinical history. And, because many medical conditions may have nonspecific or similar causes, Dr. Reich highlighted the need for clinicians to perform a thorough clinical examination, as well as baseline laboratory testing (complete blood count, biochemistry profile with electrolytes, thyroid profile, and urinalysis), to help identify underlying metabolic or endocrine abnormalities in senior dogs with behavioral problems. She advised that the findings of the clinical examination and baseline laboratory testing should then inform the clinician’s decisions regarding additional diagnostic testing.

Any medical problem can potentially contribute to a dog’s developing behavioral problems, said Dr. Reich. For example, discomfort or pain can lead to behavioral changes such as pacing, restlessness, night waking, and aggression. Dr. Reich noted that the most common sources of pain she encounters in senior dogs are of musculoskeletal and gastrointestinal (GI) origin.

Dogs with underlying musculoskeletal problems may show behaviors such as aggression when they are lying down and forced off furniture, excessive licking of their feet or joints, and aggression toward other dogs in the family that occurs outside. To help identify musculoskeletal problems, clinicians should question owners about whether their dog slides on smooth flooring, is slow to rise after lying down, or has become less active and maybe gradually gained weight as a result.

GI problems may cause food aggression. In particular, new cases of food aggression directed toward people should prompt questions from the clinician to obtain information to help rule in or rule out the possibility of underlying GI disease—for example, if a dog is refusing to eat but does not want the owner to remove the food bowl. Dogs with GI disease may also have nausea, which may cause anxiety that manifests as chewing of various objects. This can be difficult to differentiate from the destructive chewing associated with separation anxiety, said Dr. Reich. However, dogs with GI disease typically show other signs as well, such as excessive swallowing or picky eating.

Endocrinopathies can also affect a senior dog’s behavior. Hyperadrenocorticism may cause irritability, lethargy, and polyuria/polydipsia and may even contribute to food aggression, said Dr. Reich. Hypothyroidism may be associated with behavioral changes ranging from lethargy to aggression. “Cushing’s disease is one of the most common endocrine disorders that I have seen associated...
with behavioral problems,” she said. “However, although hypothyroidism is a common endocrine disease in dogs, I rarely see it associated with behavioral problems.”

In all cases of behavioral problems, Dr. Reich stressed the importance of carefully questioning the owner to obtain as much specific information as possible about the dog's behavior. Clients may be unaware that certain observations or information about their pet could be useful to the veterinarian and thus may not mention some things. Clients also frequently become accustomed to some behavioral changes in their pet and may not think to discuss the problems, she said.

Additionally, “what the owner calls a problem may affect its diagnostic path,” she cautioned. For example, an owner may describe a dog's abnormal urination behavior as marking, whereas it may in fact be pollakiuria.

Dr. Reich also stressed the importance of performing urinalysis on any dog that is urinating in the house. She requests this of referring veterinarians before they refer a dog to see her. “I want to rule out urinary tract infection,” she said.

However, regarding any diagnostic testing in senior dogs with behavioral problems, Dr. Reich reminded clinicians that “failure to find an abnormality does not mean nothing is wrong—it just means nothing was found.”

PROBLEMS RELATED TO COGNITIVE DECLINE

Because many medical conditions in older dogs have signs that mimic those of cognitive decline, when evaluating senior dogs with behavioral problems, Dr. Reich noted that “the possibility of cognitive dysfunction always looms in the background, but it's really a diagnosis of exclusion.”

The acronym DISHA can help clinicians recognize the signs of cognitive dysfunction in senior dogs:

• Disorientation: Dogs may walk aimlessly, stare at walls, or lose balance and fall.
• Interactions: Dogs may begin to interact differently with people or other pets in the home.
• Sleep: Dogs that previously slept through the night may now be restless during the night or wake frequently.
• House soiling: Dogs may no longer alert the owner to the need to go outside and may urinate indoors or be incontinent.
• Activity level changes: Dogs may be restless, agitated, or show other signs of anxiety such as separation anxiety; they may stop grooming or may have a decreased appetite.

TREATING BEHAVIORAL PROBLEMS

Treatment of behavioral problems in senior dogs varies depending on whether the problem is a true primary behavioral problem, secondary to a medical problem, or cognitive dysfunction, said Dr. Reich. She stressed that clinicians should treat any underlying medical issues first. Treatment plans may also require medications or changes in how the owner manages the dog.

Managing Undesired Behaviors

Some behavioral problems—including separation anxiety—are managed the same way in older dogs as in younger dogs, said Dr. Reich. Behavioral modification techniques are also the same in older and younger dogs, but Dr. Reich stressed that such techniques may not be as effective in seniors. She discussed using treats or rewards to redirect or facilitate desired behaviors; in addition, although clinicians can use desensitization and counterconditioning to help dogs that fear noises, scary stimuli, and being alone, Dr. Reich noted that these techniques may be difficult to implement in seniors. “Dogs have limited learning ability as they age,” she said.

Owners may also need to implement various management changes, depending on the dog’s behavioral problem. For example, in cases involving food aggression, owners should feed the dog where it cannot be disturbed. In cases involving house soiling, owners should take the dog outside more frequently to urinate, including as late as possible before bedtime. Owners may also wish to teach their dog a cue for elimination if the dog is easily distracted when outside. They can also train their dog to urinate on pads or paper indoors.

Supplements and Drug Therapy

Dr. Reich discussed various supplements that have been used to treat senior dogs with behavioral problems, including S-adenosylmethionine (SAMe), apoaequorin, alpha-casozepine, and omega-3 fatty acids.

Although Dr. Reich said that many of the medications used to treat young dogs with behavioral problems can also be used in seniors, she stressed that drugs with fewer adverse effects are preferred—for example, selective serotonin reuptake inhibitors such as fluoxetine and sertraline.

For dogs with poor liver function, Dr. Reich advises that clinicians avoid using diazepam and instead choose other benzodiazepines, such as lorazepam and clonazepam, because metabolism of these drugs is minimally affected by age and liver disease. She also recommends that clinicians perform bloodwork regularly—once or twice each year—on dogs receiving long-term medications for behavioral problems to ensure that the drugs are not adversely affecting the animal’s metabolism.

For dogs with cognitive dysfunction, in particular, Dr. Reich favors using SAMe supplements. “I try to treat as many senior dogs as possible with SAMe,” she said. It stimulates brain glutathione and decreases oxidative stress, which is implicated in cognitive dysfunction, she explained. Many dogs that receive SAMe supplementation show clinical improvement, she said.

In contrast, Dr. Reich noted that she does not typically use selegiline, a monoamine oxidase-B inhibitor, for dogs with cognitive dysfunction because of its potential to interact with other products or drugs such as amitraz and fluoxetine.

Combination Therapy

For managing senior dogs with behavioral problems, Dr. Reich recommends using an approach that combines medical, behavioral, and environmental management strategies, with drug therapy as needed. This approach can help to improve quality of life for both the dog and the owner.
Feline Euthanasia: Part 1—Ethics, Aesculapian Authority, and Moral Stress

Beyond guiding clients and facilitating the process, veterinarians must learn to deal with the moral stress associated with euthanasia.

By William Ray Folger, DVM, MS, DABVP (Feline Practice); Elizabeth Colleran, DVM, MS, DABVP (Feline Practice); Tina Han, DVM; and Elizabeth Strand, MSSW, PhD

responsibility that we sometimes recommend euthanasia at the end of the patient’s life.

The American Veterinary Medical Association (AVMA) defines euthanasia as a “good death” in a way that “minimizes or eliminates pain and distress.”1 Euthanasia has also been described as “the unfortunate, unavoidable, and unintended consequence to end patient suffering.”2 Unification of these definitions renders a uniquely useful definition for veterinarians: Euthanasia is the necessary but unfortunate, unavoidable, and unintended consequence to end patient suffering in a manner that minimizes pain, anxiety, and distress.

THE PET AS FAMILY

The past half-century has witnessed a metamorphosis in the importance of pets in the family structure.3-5 For many clients, the emotional bond they share with their pets transcends the bonds they have with other family members or friends. This emotional attachment demands respect, dignity, and empathy from veterinary professionals. Cats provide their human companions with unconditional love and loyalty, and veterinarians must deploy their Aesculapian authority in making end-of-life recommendations for euthanasia to prevent needless suffering.6,7

Aesculapian authority is conferred on those individuals whom society perceives as healers and medical experts; it transcends our education, training, and experience. We are viewed by society as the moral authority in medicine; we have the power to heal, relieve suffering, and retard death.

USE AND MISUSE OF AESCULAPIAN AUTHORITY

The proper use of Aesculapian authority is displayed when veterinarians understand and appreciate that clients view their pets as family members. We are required to consider the needs of the patient as our first priority. At the end of a cat’s life, when restoration of comfort and function is unattainable and the patient appears to be suffering or suffering is imminent, it is our moral and ethical responsibility to focus the owner’s attention on the patient’s quality of life.8

Several practical quality of life evaluations have been proposed in the veterinary literature, the principles of which should be introduced to the client long before the discussion of euthanasia. The first practical evaluation is to determine whether the patient is able to enjoy the Five Freedoms (Box).9 A patient’s inability to enjoy these freedoms calls into question its quality of life.

Owners should be advised to evaluate subjectively what the cat is experiencing on a daily basis, ranking quality of life on a scale
of 1 to 10, with 10 representing the best day and 1 being inexorable suffering. If the patient has continuous days in the 2's and 3's, it is time to consider the discussion of euthanasia.\(^3\)

Alice Villalobos, DVM, DPNAp, has provided a comprehensive scale to help measure quality of life for cats (Table).\(^3,10\) If clients evaluate their cat successively over a convenient period of time, the scale helps them arrive at their own conclusion concerning the quality of life of their beloved pet.

Failure to implement Aesculapian authority properly may result in a client demand of euthanasia for trivial or non-health-related reasons (eg, inappropriate behavior, new house, new spouse). This so-called convenience euthanasia is a primary source of moral stress for veterinary professionals. The American Association of Feline Practitioners is opposed to convenience euthanasia, stating that “It is not in the best interest of the patient, and it is not in the best interest of the veterinary profession to perpetuate an image of itself as willing to kill a companion animal ‘on demand.’”

THE DECISION TO END PATIENT SUFFERING

Discussion of quality of life issues should begin as early as possible prior to the eventual deterioration of the pet.\(^10\) Once the owner and veterinarian embrace the discussion regarding the need to end the patient's suffering, a flexible timeframe should be established to allow the client to adjust emotionally to the decision. Patience, respect, empathy, and good listening skills are all vital characteristics the veterinarian must display to make the patient's passing as peaceful as possible for all involved. The caregiver should be given the option to be present for the procedure, and careful explanation of the procedure prior to starting the process is critical. It is also tactful to discuss the final disposition of the pet's remains prior to the procedure.

CLIENT EXPECTATIONS OF THE VETERINARY CARE TEAM

It is expected that the veterinary team, within the bounds of safe medical practice, place few limits on the emotional and logistical needs of clients. This can include allowing the client to spend ample time with the cat before and after the euthanasia, regardless of time of day; allowing the presence of family members, even small children, as well as the integration of religious or spiritual needs into the euthanasia process; compassionately handling the disposition of the body; and helping the client through the grieving process.

Veterinarians take the process of euthanasia seriously for their clients. What is less clear is whether they take the personal emotional impact of performing euthanasia as seriously. Emotional labor is work that creates an emotional response in caregivers; euthanasia certainly meets that criterion.

The AVMA’s guidelines for euthanasia\(^1\) include “human behavior” and acknowledge that euthanasia can have an emotional impact on the entire veterinary team. There is also a long history of implicit euthanasia “practice wisdom” that has been handed down from seasoned to new veterinarians for hundreds of years. These standards and experience of practice wisdom exist for good reason. One of the biggest predictors of clients’ difficulty in dealing with their grief after euthanasia is feeling unsupported by the veterinary team.\(^11\)

Grief-stricken clients often report feeling haunted by something they saw and were not prepared for, or something they did not feel comfortable saying or asking about during the euthanasia process. Because veterinarians know this can happen, usually based on a few difficult client experiences, they have become very alert and attentive to handling euthanasia well.

MORAL STRESS AND THE VETERINARY CARE TEAM

How does all this pressure affect the veterinary team over time? This common but high-stakes procedure can take a toll, especially when confounding issues are involved. It is now common knowledge in the profession that veterinarians experience poor well-being. Poor work-life balance, depression, anxiety, and even suicide are associated with the stressors veterinarians face on the job.\(^12\) Sources of stress include financial pressure,\(^13\) number

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**Box. The Five Freedoms**\(^10\)

1. **Freedom from hunger or thirst** by ready access to fresh water and a diet to maintain full health and vigor
2. **Freedom from discomfort** by providing an appropriate environment, including shelter and a comfortable resting area
3. **Freedom from pain, injury, or disease** by prevention or rapid diagnosis and treatment
4. **Freedom to express** (most) normal behavior by providing sufficient space, proper facilities, and company of the animal’s own kind
5. **Freedom from fear and distress** by ensuring conditions and treatment that avoid mental suffering

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Table. The HHHHMMMM Quality of Life Scale for Cats

<table>
<thead>
<tr>
<th>Score</th>
<th>Criterion</th>
</tr>
</thead>
<tbody>
<tr>
<td>H: 0–10</td>
<td>HURT:</td>
</tr>
<tr>
<td></td>
<td>• Adequate pain control, including breathing ability, is the first and foremost consideration.</td>
</tr>
<tr>
<td></td>
<td>• Is the cat’s pain being managed successfully?</td>
</tr>
<tr>
<td></td>
<td>• Trouble breathing outweighs all other concerns.</td>
</tr>
<tr>
<td>H: 0–10</td>
<td>HUNGER:</td>
</tr>
<tr>
<td></td>
<td>• Is the cat eating enough nutritious food?</td>
</tr>
<tr>
<td></td>
<td>• Do coaxing and hand feeding help?</td>
</tr>
<tr>
<td></td>
<td>• Does the cat require a feeding tube for nutrition?</td>
</tr>
<tr>
<td>H: 0–10</td>
<td>HYDRATION:</td>
</tr>
<tr>
<td></td>
<td>• Is the cat dehydrated, hypovolemic?</td>
</tr>
<tr>
<td></td>
<td>• For cats not drinking or eating enough food that contains water, provide subcutaneous fluids once or twice daily to supplement fluid intake.</td>
</tr>
<tr>
<td>H: 0–10</td>
<td>HYGIENE:</td>
</tr>
<tr>
<td></td>
<td>• The cat should be kept brushed, cleaned, and parasite free. This is paramount for cats with oral cancer.</td>
</tr>
<tr>
<td></td>
<td>• Check the body for soiling after elimination.</td>
</tr>
<tr>
<td></td>
<td>• Avoid pressure sores and keep all wounds clean.</td>
</tr>
<tr>
<td>H: 0–10</td>
<td>HAPPINESS:</td>
</tr>
<tr>
<td></td>
<td>• Does the cat express joy and interest?</td>
</tr>
<tr>
<td></td>
<td>• Is the cat responsive to surroundings (eg, family, toys)? Does the cat purr when scratched or petted?</td>
</tr>
<tr>
<td></td>
<td>• Is the cat depressed, lonely, anxious, bored, afraid?</td>
</tr>
<tr>
<td></td>
<td>• Can the cat’s bed be near the kitchen and moved near family activities so as not to be isolated?</td>
</tr>
<tr>
<td>M: 0–10</td>
<td>MOBILITY:</td>
</tr>
<tr>
<td></td>
<td>• Can the cat use the litter box without help?</td>
</tr>
<tr>
<td></td>
<td>• Is the cat ataxic, stumbling, or having seizures?</td>
</tr>
<tr>
<td></td>
<td>• Some caregivers feel euthanasia is preferable to a definitive surgery, yet cats are resilient. Cats with limited mobility may still be alert and responsive and can have a good quality of life if the family is committed to providing quality care.</td>
</tr>
<tr>
<td>M: 0–10</td>
<td>MORE GOOD DAYS THAN BAD:</td>
</tr>
<tr>
<td></td>
<td>• When bad days outnumber good days, quality of life for a declining cat might be too compromised.</td>
</tr>
<tr>
<td></td>
<td>• When a healthy human-animal bond is no longer possible, caregivers must be made aware that their duty is to protect their cat from pointless pain and frustration by making the final call for the gift of euthanasia. The decision needs to be made if the cat has unresponsive suffering. If death comes peacefully and painlessly at home, that is OK.</td>
</tr>
</tbody>
</table>

Total: A total score >35 indicates acceptable quality of life.

Created by Alice Villalobos; used with permission of the author.
Moral resilience, however, is required in situations that are more difficult. It is “the ability to respond positively to the distress and adversity caused by an ethically complex situation.” Veterinarians may be able to respond positively on a temporary basis, taking care of their clients and perhaps their team’s needs. Over time, however, coping can take a negative turn and result in overworking, substance abuse, lack of sleep, feelings of inadequacy, and lack of emotional connection with loved ones at home. Moral resilience means that one has the capacity to consistently and in all areas of life respond positively to the emotional labor and ethical action that accompany morally distressing situations.

**PROFESSIONAL SELF-CARE**

Just as sutures are needed for surgery, so too are emotional labor tools needed for end-of-life care counseling. Handling emotional labor well involves the attitude of acceptance and the tools of team bonding and professional self-care. Having an attitude of acceptance means acknowledging that part of the job of the veterinarian and veterinary team is to feel distressing emotions with clients. Doing so helps clients make the best decisions for their cats. Veterinarians who do not acknowledge these feelings will be less able to influence their clients, who will experience the veterinarian as not “getting it” or being “cold.” Clients know whether their veterinarian has empathy for them. Accepting this as a job responsibility will allow the veterinarian to acknowledge that resources are needed to do the emotional job well.

Team bonding is also a required emotional labor tool. The term “moral climate” describes an organization “that supports the process of ethical decision making.” This means that if an ethically complex and/or highly emotional case comes into the clinic, the veterinary professionals attending to the patient feel they can lean on their colleagues to help make the right decisions. The common habit of “going it alone”—if used as the only tool over time—seems to increase burnout and lead to poor decisions. In human medicine, facilitating regular team discussion about morally complex and emotional cases is associated with less stress and burnout.

Finding a regular way to meet as a team to discuss morally challenging cases improves the moral climate of a practice and increases the likelihood that a veterinarian or a veterinary nurse will reach out for social support when needed rather than “going it alone.”

Taking time to attend to personal needs is often described as being selfish. It has even been said to veterinarians and veterinary nurses experiencing burnout, “You need to be more selfish.” However, “selfish” is perceived as a negative term that implies caring for one’s basic needs is somehow wrong. Instead, for veterinarians, self-care is an essential professional responsibility required for bearing the emotional labor of end-of-life care in a healthy manner.

Basic self-care requirements can be found in the Healthy Mind Platter model and include such behaviors as exercise, sleep, social support, play, and down time. Eating healthy food is also essential to self-care. By embracing the idea that regularly performing these behaviors is a “professional responsibility” as opposed to being “selfish,” the veterinary care team can ensure it has the necessary resources to perform emotional labor duties. The stakes are high because when clients feel a lack of empathy or a disconnect between themselves and the veterinary team during the highly emotional end-of-life decision-making process, it negatively impacts their grief trajectory. Professional self-care prepares veterinarians to provide excellent counseling for clients without causing harm to themselves.

**CONCLUSION**

Euthanasia is the necessary but unfortunate, unavoidable, and unintended consequence to end patient suffering in a manner that minimizes pain, anxiety, and distress. Achieving this in a compassionate way for the client requires all the excellent attributes of veterinarians: empathy, a careful sense of timing, patience, and sincerity. Achieving this for the patient requires proper facilities, training, proper selection of premedicants, a quiet place in the hospital or home, and a broad sense of decency and respect in handling the patient.

Just as important as these considerations is the recognition that an emotional price is paid for performing this service month after month, year after year. For veterinary care teams to maintain usefulness and effectiveness to all patients, appropriate attention to maintenance of good mental health is necessary. We must recognize that anxiety, depression, and suicidal ideation are common in our profession and take all appropriate action to minimize the moral stress we endure in the process of saying goodbye to our patients.

References available at AmericanVeterinarian.com.

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**When euthanasia goes well, it can be a beautiful and satisfying experience for the veterinary health care team as well as clients.**

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In the Next Issue:

Clinical considerations and technical recommendations for in-clinic and at-home euthanasia.
When Wanda Presnell, owner of a dachshund rescue in Raleigh, North Carolina, took custody of 10-year-old Precious in early January, the dog was riddled with health problems, including a urinary tract infection, back issues, heartworms, and, perhaps most troubling, severe bilateral dry eye, which was originally believed to be an infection.

“Her eyes were terribly matted,” Presnell recalls. “There was a pus-like discharge and irritation in both eyes, and she was in severe pain.”

Presnell took Precious to Magnolia Veterinary Hospital in Raleigh, where Jon Dick, DVM, confirmed a diagnosis of dry eye and prescribed tacrolimus aqueous drops. “It worked great on the left eye,” Presnell says, “but the right eye did not respond at all. A veterinary ophthalmologist in Cary, North Carolina, prescribed tacrosorine NCT, but after a couple of months we saw that it was not working either.”

Presnell is still conferring with her veterinary care team to find an effective treatment for Precious’s right eye. In the meantime, she cleans Precious’s eyes 2 or 3 times a day, which eases the dog’s discomfort and makes it easier for her to see. “This is the most significant case of dry eye I’ve had to deal with,” Presnell says. “It’s a real problem.”

PREVALENCE, CAUSES, AND CLINICAL SIGNS

Dry eye, known clinically as keratoconjunctivitis sicca, is almost exclusively a canine health issue, notes Brian Gilger, DVM, MS, DACVO, DABT, professor of ophthalmology at North Carolina State University (NCSU) College of Veterinary Medicine in Raleigh.

“Around 5% of dogs will have some level of dry eye during their lifetime,” he reports. “It is seen far less commonly in cats and is almost unheard of in larger animals.”

Michala de Linde Henriksen, DVM, PhD, DACVO, assistant professor of comparative ophthalmology at Colorado State University College of Veterinary Medicine and Biomedical Sciences in Fort Collins, attends to around 20 cases of dry eye a month, including diagnoses and rechecks. The condition can affect all dogs, she notes, but tends to afflict certain breeds more than others, including shih tuz, Boston terriers, English bulldogs, cavalier King Charles spaniels, and West Highland white terriers.

“We believe that the autoimmune type of dry eye is a hereditary disease in specific breeds, but we have not yet found the gene for it, except for the cavalier King Charles spaniel,” Dr. Henriksen says. “The gene for curly coat syndrome and dry eye has been identified by a research group with the Animal Health Trust in Kentford, United Kingdom. They also determined that this gene does not cause dry eye in any other breed of dog.”

The signs of dry eye are fairly telltale, reports Dr. Gilger, and include...
reduced tear production; a thick, mucoid discharge; redness and irritation of the eye tissue; and noticeable discomfort that is sometimes indicated by squinting. “Clients often think their pets have an eye infection, but it’s really dry eye developing,” Dr. Gilger notes.

Pet owners may question a diagnosis of dry eye because of the discharge—how can the eye be dry when there’s so much fluid?—and it’s the veterinarian’s responsibility to explain that the discharge is the result of irritation and is not an ocular lubricant.

FORMS OF DRY EYE
Spontaneous dry eye is the most common form of the condition, but there are others, known as qualitative tear film deficiencies, that are characterized by a lack of mucin or other important tear components, Dr. Gilger says. In addition, a small percentage of dogs are born with an ocular defect that inhibits tear production in sufficient quantity. Although relatively rare, the condition is considered serious because it does not respond to conventional treatments.

Most cases of spontaneous dry eye are immune mediated, Dr. Henriksen says, which means the patient’s immune system is attacking the lacrimal glands and adversely affecting tear production. In others, the nerve to the lacrimal gland may stop working, causing tear production to cease.

The condition can also be caused by certain medications, such as sulfa drugs; trauma; and environmental conditions. Dr. Gilger notes that dogs living in dry, dusty, windy regions are at greater risk for developing dry eye than are dogs living in less extreme environments. Dogs that enjoy sticking their head out of the car window during drives are also at greater risk.

Dry eye can have a dramatic impact on a dog’s quality of life, which is why it should be diagnosed and treated as early as possible. Mildly uncomfortable in the earliest stages, untreated dry eye can lead to blindness as a result of corneal fibrosis, corneal pigmentation, and potentially excruciating abrasions and corneal ulcerations that can become infected and eventually perforate, Dr. Henriksen says. In addition, the continuous mucoid discharge associated with dry eye can make it extremely difficult for a dog to see clearly, which is why regular cleaning is recommended.

DIAGNOSIS AND TREATMENT
A diagnosis of dry eye is typically based on observed signs, such as mucoid discharge and tissue inflammation, and can be confirmed with certainty using the Schirmer tear test. This simple test involves placing a small piece of filter paper on the patient’s eye for 1 minute and measuring the amount of tears that are produced. Minimal tear production usually confirms dry eye.

Treating dry eye in dogs depends on the type and severity of the condition. In most cases, treatments are very similar to those used in humans. “Mild tear deficiencies can usually be well managed with an OTC lubricant, or artificial tears,” which is the go-to treatment for people as well, observes Dr. Gilger. “It’s a little bit more challenging in a dog,” he adds, “because dogs don’t express very well when they have mild irritation, so owners tend to undertreat their pets when using artificial tears.”

Veterinarians usually become involved when dry eye progresses from mild to moderate or severe. The standard of care in such cases is immunosuppressant drugs, such as cyclosporine and tacrolimus, which are typically administered once or twice a day to restore function in the lacrimal glands. “Cyclosporine has been around for nearly 30 years and is kind of the hallmark treatment that showed that dogs and humans are similar when it comes to this condition,” Dr. Gilger says. “Restasis [a treatment for dry eye in humans] is a form of cyclosporine that was first used in dogs years ago, then was developed for use in people. And since then, almost every product approved for people has gone that route, including lifitegrast, which is the newest drug approved for people.”

A higher concentration of immunosuppressive medication is often required because dogs don’t take up the medication quite as well as people, adds Dr. Henriksen. Restasis, for example, contains 0.002% cyclosporine compared with 0.2%, and even up to 1% or 2%, in veterinary compounds.

Research is ongoing into implantable drug-release devices that would eliminate the need for daily drops. At the NCSU College of Veterinary Medicine, for example, Dr. Gilger is involved in the study of a ring that fits under the eyelids and gradually releases an immunosuppressive drug over a period of months. “It’s a very practical approach,” Dr. Gilger says. “The rings are very well tolerated, and so far the results have been promising.”

In addition to immunosuppressive medications, an anti-inflammatory drug may be used temporarily to reduce redness and irritation. However, veterinarians should ensure that the patient does not have ulcerations when prescribing a corticosteroid because of the potential for harmful side effects, Dr. Henriksen warns. In doubt, she suggests consulting with a veterinary ophthalmologist.

If medication fails, there is a surgical option, says Dr. Gilger—transposing a salivary gland from the patient’s mouth to the affected eye. “The gland will produce a very watery saliva that acts like tears and can make a huge difference in the quality of life for dogs that don’t respond well to other treatments,” Dr. Gilger notes. “It’s a last-resort surgery, but it’s very effective.”

PROMISING NEW RESEARCH
There are, Dr. Gilger adds, some intriguing areas of research regarding the treatment of canine dry eye, including the use of stem cells and gene therapy. “We know that stem cell therapy can help promote the redevelopment of normal lacrimal gland function,” he says, “and we have some ability to provide gene therapy, which can help induce a more natural ocular surface and promote better dry-eye care. The beauty of these therapies is that they are potentially curative; it’s not just about managing the disease.”

Once treatment has been prescribed, it’s the doctor’s role to ensure that the client is compliant when the patient goes home. “Most of my clients are not only very compliant, but [they are] highly motivated people,” Dr. Gilger says. “Care can be a huge challenge, however, because they must give their pets medication every day and return for follow-up exams. Although the medication is not expensive, it’s an ongoing cost because dry eye is usually a chronic condition and sometimes clients can’t afford it or they don’t have the time to treat their pets as frequently as needed. In cases like that, the patient will have persistent discomfort and ultimately could lose its vision. I’m sure there are a lot of dogs out there that lose their eyesight or are euthanized because they are persistently uncomfortable.”

Working in teaching hospitals, Drs. Gilger and Henriksen see dry eye on an almost daily basis—far more frequently than most veterinarians in private practice. Dr. Gilger encourages community practitioners to consider dry eye and test for tear production whenever they see a patient with ocular discharge and redness. “Sometimes it can take veterinarians several months to make a definitive diagnosis just because they haven’t thought about dry eye,” he says. “The eye doesn’t have to look physically dry for the dog to have dry eye; it can be slightly dry.”
Prevention Is the Best Medicine:
Vaccines in the 21st Century

The use of vaccines dates back centuries. A look backward and forward shows how far we’ve come—and where we’re going.

By Meredith Rogers, MS, CMPP

An ounce of prevention is worth a pound of cure. Benjamin Franklin’s words ring as true today as they did in 1736, and although he was referring to fire prevention, prevention is a central tenet of immunization programs.

The first evidence of vaccination is from the Chinese, who as early as 1000 CE were inoculating against smallpox by taking powdered smallpox scabs from people with the disease and blowing it up the nostrils of healthy people or rubbing it into superficial cuts in the skin. In the 16th century, explorers reported on nomadic herders in Africa who were performing similar variolation techniques to protect their sheep from sheep pox. Although using smallpox to immunize humans and sheep pox to immunize sheep resulted in solid immunity in both populations, postinoculation mortality was high as a result of contracting the full virulent disease instead of an attenuated version. The modern age of vaccination has its origin with Edward Jenner, who in 1796 recognized that humans could be protected from smallpox using cowpox as the inoculant, which was significantly less dangerous.

Following Jenner’s discovery, vaccine development intensified. Although more than 1900 veterinary vaccines against at least 60 diseases are registered worldwide today, only a handful are considered core for companion animals and livestock. These vaccines are intended to protect our animals from infectious agents, be they viruses, bacteria, or parasites. However, new classes of vaccines against chronic diseases are under investigation. For example, a vaccine against canine melanoma (Oncept, Merial), introduced in the United States in 2010, was the first therapeutic vaccine for the treatment of cancer in either animals or humans.

Unlike traditional vaccines, which normally activate the immune system to protect against future disease, therapeutic vaccines activate the immune system to fight existing disease. There is even a vaccine to increase fertility in sheep that stimulates an immune response against the steroid androstenedione to decrease estrogen levels (Ovastim, Virbac; not available in the United States).

HOW VACCINES ARE CREATED

Another area under investigation is how vaccines are created. Traditional vaccines rely heavily on either attenuation or the killing of the whole pathogen to render it safe. With attenuated vaccines, a less virulent strain of the pathogen replicates in the host to promote an immune response, which sometimes leads to clinical signs of disease, especially in immunocompromised individuals. Inactivated (killed) vaccines cannot replicate inside an individual, so they do not cause clinical signs of disease, but some of these vaccines have been associated with sometimes severe immune-related adverse effects.

To improve safety, recombinant technology is being used to create vaccines that are made from just the genes that code for those antigens that induce immunity. Similarly, specific genes related to virulence are being deleted from whole pathogens, making them less likely to cause disease but still capable of promoting an immune response. Genetic engineering is also being used to
insert antigens from animal pathogens into plants, which then produce large amounts of the antigen to be used as a vaccine. (See Table 6-10 for a list of currently available vaccine types.)

**ADJUVANTS**

Adjuvants are used to boost immune responses and are a necessary component of inactivated vaccines. The use of adjuvants has its origins in the early days of vaccine exploration when Gaston Ramon developed an anti-tetanus vaccine in 1924 that combined the inactivated tetanus toxin with aluminum hydroxide after observing the varying effectiveness of different vaccine preparations in horses. Although aluminum-based vaccines have been around since that time, the exact mechanism behind how they work to boost immunity remains unclear. Aluminum-based adjuvants are safe in the majority of cases, but adverse reactions can occur, including fever, arthritis, uveitis, anorexia, soreness, lethargy, and injection-site sarcomas. Thus, investigations are ongoing to find safer and more effective adjuvants and to further expand the development of non-adjuvanted vaccines.

Veterinary medicine is actually ahead of human medicine in this area because any adjuvant destined for human use is tested first in animals. Adjuvants under development or in experimental and commercial vaccines beyond aluminum salts include oil emulsions, saponins, immune-stimulating complexes, liposomes, microparticles, nonionic block copolymers, derivatized polysaccharides, cytokines, and a wide variety of bacterial derivatives. In addition, an adjuvant-free 3-year rabies vaccine for cats, which are particularly prone to injection-site sarcomas, was introduced to the market in 2014 (PureVax Feline Rabies 3 YR, Merial).

**ALTERNATIVE DELIVERY METHODS**

There is much interest in finding alternative vaccine delivery methods. A number of oral vaccines are commercially available, such as a coccidiosis vaccine for poultry that can be delivered through automatic waterers for mass vaccination (eg, Coccivac-B, MSD Animal Health) and a recombinant rabies vaccine administered to wildlife in sachets encased in fish meal bait (eg, Raboral V-RG, Merial). The aforementioned canine melanoma vaccine is administered transdermally by propelling the vaccine at high speeds through the skin via a proprietary device.

You most likely have administered an intranasal Bordetella vaccine to a cat or a dog; vaccines administered via this route are intended to mimic the course of natural infection. Similarly, ocular vaccines, such as a vaccine against Newcastle disease, are applied to the surface of the eye, which is a route of infection. Spray and topical vaccines, such as the ectoparasites vaccine for poultry, are used in mass-vaccination scenarios, but it is difficult to ensure that all animals are inoculated. Until vaccines delivered through alternative methods are proven as effective and safe as those given parenterally, the core vaccines, at least for companion animals, will be delivered via needle.

**VACCINE REGULATION**

While the science of vaccines is evolving, encompassing new knowledge and technologies, the regulatory landscape is also changing based on these advances. For example, vaccines that target noninfectious disease (eg, cancer, fertility) fall under the more stringent authority of the FDA instead of the Department of Agriculture, which increases both time to approval and cost of development. Nevertheless, the value of vaccines for disease prevention is clear, and the pace of vaccine development will only increase as new illnesses come to light. As Bill Gates said, “Treatment without prevention is simply unsustainable.”

References available at AmericanVeterinarian.com.

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**Table. Vaccine Categories**

<table>
<thead>
<tr>
<th>VACCINE TYPE</th>
<th>EXAMPLE</th>
<th>DESCRIPTION</th>
<th>ADVANTAGES</th>
<th>DISADVANTAGES</th>
</tr>
</thead>
<tbody>
<tr>
<td>Attenuated</td>
<td>Influenza</td>
<td>Live virus with less virulence than the disease-causing pathogen</td>
<td>Elicits solid, long-term immunity</td>
<td>Risk for disease</td>
</tr>
<tr>
<td>Inactivated</td>
<td>Rabies</td>
<td>Virus is killed but retains the antigens that can be recognized by the immune system</td>
<td>Cannot cause disease</td>
<td>Requires adjuvant, shorter length of protection</td>
</tr>
<tr>
<td>Toxoid</td>
<td>Tetanus</td>
<td>Inactivated toxin that promotes an immune response against a bacterial toxin</td>
<td>Cannot cause disease</td>
<td>Requires adjuvant</td>
</tr>
<tr>
<td>Conjugated</td>
<td>Streptococcus pneumoniae</td>
<td>Polysaccharide capsule of a pathogenic bacterium chemically linked with an immunogenic protein</td>
<td>Cannot cause disease</td>
<td>Expensive to produce</td>
</tr>
<tr>
<td>Subunit</td>
<td>Actinobacillus pleuropneumonia</td>
<td>Component(s) of the target pathogen capable of promoting an immune response against the whole pathogen without the nucleic acids necessary for replication</td>
<td>Cannot cause disease, purified product less likely to cause adverse effects</td>
<td>Produced through genetic engineering (expensive), requires adjuvant</td>
</tr>
<tr>
<td>Recombinant</td>
<td>Porcine circovirus type 2</td>
<td>Antigenic protein produced by inserting its gene into a heterologous expression system (eg, yeast, bacteria, plant)</td>
<td>Cannot cause disease, purified product less likely to cause adverse effects, can be made in large quantities</td>
<td>Produced through genetic engineering (expensive)</td>
</tr>
<tr>
<td>DNA</td>
<td>West Nile virus</td>
<td>DNA that codes for an antigenic protein inserted into a plasmid that when injected is taken up by cells, which then transcribe the DNA</td>
<td>Cannot cause disease, purified product less likely to cause adverse effects</td>
<td>Produced through genetic engineering (expensive), may cause antibodies against DNA</td>
</tr>
<tr>
<td>Therapeutic</td>
<td>Canine melanoma</td>
<td>Vaccine that stimulates the immune system to recognize and attack an existing pathogen or disease</td>
<td>Effective against diseases resistant to traditional drugs</td>
<td>Varies with type of vaccine</td>
</tr>
</tbody>
</table>
Checklist Use During Wellness Visits

Does the use of checklists prompt veterinarians to discuss important preventive care topics with clients?

By JoAnna Pendergrass, DVM

Veterinary clinical education could benefit from the use of checklists during companion animal wellness visits, according to the authors of a study recently published in *Frontiers in Veterinary Science*. Study results could support the use of checklists in private practice, noted the researchers.

Wellness visits play an important role in companion animal medicine, allowing veterinarians to thoroughly examine their patients and make recommendations for preventing disease, improving overall health, and enhancing quality of life. These visits also give clients the opportunity to ask specific questions they may have about their pet.

Despite the importance of regular wellness care, the frequency of veterinary visits has declined steadily. A survey by the American Animal Hospital Association (AAHA) reported a 17% decrease between 2001 and 2009 in the number of active clients per full-time veterinarian. Also, results of the Bayer Veterinary Care Usage study showed that nearly 15% of dogs and 40% of cats had not had a veterinary visit in the previous 12 months.

The Bayer study identified a key reason why veterinary visits decreased: an “inadequate understanding of the need for routine examinations.” This lack of understanding highlights the communication gap between veterinarians and pet owners regarding the value of regular wellness visits.

To address this decrease in veterinary wellness visits, AAHA and the American Veterinary Medical Association collaborated with other organizations to form Partners for Healthy Pets (PHP). PHP has developed several checklists to help veterinarians perform comprehensive wellness visits that include discussions on a full range of preventive care topics.

Previous studies have reported the benefit of checklists in human medical education, evidenced by improvements in acquisition of clinical skills and clinical examination scores. To date, however, limited definitive data are available on the use of checklists in veterinary medical education.

**STUDY DESIGN**

The current study was conducted during the Community Practice (CP) clerkship at the Virginia-Maryland College of Veterinary Medicine’s Veterinary Teaching Hospital. During this 3-week clerkship, fourth-year veterinary students see dogs and cats for routine wellness visits in which they obtain each patient’s history, perform a physical exam, and formulate an individualized wellness plan.

The researchers selected students from the first 6 blocks of the CP clerkship; 33 students agreed to participate. At the beginning of each block, students received information on wellness visits and PHP wellness checklists. For this study’s purposes, the PHP checklists were modified to reflect health considerations relevant to southwest Virginia. The 19 major wellness topics listed in the checklists were grouped into 4 categories: history, vaccinations, parasite control, and discussion topics (eg, at-home dental care, wellness lab work, scheduling of next visit).

In blocks 1 to 3, 14 students performed their wellness visits without the checklists; in blocks 4 to 6, 19 students used the checklists during wellness visits. All study participants submitted a completed paper record of their visits before presenting the case to the block’s lead clinician.
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Clinical Focus

Images provided by Kim Campbell Thornton.

Despite the importance of regular wellness care, the frequency of veterinary visits has declined steadily, with pets spending less time with their veterinarians. This trend is concerning because it limits the ability of pets to receive necessary care and monitoring. According to data from the American Veterinary Medical Association, visits to veterinary clinics have decreased by 26% over the past 10 years. This decline is particularly evident in cases of vomiting, diarrhea, and dark or tarry stools, which are significant indicators of potential health issues in pets.

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Adverse reactions associated with this drug class may result in death and require hospitalization in rare situations (see Adverse Reactions). Owners should be advised to discontinue Carprofene therapy and contact their veterinarian immediately if signs of intolerance are observed.

**ADVERSE REACTIONS:**
During investigational studies for the canine formulation with twice daily administration of 1 mg/lb, no clinically significant adverse reactions were reported. Some clinical signs were observed during field studies (n=26) which were similar for carprofen caplet- and placebo-treated dogs. Incidences of the following were observed in both groups: vomiting (6%), diarrhea (4%), changes in appetite (2%), lethargy (1.4%), behavioral changes (1%), and constipation (0.3%). The product vehicle served as control. There were no serious adverse events reported during field studies with once daily administration of 2 mg/lb. The following categories of abnormal health observations were reported. The product vehicle was considered.

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To Clone or Not to Clone

As technology advances and medicine can make miracles reality, we need to ask ourselves: Is every breakthrough worth the cost?

By Greg Kelly

(continued from front cover)

and the wonders of biotechnology magnify, there will be a need for some clarity. As authorities on animal science and welfare, it behooves veterinarians to understand the science of cloning and be able to speak to clients about the issues and debate surrounding it.

WHAT IS CLONING?

Fundamentally, a cloned pet is a genetic twin born at a later date. The cloning procedure involves injecting preserved cells from the original dog into a hollow egg from a female dog, a jolt of electricity to help them fuse, and implanting the resulting embryo into a surrogate mother dog that carries the pup to birth. This embryo contains the complete DNA of the original dog and that dog only (Figure).

The end result is a hereditary facsimile that is supposed to mirror the original pet’s characteristics, from appearance to disposition to intelligence. Research has shown that cloned animals have the same health traits and life expectancy as other pets.1 Although the technology of pet cloning continues to advance, it’s important to remember that having the right pet is more complicated—both nature and nurture play a role.

At this point in pet cloning, money can buy happiness. Billionaire media couple Barry Diller and his fashion mogul wife, Diane von Furstenberg, recently paid $100,000 to have their Jack Russell terrier cloned.2

Animal cloning isn’t really a young science. It all started with mice in the late 1970s, according to the National Institutes of Health,3 then came genetically identical cows, sheep, and chickens. It was widely reported when Dolly the Sheep became the first mammal to be cloned successfully by Scottish scientists at the University of Edinburgh back in 1996 (after 276 attempts). The first cloned pet (Snuppy, an Afghan hound) was born over a decade ago in South Korea; the cost in 2005 was $100,000.

PET CLONING IN THE UNITED STATES

Once available only in Asia, dog and cat cloning is now available in the United States. Texas-based ViaGen, originally a livestock cloning company, began cloning pets in 2015 and remains the only company in the United States to do so. Last year, ViaGen Pets cloned the first American puppy (Nubia, a female Jack Russell Terrier) for $50,000.

ViaGen has produced thousands of cloned horses and livestock over the past 15 years and is now approaching over 100 cloned puppies and kittens, says Lauren Aston, the company’s marketing coordinator. “We are having healthy, happy puppies and kittens born each week, as word gets out that we are offering this service.”

The company, which began operations in 2002, offers several services for pet owners. “The genetic preservation fee is $1600,” Cohen says. “This initial fee, plus all paid storage fees, are applied toward the cloning fee whenever the pet owner is ready to proceed to that next step.” The fee for dog cloning is $50,000; it’s $25,000 to clone a cat. The arrangement calls for 50% of the cloning fee to be paid upon entering into the deal, and the remaining 50% is paid when a cloned puppy or kitten goes home at 8 to 12 weeks of age, Cohen says.

When it comes to professional veterinarian involvement in the science and practice of cloning, Cohen explains that her company “works closely with veterinarians and their staff to..."
help them educate and offer clients options for preserving, protecting, and memorializing a relationship with a beloved animal companion. She believes veterinarians “are essential for genetic preservation where they perform a very simple skin punch biopsy.”

In an effort to build awareness and support, Cohen says that ViaGen Pets attends many veterinary conferences throughout the year to educate the profession about their services. “We’ve been thrilled with the warm reception and interest from the veterinary community,” she says.

As a testament to the excitement of pet cloning, Cohen says more than 140 veterinarians (and more added weekly) are now part of ViaGen Pets Veterinary Network. “This network allows veterinarians to enhance their practice offerings with support from the ViaGen Pets team,” she explains.

Regarding the ethical considerations of pet cloning, Cohen notes that many people are opposed to any form of reproduction for companion animals because too many cats and dogs already lack suitable homes. “We fully understand this position and support shelters and adoption whenever possible,” she says. However, we also see many clients who are determined to enjoy an identical twin of their beloved animal companion.” She mentions at the beginning of the article—recording customer finally gets his or her pet (after 3 to 4 months or possibly longer, depending customer finally gets his or her pet (after 3 to 4 months or possibly longer, given quarantine issues, if the cloning is done overseas). A clone is a twin, and most of us know how different, personality-wise, twins can be.”

COMPANION PET CLONING FALLS INTO THE CATEGORY OF “JUST BECAUSE WE CAN DO SOMETHING DOESN’T MEAN YOU SHOULD,” SAYS WOESTENDIEK.

It behooves veterinarians to understand the science of cloning and be able to speak to clients about it.

With so many pet owners considering their pets to be part of the family, these life-and-death issues are certain to generate controversy and passion.

John Woestendiek, a Pulitzer prize-winning investigative reporter and author of Dog, Inc.: The Uncanny Inside Story of Cloning Man’s Best Friend, has some decidedly negative opinions about pet cloning.

In an interview with Scientific American, Woestendiek says, “An argument can be made that dog cloning is not only adding to the dog overpopulation problem, but causing a lot of pain and suffering along the way.” He views cloning “as an insult to the original dog—the equivalent of saying ‘I can easily (assuming I am wealthy enough) have another you created.’ The fact is you can’t. And it seems unfair to the clone as well, in terms of the expectations the dog owner will likely have for it.”

The major difference between the original and a clone, says Woestendiek, is “personality, which even the cloners now admit (they didn’t at first) can’t be duplicated. Given that much of personality is shaped during the first months of puppy life, much of it will probably already be in place before a dog cloning customer finally gets his or her pet (after 3 to 4 months or possibly longer, given quarantine issues, if the cloning is done overseas). A clone is a twin, and most of us know how different, personality-wise, twins can be.”

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THE VETERINARIAN’S ANGLE
When it comes to educating the public about pet cloning, veterinarians can have a considerable impact. Pet cloning isn’t going away. And with such a peculiar mix of science and sentiment involved, the outlook of a trained expert is valuable.

Very few professionals beyond the veterinarian have the training, talent, and technique to alert pet owners about the realities of this approach. It benefits veterinary professionals to educate themselves on the matter so as to better counsel their clients.

GENETICS

PROS AND CONS

Alice Villalobos, DVM, former president of the Society for Veterinary Medical Ethics and a pioneer in the field of cancer care for companion animals, looks favorably on the prospects of pet cloning: “As a veterinary oncologist also focused on palliative care and hospice for dogs and cats, I see how this could become a more accessible opportunity for those who want to have an option for a continuum with a genetically similar pet who they are on the verge of losing. I’ve had cloned dogs as patients and the owners are very happy with their decision,” says the California veterinarian.

Even as the science of pet cloning comes into its own, there is some opposition to the practice from pet lovers and veterinary professionals.

For sure, powerful emotions surround Americans and their pets. One pet owner who has already decided to enjoy a twin of a beloved companion is a woman who had a prototype cloned from her dog for a friend who had recently lost her golden retriever. The effort was so heartening that the woman eventually decided to clone her own dog, which she named Lila. The project was a success and her new dog was available if people want one.”

As to the ethics of veterinarians in pet cloning, James A. Serpell, PhD, professor of Animal Ethics & Welfare at the School of Veterinary Medicine at the University of Pennsylvania—the Ivy League professor mentioned at the beginning of the article—recommends a path of full discourse by encouraging people to understand what they are doing. “Try to make them think twice,” he says.

Dr. Serpell says the process of cloning is not easy and there are still many errors—lots of fetuses are aborted or born with severe abnormalities. “This brings up animal welfare considerations,” he says.

“There are also considerations for the egg donor animals and surrogates. Companies often use purpose-bred female dogs as surrogates. And it’s not really clear what happens to them afterwards.”

He also has concerns about the health of the clones “because we don’t have a long enough track record to know whether they’re likely to live long and healthy lives.”

The most serious issue, according to Dr. Serpell, is when “people are made to believe that the animal they get back will be a replica of the original pet. That’s a huge mistake. They may be genetically identical, but a lot can happen after conception. It’s classic nature versus nurture, and with dogs and cats an awful lot is nurture.”

Dr. Serpell says, “It’s fair for veterinarians to explain to clients that they’re making a big mistake if they think they’re going to get them they’re old pet back. They won’t be. Veterinarians must make the client understand what goes into cloning. Know what happens to the other embryos—some may be destroyed, some may be deformed or disabled. They should also be aware that the surrogate dogs may have a very uncertain future. Also, they should realize that our society already has an excess of dogs, just waiting to be adopted. There are plenty of perfectly good dogs available if people want one.”

Attempting to remove emotion from the mix, a more sensible application of cloning could include “working animals” (i.e., police K9s, search-and-rescue dogs, and other service dogs), suggests Dr. Serpell.

Since these dogs are routinely neutered but later are found to have fine service abilities, cloning is a practical solution. “This would be an opportunity to re-create some very successful dogs. That would be more ethically palatable,” says Dr. Serpell.
Diagnosing and Treating Cancer
The basics of cancer care: identifying tumor type, staging, and treatment.

By Laurie Anne Walden, DVM, ELS

(continued from front cover)

“WHAT IS IT?” IDENTIFYING TUMOR TYPE
In many cases, veterinarians can identify the cancer category (carcinoma, sarcoma, or round cell tumor) during the initial appointment, said Dr. Suter, who is director of the Canine/Feline Oncology Diagnostic Laboratory and medical director of the Canine Bone Marrow Transplant Unit at NC State. Pinpointing the category is crucial because tumors in different classes behave differently with respect to metastasis and response to therapy.

Fine-needle aspiration is a low-cost, low-risk, rapid method to identify tumor category (but not grade), Dr. Suter said. He discussed tips for obtaining fine-needle aspirates.

• If an aspirate has low cellularity, try again with a larger needle, use suction if you did not on the first attempt, and be more aggressive (the procedure is rarely painful).
• Evaluate only intact cells.
• Be sure the sample accurately represents the mass.

Inflammatory changes can look like neoplasia, he cautioned. Criteria for malignancy include anisocytosis, anisokaryosis, increased nucleus:cytoplasm ratio, high mitotic index, basophilic cytoplasm, and multiple or prominent nucleoli. He described cytology characteristics of tumors of different categories:

• Carcinomas: These tumors are epithelial in origin, so the cells tend to clump together on the slide. Anal sac adenocarcinoma cells have minimal anisokaryosis and almost no cytoplasm. Squamous cell carcinoma cells may have nuclei, unlike normal squamous epithelial cells.
• Sarcomas: Aspirates of these mesenchymal-origin tumors typically include more blood and fewer nucleated cells than do aspirates of the other tumor types. Osteosarcoma yields cells with very eccentric (off-center) nuclei.
• Round cell tumors: These tumors “love to give up their cells,” Dr. Suter said. High-grade lymphosarcoma aspirates may include lymphoglandular bodies (small blebs of cytoplasm outside cells) and cells with a thin rim of basophilic cytoplasm.

Biopsy
Biopsy is the diagnostic gold standard, said Dr. Suter, who offered the following tips:

• Avoid Penrose drains as they increase the risk for tumor seeding.
• Avoid cautering the margins, use proper fixation, and provide an appropriate case history when submitting samples.
• Request a microscopic description on the pathology submission form so the report will include the mitotic index.

WHERE IS IT?” CANCER STAGING
Cancer staging is costly, but it is the only way to determine the tumor burden and uncover concurrent diseases (including other cancers), Dr. Suter said. Clients should understand the reasons for staging before deciding whether to pursue it. Staging includes a complete blood count and biochemistry profile, urinalysis, aspiration of regional lymph nodes, thoracic radiographs, abdominal ultrasound, and advanced imaging if indicated and if finances allow.

Sarcomas tend to metastasize hematogenously, he said, so thoracic radiographs are crucial for staging these cancers. Carcinomas spread through lymphatics, making fine-needle aspiration of lymph nodes necessary; be aware that some cancers skip nodes or spread to contralateral nodes. Round cell tumors are systemic and can metastasize to any location.

HOW CAN I GET RID OF IT?” CANCER TREATMENTS
Dr. Suter gave a broad overview of the 3 treatment modalities available for companion animals: surgery, irradiation, and chemotherapy/immunotherapy. In general, he said, surgery and irradiation are used for local control and chemotherapy is used for systemic control.

Surgery
The best way to remove a solid, visible tumor is by surgical excision, he said. For cancer that has not metastasized, surgery can be curative if the margins are large enough. Dr. Suter underscored the following points:

• Do not “shell out” a tumor; tumor capsules are composed of compressed cancer cells.
• Remove as much normal tissue as possible that will still allow wound closure.
• Ideal margins are greater than 1 cm; margins less than 5 mm are concerning.
• Obtain very large margins with feline injection-site sarcomas and high-grade mast cell tumors.

Irradiation
Irradiation can be either definitive (curative) or palliative. Curative irradiation targets microscopic disease; high-dose stereotactic radiation can also be used as definitive treatment. Palliative radiation is designed to slow or stop tumor growth and can also be used to control osteosarcoma pain, he said.

Chemotherapy
Chemotherapy is used as the primary treatment for hematologic cancers and to control metastasis of solid tumors. The main goal in veterinary medicine is maintaining a good quality of life; therefore, to avoid toxicity, doses are lower and protocols are less intense than in human medicine. For this reason, the cure rate with chemotherapy is very low, Dr. Suter said, although chemotherapy does extend life span in dogs with some types of cancer.

THE FINAL ANSWER
Ultimately, the role of the veterinarian is to advise the client, who will then decide how aggressively to pursue staging and treatment, Dr. Suter said. “Our job is not to get them to make a [particular] decision,” he said. “Our job is to present the options and let them make the decision.” In general, more aggressive treatment will prolong life. However, because pet owners also take into account cost and the pet’s age, options should not be framed as right or wrong, he said.
**Product Spotlight**

**PROTAZIL**  
Marketed By: Merck Animal Health  
Protazil (1.56% diclazuril) is the first and only FDA-approved alfalfa-based top-dress antiprotozoal pelleted formulation for the treatment of equine protozoal myeloencephalitis caused by *Sarcocystis neurona*.  
Dosage Form: Pellets (1 mg/kg [0.45 mg/lb])  
For More Information: merck-animal-health-equine.com

**MAXI/GUARD ORAL CLEANSING GEL**  
Marketed By: Addison Biological Laboratory  
This natural, safe, and taste-free product is an effective oral cleanser and freshener for dogs, cats, horses, and exotics. This cleaning gel works with or without brushing.  
Dosage Form: 4-ounce soft squeeze bottles  
For More Information: addisonlabs.com

**DIROBAN**  
Marketed By: Zoetis  
Diroban (melarsomine dihydrochloride) is a generic drug used to treat dogs infected with *Dirofilaria immitis*, the causative agent of canine heartworm disease. Diroban is currently the only FDA-approved drug available in the United States for canine heart disease.  
Dosage Form: Intramuscular injection (0.1 mL/kg [0.045 mg/lb])  
For More Information: zoetisus.com

**INTERCEPTOR PLUS**  
Marketed By: Elanco  
This chicken-flavored soft chew (milbemycin oxime/praziquantel) is given once monthly to prevent heartworm disease and treat and control adult tapeworm, hookworm, roundworm, and whipworm infections in dogs and puppies 2 pounds or greater and 6 weeks of age or older.  
Dosage Form: Chewable tablets  
For More Information: interceptorplus.com

**OCUBRIGHT TEAR STAIN REMOVER**  
Marketed By: OcuBright  
These premeasured soft chews are given once daily to diminish tear stains in dogs and cats. Tylosin, the active ingredient, possesses a high degree of lipid solubility that is not intended to treat or prevent disease but rather to act as a grooming aid.  
Dosage Form: Soft, beef-flavored chewable snacks  
For More Information: ocubright.com

**COSEQUIN FOR CATS**  
Marketed By: Nutramax Laboratories  
Cosequin for Cats is now available in convenient soft chews, combining glucosamine hydrochloride and chondroitin sulfate for joint support along with omega-3 fatty acids to help support skin and coat health and overall wellness.  
Dosage Form: Soft chews and sprinkle capsules  
For More Information: cosequin.com/cats
Choose a product that offers forgiveness

Because life happens, choose Advantage Multi® for Dogs. Heartworm protection that forgives if clients forget to apply on the same day every month.*

Broad-Spectrum parasite protection in a convenient monthly topical application
Don’t Take Risks. Practice Safe Sticks.

Help protect your staff against accidental needlesticks with innovative sharps safety devices from Terumo

Surshield® Safety Winged Infusion and Blood Collection Sets

SurGuard®3 Safety Hypodermic Needles and Needles with Syringe