PRACTICE GUIDELINES

The American College of Veterinary Anesthesia and Analgesia Small Animal Anesthesia and Sedation Monitoring Guidelines 2025

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The following small animal anesthesia monitoring guidelines were prepared by the American College of Veterinary Anesthesia and Analgesia (ACVAA) in collaboration with the North American Veterinary Anesthesia Society and the Academy of Veterinary Technicians in Anesthesia and Analgesia. The 2025 guidelines have revised and expanded upon the 2009 guidelines. These guidelines are derived from evidence-based studies whenever possible; however, some of the recommendations represent a consensus of expert opinion and clinical experience. They were prepared by the authors, and opened to comments from all ACVAA members, and thereafter, approved by the ACVAA Board of Directors. The document was submitted to *Veterinary Anaesthesia and Analgesia* (VAA), and it was edited to comply with journal style and formatting requirements. There was no VAA peer review. The authors are solely responsible for the content of the guidelines. Publication of the updated guidelines in VAA was approved by the Trustees of the Association of Veterinary Anaesthetists and the American College of Veterinary Anesthesia and Analgesia, as co-owners of this journal.

Abstract

The American College of Veterinary Anesthesia and Analgesia (ACVAA) in collaboration with the North American Veterinary Anesthesia Society and the Academy of Veterinary Technicians in Anesthesia and Analgesia have revised and expanded the 2009 guidelines. The 2025 guidelines include updated recommendations for monitoring circulation, oxygenation, ventilation, body temperature, neuromuscular blockade, and anesthetic depth in feline and canine patients. Monitoring during sedation (sedation-specific guidelines are in the Monitoring During Sedation Section), recommendations for personnel managing the patient, and the use of cognitive aids have been incorporated. This document is meant to establish guidelines for monitoring small animals during sedation and in the perianesthetic time period. Further information concerning techniques, reference values, differential diagnoses, and details of various interventions can be found in the reference literature cited at the end of this paper. These guidelines use objective, evidence-based criteria whenever possible; however, some of the recommendations are a consensus of expert opinion and clinical experience. This document is intended to guide monitoring of small animal patients during sedation and anesthesia; it is not to be construed as a standard of care as the choice of monitoring techniques and methods can vary depending on the type of practice and spectrum of care considerations. Alternative methods are suggested if a minimally recommended technique is unavailable.

Keywords anesthesia monitoring, capnography, guidelines, neuromuscular blockade, pulse oximetry, small animal.

Audience

Anyone providing anesthesia or sedation in small animal practice including but not limited to veterinary technicians, veterinary assistants, veterinary paraprofessionals, veterinary professionals in training, primary care and specialist veterinarians, as well as administrators.

Definitions

Minimum recommendations: applicable to all anesthetized small animals (Table 1). If a minimum monitoring modality cannot be used, the reason should be documented in the medical record.

Alternatives

To be used only when minimum recommended options are not available. Their use should be documented in the medical record.

Advanced recommendations

Options to consider for veterinary patients with coexisting disease and/or unstable patients (Table 1).

Monitoring depth of anesthesia

Objective

To achieve an adequate anesthetic depth to prevent patient awareness and movement while minimizing cardiorespiratory and other physiological side effects of anesthetic agents.

Minimum recommendations

1. A dedicated anesthetist (see Personnel section) should repeatedly observe the animal to assess eye position, muscle tone, including jaw muscle tone, and reflexes, including the palpebral reflex or peripheral reflexes such as withdrawal of a limb. Special considerations for monitoring anesthetic depth in the face of neuromuscular blockade (NMB) use are outlined in that section below.
   During anesthesia with volatile agents, the eyes will generally rotate ventromedially, body and jaw muscle tone will be relaxed, and the palpebral reflex will be sluggish or absent (Bleijenberg et al. 2011). Patients anesthetized with injectable protocols, especially with dissociative-based approaches, may not display the traditional progressive signs of reflex depression and muscle relaxation.
2. A dedicated anesthetist should anticipate and monitor for indication of sympathetic responses, including increases in heart

Table 1 Summary of minimum and advanced monitoring recommendations for monitoring physiological variables during anesthesia in dogs and cats. CNS, central nervous system; ECG, electrocardiogram; EEG, electroencephalography; PVI, plethysmographic variability index; PPV, pulse pressure variation; SPV, systolic pressure variation; •, recommended.

Body system	Recommendation	Minimum	Advanced
All	Dedicated anesthetist	•	•
CNS	Physical signs of anesthetic depth including muscle tone, eye position, and reflexes	•	•
	Inspired/expired inhalant concentrations		•
	EEG-based monitors		•
Circulation	Continuous ECG	•	•
	Noninvasive blood pressure (oscillometric)	•	•
	Invasive blood pressure		•
	Dynamic hemodynamic variables (e.g., PVI, SPV, PPV)		•
Oxygenation	Pulse oximetry	•	•
	Arterial blood gas analysis		•
	Oxygen concentration in inspired gas		•
	Co-oximetry		•
Ventilation	Capnography	•	•
	Blood gas analysis		•
	Spirometry		•
Temperature	Rectal/esophageal temperature	•	•

rate, respiratory rate, and arterial blood pressure (BP), in response to noxious stimuli.

Advanced recommendations

1. Monitoring of inspired and expired inhalant concentrations is indicated whenever such technology is available to ensure adequate but not excessive inhalant delivery to the patient.
2. Mathematical transformations of the electroencephalogram [e.g., bispectral index (BIS) or patient state index] may be useful in some clinical or laboratory settings (March & Muir 2003; Sakai et al. 2023).

Circulation monitoring

Objective

To confirm adequate tissue perfusion, ensuring delivery of oxygen and nutrients and removal of metabolic waste products.

Minimum recommendations

1. A dedicated anesthetist (see Personnel section) should continuously observe the patient, using intermittent subjective clinical assessments to supplement readings from electronic monitors, including manual palpation of the pulse, auscultation of the heart using an external or esophageal stethoscope and/or continuous pulse rate detection via Doppler flow probe, and assessment of capillary refill time.
2. Oscillometric BP monitoring should be utilized with measurements taken at least every 5 minutes.
   A mean arterial pressure < 60−65 mmHg should prompt assessment of the patient and intervention, which may include decreasing anesthetic depth, managing bradycardia and intravascular volume status, and/or the use of inotropes or pressors. Algorithms of oscillometric BP monitors vary by manufacturer and have an impact on the performance of the monitor. Clinicians are encouraged to check monitoring brands against validation studies that compare performance against the American College of Veterinary Internal Medicine Hypertension Consensus Panel and Veterinary Blood Pressure Society Recommendations (AHCP-VBPS Validation) (Skelding & Valverde 2020a,b).
3. Continuous electrocardiogram (ECG) monitoring to detect changes in heart rate, rhythm, or conduction abnormalities.
4. Time-based capnography is reflective of pulmonary perfusion when ventilation is constant and should be monitored continuously.

Alternative recommendations

When an oscillometric BP device is unavailable or unreliable, a Doppler flow probe and sphygmomanometer with a cuff can be substituted. Doppler BP readings generally display poor agreement with invasively measured pressures (da Cunha et al. 2014; Kennedy & Barletta 2015; Skelding & Valverde 2020b). Doppler BP readings of 90 mmHg or below should prompt assessment of the patient and intervention as described for oscillometry. Doppler flow probes also provide an audible signal of peripheral blood flow and pulse rhythm. The plethysmograph and audible signal from a pulse oximeter can also be used to confirm the rate and rhythm of peripheral pulses.

Advanced recommendations

The following are in addition to the minimum recommendations:

1. Invasive BP measurement via arterial catheterization should be considered for critically ill patients, complex diagnostic or interventional procedures, or patients with advanced cardiovascular disease.
   In certain environments, including during magnetic resonance imaging, invasive pressure measurement may be helpful in providing continuous cardiovascular monitoring when other monitoring modalities may experience interference.
2. Dynamic indices of hemodynamic variables, including plethysmographic variability index (PVI) from a pulse oximeter waveform, systolic pressure variation (SPV), or pulse pressure variation (PPV) from the invasive arterial pressure waveform during positive pressure ventilation can provide information on fluid responsiveness.
3. Other forms of fluid responsiveness monitoring may be considered when available, including transthoracic or transesophageal echocardiography and ultrasound evaluation of caudal vena cava distensibility.
4. Venous blood gas and lactate analysis can be useful in evaluating global perfusion parameters.

Oxygenation monitoring

Objective

To ensure adequate oxygenation of blood.

Minimum recommendations

1. The anesthetist should perform a routine anesthetic equipment check using a standardized checklist prior to use of the machine and regularly assess the function of the oxygen source, flowmeter, and breathing circuit throughout the anesthetic event.
2. A dedicated anesthetist (see Personnel section) should regularly assess mucous membrane color (pink, cyanotic, or pale) and ventilatory efforts (chest excursion, auscultation, and reservoir bag movement).
   Assessment of mucous membrane color requires access to the patient and appropriate lighting (Comroe & Botelho 1947). In addition, the anesthetist should inflate the endotracheal tube cuff until there is no audible leak at a breathing circuit manometer pressure of 20 cmH_2O (or use a cuff manometer) and perform bilateral auscultation of the chest following intubation to help ensure that the endotracheal tube is placed correctly in the trachea, rather than into one bronchus.

3. Pulse oximetry is recommended in all heavily sedated or anesthetized small animal patients.
   The use of pulse oximetry has been associated with a decreased risk of mortality in veterinary anesthesia (Brodbelt et al. 2007; Itami et al. 2017; Matthews et al. 2017). A transmission probe on the tongue, ear, toe, or fold of skin can be utilized or a reflectance probe can be placed on a shaved or hairless area such as the underside of the base of the tail or metatarsus (Nixdorff et al. 2021). The variable pitch pulse tone and low saturation alarm should be easily audible. Pulse oximetry is a late indicator of an oxygenation problem when oxygen is being supplemented and therefore any value <95% should be investigated to ascertain patient status and rule out technical issues. Patient (respiratory or cardiovascular) and equipment issues are potential causes of hypoxemia during sedation and anesthesia.

Advanced recommendations

1. Arterial blood gas (ABG) analysis and measurement of the partial pressure of oxygen in arterial blood (PaO_2) are useful for assessing pulmonary gas exchange.
   Determination of PaO_2 should be considered in patients with persistently low pulse oximetry readings, pre-existing pulmonary disease, those undergoing thoracic or pulmonary procedures, or situations in which ventilation-perfusion mismatch or shunt may occur (Farrell et al. 2019).
2. Measurement of the inspired oxygen concentration (FIO_2) confirms that adequate oxygen is being delivered to the patient.
   This monitoring modality is recommended whenever possible to confirm functional oxygen supply and to ascertain the percentage of oxygen delivered to the patient. In addition, FIO_2 monitoring should be employed if the use of medical air mixtures is planned.
3. Co-oximetry (with an arterial blood sample) is more reliable than standard pulse oximetry when dysfunctional hemoglobins are present (e.g., carboxyhemoglobin, methemoglobin) and will provide more accurate oxygen hemoglobin saturation values.

Ventilation monitoring

Objective

To ensure adequate ventilation.

Minimum recommendations

1. A dedicated anesthetist should consistently monitor the patient by observation of thoracic wall and/or reservoir bag/ventilator bellows movements during inhalation and exhalation, auscultation using a stethoscope (esophageal or external) for respiratory sounds to supplement other objective monitoring as necessary, and utilize a manometer to assess peak airway pressures during positive pressure ventilation.
2. Time-based capnography [inspired and expired carbon dioxide (CO_2) analysis with a waveform] should be utilized as it provides information on the partial pressure of CO_2 in respiratory gases, can be used to evaluate the integrity of the endotracheal tube (or laryngeal mask airway) and breathing circuit, pulmonary perfusion (including during cardiopulmonary resuscitation), and ventilation status, and is useful in the differential diagnosis of hypoxemia (Hogen et al. 2018; Wollner et al. 2020; Chrimes et al. 2022).
   Inspiratory CO_2 concentrations should be, or approach, 0 mmHg with normally functioning anesthetic delivery equipment and minimal mechanical dead space. Mild increases in end-tidal CO_2 concentrations may be tolerated in healthy patients but values > 60 mmHg should be addressed, including decreasing anesthetic depth if possible and instituting positive pressure ventilation.

Alternative recommendations

1. A capnometer can be used if a capnograph is not available.
   Capnometry displays the partial pressure of inhaled and exhaled CO_2 and the respiratory rate but does not display the waveform.
2. An apnea monitor is designed to create audible noise during exhalation, or alarm during prolonged periods of apnea.
   If capnography and capnometry are not available, an apnea monitor may be used although it will not evaluate adequacy of ventilation and may add dead space to the breathing circuit.
3. During positive pressure ventilation, if an airway pressure manometer is not available, the anesthetist should visually evaluate the patient for adequate, but not excessive, thoracic excursions.

Advanced recommendations

1. Arterial (or venous) blood gas sampling enables measurement of partial pressure of CO_2 (PCO_2).
   Measurement of arterial CO_2 (and oxygen) should be considered when ventilation is abnormal prior to the procedure (patients with forebrain or brainstem disease, significant pulmonary or pleural disease, or patients with significant ventilation-perfusion mismatch).
2. Spirometry can be used to provide information on lung/chest wall compliance and tidal volume.
   Tidal volume measurement should be considered when changes in tidal volume are possible, such as during thoracotomy and with asthmatic patients. Displayed spirometry loops can be analyzed for abnormalities such as those produced by endotracheal tube cuff leaks, spontaneous breathing during ventilator use, changes in pulmonary compliance, and the presence of airway secretions.

Temperature monitoring

Objective

To identify, prevent, and manage moderate to severe deviations from normal temperature ranges.

Minimum recommendations

1. The use of a digital thermometer to measure rectal body temperature at least every 15 minutes is recommended in all moderately to heavily sedated, or anesthetized, small animal patients.
2. Continuous measurement of body temperature via a thermistor inserted into the esophagus or rectum is desirable.
3. Body temperature can be measured at different sites.
   Core body temperature refers to the temperature of internal organs and is measured invasively in the pulmonary artery using special intravenous catheters with thermistors. Esophageal and rectal temperature measurements are clinically reasonable substitutes in veterinary patients (Southward et al. 2006; Hymczak et al. 2021). When a site other than rectal or esophageal placement is used for temperature measurement (e.g., axillary, nasal, tympanic, pharyngeal), any deviations from normothermia should be confirmed using a standard measurement site when possible (Ward et al. 2023).
4. Monitoring of body temperature at least every 30 minutes should continue into the recovery period to confirm return and maintenance of normothermia.
5. If body temperature decreases below 37.8 °C/100 °F, safe active external warming should be instituted.
   Passive insulation with towels, blankets, or drapes and protection from tables should always be utilized. Safe active external warming methods include forced warm air, conductive blankets with a functioning sensor, and warm water blankets. Electric heating pads, microwaved objects (e.g., rice socks, heated disks), and warmed saline bags may cause burns. Recommended devices must be maintained appropriately to avoid malfunction and the risk of burns.

Neuromuscular blockade monitoring

Objective

To characterize effectiveness of neuromuscular transmission when using nondepolarizing neuromuscular blocking agents (NMBAs). This allows identification of the onset of action of the NMBA and quantification of the depth of NMB (i.e., deep, moderate, shallow, and minimal) (Table 2). NMB monitoring guides the re-dosing or titration of infusion rates of NMBAs, assesses conditions for administration of reversal agents, and ensures adequate restoration of neuromuscular function before emergence from anesthesia.

Minimum recommendations

1. A peripheral nerve stimulator (PNS) should be used to provide subjective (visual or tactile) assessment of muscular responses (twitches) (Martin-Flores 2025).
   Assessment includes the detection of twitches via train of four (TOF) count, 0−4, or double burst suppression (DBS) count, 0−2, and identifying a fade within the TOF or DBS during shallow or minimal NMB. NMBAs should not be administered without a PNS. Capnometry or capnography, spirometry, and other ventilation monitors are not adequate surrogates to monitor neuromuscular function (Martin-Flores et al. 2014). This recommendation differs from the previous guidelines (ACVA 2009).
2. As normal function cannot be determined by subjective means (Martin-Flores et al. 2019), it is recommended to always administer pharmacological reversal when subjective PNS is used.
3. It is mandatory to only administer NMBAs during general anesthesia (injectable or inhalant).
   NMB will cease all skeletal neuromuscular function without inducing unconsciousness. Some clinical signs of the depth of anesthesia commonly used, such as muscle (jaw) tone, palpebral reflex, or eye position, will be abolished (Cullen & Jones 1980). The loss of ability to monitor muscle tone and peripheral reflexes may require greater emphasis on close monitoring of autonomic responses, and the analysis of inhaled anesthetic agent concentrations should be considered.
4. Heart rate monitoring should be in place when reversal agents are administered as they are associated with an increase in vagal tone and could lead to life-threatening bradyarrhythmia.
   Pretreatment with anticholinergic drugs may be warranted but does not negate the need for pulse rate and ECG monitoring.

Advanced recommendations

1. Objective quantification of the TOF ratio (T4:T1) or the DBS ratio (DBS2:DBS1), typically expressed as ratio (0 to > 1) or percentage (0 to > 100%).

Table 2 Characteristics of neuromuscular blockade (NMB) are assessed subjectively and objectively. Note that normal function and minimal NMB cannot be effectively distinguished by subjective means alone (Martin-Flores et al. 2019). *via acceleromyography; TOF, train of four. The threshold for normal function has been increased from the ACVA 2009 monitoring guidelines (ACVA 2009).

NMB	Objective monitoring*	Subjective (visual) monitoring
Normal function	TOF ratio ≥ 90%	Cannot be determined
Minimal NMB	TOF ratio 40−89%	TOF count 4
Shallow NMB	TOF count 4 − TOF ratio 39%	TOF count 4
Moderate NMB	TOF count 1−3	TOF count 1−3
Deep NMB	TOF count 0	TOF count 0

Baseline values often are > 1. Quantitative assessment allows the detection of residual NMB. Indirect reversal agents such as neostigmine should not be administered during deep NMB (i.e., TOF count = 0) as they will be ineffective. Reversal is more effective and predictable as the level of NMB decreases.

Monitoring in the immediate recovery time period

Objective

To ascertain normal progression from the anesthetized state to independent maintenance of homeostasis. The first 3 hours following the cessation of anesthesia in companion animals carries the highest risk of morbidity and mortality (Brodbelt et al. 2008; Redondo et al. 2023).

At minimum, each physiological variable described below should be assessed at frequent, regular time intervals throughout the immediate postanesthetic period until the patient is deemed physiologically stable (warm, oriented, ambulatory, pain and nausea free) by the attending clinician and cardiorespiratory variables have returned to normal. Patients that require ongoing physiological monitoring and supportive care should remain under continuous observance and may require transfer to an appropriate care unit (e.g., an intensive care unit) for continued management.

Minimum recommendations

1. The recovery period encompasses the time from discontinuation of the delivery of anesthetic agents, through extubation, until the patient can maintain their own physiological stability (see #9 below) and is therefore ready for discharge. Patients should be under continuous visual observation until this time.
2. The anesthetist or designated recovery personnel should ensure patient safety through continued monitoring of physiological variables and communication of patient status with the team during the recovery period. At least one more person should be immediately available to help with patient care and in emergency situations.
3. Oxygenation should be regularly assessed by examination of mucous membrane color, ventilatory efforts (patency of upper airway, chest excursions, and auscultation), and the use of a pulse oximeter when possible. Monitoring of minimum requirements as previously described continues during the immediate postanesthetic period.
4. Circulation should be regularly assessed by assessment of heart rate, rhythm, and, in patients that have been or are unstable, continued BP measurements. Monitoring of minimum requirements as previously described continues during the immediate postanesthetic period.
5. Ventilation should be regularly assessed by evaluating chest excursion and thoracic auscultation. Monitoring of minimum requirements as previously described continues during the immediate postanesthetic period.
6. Temperature: monitoring of minimum requirements as previously described continues during the immediate postanesthetic period.
7. Pain assessment should be performed utilizing a pain scoring instrument for acute postoperative pain (e.g., the Feline Grimace scale, Glasgow Composite Measures Pain Scale-Short Form, UNESP-Botucatu Multidimensional Composite pain scale). These scales have been validated to various degrees in certain clinical situations (Reid et al. 2007; Evangelista et al. 2019; Belli et al. 2021). Clinicians must evaluate which scale is most appropriate for their clinical setting.
8. Documentation must be provided using a written or electronic record of the postanesthetic recovery anesthesia event, including drugs administered, monitoring values, and interventional notes (see Record keeping section below).
9. Patient discharge should only occur once the patient is normothermic, mentally oriented, and ambulatory (unless the disease or surgical intervention precludes this), nausea and pain free.

Advanced recommendations

1. Advanced monitoring recommendations as described in previous sections either continuously or at regular time intervals until the patient's vital parameters have returned to normal and are deemed stable.

Monitoring during sedation

Objective

To ensure adequate oxygenation and hemodynamic stability in sedated patients to prevent, recognize, and manage physiological abnormalities (Table 3).

Sedation is a dynamic continuum of central nervous system (CNS) depression and drowsiness during which the patient displays less awareness of their surroundings while continuing to be responsive to noxious stimuli. When deep enough, sedation may overlap with general anesthesia (ASA 2024). For any moderate to profound sedation procedure, monitoring of cardiopulmonary status is required, an intravenous catheter should be placed, and endotracheal intubation equipment and supplemental oxygen should be readily available. Emergency medications and reversal agents should be calculated with a digital or printed drug calculation sheet and be immediately available. Discharge criteria for when a patient has recovered from sedation and is ready to be released to the client and home are similar to recommendations for general anesthesia.

Sedation can be classified as mild, moderate, or deep/profound. Depth of sedation is dynamic and should be evaluated frequently by a dedicated, trained individual.

1. Mild sedation: patient will readily respond to stimuli but is less likely to exhibit anxiety, excitement, or other behaviors that interfere with ability to complete minimally painful procedures, such as a basic physical examination, simple blood draw, or

Table 3 Monitoring for the sedation continuum in small animal practice. ECG, electrocardiogram; •, recommended.

Sedation guidelines	Mild sedation Patient will readily respond to stimuli. May or may not assume lateral recumbency	Moderate sedation Patient remains responsive to auditory stimuli, light tactile stimulation, can reposition if assisted or stimulated but is otherwise content to lie recumbent	Deep or profound sedation Patient is not easily aroused but may still respond to repeated or painful stimuli. The patient cannot readily maintain sternal recumbency or reposition from lateral recumbency
Dedicated anesthetist	•	•	•
Pulse oximetry		•	•
Temperature		•	•
Oscillometric blood pressure, ECG, and capnography		May be indicated by patient status	Consider strongly

minor grooming procedures. The patient may not become or remain recumbent. While respiratory or cardiovascular problems are rare, continual observation during mild sedation is recommended and objective monitoring equipment should be available. The following are recommended:
   a Palpation of pulse rate, rhythm, and quality
   b Observation of mucous membrane color and capillary refill time
   c Observation of respiratory rate and pattern
   d Auscultation of heart rate and respiratory sounds
2. Moderate sedation: patient remains responsive to auditory stimuli, light tactile stimulation, can reposition if assisted or stimulated but is otherwise content to lie recumbent. Patients can usually maintain a patent airway, ventilate and oxygenate adequately, and maintain stable cardiovascular function. However, they should be observed continuously and monitored for any change in respiratory or cardiovascular status. The following are recommended:
   a Supplemental oxygen (by face mask or nasal prongs) (Ambros et al. 2018).
   b All recommended monitoring for mild sedation
   c Temperature monitoring
   d Pulse oximetry
   e Other monitoring equipment, including BP and ECG, when indicated by patient status
3. Deep or profound sedation: Patient is not easily aroused but may still respond to repeated or painful stimuli. In this state they cannot readily maintain sternal recumbency or reposition from lateral recumbency. Deeply sedated patients often require assistance to maintain a patent airway, oxygenation, or ventilation, but cardiovascular function is typically maintained. Deeply sedated patients must be monitored for respiratory and cardiovascular abnormalities. The following is recommended:
   a Supplemental oxygen (e.g., via face mask, nasal prongs, oxygen collars, nasal cannula, etc.)
   b All recommended monitoring for moderate sedation
   c Consider monitoring ECG, noninvasive BP, and capnography via nasal prong or catheter
   d Intubation should be performed if the patient is not maintaining their airway or is not ventilating adequately

Personnel and record keeping recommendations

Objective

To ensure patient safety and maintain a record of drug administration, physiological parameters, and prescribed interventions.

The presence of vigilant, trained personnel during the perianesthetic period is a key determinant for patient safety.

Minimum recommendations

1. The anesthesia care team may consist of a combination of veterinary anesthesiologists, non-specialist veterinarians, veterinary anesthesia residents, veterinary technician specialists in anesthesia and analgesia, credentialed veterinary technicians, and veterinary professionals in training. In some jurisdictions, veterinary assistants and veterinary paraprofessionals may also be part of an anesthesia care team.
2. A licensed veterinarian, credentialed veterinary technician, veterinary student under the direct supervision of a licensed veterinarian, hereby known as the anesthetist, should be responsible and always remain with the anesthetized patient, whether using sedation, partial or total intravenous anesthesia, or inhalational anesthesia. In some jurisdictions, a veterinary assistant under the supervision of a licensed veterinarian or a veterinary paraprofessional may fill this role. This individual is responsible for the perianesthetic preparation of the patient, including perianesthetic physical examination, equipment selection, including functional testing for accuracy, anesthetic drug administration, and vital parameter monitoring as described in previous sections.
3. Equipment checklist: the anesthetist should utilize a standardized anesthesia checklist, including an equipment checklist, prior to the start of the anesthetic event.
4. Emergency drugs and reversal agents: doses should be calculated prior to sedation or anesthesia and immediately available to the

anesthetist. A digital (printed or immediately available on a hand-held device) spreadsheet should be utilized.

5. Patient evaluation: the anesthetist should perform patient history evaluation, review current medication, and perform a patient physical examination prior to the administration of anesthetic drugs.
6. Anesthetic protocol: an individual anesthetic protocol should be created for each patient; a licensed veterinarian should approve the protocol.
7. Record keeping: documentation of the anesthetic procedure is a key component of anesthetic safety during the event, for retrospective study, in case reviews, and is a part of the medical record.
   a The anesthetist should create and maintain a written or electronic record of the perianesthetic anesthesia event, including recovery, documenting drugs administered, monitored physiological values, and interventional notes.
   b While vigilant monitoring of the patient is continuous, heart rate, arterial BP, arterial oxygen saturation, and end-tidal CO_2 should generally be recorded every 5 minutes, and all other physiological variables at least every 15 minutes. In unstable hemodynamic conditions, more frequent recording may be desirable (Gravenstein 1989; Walsh et al. 2013; Sun et al. 2015; ASA 2020).
8. Patient monitoring: the anesthetist should use patient monitoring recommendations as described above for circulation, ventilation, oxygenation, and temperature regulation through use of hands-on patient evaluation and electronic or multiparameter devices. The anesthetist should monitor vital parameter alarms alongside set reference ranges.
9. Communication: direct and frequent communication of patient status should occur between the anesthetist and the veterinary team, including the surgeon.
   a A surgical safety checklist, tailored to the environment, should be utilized by the anesthesia and surgical team to ensure quality standards and assess perianesthetic communication.
   b If complications arise during the anesthetic period, intervention is administered by the anesthetist with oversight by a prescribing veterinarian if necessary.
   c If a patient is transferred to another team member, including during the immediate recovery period, patient care communication must be directed from the anesthetist to the team member; including patient signalment, anesthetic protocol, anesthetic complications encountered, interventions administered, and postoperative plan. A standardized handoff checklist is recommended.

Advanced recommendations

1. A board-certified veterinary anesthesiologist should lead the anesthesia care team whenever possible.

Conflict of interest statement

The authors declare the following financial interests/personal relationships which may be considered as potential competing interests: AW Schultz reports a relationship with Midmark Corporation, Versailles, OH that includes: employment. J Sager reports a relationship with Midmark Corp that includes: consulting or advisory. Daniel Pang is an Editor-in-Chief of *Veterinary Anaesthesia and Analgesia* but took no role in the editorial management of this paper following submission. If there are other authors, they declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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Authors' contributions

All authors participated in conceptualization, literature review, and manuscript writing.

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