Chapter 1

Patient evaluation and risk management

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Introduction

The purpose of anesthesia is to provide reversible unconsciousness, amnesia, analgesia, and immobility for invasive procedures. The administration of anesthetic drugs and the unconscious, recumbent, and immobile state, however, compromise patient homeostasis. Anesthetic crises are unpredictable and tend to be rapid in onset and devastating in nature. The purpose of monitoring is to achieve the goals while maximizing the safety of the anesthetic experience.

Preanesthetic evaluation

All body systems should be examined and any abnormalities identified. The physical examination and medical history will determine the extent to which laboratory tests and special procedures are necessary. In all but extreme emergencies, packed cell volume and plasma protein concentration should be routinely determined. Contingent on the medical history and physical examination, additional evaluations may include complete blood counts; urinalysis; blood chemistries to identify the status of kidney and liver function, blood gases, and pH; electrocardiography; clotting time and platelet counts; fecal and/or filarial examinations; and blood electrolyte determinations. Radiographic and/or ultrasonographic examination may also be indicated.

Following examination, the physical status of the patient should be classified as to its general state of health according to the American Society of Anesthesiologists (ASA) classification (Table 1.1). This mental exercise forces the anesthetist to evaluate the patient's condition and proves valuable in the proper selection of anesthetic drugs. Classification of overall health is an essential part of any anesthetic record system. The preliminary physical examination should be done in the owner's presence, if possible, so that a prognosis can be given personally. This allows the client to ask questions and enables the veterinarian to communicate the risks of anesthesia and allay any fears regarding management of the patient.

Essentials of Small Animal Anesthesia and Analgesia, Second Edition. Edited by Kurt A. Grimm, William J. Tranquilli, Leigh A. Lamont.

Table 1.1. Classification of physical status[a]

Category	Physical status	Possible examples of this category
I	Normal healthy patients	No discernible disease; animals entered for ovariohysterectomy, ear trim, caudectomy, or castration
II	Patients with mild systemic disease	Skin tumor, fracture without shock, uncomplicated hernia, cryptorchidectomy, localized infection, or compensated cardiac disease
III	Patients with severe systemic disease	Fever, dehydration, anemia, cachexia, or moderate hypovolemia
IV	Patients with severe systemic disease that is a constant threat to life	Uremia, toxemia, severe dehydration and hypovolemia, anemia, cardiac decompensation, emaciation, or high fever
V	Moribund patients not expected to survive 1 day with or without operation	Extreme shock and dehydration, terminal malignancy or infection, or severe trauma

[a] This classification is the same as that adopted by the ASA.
Source: Muir W.W. 2007. Considerations for general anesthesia. In: *Lumb and Jones' Veterinary Anesthesia and Analgesia*, 4th ed. W.J. Tranquilli, J.C. Thurmon, and K.A. Grimm, eds. Ames, IA: Blackwell Publishing, p. 17.

Preanesthetic pain evaluation

The diagnosis and treatment of pain require an appreciation of its consequences, a fundamental understanding of the mechanisms responsible for its production, and a practical appreciation of the analgesic drugs that are available. Semiobjective and objective behavioral, numerical, and categorical methods have been developed for the characterization of pain and, among these, the visual analog scale (VAS) has become popular. Ideally, pain therapy should be directed toward the mechanisms responsible for its production (multimodal therapy), with consideration, when possible, of initiating therapy before pain is initiated (preemptive analgesia). The American Animal Hospital Association (AAHA) has developed standards for the assessment, diagnosis, and therapy of pain that should be adopted by all veterinarians (Table 1.2).

Preanesthetic stress evaluation

Both acute and chronic pain can produce stress. Untreated pain can initiate an extended and potentially destructive series of events characterized by neuroendocrine dysregulation, fatigue, dysphoria, myalgia, abnormal behavior, and altered physical performance. Even without a painful stimulus, environmental factors (loud noise, restraint, or a predator) can produce a state of anxiety or fear that sensitizes and amplifies the stress response. Distress, an exaggerated form of stress, is present when the biologic cost of stress negatively affects the biologic functions critical to survival. Pain, therefore, should be considered in terms of the stress response and the potential to develop distress.

Increased central sympathetic output causes increases in heart rate and arterial blood pressure, piloerection, and pupil dilatation. The secretion of catecholamines from the

Table 1.2. AAHA pain management standards (2003)

1. Pain assessment for all patients regardless of presenting complaint
2. Pain assessment using standardized scale/score and recorded in the medical record
3. Pain management is individualized for each patient
4. Practice utilizes preemptive pain management
5. Appropriate pain management is provided for the anticipated level of pain
6. Pain management is provided for the anticipated duration of pain
7. Patient is reassessed for pain throughout potentially painful procedure
8. Patients with persistent or recurring disease are evaluated to determine their pain management needs
9. Analgesic therapy is used as a tool to confirm the existence of a painful condition when pain is suspected but cannot be confirmed by objective methods
10. A written pain management protocol is utilized
11. When pain management is part of the therapeutic plan, the client is effectively educated

Sources: Muir W.W. 2007. Considerations for general anesthesia. In: *Lumb and Jones' Veterinary Anesthesia and Analgesia,* 4th ed. W.J. Tranquilli, J.C. Thurmon, and K.A. Grimm, eds. Ames, IA: Blackwell Publishing, p. 19, and the AAHA, Lakewood, CO.

adrenal medulla and spillover of norepinephrine released from postganglionic sympathetic nerve terminals augment these central effects. Ultimately, changes in an animal's behavior may be the most noninvasive and promising method to monitor the severity of an animal's pain and associated stress.

Patient preparation

Preanesthetic fasting

Too often, operations are undertaken with inadequate preparation of patients. With most types of general anesthesia, it is best to have patients off feed for 12 hours previously. Some species are adversely affected by fasting. Birds, neonates, and small mammals may become hypoglycemic within a few hours of starvation, and mobilization of glycogen stores may alter rates of drug metabolism and clearance. Induction of anesthesia in animals having a full stomach should be avoided, if at all possible, because of the hazards of aspiration.

Preanesthetic fluid therapy

In most species, water is offered up to the time that preanesthetic agents are administered. It should be remembered that many older animals have clinical or subclinical renal compromise. Although these animals remain compensated under ideal conditions, the stress of hospitalization, water deprivation, and anesthesia, even without surgery, may cause acute decompensation. Ideally, a mild state of diuresis should be established with intravenous fluids in nephritic patients prior to the administration of anesthetic drugs.

Dehydrated animals should be treated with fluids and appropriate alimentation prior to operation; fluid therapy should be continued as required. An attempt should be made to

correlate the patient's electrolyte balance with the type of fluid that is administered. Anemia and hypovolemia, as determined clinically and hematologically, should be corrected by administration of whole blood or blood components and balanced electrolyte solutions. Patients in shock without blood loss or in a state of nutritional deficiency benefit by administration of plasma or plasma expanders. In any case, it is good anesthetic practice to administer intravenous fluids during anesthesia to help maintain adequate blood volume and urine production, and to provide an available route for drug administration.

Prophylactic antibiotic administration

Systemic administration of antibiotics preoperatively is a helpful prophylactic measure prior to major surgery or if contamination of the operative site is anticipated. Antibiotics are ideally given approximately 1 hour before anesthetic induction.

Oxygenation and ventilation

Several conditions may severely restrict effective oxygenation and ventilation. These include upper airway obstruction by masses or abscesses, pneumothorax, hemothorax, pyothorax, chylothorax, diaphragmatic hernia, and gastric distention. Affected animals are often in a marginal state of oxygenation. Oxygen administration by nasal catheter or mask is indicated if the patient will accept it. Intrapleural air or fluid should be removed by thoracocentisis prior to induction because the effective lung volume may be greatly reduced and severe respiratory embarrassment may occur on induction. Anesthetists should be prepared to carry out all phases of induction, intubation, and controlled ventilation in one continuous operation.

Heart disease

Decompensated heart disease is a relative contraindication for general anesthesia. If animals must be anesthetized, an attempt at stabilization through administration of appropriate inotropes, antiarrhythmic drugs, and diuretics should be made prior to anesthesia. If ascites is present, fluid may be aspirated to reduce excessive pressure on the diaphragm.

Hepatorenal disease

In cases of severe hepatic or renal insufficiency, the mode of anesthetic elimination should receive consideration, with inhalation anesthetics often preferred. Just prior to induction, it is desirable to encourage defecation and/or urination by giving animals access to a run or exercise pen.

Patient positioning

During anesthesia, patients should, if possible, be restrained in a normal physiological position. Compression of the chest, acute angulation of the neck, overextension or

compression of the limbs, and compression of the posterior vena cava by large viscera can all lead to serious complications, which include hypoventilation, nerve and/or muscle damage, and impaired venous return.

Tilting anesthetized patients alters the amount of respiratory gases that can be accommodated in the chest (functional residual capacity [FRC]) by as much as 26%. In dogs subjected to hemorrhage, tilting them head-up (reverse Trendelenburg position) was detrimental, producing lowered blood pressure, hyperpnea, and depression of cardiac contractile force. When dogs were tilted head-down (Trendelenburg position), no circulatory improvement occurred. In most species, the head should be extended to provide a free airway and to prevent kinking of the endotracheal tube.

Selection of an anesthetic and analgesic drugs

The selection of an anesthetic is based on appraising several factors, including:

(1) The patient's species, breed, and age.
(2) The patient's physical status.
(3) The time required for the surgical (or other) procedure, its type and severity, and the surgeon's skill.
(4) Familiarity with the proposed anesthetic technique.
(5) Equipment and personnel available.

In general, veterinarians will have greatest success with drugs they have used most frequently and with which they are most familiar. The skills of administration and monitoring are developed only with experience; therefore, change from a familiar drug to a new one is usually accompanied by a temporary increase in anesthetic risk.

The length of time required to perform a surgical procedure and the amount of help available during this period often dictate the anesthetic that is used. Generally, shorter procedures are done with short-acting agents, such as propofol, alphaxalone-CD, and etomidate, or with combinations using dissociative, tranquilizing, and/or opioid drugs. Where longer anesthesia is required, inhalation or balanced anesthetic techniques are preferred.

Drug interactions

When providing anesthesia and analgesia to animals, veterinarians often administer combinations of drugs without fully appreciating the possible interactions that may and do occur. Many drug interactions, both beneficial (resulting in decreased anesthetic risk) and harmful (increasing anesthetic risk), are possible. Although most veterinarians view drug interactions as undesirable, modern anesthesia and analgesic practice emphasizes the use of drug interactions for the benefit of the patient (multimodal anesthesia or analgesia).

A distinction should be made between drug interactions that occur *in vitro* (such as in a syringe or vial) from those that occur *in vivo* (in patients). Veterinarians frequently mix drugs together (compound) in syringes, vials, or fluids before administration to animals.

In vitro reactions, also called pharmaceutical interactions, may form a drug precipitate or a toxic product or inactivate one of the drugs in the mixture. *In vivo* interactions are also possible, affecting the pharmacokinetics (absorption, distribution, or biotransformation) or the pharmacodynamics (mechanism of action) of the drugs and can result in enhanced or reduced pharmacological actions or increased incidence of adverse events.

Nomenclature

Commonly used terms to describe drug interactions are addition, antagonism, synergism, and potentiation. In purely pharmacological terms that have underlying theoretical implications, addition refers to simple additivity of fractional doses of two or more drugs, the fraction being expressed relative to the dose of each drug required to produce the same magnitude of response; that is, response to X amount of drug A = response to Y amount of drug B = response to 1/2XA + 1/2YB, 1/4XA + 3/4YB, and so on. Additivity is strong support for the assumption that drug A and drug B act via the same mechanism (e.g., on the same receptors). Confirmatory data are provided by *in vitro* receptor-binding assays. Minimum alveolar concentration (MAC) fractions for inhalational anesthetics are additive. All inhalants have similar mechanisms of action but do not appear to act on specific receptors.

Synergism refers to the situation where the response to fractional doses as described previously is greater than the response to the sum of the fractional doses (e.g., 1/2XA + 1/2YB produces more than the response to XA or YB).

Potentiation refers to the enhancement of action of one drug by a second drug that has no detectable action of its own.

Antagonism refers to the opposing action of one drug toward another. Antagonism may be competitive or noncompetitive. In competitive antagonism, the agonist and antagonist compete for the same receptor site. Noncompetitive antagonism occurs when the agonist and antagonist act via different receptors.

The way anesthetic drugs are usually used raises special considerations with regard to drug interactions. For example, (1) drugs that act rapidly are usually used; (2) responses to administered drugs are measured, often very precisely; (3) drug antagonism is often relied upon; and (4) doses or concentrations of drugs are usually titrated to effect. Minor increases or decreases in responses are usually of little consequence and are dealt with routinely.

Commonly used anesthetic drug interactions

Two or more different kinds of injectable neuroactive agents are frequently used to induce anesthesia with the goal of achieving a better quality of anesthesia with minimal side effects. Agents frequently have complementary effects on the brain, but one agent may also antagonize an undesirable effect of the other. Examples of such combinations are tiletamine and zolazepam (Telazol®) or ketamine and midazolam. Tiletamine and ketamine produce sedation, immobility, amnesia, and differential analgesia, but may also produce muscle rigidity and grand mal seizures. Zolazepam and midazolam produce sedation, reduce anxiety, and minimize the likelihood of inducing muscle rigidity and seizures.

To better manage the pain associated with surgical procedures, it is becoming increasingly common to combine the use of regionally administered analgesics and light general anesthesia (twilight anesthesia). An example of such an approach is to administer a local anesthetic alone or in combination with an opioid or an alpha$_2$ adrenergic agonist into the epidural space before or during general anesthesia. Benefits sought with this approach are reduction in the amount of general anesthetic required and the provision of preemptive analgesia. Reducing general anesthetic requirements decreases the potential of systemic side effects.

Interactions among opioid drugs

In recent years, there has been some confusion as to whether the administration of opioid agonists with opioid agonist/antagonists will produce an interaction that diminishes the analgesic effect of the combination. In theory, drugs such as butorphanol and nalbuphine have antagonistic properties on the μ receptor, so they should partially reverse some effects of μ-receptor agonists (e.g., morphine) when administered together. The clinical significance of this antagonism has been debated, however. In dogs, for example, although butorphanol reverses some respiratory depression and sedation produced by pure agonists, the analgesic efficacy may be preserved. Similarly, in dogs given butorphanol for postoperative pain associated with orthopedic surgery, there was no diminished efficacy with subsequent administration of oxymorphone. However, in another study, dogs that had not responded to butorphanol after shoulder arthrotomy responded to subsequent administration of oxymorphone, but the oxymorphone dose required to produce an adequate effect was higher than what would be required if oxymorphone was used alone, suggesting that some antagonism of analgesia may have been present. When butorphanol and oxymorphone have been administered together to cats, a greater efficacy has been reported than when either drug was used alone. These clinical observations, taken together, suggest that antagonism may indeed occur in some clinical patients, but in other patients, coadministration actually results in a synergistic analgesic effect. These divergent results from one individual to the next may be due to a variety of factors, including: (1) differences in the pain syndrome being treated, (2) species variation in response to opioids, (3) dosage ratios of the specific opioids being administered, and (4) variation in opioid efficacy between genders. For example, when looking at the first of these factors in humans, whether antagonism or synergism occurs with the coadministration of butorphanol and a pure opioid agonist appears to depend on whether somatic pain versus visceral pain is present. These types of studies have not been performed to date in common pet species.

Risk

Risk refers to uncertainty and the potential for adverse outcome as a result of anesthesia and surgery. It should be emphasized that physical status, anesthetic risk, and operative risk are different.

Major surgical procedures and complex procedures are associated with increased morbidity and mortality as compared with minor procedures. Involvement of major

organs increases risk; central nervous system (CNS), cardiac, and pulmonary procedures have the highest risk, followed by the gastrointestinal tract, liver, kidney, reproductive organs, muscles, bone, and skin. Emergency procedures are more risky because of unstable or severely compromised homeostasis, decreased ability to prepare or stabilize the patient, and lack of preparation by the surgical and anesthetic team. Operating conditions refer to the physical facilities and equipment and support personnel available. The aggressiveness of the surgical team, experience with the procedure, and frequency of performance are also important. Lastly, the duration of the procedure and fatigue must be considered because patients cannot be operated on indefinitely. The incidence of morbidity and mortality increases with the duration of anesthesia and surgery. Thus, efficiency of the surgical team is important in reducing risk.

Anesthetic factors that can affect risk include the choice of anesthetic drugs to be used, the anesthetic technique, and the duration of anesthesia. The choice of anesthetic can adversely affect the outcome, but more commonly the agents are not so much at fault as the manner in which they are given. Experience of the anesthetist with the protocol is important to its safe administration. It is worth noting that human error remains the number one reason for anesthesia-related mishap and is a major contributor to anesthetic risk.

Several retrospective studies have reported a perioperative mortality rate of 20–189 per 10,000 patients administered anesthetics. Anesthesia reportedly contributed to 2.5–9.2 deaths per 10,000 patients (Table 1.3). Mortality rates were higher among patients

Table 1.3. Complications in small animal anesthesia

Species	Number at risk	Number of anesthetic- and sedative-related fatalities	Risk of anesthetic-/sedative-related death (%)	95% CI (%)
Dog	98,036	163	0.17	0.14–0.19
Cat	79,178	189	0.24	0.20–0.27
Rabbit	8209	114	1.39	1.14–1.64
Guinea pig	1288	49	3.80	2.76–4.85
Ferret	601	2	0.33	0.04–1.20[a]
Hamsters	246	9	3.66	1.69–6.83[a]
Chinchilla	334	11	3.29	1.38–5.21
Rat	398	8	2.01	0.87–3.92[a]
Other small mammals	232	4	1.72	0.47–4.36[a]
Budgerigar	49	8	16.33	7.32–29.66[a]
Parrot	127	5	3.94	1.29–8.95[a]
Other birds	284	5	1.76	0.57–4.06[a]
Reptiles	134	2	1.49	0.18–5.29[a]
Other	50	0	0	0–7.11[a]

[a] Exact 95% confidence interval (CI).

Source: Broadbelt D.C., Blissitt K.J., Hammond R.A., Neath P.J., Young L.E., Pfeiffer D.U., Wood J.L. 2008. The risk of death: the confidential enquiry into perioperative small animal fatalities. *Vet Anaesth Analg* **35**(5): 365–373. Epub May 5, 2008.

with poorer preoperative physical status and greater age where biologic reserves are limited, and among patients undergoing emergency procedures where preoperative planning and preparation are limited, but were still of notable frequency in young, healthy patients undergoing planned procedures (Table 1.4). Of the deaths, 1% occurred at premedication, 6–8% at induction, 30–46% intraoperatively, and 47–61% postoperatively (Table 1.5). Intraoperative causes of death included the primary disease process;

Table 1.4. Risks of anesthetic- and sedation-related death in healthy and sick dogs, cats, and rabbits

Species	Health status[a]	Number of anesthetic-related deaths	Estimated number of anesthetics	Risk of anesthetic- and sedation-related death (%)	95% CI (%)
Dog	Healthy	49	90,618	0.05	0.04–0.07
	Sick	99	7418	1.33	1.07–1.60
	Overall[b]	163	98,036	0.17	0.14–0.19
Cat	Healthy	81	72,473	0.11	0.09–0.14
	Sick	94	6705	1.40	1.12–1.68
	Overall[b]	189	79,178	0.24	0.20–0.27
Rabbit	Healthy	56	7652	0.73	0.54–0.93
	Sick	41	557	7.37	5.20–9.54
	Overall[b]	114	8209	1.39	1.14–1.64

[a] Healthy (ASA I and II) no/mild preoperative disease, sick (ASA III–V) severe preoperative disease.
[b] Overall risks include additional deaths for which insufficient information was available (including health status) to exclude them from being classified as anesthetic related.
Source: Broadbelt D.C., Blissitt K.J., Hammond R.A., Neath P.J., Young L.E., Pfeiffer D.U., Wood J.L. 2008. The risk of death: the confidential enquiry into perioperative small animal fatalities. *Vet Anaesth Analg* **35**(5): 365–373. Epub May 5, 2008.
CI, confidence interval.

Table 1.5. Timing of anesthetic- and sedation-related deaths in dogs, cats, and rabbits

Timing of death	Dogs (%)	Cats (%)	Rabbits (%)
After premedication	1 (1)	2 (1)	0
Induction of anesthesia	9 (6)	14 (8)	6 (6)
Maintenance of anesthesia	68 (46)	53 (30)	29 (30)
Postoperative death[a]	70 (47)	106 (61)	62 (64)
0–3 hours postoperative	31	66	26
3–6 hours postoperative	11	9	7
6–12 hours postoperative	12	7	13
12–24 hours postoperative	13	12	9
24–48 hours postoperative	3	10	3
Unknown time	0	2	4
Total	148 (100)	175 (100)	97 (100)

[a] Postoperative deaths were additionally categorized by time after anesthesia. The percent values are given within parentheses.
Source: Broadbelt D.C., Blissitt K.J., Hammond R.A., Neath P.J., Young L.E., Pfeiffer D.U., Wood J.L. 2008. The risk of death: the confidential enquiry into perioperative small animal fatalities. *Vet Anaesth Analg* **35**(5): 365–373. Epub May 5, 2008.

aspiration; hypovolemia and hypotension; hypoxia secondary to airway or endotracheal tube problems, or pneumothorax; misdosing of drugs; and hypothermia. Postoperative causes of death included the primary disease process, arrest during endotracheal tube suctioning, aspiration, pneumonia, and heart failure (Table 1.6).

Claims presented to the American Veterinary Medical Association Professional Liability Insurance Trust based on anesthetic, surgical, and medical incidents reflect changing trends in veterinary practice and owner concern for optimal patient care (Table 1.7). It should be noted that the percentage of anesthesia claims decreased by over 50% for both dogs and horses from 1982 to 2003, reflecting the increasing sophistication and safety of veterinary anesthesia during this period. For more recent data on

Table 1.6. Primary causes of death in dogs, cats, and rabbits

Cause of death	Dogs (%)	Cats (%)	Rabbits (%)
Cardiovascular cause	34 (23)	11 (6)	3 (3)
Respiratory causes	20 (13)	16 (9)	13 (13)
Either cardiovascular or respiratory	55 (37)	99 (57)	22 (23)
Neurological cause	7 (5)	8 (5)	2 (2)
Renal	1 (1)	6 (3)	0
Unknown	31 (21)	35 (20)	57 (59)
Total	148 (100)	175 (100)	97 (100)

Deaths are expressed as number of animals (percent of total). Only cases where a case–control questionnaire was received are included.
Source: Broadbelt D.C., Blissitt K.J., Hammond R.A., Neath P.J., Young L.E., Pfeiffer D.U., Wood J.L. 2008. The risk of death: the confidential enquiry into perioperative small animal fatalities. *Vet Anaesth Analg* **35**(5): 365–373. Epub May 5, 2008.

Table 1.7. Trends in claims involving anesthesia, surgery, and medicine presented to the American Veterinary Medical Association Professional Liability Insurance Trust (AVMA-PLIT)

Species	Total	Anesthesia (%)	Medical (%)	Surgical (%)
1976–1982				
Dogs	1225	13.1	44.4	42.5
Cats	216	6.5	47.7	45.8
Horses	542	13.8	44.5	41.7
Cattle	436	3.9	51.8	44.2
1999–2003				
Dogs	6892	5.1	41.8	40.7
Cats	2135	7.0	42.2	40.7
Horses	1521	4.5	42.3	37.2
Cattle	727	2.1	29.3	52.4
2005–November 30, 2010				
Dogs	9586	4.3	35.5	60.3
Cats	2571	6.0	38.3	55.7
Horses	994	4.9	37.3	57.8
Cattle	385	0.8	24.4	74.8

Source: Data courtesy of the AVMA-PLIT.

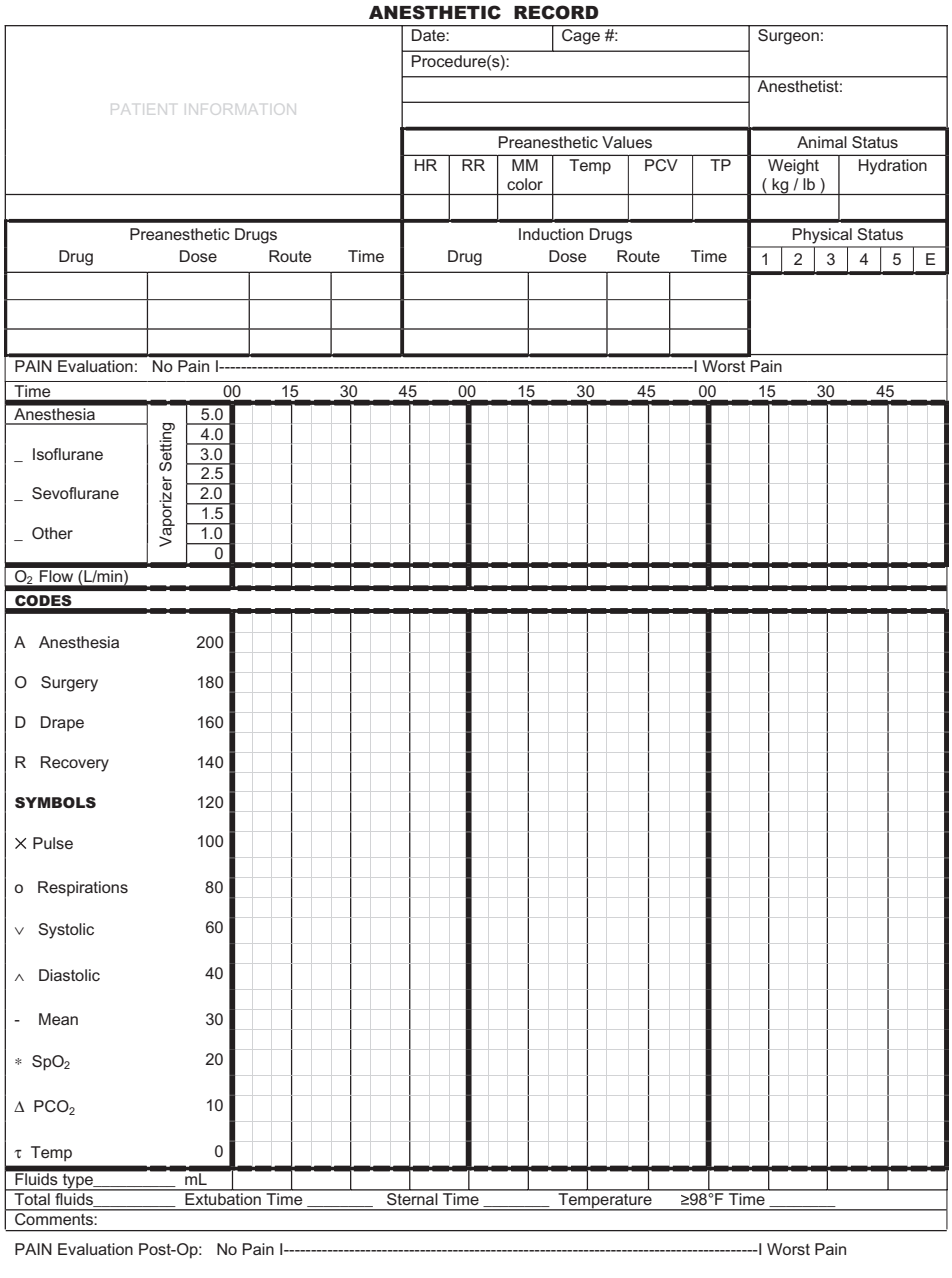

Figure 1.1. Example of an anesthetic record.
Source: Muir W.W. 2007. Considerations for general anesthesia. In: *Lumb and Jones' Veterinary Anesthesia and Analgesia*, 4th ed. W.J. Tranquilli, J.C. Thurmon, and K.A. Grimm, eds. Ames, IA: Blackwell Publishing, p. 26.

anesthetic-related claims, the reader is referred to the American Veterinary Medical Association Liability Insurance Trust.

As long as anesthetics are administered, the hazard of death can never be eliminated completely; however, it can be minimized, particularly if one is willing to investigate and to learn from mistakes. Once an anesthetic fatality has occurred, the sequence of the perioperative events preceding the death should be reviewed, their significance should be evaluated, and a necropsy should be recommended to piece together its pathogenesis and etiology. Armed with this information, the practitioner can then take steps to prevent a recurrence.

Record keeping

The American College of Veterinary Anesthesiologists (ACVA) has recently updated its recommendations for anesthetic monitoring, with the intention of improving the care of veterinary patients. The ACVA recognizes that some of the methods may be impractical in certain clinical settings and that anesthetized patients can be monitored and managed without specialized equipment. The aspects of anesthetic management addressed by the ACVA guidelines that deserve careful attention include patient circulation, oxygenation, ventilation, record keeping, and personnel.

To obtain meaningful data concerning anesthesia, certain information must be collected. An individual record must be made for each animal anesthetized. Among the items that should be recorded in the anesthetic or patient record are:

(1) Patient identification, species, breed, age, gender, weight, and physical status of the animal.
(2) Surgical procedure or other reason for anesthesia.
(3) Preanesthetic agents given (dose, route, and time).
(4) Anesthetic agents used (dose, route, and time).
(5) Person administering anesthesia (veterinarian, technician, student, or lay personnel).
(6) Duration of anesthesia.
(7) Supportive measures.
(8) Difficulties encountered and methods of correction.

It is necessary that each step of anesthetic administration be recorded in an anesthetic record (Figure 1.1). Minimally, the pulse and respiratory rate should be monitored at 5-minute intervals and recorded at 10-minute intervals. Trends in these parameters thus become apparent before a patient's condition severely deteriorates, so that remedial steps may be taken.

Revised from "Considerations for General Anesthesia" by William W. Muir; "Monitoring Anesthetized Patients" by Steve C. Haskins; and "Drug Interactions" by Mark G. Papich in Lumb & Jones' Veterinary Anesthesia and Analgesia, Fourth Edition.