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Promoting Smooth Anesthetic Recovery

Anesthetic recovery is one of the most important periods of the anesthetic process, yet veterinary patients often receive minimal attention during this time. Important considerations in the recovering animal include ensuring a smooth and rapid return of consciousness, support of normal physiologic functions, and assessment and management of pain.

Preanesthetic Patient Management

Stress

Promotion of a smooth anesthetic recovery begins in the preanesthetic period. A discussion of the details of preanesthetic patient preparation is beyond the scope of this article; however, basic considerations include ensuring normal physiologic activity and minimizing pain and stress. Animals that are stressed in the preanesthetic period are likely to have stressful recoveries.

Hospitalization increases stress levels in many pets, leading to increased levels of circulating catecholamines, such as epinephrine and norepinephrine. These sympathetic neurotransmitters cause tachycardia and hypertension and increase the likelihood of tachyarrhythmia. High sympathetic tone may also decrease gastrointestinal motility, increasing the risk for regurgitation during anesthesia and subsequent postanesthetic esophagitis. Some patients, especially geriatric animals, may be better anesthetic candidates if they are not hospitalized the night before a procedure. A detailed discussion of the benefits and risks of hospitalization with the client will determine whether hospitalization is better for an individual animal.

Historically, veterinarians have advocated withholding food and water from pets for 12 hours before anesthesia. While several hours of fasting from solid food is still recommended, access to water should be allowed until the time for anesthesia. Prolonged fasting may actually increase the likelihood of reflux of acidic gastric fluid.[1]

Analgesic Strategies

Including appropriate antianxiety and analgesic drugs and techniques in the preanesthetic plan can significantly enhance recovery quality. A low dose of acepromazine may benefit an anxious animal and smooth both induction and recovery. Popular preemptive analgesics include opioids, such as butorphanol, transdermal fentanyl, buprenorphine, hydromorphone, and morphine; the alpha-2 adrenergic agonists xylazine and medetomidine; and such nonsteroidal antiinflammatory drugs as carprofen and meloxicam. Preemptive use of local anesthetic agents and techniques also greatly minimizes postoperative pain and improves recovery quality. Popular regional techniques include epidural injections, brachial plexus blocks, and such infiltrative blocks as dental and intercostal nerve blocks. Bupivacaine is the longest-lasting local anesthetic; thus, it may provide the most significant pain relief from preanesthetic injection into the recovery period. Recent reviews provide detailed information regarding local anesthetic drugs and techniques in dogs and cats.[2,3]

Patient Management During Anesthesia

Induction

The effect of anesthetic induction drugs on recovery depends on the duration of anesthesia and the drug used for maintenance. If the procedure is brief, the choice of induction drug may significantly influence recovery quality; however, if the animal is maintained under anesthesia longer than 20 to 30 minutes, the drug used to maintain anesthesia becomes more important for recovery quality than the induction drug. For short procedures, propofol has become the injectable anesthetic induction agent of choice—it offers a smoother and faster recovery than other injectable induction drugs. However, propofol does not provide analgesia, so other drugs must be given for pain relief during painful procedures, even if the procedure will be short.

Other options for rapid induction are isoflurane and sevoflurane. Either of these insoluble anesthetic agents offers rapid induction of anesthesia via face mask delivery; however, mask delivery can be stressful (consider chamber if possible) and is not be recommended when it is necessary to gain control of the airway rapidly. Pulmonary disease slows inhalant inductions. Sevoflurane may be preferred over isoflurane because it is

continues

less pungent and may be more readily accepted by the animal than isoflurane.

Whether sevoflurane or isoflurane offers better anesthetic recovery quality is controversial. Sevoflurane is slightly less soluble in blood than is isoflurane; as a result, recovery is a few minutes faster after discontinuation of sevoflurane than after isoflurane, but the difference has not been shown to be statistically significant. Additionally, speed of recovery does not necessarily equate to smoothness of recovery quality, and isoflurane and sevoflurane seem to offer similar quality of recovery in small animal patients. The decision of which inhalant to use is primarily a matter of personal preference and availability.

Intraoperative Analgesia

Providing intraoperative analgesia during painful procedures can help smooth recovery. Constant-rate infusion of such drugs as lidocaine, ketamine, and/or morphine has become popular for canine patients. In isoflurane-anesthetized cats, lidocaine infusion has been associated with hemodynamic compromise and cannot be recommended.[4] Further research to determine the appropriate pharmacokinetics of lidocaine infusion in cats may allow for its use in the future. For extremely painful procedures, such as total ear canal ablations and forelimb amputations, placement of diffusion catheters before recovery from anesthesia allows for repeated administration of local anesthetic solutions into the painful site.

Complications

Hypothermia

Hypothermia is one of the most common anesthetic complications in small animals.[5] At the beginning of recovery, body temperatures are usually between 92° and 96° F (33.3° and 35.5° C). Hypothermia and the resultant rewarming process can adversely affect recovery quality. Shivering causes significant increases in oxygen demand and cardiac output. While shivering can effectively increase body temperature, the muscle activity generated in the process can be a source of discomfort. Energy requirements exceed 200% to 400% of baseline, and fragile patients can decompensate while trying to get warm.

A forced air warming system used to warm a cat during anesthetic recovery

Hypothermia is best prevented by warming the environment surrounding the patient; however, a warm operating environment is usually not practical. Circulating warm-water heating pads provide minimal warmth, and electric heating pads are dangerous. Forced-air warming blankets provide the most effective means for preventing and treating hypothermia. Several companies offer forced-air heating units and disposable blankets. Layers of lightweight blankets or towels can also be used to maintain the circulating warm air around the patient. Most forced-air warming units have variable temperature controls to optimize patient warming while minimizing the risk for burn injury. Both new and refurbished units are available.

Treatment of hypothermia usually extends from the anesthetic period into recovery. Use of a forced-air warming blanket provides the safest and quickest way to restore recovering animals to normothermia. Some practices have clothes dryers to keep warm, dry blankets available for recovering animals. Others use hand-held hair dryers to warm and dry recovering patients. However, extreme caution must be taken if using hair dryers—serious burns can result if the dryer is held too close to the patient for too long. The skin of dogs and cats tends to be much more fragile than that of human scalps. (See **Warming the Patient** on page 13 for further discussion.)

Hyperthermia

On the other hand, it is important to keep in mind that some cats become hyperthermic during the recovery period, especially if they received a dissociative drug, such as ketamine, or an opioid, such as hydromorphone. Temperatures exceeding 106º F (41º C) have been recorded in cats hours after receiving a mu-agonist opioid.[6] Supportive care (IV fluids, a fan, a sponge bath) is effective in restoring normothermia.

Respiratory Compromise

Unrecognized respiratory compromise can be a life-threatening problem in an anesthetized patient and is a continued risk during recovery. In a busy practice, animals may not be monitored as closely in the recovery period as during anesthesia, and at-risk patients may hypoventilate. Respiratory depression as a result of pro-

longed sedative activity and upper airway obstruction are common causes of postanesthetic respiratory compromise. Determining the animal's level of consciousness and whether it is able to effectively ventilate before and after extubation are simple ways to monitor whether the patient is hypoventilating. The best monitors are trained personnel, but if personnel are unavailable simple respiratory monitors can be purchased to assist in determining respiratory function in the intubated patient.

If possible, place the recovering animal in sternal recumbency to optimize pulmonary function. The animal should be actively swallowing before extubation. In a brachycephalic patient or one having face, head, or neck surgery, allow the animal to fully recover while remaining intubated as long as it is not chewing on the endotracheal tube. When possible, keep the patient attached to the anesthesia machine and breathing oxygen until ready to extubate. Attachment to the breathing system allows closer monitoring of respiratory function, delivers oxygen, enables the patient to ventilate if spontaneous ventilation is inadequate, and enables continued scavenging of the exhaled inhalant anesthetic agent.

Always have emergency airway equipment readily available in the recovery area in case emergency intubation becomes necessary. This equipment should include a long-bladed laryngoscope, several sizes of endotracheal tubes, a rapidly acting induction drug (propofol is ideal), and a means of providing ventilatory support (anesthesia machine or Ambu-type breathing bag).

Pain

Recognition and management of pain are very important aspects of patient care in the recovery period. Dogs and cats often indicate pain in very different ways. Dogs may pant or vocalize (range from a soft whine to a howl) or become restless in response to pain, whereas cats are typically quiet, displaying decreased movement. A cat that is in pain may sit very still for long periods hunched in a corner of the cage. Knowing a patient's behavior when it is not in pain helps to determine the presence of pain. Comparison of

A pug recovering with the endotracheal tube in place

such physiologic information as heart rate, respiratory rate, appetite, and interest in surroundings before and after a painful procedure assists in making a pain assessment. Close observation of the animal in its cage, measurement of physiologic parameters, and gentle palpation of the area surrounding the surgical site aid in determining the extent of pain.

Pain management options are similar to the preemptive options. Constant-rate infusion drugs used during surgery, such as fentanyl, morphine, ketamine, and, in dogs, lidocaine, can be continued into the recovery period at the lowest effective dose. Mu-agonist opioids continue to be excellent choices for postoperative pain relief. In healthy patients, if opioid administration alone provides inadequate analgesia or if the animal becomes dysphoric after opioid administration, addition of a low dose of medetomidine will provide analgesia and sedation. NSAIDs are extremely useful adjunct drugs for pain management during recovery. Acepromazine is also a useful adjunctive after it is determined that the dog is no longer in pain. Numerous reviews provide detailed information on analgesic choices in recovering animals.[7]

Summary

The transition from general anesthesia to recovery should be smooth and seamless. Understanding the pharmacology of anesthetic drugs and paying attention to physiologic details promote a safe and uneventful anesthetic recovery.

See Aids & Resources, back page, for references, contacts, and appendices.

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