How Low Can You Go?

Managing Hypothermia in Anesthetized Patients

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Anesthetized patients are at risk for hypothermia because of heat loss associated with anesthetic drugs and surgical procedures. This article discusses potential causes of heat loss and provides strategies for preventing and treating pre-, intra-, and postoperative heat loss.

See related article, **Put Medicine to Work: Postoperative Protocols**, page 38

Normal body temperature for dogs and cats ranges from 37.7°C to 38.8°C (100°F-102.2°F).[1] Body temperatures obtained at a veterinary practice may be higher than the midrange of normal because of stress or excitement. Body temperatures typically are lower during the intraoperative period, and in patients under anesthesia, mild hypothermia begins at 36.6°C (98°F).[1]

During an anesthetic procedure, there are many causes of heat loss. However, drugs (eg, opioids) can sometimes increase body temperature, and the surgical team should be familiar with hyperthermia values. A 2010 study that reviewed opioid use in feline patients showed all the opioids tested caused a mild-to-moderate (ie, less than 40.1°C [104.2°F]), self-limiting increase in body temperature.[2]

Treating Hypothermia

Hypothermia in anesthetized patients can be prevented and treated by following a few simple steps:

- Put warming devices in place (eg, circulating warm water blanket under the patient, circulating warm air blanket over the patient) preoperatively. Consider prewarming patients because hypothermia often occurs with anesthetic procedures.
- Cover the patient with blankets and place Bubble Wrap over the extremities to prevent additional pre-, intra-, and postoperative heat loss.
- Monitor the temperature of anesthetized patients continuously via an esophageal temperature probe or rectal thermometer.
- Establish a practice protocol for when hypothermia treatment should begin (eg, less than 37.2°C [99°F] in dogs, less than 36.7°C [98°F] in cats).
- Alert the veterinarian if warming attempts are unsuccessful and the patient's temperature continues to decrease.

Causes of Heat Loss

Hypothermia typically is defined as body temperature less than 36°C (97°F), although different sources cite different temperatures. Hypothermia during the pre- and intraoperative periods can be caused by a number of factors:

- Administration of vasodilators (eg, acepromazine, propofol, inhalants) that result in peripheral heat loss
- Administration of room temperature IV fluids
- Exposure of body cavities during surgical procedures
- Lavage of body cavities with room temperature fluids
- Cold ambient temperatures in the surgical suite
- Oxygen flow rate, which plays an important role in temperature regulation during anesthesia. Patients maintained on nonbreathing systems or circle systems with high oxygen flows are more susceptible to body temperature decreases because the oxygen is cold and dry.[3]

As body temperature decreases, so does a patient's anesthetic requirement, so vaporizer settings and anesthetic doses must be adjusted to minimize potential complications from hypothermia. For every 1°C (1.8°F) decrease in body temperature, there is a 5% decrease in minimum alveolar concentration requirements.[4]

Intra- & Postoperative Monitoring

During the intraoperative period, body temperature should be measured constantly with a thermometer probe in the rectum or esophagus, or at least every

In-line fluid warmers should be placed as close as possible to the patient to minimize the distance that the warmed fluids must travel to reach the patient.

15 minutes.[5] Small patients lose body heat more quickly than larger patients because their body surface area is proportionately greater.[6] Patient body temperature also must be monitored vigilantly during the postoperative period because animals with hypothermia process anesthetic drugs more slowly, resulting in prolonged recovery.[6] A rectal temperature should be obtained every 30 minutes during recovery until the patient's temperature is normal. Step-down rewarming efforts should be used as the patient's temperature approaches normal to avoid rebound hyperthermia, especially in cats and small dogs.[7]

Managing Hypothermia

Active warming devices can prevent and treat hypothermia during the intra- and postoperative period. Forced-air warming systems (eg, Bair-Hugger) blow warm air through porous blankets that surround a patient. The blankets are in sterile packages that maintain the sterility of the surgery site and are considered one-time use. Some of these systems also can be used to warm IV fluids. The Bair-Hugger system offers an attachment coil that acts as an in-line fluid warmer. While these fluids are warmed, considerable cooling can occur in the extension set, depending on the fluid flow rate. These methods also can be used preoperatively to warm the patient. However, body temperature must be monitored while these systems are in place because they can increase temperature rapidly.

The HotDog warming system consists of a heavy-weight but flexible polymeric fabric that is electrically conductive for even heat distribution. The blankets are puncture resistant, reusable, and easy to clean, and can be used over, under, or wrapped around a patient. These blankets do not use forced air, so the surgical site and ECG leads are less likely to become dry.

Many practices warm the IV fluids administered to anesthetized patients. Although the IV fluids may be warm within the bag, cooling begins rapidly even when insulating methods are used (eg, wrapping the warm IV bag with a towel or blanket). Be aware that fluids warmed in a microwave, for example, can heat unevenly and/or reach temperatures that damage tissues.

In-line IV fluid warmers keep fluids at consistent temperatures. Some, such as I-Warm, use dry heat exchange to quickly increase the fluid's temperature to match the patient's. Again, depending on the fluid flow rate, heat loss can occur rapidly within the fluid line. For this reason, in-line fluid warmers should be placed as close as possible to the patient to minimize the distance that the warmed fluids must travel to reach the patient.

Other passive methods for preventing heat loss include blankets, towels, Bubble Wrap, and even placing infant socks over the patient's extremities. A microwave can be used to heat rice bags or socks, reusable plastic discs, water bottles, water-filled latex gloves, lavage, or IV solutions, but care must be taken because microwaving has been associated with increased risk for thermal burns and is not recommended.[8]

TAKE ACTION

1. Select warming devices carefully, and ensure proper use to avoid risk for thermal burns.
2. Monitor patients vigilantly during surgery and in recovery—at a minimum, body temperature should be taken every 15 minutes.

Conclusion

Heat loss is a common problem in anesthetized patients, and veterinary surgical teams should be prepared to treat it aggressively. They should be familiar with the values for both hypothermia and hyperthermia, the causes of hypothermia, the importance of monitoring heat loss pre-, intra-, and postoperatively, and the many options available on the market to help treat hypothermia. (See **Treating Hypothermia**, page 44.)

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FUN FACT: Tasha's favorite movie is Super Troopers, and she has finally come to terms with the fact that she actually likes Petyr Baelish.

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