



# Veterinary Medical Care Guidelines for Spay-Neuter Programs

## Comparison of documents published in 2008 and 2016

The 2016 document includes the following:

### Introduction

- By targeting underserved populations for which spay-neuter services are unlikely to be available or accessible, programs provide surgical sterilization to animals that are most at risk for contributing to shelter impoundment and euthanasia. In the United States, these typically include pets from low-income households and community cats, (ie, unowned free-roaming cats, including unsocialized feral cats and socialized stray cats).
- Over the past decade, spay-neuter practice has emerged as a rapidly growing area in clinical veterinary medicine.
- While focused on high volume spay-neuter programs, the guidelines were intended to be applicable and achievable in any veterinary practice environment providing spay-neuter services. (The 2008 version indicated that the guidelines represent practical recommendations that are attainable by the vast majority of spay-neuter programs.)
- In 2014, ASV reconvened its task force for the purpose of updating these guidelines by reviewing current scientific literature and integrating the latest information and evidence available into its recommendations for spay-neuter practice.
- In this second edition of its guidelines, the task force included general guidelines for patient care and clinical procedures and added recommendations for operations management of high volume spay-neuter programs to address management, staff, and clinic issues.
- ASV defines high quality, high volume spay-neuter (HQHVSN) services as efficient surgical initiatives that meet or exceed veterinary medical standards of care in providing accessible, targeted sterilization of large numbers of cats and dogs to reduce their overpopulation and subsequent euthanasia.
- ASV supports continued development of HQHVSN services to provide the necessary capacity to serve existing cat and dog populations.

- While recognizing the importance of high volume spay-neuter services, the ASV remains committed to the delivery of high quality care to each individual animal. The application of the guidelines will enhance the quality of patient care, reduce risks, and improve patient outcomes in all settings where surgical sterilization is performed.
- While ASV recognizes that nonsurgical sterilization is an emerging approach that may be of value for specific populations or patients, these guidelines do not include recommendations for nonsurgical methods of sterilization.
- In keeping with its original intent, ASV hopes that these guidelines will be used by the profession to maintain consistent veterinary medical care in all settings where spay-neuter services are provided and promote these services as a means to reduce sheltering and euthanasia of cats and dogs.

## **Guidelines for Patient Care and Clinical Procedures**

(Although this is a new section in the 2016 document, many of these concepts were discussed under different headings in the 2008 document.)

### **Introduction**

As is the case for all clinical veterinary practice settings, attention to the details involved in providing patients with quality care during all aspects of their veterinary experience is integral to success. The provision of safe and humane patient housing and handling practices, infection control procedures, proper record-keeping, emergency readiness protocols, and follow-up and emergency care plans are important considerations for spay-neuter programs.

### **Patient transportation services**

- Acknowledgement that there is inherent risk associated with transport of live animals.
- Periodic monitoring of animals within the transport vehicle and good air quality are mentioned in the list of provisions for safe transport (the 2008 version indicated that patients should have continual monitoring during transport).
- Patients should be observed at appropriate intervals during transport as determined to be necessary on the basis of needs of the animals, duration of transport, and the attendant environmental temperatures. Commercially available monitoring devices are especially helpful during extended transports. Patient monitoring may be facilitated by video surveillance without compromising efficiency or security. In addition, the use of portable, remote temperature and air quality monitors may enhance monitoring during transport. The timing and methods of monitoring are chosen at the discretion of the program, taking into account the constraints associated with transport, resources, and safety.
- To the extent possible, strategies to reduce animal stress during transport, including separation of species, should be employed.

### **Record-keeping**

- Record-keeping procedures should comply with federal regulations (in addition to state and local laws, which were mentioned in the 2008 version).

### **Vaccination**

- Perioperative vaccination is safe and can effectively confer immunity.
- Vaccination against rabies should be strongly recommended, as it is mandated by state and local laws and regulations (in addition to state laws and regulations that were mentioned in the 2008 version). Spay-neuter programs can facilitate owner compliance by offering rabies vaccinations; however, pet owners are ultimately responsible for maintaining their pets' current vaccination status in accordance with existing laws and regulations. (The 2008 version indicated that rabies vaccination should be required and administered as mandated by state regulations.)

## Patient handling and housing

- Proactive strategies to decrease patient stress and fear while promoting patient comfort are essential components of patient care in all clinical settings. Among these strategies, safe, low-stress handling is a key requirement for animal health and well-being. Dogs that do not walk willingly on a leash should be carried when possible. Cats exhibiting signs of fractious or feral behavior should be transported in covered traps or other transport carriers. Procedures for temporary housing of patients before and after surgery must be designed to enhance safety and comfort.
- Additional housing recommendations
  - Species should be separated to the extent possible.
  - Noise and other stressors, such as barking, loud music, and unnecessary foot traffic, should be minimized.
  - Use of portable crates or pet carriers that allow for good visibility and adequate space to stand and turn around as well as for safety at various stages of sedation and anesthesia are acceptable.
- Handling and movement of sedated and anesthetized patients warrant special considerations. The head and neck should be supported and maintained in straight alignment with the patient's body to promote optimal airway patency. The patient's torso should be continuously supported to avoid stressing joints. Patient comfort should be continuously addressed by ensuring proper thermoregulation and managing stress and pain.

## Infectious disease control procedures

- Reducing the potential risk of infectious disease exposure for patients undergoing spay-neuter surgery is a crucial priority. From the time of initial patient contact until discharge, patients should be carefully observed for signs of infectious disease. When such signs are identified, the patient should be segregated from other patients for the duration of its clinic stay. As is typical for any veterinary setting, standard procedures for cleaning, disinfection, and containment of potential infectious diseases should be established and regularly practiced.
- Masks used to deliver anesthesia have been added to the list of items that should be cleaned and disinfected between each patient.
- Emphasis is on using agents that destroy common veterinary pathogens, including unenveloped viruses (eg, parvo- and calicivirus), which are resistant to some disinfectants.
- Anesthetic equipment should be inspected, cleaned, and maintained on a schedule commensurate to surgery volume. (The 2008 version included more details in regard to cleaning specific equipment.)
- Changing gloves between patients is listed as acceptable (in addition to washing or sanitizing hands, which was listed in the 2008 version).
- Spay-neuter programs may routinely admit patients from multiple sources on the same day, such as animals from shelters or rescue organizations. Strategies to limit cross-contamination among patients from multiple sources should be employed. For example, separate sets of equipment could be designated for use with patients from a common source. In this situation, each set of equipment would be used on a rotating basis for patients from the designated source. When feasible, housing animals in cohorts by source and/or scheduling patients from different sources on different days may also facilitate infectious disease control.

## Preparation for emergencies

- A veterinarian should be present and available to triage and address complications that might

occur during anesthesia, surgery, or the immediate postoperative recovery period and should remain on clinic premises until all patients are extubated, sternal, and responsive.

- Clinic staffing should be appropriate and commensurate with the volume of patients as necessary to provide high quality veterinary medical care in accordance with these guidelines.
- Designated clinic staff trained in cardiopulmonary resuscitation should be available to provide life support, if required.

## Follow-up and emergency care

- Spay-neuter programs must establish regular policies for managing complications and emergencies that occur after surgery. (The 2008 version indicated that such policies for managing complications and emergencies pertained to the 48-hour period after surgery.)
- In the event of inpatient death, the owner, caregiver, or their duly authorized agent should immediately be notified; and permission to perform a necropsy should be requested.
- Patient discharge instructions should indicate that the clinic should be contacted regarding post-operative concerns or problems that may arise. (The 2008 version indicated that discharge instructions should include resources for handling questions or concerns about postoperative complications and emergencies.)

## Guidelines for Preoperative Care

### Patient selection

- Lactating was added to the list of conditions where, in the task force's experience, animals can be safely spayed/neutered.

### Client communication

- Additions to the list of items that must be obtained for a patient history.
  - Current clinical signs of disease.
  - Current supplements.
  - Previous vaccinations.
  - Previous adverse reactions.
- Clients must be informed of surgical and anesthetic risks and must consent to the anticipated procedures.
- (The following was stated in the 2008 version and was removed in 2016: “In the case of shelter, rescue, and feral animals, general consent inclusive of all patients should be obtained on the basis of established guidelines of the participating shelter, program, or humane organization.”)
- A duly authorized agent (ie, an individual of legal age who is authorized to make decisions for the patient) can sign the consent form.
- Additions to the list of topics to consider including in consent form:
  - Acknowledgment of the risks of transport, if applicable.
  - Notification of any permanent identification procedure(s), including tattooing, ear tipping, and microchipping.
  - Authorization for other procedures.

## Withholding food

- For juvenile (ie, animals >16 weeks old) and adult animals, overnight fasting is acceptable; however, withholding food for >6 hours is not necessary.

## Physical examination

- Additions to the list of items that should be performed with physical examination:
  - Inspecting animals for presence of ventral abdominal tattoos, surgically tipped ears, and other possible indicators of previous sterilization.
  - Microchip scanning can also occur.

## Guidelines for Anesthetic Procedures

### Introduction

- Spay-neuter programs require safe and efficient protocols for anesthesia.
- Balanced anesthesia involves the administration of a combination of drugs in order to safely produce analgesia, loss of consciousness, muscle relaxation, and immobility without patient compromise (the previous items were also included in 2008).

### Perioperative thermoregulation (In 2008, this section was entitled “Perioperative and intraoperative thermoregulation.”)

- Hypothermia can be an inadvertent perioperative problem in any surgical setting.
- Efforts to maintain normal body temperature should be made from the time of patient admission until discharge (the 2008 version indicated that efforts to preserve body temperature should be consistent and continual).
- Prior to premedication and induction of anesthesia, ambient temperature and humidity should be controlled to keep animals comfortable. Drafts should be avoided, and animals should be kept dry. Body heat can be preserved through the use of various bedding materials, such as papers, towels, or blankets.
- The thermoneutral zone for cats and dogs will vary depending on the individual animal. The recommended ambient temperature range for housing cats and dogs is between 18 and 28 degrees Celsius (64 and 84 degrees Fahrenheit) with a temperature setting in the low to mid 70s being typical. However, the temperature setting and amount of bedding material used for insulation should be tailored to the needs of individual animals. Animals recovering from anesthesia often require warmer environmental temperatures; and sick, frail, and pediatric patients may require warmer temperatures than healthy animals. The location of the animal should also be considered as there may be a temperature differential between floor level and elevated enclosures.
- If necessary, supplemental heat sources should be used, but care must be taken to prevent hyperthermia and thermal burns.
- Studies in human medicine demonstrate that patients remain warmer with warmer environmental temperatures in preop, surgery, and recovery areas.
- Prewarming patients prior to administration of premedications and anesthetic agents may reduce perioperative hypothermia.
- Contact with cold surfaces should be minimized to the extent possible, for example, by placing a small blanket, towel, fleece pad, or papers underneath each patient immediately following anesthetic induction and keeping these materials under patients as they are moved through various areas of the clinic (eg, preparation, surgery, and recovery areas). This technique may also serve to enhance biosecurity by providing a physical barrier to reduce the risk of cross-contamination among patients.

- Use of warmed preparation solution is mentioned as a way to minimize heat loss. (The following was stated in the 2008 version and was removed in 2016 due to lack of supporting evidence: "... use of isopropyl alcohol or aggressive scrubbing should be avoided to minimize heat loss....")
- Surgery should begin as soon as possible after preparation is completed in order to minimize additional heat loss.
- Additions to list of items that help minimize intraoperative heat loss:
  - Increasing environmental temperature
  - Providing additional insulation for patient (eg, by wrapping extremities in materials, such as bubble wrap, newspaper, and polystyrene)
  - Heated surgical tables
  - Semiconductive polymer fabric heating blankets
  - Warm air blankets
- Warmth in the patient's microenvironment can be provided by the use of carefully protected warmed containers.

### **Anesthesia equipment** (In 2008, this section was entitled "Equipment.")

- The anesthesia equipment used in spay-neuter programs is generally the same as that used in any veterinary practice setting. However, when equipment is used in a high volume setting, special consideration should be given to its use and maintenance to enhance patient safety. As in any surgical setting, all anesthesia equipment, including endotracheal tubes, laryngoscopes, anesthesia machines, and monitors, should be prepared and checked daily prior to use.
- Anesthesia equipment in high volume programs undergoes a high level of use, often by multiple personnel, therefore all programs should develop and implement a regular maintenance schedule for equipment. The frequency of maintenance service should be commensurate with the level of use (ie, heavily used equipment in high volume programs should be serviced more frequently). Anesthesia machines and monitors should be maintained in accordance with manufacturers' recommendations through regularly performed in-house procedures or regular outsourcing to equipment and vaporizer service companies.
- Carbon dioxide absorbents should be checked and changed regularly; higher volumes of patients dictate increased frequency of changing and cleaning of canisters. For personnel safety, particularly in high volume settings where surgery is performed for several hours per day on a regular basis, use of charcoal canisters for waste gas scavenging is discouraged. This is because charcoal canisters are effective for only short periods of time ... and may be variably effective. When canisters are used, they must be carefully monitored, weighed regularly, and discarded at the conclusion of their effective service life.

### **Oxygen supplementation and ventilation strategies**

- While not required for all patients, oxygen supplementation, including before and after surgery, is recommended for high-risk patients, such as brachycephalic animals as well as those that are frail, ill, or in advanced stages of pregnancy. (The following was stated in the 2008 version and was removed in 2016: "Oxygen supplementation is especially helpful for patients that are debilitated, traumatized, dehydrated, or nutritionally compromised.") The ability to provide oxygen supplementation when medically indicated is a requirement for all spay-neuter programs.
- Oxygen flow rates for oxygen delivered through endotracheal tubes should be adequate and specific for the rebreathing or nonrebreathing circuits being used. (The following was stated in the 2008 version and was removed in 2016: "Appropriate flow rates when oxygen supplementation is delivered by mask range from 2 to 5 L/min ..." as the rate depends on patient size and circuit.)

- (The following was stated in the 2008 version and was removed in 2016: “Caution should be exercised when using oxygen in an environment where electrocautery is used because of the potential for explosion or fire.”)
- A manual resuscitator connected to an oxygen source with a regulator can be used as a means of oxygen supplementation and ventilation.
- Capnography is a useful tool for judging adequacy of ventilation, carbon dioxide absorbent adequacy, or other causes of rebreathing, and patient circulatory status.

### **Airway management** (In 2008, this section was entitled “Intubation.”)

- For cats, dogs, and rabbits, options for airway management include the use of facemasks and endotracheal tubes. An additional option is to use commercially available supraglottic airway devices. When used, airway management devices should be properly fitted and carefully secured in place. Tape or ties made from plastic tubing, gauze, or other materials are acceptable for this purpose. When using a mask in patients with nasal congestion, care must be taken to ensure that the mouth remains open for breathing.
- Improper or traumatic placement of endotracheal tubes can increase patient risk, especially in cats. A recent large-scale epidemiologic investigation of risk factors associated with anesthetic complications documented that intubation of cats is not a benign technique and may result in iatrogenic trauma. Furthermore, the study documented a significant increase in the risk of adverse events related to intubation, including death, for cats undergoing a short duration of anesthesia (less than 30 minutes). On the basis of these findings, it is acceptable not to intubate cats for procedures of short duration provided equipment for intubation is available in case of an anesthetic emergency.
- The ability to perform intubation when medically indicated, including rapid intubation in emergency situations, is required for all spay-neuter programs.
- The anesthetist must verify the placement of the endotracheal tube by direct visualization or by the use of a capnograph.
- Patients that may benefit from intubation include all (the 2008 version utilized the word “most”) brachycephalic patients and overweight or obese patients. Added to this list are animals in advanced stages of gestation and patients for which procedures are anticipated to require a longer duration of anesthesia (eg, greater than 30 minutes).

### **Fluid therapy**

- Fluid administration is not required for all elective surgical procedures especially when surgical times are brief. Fluid supplementation is recommended for high-risk patients, such as those that may be presented for ovariohysterectomy in advanced stages of pregnancy or with evidence of pyometra, and when substantial blood loss or prolonged surgery times are anticipated or encountered.
- Ability to provide intravenous fluid administration when medically indicated is required for all spay-neuter programs.
- For routine fluid support for many patients, subcutaneous administration is adequate.
- For those patients at greatest risk of clinically important hypothermia (eg, pediatric, small, frail, and ill patients) consideration should be given to warming the fluids to body temperature prior to administration or the fluid line during administration. (The 2008 version indicated that fluids should be warmed prior to administration, particularly for patients predisposed to hypothermia.)
- Fluid administration may enhance recovery from anesthesia.
- Fluids should be administered in accordance with current veterinary medical guidelines for fluid therapy.

## Monitoring

- The time frame for patient monitoring is stated to begin at the time of administration of pre-medications or anesthetic agents and continue until the conclusion of the recovery period.
- In accordance with current veterinary anesthesia monitoring guidelines, the use of an objective means of monitoring is also necessary. Options include but are not limited to: pulse detection via palpation or Doppler ultrasound, auscultation of the heartbeat, pulse oximetry, capnography, and blood pressure monitoring. The use of pulse oximetry is highly encouraged because this modality provides an objective auditory and visual means of determining the presence of a pulse, pulse rate, and adequacy of oxygenation. Use of pulse oximetry monitors has been shown to decrease the risk of anesthetic death in cats. Pulse oximetry is preferred over electrocardiography, which may not accurately assess heart rate because it reflects electrical rather than mechanical activity and does not provide an indication of oxygenation.
- The precise time frames for and means of monitoring and recording vital parameters are at the attending veterinarian's discretion and should be appropriate for each program, patient, and procedure.

### **Pulse quality, rate, and rhythm**

- It is important to directly monitor patient pulse quality.

### **Jaw tone**

- Pediatric puppies normally lack mandibular tone, therefore jaw tone should not be used to assess anesthetic depth in these patients.

### **Mucous membrane color and capillary refill time**

- Mucous membrane color and capillary refill time are subjective assessments of perfusion but should not be used as sole indicators of adequacy of circulation.
- The presence of pallor is a nonspecific clinical finding: pale mucous membranes can indicate peripheral vasoconstriction, which often accompanies the use of alpha2-adrenoceptor agonists, hypothermia, anemia, or hypoxemia.

## Anesthetic protocol

- Drug availability was added to list of factors that spay-neuter programs are dependent upon when selecting anesthetic protocol. (Financial constraints for each individual program was a factor listed in the 2008 version and removed in 2016.)
- A complete listing of all effective and appropriate anesthetic and analgesic drugs is beyond the scope of these guidelines and is not included here.
- Extralabel use of many of these agents is an appropriate and common practice in any veterinary medical setting.

## Accurate dosing of anesthetic agents (In 2008, this section was entitled "Accurate drug calculation and administration.")

- When using a dose chart, caution should be used for patient weights at both extremes of the range provided (ie, very small and very large patients). In these cases, dosing based on body surface area or metabolic scaling is recommended to improve accuracy.
- The phrase "community cats" is utilized instead of "feral cats," which was utilized in 2008.
- Careful attention to the labeled concentration of each drug is also essential for accurate dosing.
- The use of compounded drugs may facilitate accurate dosing of patients; however, clinics must be in compliance with all federal, state, and local laws and regulations related to compounding.

## **Administration of analgesics and anxiolytics** (In 2008, this section was entitled “Administration of analgesics.”)

- Analgesics should be administered prior to the initial surgical incision. (The following was stated in the 2008 version and was removed in 2016: “Use of ... preemptive administration of analgesics prior to the initial surgical incision are common methods for providing safe and effective analgesia in high-volume settings.”)
- In 2008, examples of each type of analgesic agent were listed and these were removed in 2016.
- Multimodal analgesia is recommended whenever possible because agents work synergistically to control pain, usually with fewer side effects than when single agents are used, and with improved analgesia.
- Use and timing of NSAID administration should be based on the specific drug and individual patient. In particular, consideration should be given to patient hydration status and the presence of preexisting hepatic, renal, or gastrointestinal disease or clotting abnormalities. Administration of NSAIDs to patients that are clinically or subclinically dehydrated should be avoided owing to the increased risk of adverse effects, including nephrotoxicity.

## **Total intramuscular anesthesia** (Although this is a new section in 2016, concepts were discussed elsewhere in the 2008 version.)

### **Anticholinergic agents**

- Anticholinergic agents may or may not be routinely administered as part of an anesthetic protocol. However, they should be available in all spay-neuter clinics for individual patients and emergency use. Anticholinergic agents are not appropriate for the treatment of bradycardia induced by alpha2-adrenoceptor agonists because of the increased cardiac workload that results. In rare cases where an alpha2 adrenoceptor agonist associated bradycardia results in patient compromise, reversal or partial reversal of the alpha2 adrenoceptor agonist should restore the heart rate.
- The 2008 version included a list of potential adverse effects of anticholinergic agents, and this was removed in 2016.
- (The following was stated in the 2008 version and was removed in 2016: “Even in pediatric patients [ie, animals between 6 and 16 weeks old], the routine use of anticholinergics is not recommended because clinical studies and experience to support their use are lacking. Only in neonatal patients [ie, animals <3 weeks old] should anticholinergics, such as glycopyrrolate, be routinely administered because cardiac output is more dependent on heart rate in these patients.”)

### **Induction and maintenance of anesthesia with inhalant anesthetics**

- (The following was stated in the 2008 version and was removed in 2016: “Although there may be times when mask administration of inhalant anesthetics is required for patients in spay-neuter programs, mask administration of inhalant anesthetics for induction or maintenance of anesthesia should be minimized.”) However, both the 2008 and 2016 versions indicate that mask induction should not be performed routinely and should be avoided.
- The use of a chamber for administration of inhalant anesthetics should be strictly avoided. (The 2008 version indicates that this method of induction is not recommended.)

#### **Mask induction** (This section subtitle is new in 2016.)

- (The following was stated in the 2008 version and was removed in 2016: “Mask induction with isoflurane is associated with severe sympathomimetic effects and bronchial irritation. Mask induction is also associated with increased risk of aspiration of gastric contents because the patient’s airway is not protected.”)

- In dogs, this method has been associated with a higher risk of anesthesia-related death.
- Patients are more amenable to mask induction when adequately premedicated with injectable agents prior to administration of inhalant anesthesia.

**Chamber induction** (This section subtitle is new in 2016.)

- Given the availability of multiple safe alternative anesthetic protocols, the use of chamber induction in high volume spay-neuter settings is rarely justified or necessary. (The 2008 version indicated that this method of induction is not recommended.)
- However, in rare cases (ie, failure of an injectable protocol, lack of IV access, extremely fractious animals that cannot be safely injected) chamber induction, particularly with rapid-acting induction inhalants, such as sevoflurane, may be an appropriate choice for some animals.
- (The following was stated in the 2008 version and was removed in 2016: “Chamber induction is more likely than mask induction to result in prolonged and excessive patient stress and excitement as well as potentially high inhalant anesthetic concentrations that may harm the patient.”)

**Mask maintenance** (This section subtitle is new in 2016.)

- The use of mask maintenance on an as-needed basis for some patients is common in some spay-neuter programs. For cats, it may be safer than intubation for short procedures.
- Currently available, commonly used anesthetic gases (eg, isoflurane and sevoflurane) cause minor bronchial irritation compared with the irritation caused by their precursors.

**Mitigating waste anesthetic gas exposure** (This section title is new in 2016.)

- Anesthetic machines may contribute to environmental pollution from waste anesthetic gases. In addition to performing daily leak tests and the use of properly functioning scavenging systems, several other measures should be routinely employed to limit waste gas release:
  - Minimize airway leaks by using appropriately sized endotracheal tubes with proper cuff inflation.
  - Eliminate as much residual gas as possible prior to disconnecting the patient from a breathing system after surgery by turning off the vaporizer and allowing the patient to breathe oxygen, ideally for five minutes, prior to disconnection.
  - Prior to disconnecting the patient, empty the rebreathing bag after the vaporizer is turned off and, if using a circle system, increase the oxygen flow rate two to three times the maintenance rate to aid in flushing the system.
  - Turn off vaporizers and flow meters when the patient is disconnected from the anesthesia machine.
  - Use caution when filling vaporizers to ensure that the room is well ventilated and as few staff members as possible are present.

**High-risk patients**

- The veterinarian or a designated and supervised member of the care team should communicate with the owner, caregiver, or the duly authorized agent of high-risk patients specifically about the patient’s anesthetic risk.

**Guidelines for Surgical Care**

**Introduction**

- Spay-neuter surgical practices optimize surgical success while decreasing the risk of complications.
- When surgical practices are efficient, surgery times are shorter, which in turn can be expected to improve patient recovery.

- Spay-neuter programs may establish and use standard operating procedures for surgical techniques, with these techniques tailored to the needs of the individual patient at the surgeon's discretion.
- The 2008 version indicated that practices described within the guidelines represent standards that are attainable in spay-neuter programs. The 2016 version adds the following: "...regardless of location, facility, or type of program."

## Operating room environment

- The operating area should be a room or space in which anesthesia, surgery, and immediate postoperative recovery can be safely performed. (The 2008 version indicated that the operating area should be a room or an area dedicated to surgery.)
- Sanitation procedures should be carried out on a regular schedule. (The 2008 version indicated that scheduled disinfection policies and procedures should be in place.)

## Surgical pack preparation.

- The date of and person responsible for sterilization of packs should be identifiable.

## Patient preparation

### Bladder

- An empty urinary bladder simplifies an abdominal surgical procedure and increases postoperative comfort for both male and female patients.

### Patient positioning (This section subtitle is new in 2016.)

- Ties, V-trays, adjustable tables, or other devices may be used to position patients for surgery.
- The patient's body may be maintained in a level or tilted position with the head and neck in straight alignment.
- Care should be taken to position the patient in a manner that avoids compression of the thorax or compromise of the diaphragm and that optimizes airway patency.
- The patient's limbs may be secured in place or left unconstrained at the discretion of the surgeon. Hyperextension of the limbs should be avoided, because it could limit excursion of the chest, compromising respiration, or result in increased tension on the suspensory ligaments, potentially complicating exposure of the ovaries and increasing postoperative discomfort. For abdominal procedures, the thoracic limbs may be positioned cranially such that they rest on either side of the head or neck, or caudally such that they rest alongside the lateral aspects of the thorax. If ties are used to secure the limbs, care must be taken to avoid any constriction of the extremities.

## Surgeon preparation

### Surgical hand and arm scrub

- For routine castration of cats and puppies, surgeons should wash their hands or perform hand antisepsis prior to gloving.

### Surgical gloves

- Single-use sterile surgical gloves are required for all abdominal surgeries and for the castration of adult dogs. For routine cat and puppy castration, either single-use sterile gloves or examination gloves are acceptable. (The following was stated in the 2008 version and was removed in 2016: "Single-use sterile surgical gloves are required for all surgeries, except for routine castration of cats. For routine cat castrations, sterile gloves are ideal; however, single-use examination gloves are permissible for this procedure when incisions are left open to heal by second intention.")

## Surgical procedures

- A paramedian approach is added to the list of acceptable approaches for ovariohysterectomy and ovariectomy in pediatric and adult patients.
- In order to reduce postoperative morbidity and improve overall outcomes, surgeons should strive to reduce surgical trauma in every way possible. Tissue handling, size and placement of sutures, and the length of the incision should all be considered. Small, properly located incisions can help to achieve the goal of minimizing surgical trauma while concurrently maintaining the goal of gentle tissue handling.

### Ovariohysterectomy and ovariectomy

- The 2016 version expands upon the 2008 version by indicating that the particular surgical procedure, including ligation techniques, will vary depending on the program and the individual patient's needs.
- For cats, ovarian pedicle ligation may be achieved by autoligation of the ovarian artery (ie, pedicle tie).

### Spaying pregnant cats and dogs (This section title is new in 2016.)

- When spaying pregnant cats and dogs, fetal euthanasia is not necessary to ensure humane death. Mammalian fetuses remain in a state of unconsciousness throughout gestation, and therefore cannot consciously perceive pain.
- When a gravid uterus is removed en bloc, fetuses will not experience consciousness regardless of stage of gestation, and death will occur without pain.
- However, if the uterus and amniotic sac are opened, it may be possible for near term fetuses to gain consciousness. In this case, humane euthanasia of each individual fetus is required unless resuscitation efforts are medically indicated and elected.

### Orchidectomy

- The 2016 version expands upon the 2008 version by indicating that the specific procedure performed will vary depending on the program and the individual patient's needs.
- When a prescrotal approach is used, closure of the subcutaneous tissue and skin are required.
- When a scrotal approach is used, incisions may be closed or left open to heal by second intention.
- For cryptorchid cats and dogs, the undescended testicle should be located and removed first. If the cryptorchid testicle cannot be found, the descended testicle should not be removed.

### Procedures in pediatric (6- to 16-week old) patients

- The 2008 version indicated that neutering of pediatric animals has been endorsed by the AVMA. The 2016 version indicates that numerous other national and international veterinary and humane organizations have also endorsed neutering of pediatric animals.
- The 2016 version expands upon the 2008 version by indicating that the specific procedure performed will vary depending on the program and the individual patient's needs.

## Suture materials

- Materials must be absorbable or inert and nonabsorbable.
- Suture materials supplied in individual packets or on a reel or cassette are accepted and should be used according to manufacturer's guidelines.
- Suture material must not be shared among patients due to the risk of disease transmission. Furthermore, with the exception of stainless steel, suture material cannot be effectively resterilized for future use.

- If reusable needles are used, they must be cleaned and resterilized between patients.

## Identification of neutered animals

- Application of a visible, standard, distinct identifying mark is recommended. Specifically, the task force recommends the use of a simple green linear tattoo to identify all neutered pets and ear-tipping to identify all community cats.
- For all male and female pet cats and dogs, a green linear tattoo should be applied to the ventral aspect of the abdomen at the time of surgical sterilization. For female animals, the tattoo should be applied directly on or immediately lateral to the ventral midline incision. If a flank approach is used to spay a female patient, the tattoo should be placed in the area where a ventral midline spay incision would have been placed. For male dogs, the tattoo should be applied to the skin in the caudal aspect of the abdomen. If a prescrotal incision is used, the tattoo may be applied directly to the incision. Alternately, the tattoo can be applied in the prescrotal area immediately lateral to the prepuce. For male cats, the tattoo should be applied in the area where a ventral midline spay incision would typically be placed.
- (The following was stated as an acceptable method for creating tattoos in the 2008 version and was removed in 2016: “Use of a tattoo gun with a sterile needle for each patient.”)
- Regardless of the method used to create them, green linear tattoos should be placed in the standard locations described and should be distinct and readily identifiable to effectively serve as an identifying mark for neutered pets.
- The 2008 version utilized the terms “free-roaming and feral cats” whereas the 2016 version utilizes the phrase “community cats.”
- Regarding ear tipping: To ensure a distinct and readily visible identifying mark, approximately a third of the distal earflap should be removed, taking care to transect perpendicular to the long axis of the pinna. In contrast, ear notching is not recommended because torn earflaps are a frequent occurrence in cats as a result of fighting and are easily mistaken for surgically notched ears.
- Instruments should be thoroughly cleaned and disinfected or sterilized between patients to prevent the spread of pathogens.
- Spay-neuter programs may elect to utilize more than one method of identifying individual neutered animals (ie, combining ear-tipping and tattooing or implanting microchips or using other forms of identification). In all cases, the task force recommends that neutered animals be marked by the recommended standard means as described above.

## Use of antimicrobials

- Prophylactic antimicrobial administration may be considered but is not necessary for every short, routine surgical procedure in healthy patients. (The following was stated in the 2008 version and was removed in 2016: “Routine perioperative use of antimicrobials is not recommended. Rather, antimicrobial use should be reserved for specific indications, such as preexisting infection (eg, pyometra) or a break in surgical asepsis.”)

## Use of biomedical skin glue (This section title is new in 2016.)

- If biomedical skin glue is used to seal an incision, it should only be applied after satisfactory intradermal closure described in the manufacturer’s directions, and not applied in the wound itself.

## Guidelines for Postoperative Care

### Recovery

- Patients should be assessed at the completion of the surgical procedure to determine if any conditions need to be immediately addressed or communicated to recovery personnel.

- Animals on elevated surfaces must be protected from falls.
- During recovery, animals should be positioned to prevent inadvertent airway restriction by ensuring that each patient's head and neck are carefully placed in slight extension and in straight alignment with the thorax.
- Pediatric patients or others at risk of hypoglycemia may benefit from transmucosal administration of sugar supplements (eg, corn syrup or dextrose solution) during recovery.
- Given that littermates normally pile one on top of another to sleep, inadvertent respiratory compromise may occur when littermates in various stages of recovery are housed together. When littermates are housed together during recovery, direct continuous observation is required until each animal is oriented and strongly ambulatory.
- To maximize personnel safety, community cats should be returned to their traps or transport carriers while unconscious for recovery monitoring. In this case, cats should be carefully monitored to ensure that movement or turning in the confined space during recovery does not compromise airway patency: gentle rocking or tilting of the trap or carrier may be necessary to safely reposition the cat's head and neck.

### Postoperative complications (This section title is new in 2016.)

- Postanesthetic hyperthermia has been reported in cats and most often occurs following the administration of opioids, although its occurrence has also been associated with the use of other drugs, such as ketamine, and may be multifactorial. Treatment of affected patients may include selective drug reversal and supportive care (eg, removal of external heat sources, active cooling, or sedation), taking care to ensure proper analgesia.
- Anesthetic-related deaths are most common during the postoperative recovery period, especially within the initial three hours after surgery.

### Analgesia

- Postoperative analgesia requirements will vary among individual patients owing to differences in surgical complexity, surgical technique, patient age, and individual responses to pain and analgesic agents.
- Because a portion of patients will require analgesia beyond the 24-hour postoperative period, there should be a plan in place to address analgesia after patients are discharged. Options may include dispensing medication, providing a written prescription, or furnishing contact information for assistance in acquiring additional analgesic medication if needed.
- Clinicians must be prepared to adjust protocols to meet the needs of individual patients following surgery.
- Some analgesic agents, such as orally administered tramadol, are associated with greater variability in response than others.
- Because multimodal treatment will improve analgesia for most patients, its use is recommended whenever possible.
- Postoperative pain medication is not a substitute for effective, preoperative analgesia and minimally traumatic patient preparation and surgical techniques.
- If patients frequently exhibit ongoing signs of pain or discomfort postoperatively or induce self-trauma to surgical wounds, analgesic protocols and patient preparation and surgical techniques should be carefully reviewed to identify factors that may be contributing to these problems following surgery.

## Anesthetic reversal

- Potential benefits of anesthetic reversal may include reducing or alleviating cardiorespiratory depression associated with anesthetic agents, hastening recovery, and promoting the return of thermoregulation.
- In a recent study, partial reversal of alpha2 adrenoceptor agonists was associated with shorter recovery times without compromising patient analgesia when using a multimodal protocol.

**Thermoregulation** (This section title was removed in 2016; however, the information contained within was discussed in a different section in 2016.)

**Return to patient housing** (In 2008, similar information was discussed in the section entitled “Kennel environment.”)

- Prolonged confinement without opportunities for urination and defecation away from their enclosure can increase patient stress and discomfort. This problem may be exacerbated by perioperative administration of fluids and certain anesthetic agents such as alpha2 adrenoceptor agonists, which can increase urine output. In addition, confinement inhibits elimination behavior in some patients. For all of these reasons, expression of the patient’s bladder, including both male and female patients, during anesthesia may improve comfort in the immediate postoperative period.
- (The following was stated in the 2008 version and was removed in 2016: “If cats are to be held >12 hours, a litter box should be provided after the patient is ambulatory.”) In 2016, it is stated that for overnight stays, an absorbent substrate, such as a paper, litter, or bedding, should be provided to cats.
- In addition to saying that dogs should be walked, the 2016 version indicates that dogs can be housed in an enclosure, such as a run, that allows for elimination away from their resting area, or provided with an absorbent substrate in their enclosure.
- Traps housing community cats should be covered to decrease patient stress. In addition to saying that traps can be elevated to allow urine and feces to fall through the wire bottoms away from the patient, the 2016 version indicates that traps can be lined with absorbent material that can be safely changed if soiled.

## Discharge of patients

(This is a new section title in 2016 – information contained within was previously under “Release.”)

- (The following was stated in the 2008 version and was removed in 2016 “Cats and dogs that are not ambulatory should not be discharged until they are recovered.”) The 2016 version indicates that prior to discharge, cats and dogs should be sternal, alert, and responsive. In addition, dogs should be able to ambulate.
- (The following was stated in the 2008 version and was removed in 2016: “Feral cats should be returned to their environments as soon as they are fully recovered from anesthesia.”) Trapped cats should be returned to their familiar environment or site of capture when they are no longer under the influence of anesthesia (ie, mentally alert, oriented, and able to mobilize). Balancing the need to ensure safe recovery with the stress of confinement is required but in most cases, release on the day following surgery is indicated.

## Postoperative care instructions

(This is a new section title in 2016 – information contained within was previously under “Release.”)

- Although instructions may vary from one program to the next, topics to consider include:
  - Summary of procedures performed
  - Normal and abnormal recovery behavior

- Signs of discomfort or pain
- Care and monitoring of the surgical incision
- When to offer food and water
- Exercise restriction, if any
- Medication instructions, if any
- Other special instructions as indicated based on the need of the individual patient
- Changes in status requiring urgent veterinary reevaluation
- Recommendations for ongoing veterinary care

## **Guidelines for Operations Management**

This section is entirely new in the 2016 document, although some topics were briefly discussed in the 2008 version. The section reviews process-oriented management of surgery and emphasizes the importance of using standard operating procedures and checklists. Also discussed are data collection and analysis, staff training, leadership, and legal considerations. Additionally, the health and safety of personnel as well as perioperative ergonomics are reviewed.

## **Conclusions**

- Spay-neuter programs frequently provide initial veterinary care to at-risk and underserved animals while exposing many clients to professional veterinary services for the first time.
- When spay-neuter services are accessible and attainable, pet owners can provide essential initial care for their pets, reducing the risk of relinquishment.
- For many pets, these programs may ultimately serve as gateways to a lifetime of care through referral to full-service veterinary practices for ongoing preventive care in the future.
- HQHVSN programs offer the best approach to reducing shelter impoundment.
- By engaging in this rapidly developing practice area, veterinarians can provide HQHVSN services to cats and dogs that would otherwise be unlikely to receive such care.