

**Field Manual of Veterinary Standards:  
Dog and Cat Surgical Sterilization**

**February 2017**



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## Foreword: Veterinary leadership in animal welfare

Appropriate and timely veterinary care is one of the fundamental welfare requirements for animals who are dependent on human guardianship. Veterinarians and nursing staff have the opportunity to represent the respect and empathy for animals that we wish to see reflected in our societies. We teach through our every action the consideration for animals that we strive to engender in communities and in the students who will rise to lead our profession. This begins with the manner in which we introduce ourselves to our patients, the skill and reassurance with which we restrain and handle them, and the care that they receive in our hands. Good welfare is not only the absence of suffering: we strive not only to correct disease or to relieve pain, but to make the lives of animals and the relationships that they share with people happy.

By nature of requiring veterinary treatment, animals may already be suffering. They suffer metabolic and emotional stress as they heal and fight disease. They are often frightened and confused, whether from trauma or illness or when snatched from the street for sterilization. Our clinics smell of distressed animals and chemicals. There is a great deal of human activity and mechanical sensory assault. Being handled by strangers and confined against their wills add to the trauma of an already assaulted physiology. The stress that our patients experience under clinical care may therefore be profound.

Within the provision of veterinary care, the mitigation of stress comprises a central role in the management of the patient's treatment. The inability of a patient to adapt to stressors constitutes *distress*, and compromises all the processes that we endeavor to support with veterinary care toward the physiological equilibrium of good health.

Excellent veterinary caregivers are empathetically and cognitively aware of the distress that patients may be experiencing, pre-empt stressors, and de-escalate anxiety. Under conscientious care, even distressed and fearful patients may blossom into happy, confident animals in the course of hospitalization. Our demonstrated concern for the animal's emotional and physical well-being, whether during long hospital stays or only in a moment of vaccinating a patient, are paramount to professional veterinary practice and to the manner in which animals are valued in our societies.

Veterinary caregivers have the opportunity to set a strong example in communicating respect for the inherent value of individual animal lives, regardless of the commercial, aesthetic or utilitarian worth that society may assign to an animal. We can promote veterinary professional and animal welfare standards no matter how sparse our resources may be when we work in the field, and most especially when we work in areas in which we seek to foster improved veterinary practices and attitudes of respect and compassion for animals. A moment of demonstrated affection and regard for a patient during an incident as brief as a vaccination procedure may change that animal's life through the way that her guardians see and value her thereafter.

Our roles are not only to alleviate suffering, but to prevent it: and not only to prevent it, but to leave our patients with a happier future. This begins with our own hands and attitudes, and culminates in the hope that we engender in our fellow creatures toward a kinder planet for animals and for people.

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IFAW Veterinary Advisor  
May 2014

# 1. Introduction

## 1.1 Definitions and abbreviations

**CA:** Companion Animal

**CA Project:** any IFAW-supported Companion Animal project in which staff working for, or volunteering for, IFAW are responsible for the veterinary activities.

**IFAW:** International Fund for Animal Welfare

**IFAW-qualified veterinarian:** a veterinarian with a degree from an accredited veterinary college, who meets local licensing or official authorization requirements, whose clinical skills meet international standards, and who is contracted or employed by IFAW for veterinary responsibilities.

**IFAW-qualified veterinary assistant:** a person deemed by an IFAW-qualified veterinarian to have been trained to be able to competently perform the duties of veterinary assistant according to the needs of the position. These duties may include a range of responsibilities, including, for example, humane animal handling, anesthetic monitoring, drug calculations, administering injections, applying bandages, animal husbandry, and surgical assistance.

**Sterilization Field Manual:** the IFAW Field Manual of Veterinary Standards for Dog and Cat Sterilization (this document) and the professional standards to which reference is made therein.

**Guardian:** person who assumes responsibility for the care of the animal. This may be the animal's owner, rescuer, informal guardian or foster caretaker.

**Sterilization:** in the context of the surgical procedure, "sterilization" refers to both males and females. For males, this is orchietomy (castration), and for females ovariohysterectomy.

**Spay:** lay term used for the sterilization of female dogs and cats, i.e., ovariohysterectomy.

**Neuter:** lay term used for the sterilization of male dogs and cats, i.e., orchietomy, castration.

## 1.2 Basis for the IFAW Sterilization Field Manual.

1.2.1 This document outlines basic standards for the surgical, anesthetic and nursing procedures pertaining to sterilization (spay and neuter) of cats and dogs. It is written with a mind to field conditions and the practical considerations of working in the suboptimal environments that field projects often require.

1.2.2 The standards outlined in the Sterilization Field Manual take into account the often challenging field conditions in which we work, and are based on the extensive experience of IFAW staff and their international colleagues in field projects. The guidelines set forth in these documents are not meant to be restrictive, but to assist veterinary staff in prioritizing resources and to ensure consistent and at least minimal international standards.

1.2.3 The animal welfare considerations discussed in [Section 2: Patient stress management and animal welfare](#) are implicit in all IFAW veterinary documents, including this one.

### **1.3 Primary Veterinary Health Care (PVHC)**

1.3.1 This document does not include comprehensive PVHC standards. PVHC includes a multitude of veterinary procedures and services, which may vary in emphasis among regions.

1.3.2 PVHC includes:

- issues that pertain to all aspects of animal welfare
- vaccination
- parasite management
- treatment of a variety of emergency medical and surgical conditions
- nutrition
- treatment of traumatic injuries
- infectious and non-infectious disease prevention
- treatment of common diseases
- management of behavioral abnormalities
- biosecurity
- public health considerations

### **1.4 The IFAW Sterilization Field Manual as a teaching tool**

IFAW veterinarians must keep in mind that an important element of most of our projects is to build local capacity. Therefore, it is important to recognize that everything we do as veterinarians and in every interaction that we share with an animal, we teach, we set examples, we establish images and perceptions among the veterinary staff, students, and the public who observe us. As such, our actions are likely to influence the future behaviors of trainees even more strongly than our words will.

Even if we might sometimes take small shortcuts in a well-controlled clinic with expertly-trained staff because we know from experience that it will not compromise the patient, we must be aware that while we are teaching and serving as role models, we must be consistent, establish routines, and teach through repetition of standards.

Subjective qualification of those standards is a luxury of experience, and once our students gain such experience, they will be able to afford such amendments of their own. But at the outset, it is important to work as consistently as possible within the variability that is inherent to biological systems. To this end, the IFAW Sterilization Field Manual is intended to standardize how we teach in our international projects, and to facilitate the conveyance of consistent messages by all the teachers participating in a given project.

Given the subjective skills that are inherent to excellence in the veterinary profession, it is impossible to write a precise instruction manual for everything that we do, even for procedures that are performed as often as sterilization of dogs and cats. This document serves as a guideline for standards of practice, and assumes that readers have sufficient veterinary training to implement these standards. It is not appropriate to be used as a self-teaching manual any more than is a textbook in surgery or pathology.

### **1.5 Application of the IFAW Sterilization Field Manual**

The IFAW Sterilization Field Manual is intended to be used in two ways:

- 1.5.1 As a guideline for IFAW veterinarians to ensure that everyone maintains and teaches standard protocols for dog and cat sterilization across IFAW projects.
- 1.5.2 Distributed in hard copy to IFAW grantee field project personnel once these personnel have been trained by an IFAW veterinarian (or appropriate alternative, as determined by IFAW) to be able to use the document responsibly, or when they have been evaluated by an IFAW veterinarian and determined to be qualified to use the document responsibly.

## **1.6 Requirements for use of the IFAW Sterilization Field Manual**

- 1.6.1 All veterinarians and support staff assuming patient management for the CA Project will be expected to practice competently in accordance with the Sterilization Field Manual.
- 1.6.2 All project veterinary staff must be familiar with this document in its entirety, before project work commences.
- 1.6.3 Clauses that contain the word “must” or “will” are to be prioritized and implemented without exception.
- 1.6.4 Clauses that contain the word “should” or “may” are strongly recommended. These clauses accommodate variability in staff training, experience and preference; the local environment; local availability of resources; and other constraints. Staff are expected to use their discretion and to select the most appropriate available procedure or equipment to ensure that patients who are subjected to medical or surgical intervention are at minimum risk of complications.
- 1.6.5 Questions or concerns regarding application of the Sterilization Field Manual should be directed to the IFAW CA Program Director (or his or her delegate) and/or to the senior IFAW Veterinary Advisor.

## **1.7 Disclaimer**

While IFAW endeavors to train veterinary personnel to international standards of veterinary practice in projects with which IFAW is affiliated, and to train these personnel to use the Sterilization Field Manual responsibly, IFAW is not responsible for, and will not be held liable for, misconduct, accidents, errors, omissions, or any undesirable outcomes that occur in the use of this Sterilization Field Manual. Nor shall IFAW be responsible or be held liable for inaccuracies and errors in this Sterilization Field Manual, which is provided “as is” without any warranties of any kind, whether express or implied. The Sterilization Field Manual is intended to be used just like a text book or any other reference publication in the veterinary literature, for which the user is expected to have sufficient training and skills to responsibly implement procedures described therein.

## **1.8 Appendices and cross-references**

- 1.8.1 The appendices provide extensive notes that are useful for reference as well as for teaching. These are to be used as supplementary material and as a bridge to more detailed information in published references.
- 1.8.2 Sections are cross-referenced within the body of the document and to Appendices. The links can be followed automatically in the digital version of the document: move the cursor over the name of the citation and press “Ctrl” while clicking once on the left mouse button (Ctrl + click).

## 2. Patient stress management and animal welfare in veterinary care

Appropriate and timely veterinary care is one of the fundamental welfare requirements for animals who are dependent on human guardianship. Within the provision of veterinary care, great attention must be given to minimizing the stress that a patient suffers. Stress over which an individual has no control is severely detrimental to the physical and emotional well-being of the individual, and compromises all the processes that we endeavor to support with veterinary care: healing, recovery from illness, and physiological stability.

Even acute and short-term stress profoundly affects numerous physiologic systems. Blunted activation of the hypothalamic-pituitary axis compromises the many vital systems dependent on it. Suppression of both humoral and cellular immune systems delays healing, interferes with recovery from illness, and increases the susceptibility of an animal to pathogens. Current illnesses may be exaggerated, sometimes to critical degrees. Quality of anesthesia is significantly reduced when an animal is stressed, and may predispose a patient to dangerous complications. These are all issues of which we must be particularly aware in field surgery situations. Management of patient stress is as important as every other element of pre-surgical, surgical, and post-surgical care.

In the process of administering veterinary care, we must be aware of the many stressors that we may add to an animal who may already feel unwell. By nature of requiring veterinary treatment, animals are already suffering. They may be ill or in pain. They are often frightened and confused. Their ability to control the responses of their bodies and minds to environmental challenges may be compromised. They suffer metabolic and emotional stress to heal and to fight disease.

Whether animals are ill or undergoing an elective procedure such as sterilization surgery, we must be aware that they are being subjected to a great deal of human handling to which they may not be accustomed, or which they may associate from previous experience to be punitive. When we catch animals for sterilization projects, they are frightened, confused, and severely stressed, as anyone would feel on being trapped in a cage or a net and carried off. In a clinic, there are smells of blood, illness, stress, and chemicals. There is a great deal of human activity. Lights may be bright, fluorescent, and on at unnatural times. There are sounds of machines, doors, human voices, distressed animals. Animals are confined to cages and forced to submit to our schedules and imperatives. All of these, particularly the latter, compromise one of the most critical elements of the welfare of any living being: the element of choice.

The feeling of choice is to be aware of options for how to respond to one's environment. Taking away someone's choices is one of the most profound stressors that we can imagine. Our societies use the restriction of choice by imprisonment to punish people. Caged, sick animals who must endure human handling on a human schedule have very little feeling of control. Many of the animals with whom we work in field projects come from free-roaming or previously abused lives in which confidence with humans played little role. The stress that these animals experience under clinical care, much less with less than compassionate handling, may be profound.

Personnel who handle animals, particularly fractious or highly anxious animals, must be skilled and efficient in animal restraint. There is never a need to strangle an animal or to stress him or her to the point that she or he is urinating and defecating and screaming in terror. Minimize the number of people involved: the more people crowd around an animal, the more stressed the animal will feel. Speak softly and steadily to the animal, even and particularly when s/he protests. Make a physical examination feel more like a cuddle than being poked and squeezed and pulled and stared



in the eyes. Approach animals in a way that they feel less threatened. There should be no shouting, slamming of doors, blaring of horns, loud music, cigarette smoke. It is never acceptable to raise one's voice at an animal or to strike an animal, as these are not only stressful and potentially cruel, but are most likely counterproductive to whatever one is trying to achieve. Cats are usually calmer with their heads covered. Bundle a fearful dog into a blanket rather than choking him on the end of a lead.

Be sure that all supplies that will be needed for the procedure are laid out in advance. A great deal of prolonged stress is caused when staff rush around looking for this or that while the patient is held under restraint. Diagnostic and treatment procedures must be done efficiently and with adequate restraint or sedation to avoid undue discomfort.

A moment's effort of rewarding a patient with a small treat or a cuddle following restraint or other temporary discomfort will greatly improve the animal's tractability, and reduce the stress of handling that individual the next time. Patients respond to one another's stress. The calmer each individual can be, the calmer and more tractable the others will be.

Adequate control of pain is mandatory for every veterinary procedure. Good guidelines are now available for assessing pain in animals, as summarized in [Appendix 6: Assessing the need for post-operative analgesia](#) and by the acute pain scale charts found in [Appendix 14: Examples of clinical forms and record sheets](#). By default, if the animal's illness or a procedure done to an animal would be painful to a person, it must be assumed that it is painful to the animal as well, and must be prevented and treated. Post-operative analgesia for common procedures such as spay and neuter are guided by international standards, as outlined in this document.

Analgesia is also an essential component of anesthesia for all procedures that do, or may, cause pain. Sedatives and other drugs that inhibit an animal's physical control over his or her body must simultaneously address the anxiety that is inherent to such a loss of control (e.g., see note on acepromazine, [Appendix 5: Anesthetic and analgesic drugs](#)). Anesthesia must be carried out in a way to minimize duration of anesthesia, optimize quality of the effects that anesthesia is meant to induce, and to minimize risks to the patient ([Section 8: Anesthesia](#)).

Prior to and following anesthesia, animals must be kept as calm and quiet as possible. Cages should be covered, newly-trapped animals must be allowed to calm down, and human and animal activity, light, and noise around the cages must be minimal. All of these factors may not always be possible to control under field conditions. But the stressful effects of many of them can be mitigated through the efforts and innovation of the personnel who care for the animals.

Animals must be anesthetized only when it is certain that the veterinarian will be ready for him or her immediately following induction and preparation for the procedure. Wait times because animals are anesthetized too early are a common cause of unnecessarily long anesthesia.

Veterinary personnel must be well informed about what to expect with certain anesthetic drugs, and to monitor the patient accordingly. Emergency intervention protocols must be practiced, and all necessary drugs and equipment in good working order and readily to hand.

Hydration is essential for physiologic stability, healing and well-being. Hydration is inexpensive, and must never be compromised perioperatively or in the treatment of sick animals.

Maintenance of routines has been shown to help animals to cope in a clinic environment. Feeding, cleaning, daily medication, and dog walks done at the same time each day appear to return an element of control to animals through the ability at least to anticipate some of the changes to which they are subjected. It is essential also that personnel who feed and clean and walk animals

are gentle, avoid sudden movements and noise, speak kindly to the animals, and understand basic animal communication, e.g., to avoid direct stares and how to approach an animal who is fearful in the cage. This is important not only to reduce the stress of animals, but for the safety of personnel as well.

In addition to the fundamental parameters of cage size, biosecurity, bedding, etc. that are minimum standards for caged animals, additional elements can make a great deal of difference to the stress that an animal experiences while under veterinary care. All cats must have some form of litter pan in the cage – even if it only a plate with shredded paper inside. Dogs must be taken outside to toilet on a regular schedule. If the dog is too ill for this, it is essential to keep the patient clean and to remove waste from the cage immediately. Dogs and cats who are accustomed to living in the street are capable of holding their urine and feces for days at a time if not taken outdoors, with potentially grave consequences. Cages and kennels must be kept dry and free of fumes from disinfectants, sewage, vehicle exhaust, and other noxious substances.

Retreat space – the opportunity for an animal to remove him or herself from the proximity of people or other animals – is often compromised by the necessities of caging during veterinary care. Covering cages with a cloth and placing cardboard or other barriers between them may be essential. Cats should have a small box in the cage in or behind which to hide. Prey species such as rabbits, guinea pigs, and hamsters must not be kept in the same areas as predator species such as cats and dogs. Cats are prey to dogs, and must be housed away from them. These are things that are easy to do, are inexpensive, and can make a great amount of difference to the patient – and therefore also to the effectiveness of the veterinary care.

Temperature is sometimes difficult to control under field conditions. Indigenous animals may be accustomed to high or low temperatures that are common to their environment. It is essential to keep in mind, however, that animals under veterinary care are often unnaturally stressed, have no choice in relocating themselves to an area of more suitable temperature, and may be compromised in their thermoregulatory capacities by illness or anesthesia. All efforts must be made to moderate the temperature and ventilation to a safe and comfortable range for patients.

The examples listed above are by no means exhaustive, but outline some of the common compromises to animal welfare that may be avoided in clinical situations, particularly in field conditions and makeshift clinics such as during a rescue operation. We cannot avoid handling animals, or temporarily to cage them, or to give them drugs that may make them feel confused, or to subject them to stressful procedures. But we can do a great deal to mitigate the stress that animals suffer while they are under our care.

In every direct or indirect interaction with an animal, it is important to be empathetically and cognitively aware of the stressors that he or she may be suffering, to anticipate and preempt them, to relieve them as well as possible, and to de-escalate fear and anxiety. Even if animals are under veterinary care for only a day or two, or for only a few hours as in trap-neuter-release programs, or for a moment to vaccinate, minimization of stress and addressing welfare needs of patients are paramount to professional veterinary practice and to the recovery of patients from surgery or illness.

Under no circumstances may we compromise welfare standards with the rationalization that animals are “stray” or “are used to a hard life”. Animals are not lesser beings for lacking adequate human guardianship, nor do they suffer less. Animals must never be subjected to substandard welfare during veterinary procedures or for research, or to unnecessary risks for students to

practice skills. It is our responsibility and privilege as veterinarians and as welfare guardians to ensure that all animals are held in equal respect.

### 3. Management of IFAW field veterinary projects

#### 3.1 Veterinary staff qualifications and responsibilities

- 3.1.1 An IFAW-qualified veterinarian must be assigned to every field project that is under IFAW's jurisdiction and that involves animal health, in order to ensure that the requirements outlined in the Sterilization Field Manual are being met.
- 3.1.2 All team members must respect final decisions on veterinary care made by the veterinarian in charge in the project.
- 3.1.3 The veterinarian in charge, together with the IFAW CA Program Director (or his/her designee), must determine the level of responsibility that veterinary staff and volunteers are qualified to assume within any specific project. Assignments must be in accordance with the existing guidelines of the Sterilization Field Manual, local law, and general veterinary practice.
- 3.1.4 Veterinary staff must meet the qualifications outlined in [Section 1.1 Definitions and abbreviations](#). Project veterinarians and veterinary assistants with insufficient qualifications or experience must undergo additional supervised training and evaluation by IFAW-qualified veterinarians. A subsequent evaluation of the veterinarian's or assistant's competence will be made by an IFAW-qualified veterinarian before the person may work independently.
- 3.1.5 Volunteer veterinary staff must follow the requirements and rules of the IFAW Volunteer Veterinary Staff guideline. It is strongly recommended that all volunteers be asked to sign a document similar to that shown in [Appendix 16: Legal forms for IFAW project participants](#) in order to ensure that they are properly informed of risks and responsibilities, and to protect the project organizers in the event that something goes wrong.

#### 3.2 Compliance with local regulations and legal requirements

- 3.2.1 CA Project activities must comply with all legal requirements for the operation of a veterinary facility in the locality, including:
  - staff qualifications
  - permits and licenses
  - recording and monitoring systems for controlled drugs, anesthetic equipment, x-ray equipment, and any other equipment or substances that may pose a health risk to personnel.
  - incidents and accidents
  - disposal of animal bodies, clinical waste (organic matter), and sharps
  - use and location of premises
  - patient records
- 3.2.2 In the event that legally-allowed drugs are inadequate in a given location to ensure the optimal safety and health of a patient, alternative drugs may be used with the

permission of local collaborators, and according to international veterinary practice standards governing the use of such drugs, e.g., as published by Plumb.

- 3.2.3 Where animals are subjected to anesthesia, surgery, hospitalization, or euthanasia, guardians must give informed consent by signature. In countries where it is relevant to do so, guardians should be asked to sign their consent to the off-label use of drugs. Sample forms may be found in [Appendix 16: Legal forms for IFAW project participants](#).

### **3.3 Standard operating procedures, policies, and data collection**

- 3.3.1 Written policies and protocols are essential to the management of a sterilization and primary veterinary care program. Often, these projects include volunteers and shifting personnel. Written documents are necessary to train personnel and to maintain consistency in standards and quality of care. Standardized, well-organized procedures improve safety, patient care, and efficiency. Their use reduces errors and staff disagreements.
- 3.3.2 Protocols should include sufficient flexibility to adapt to changes in local needs and resources. That said, fundamental standards in patient care, safety, and welfare must never be compromised.
- 3.3.3 Written policies are helpful in communication with authorities and animal guardians.
- 3.3.4 Policies and protocols should be reviewed at regular intervals and revised as needed.
- 3.3.5 Data collection on patient results, post-operative complications, drug use, feedback from surgeons and other veterinary staff, and feedback from the local community and animal guardians should be a standard aspect of project management. These data are essential for the informed revision of policies and protocols, and to ensure that the project is meeting its objectives.

### **3.4 Emergency preparedness**

- 3.4.1 Protocols must be written and practiced to prepare for emergencies. These include:
- Medical emergencies for patients
  - Accidents (including accidental drug exposure) requiring medical attention for personnel
  - Natural disasters, particularly in areas prone to hurricanes, floods, fires, and earthquakes
- 3.4.2 An IFAW-qualified veterinarian must be on site at all times during working hours to take the lead in the event of a veterinary emergency. Such veterinarian must remain on premises until all patients are extubated, sternal, alert, and responsive.
- 3.4.3 A trained staff member must be on site at all times during working hours to take the lead in the event of emergencies other than those overseen by the veterinary team.
- 3.4.4 All staff members and volunteers should be trained to recognize emergencies.
- 3.4.5 Regular team practice of emergency protocols should be conducted to ensure emergency preparedness.
- 3.4.6 Refer to [Section 7.2: Preparation for anesthetic emergencies](#).
- 3.4.7 Preparation for accidental exposure of staff to dangerous drugs or pathogens

- For expedient treatment of a person accidentally exposed to veterinary drugs, drug information data sheets and other information sheets for all drugs and vaccines used in a CA project should be current and readily accessible by all staff.
- Necessary antidotes and a first aid kit should be readily available and accompany a staff member to the local human hospital for administration if the need arises. Human treatment clinics in some regions may not have necessary antidotes available, and it is best to have them ready to accompany the patient. Information on the use of antidotes and other relevant information must be included in the emergency kit.
- All personnel who are handling animals are advised to be fully vaccinated against all locally-relevant zoonotic pathogens (including rabies) and endemic preventable diseases with an internationally recognized vaccine (as listed by the World Health Organization (WHO) or Centers for Disease Control and Prevention (CDC)). Refer to WHO and CDC web sites for country-specific vaccination guidelines: <http://www.who.int/ith/en> or <http://wwwnc.cdc.gov/travel/destinations/list.htm>.
- Employers and staff managers must be aware that in some countries (e.g., United States) one cannot mandate staff to be vaccinated or to take other kinds of prophylactic treatment against endemic pathogens. One may only advise staff of potential risks and provide guidelines for prophylactic care. For IFAW projects, personnel must sign a waiver of responsibility to hold IFAW harmless in the event of illness ([Appendix 16: Legal forms for IFAW project participants](#)). Other project owners are encouraged to provide personnel with similar guidelines and waivers of responsibility.

### 3.5 Records and animal identification

- 3.5.1 All animals who receive veterinary care through an IFAW CA project must have written records that describe information pertinent to the activity and according to local legal requirements.
- 3.5.2 All records for IFAW CA projects must include:
- date of activity
  - identification code or name of the patient
  - basic description of the animal (color, unique markings or characteristics, fur type)
  - sex
  - estimate of age
  - identifying markers such as tattoo or microchip
  - name and contact information of guardian or owner, if there is one
- 3.5.3 Medical and surgical records must include:
- clinical history, if available
  - physical examination results, including body weight and body condition score
  - diagnostic tests, if done
  - all drugs – name, dose, route of administration, time of administration
  - anesthetic record – minimally this must include record of drugs (name, dose, route of administration, time of administration) and any irregularities or complications

- surgical procedures performed. Details should be described if the procedure deviated from standard surgical procedure according to Fossum et al. 1997, *Small Animal Surgery*)
  - Signature of informed consent to the procedure by the patient’s guardian ([Section 5.10](#)).
- 3.5.4 All patients must be identified at all times by their individual clinical record, together with a corresponding identification on the patient (e.g., labeled collar, tag, microchip, or cage ID for animals who cannot be handled).
- 3.5.5 Sample record forms may be found in [Appendix 14: Examples of clinical forms and record sheets](#).

### **3.6 Communication with animal guardians and the community**

- 3.6.1 The project should allow for adequate time and skill in communication with animal guardians, local officials, and other community stakeholders. The community should understand and support the work, and should have opportunity to ask questions, allay concerns, and clarify expectations. Cultural and other local concerns must be understood and respected for the community to engage with the project and make it successful.
- 3.6.2 Short-term and long-term objectives must be clear, and project leaders should be able to communicate these.
- 3.6.3 A spay/neuter event, mobile service, or clinic that specializes in veterinary outreach presents a unique opportunity for the veterinary team to learn about local issues pertaining to animal health and welfare. This is often the only contact that people have with high-quality veterinary professionals. It is an opportunity to communicate the professionalism of veterinary service providers, and to model the respect and compassion that we wish to see for animals in communities.
- 3.6.4 This is an opportunity to recognize and address guardianship issues that may be compromising the health and welfare of individual animals, or of animals throughout the community (nutrition, shelter, confinement, exercise, opportunity for social engagement, veterinary care, behaviors that suggest problems with guardianship).
- 3.6.5 Professional conduct by all project personnel at all times and respect for local customs are imperative.

### **3.7 Guideline for evaluation of dog and cat sterilization events**

- 3.7.1 The first section of IFAW’s *Guideline for evaluation of dog & cat sterilization events* provides standards and guidelines for the seven aspects of a sterilization event: Organization of the event, Admission area, Patient examination and preparation for surgery, Surgery area, Patient recovery area, Patient discharge, and Post-operative patient follow-up.
- 3.7.2 The second section of the manual comprises a comprehensive questionnaire for each section, and can be reviewed with short answers or ticked boxes. This serves as a checklist with which to evaluate the quality of each section, and quickly brings into relief issues that require improvement.

- 3.7.3 The *Guideline for evaluation of dog and cat sterilization events* is written for lay people as well as for veterinary staff. It is useful for evaluation of an organization's own sterilization event, or for evaluation of the work of other groups in order to assess progress, make funding decisions, or to provide structured feedback.

## 4. Patient handling and housing

### 4.1 Environmental stress mitigation

- 4.1.1 All possible measures must be taken to minimize stress and anxiety in patients prior to anesthesia. Stress not only compromises physiologic processes necessary for homeostasis and healing, but may severely compromise the safety and quality of anesthesia. Refer to [Section 2: Patient stress management and animal welfare in veterinary care](#) and [Section 8.2: Induction of anesthesia](#)
- 4.1.2 All possible measures must be taken to maintain adequate temperature and ventilation for patients. The prevention of hypo- or hyperthermia is imperative, and must be managed from the time of patient admission through discharge.
- 4.1.3 Ventilation must ensure that noxious smells and volatile drugs do not pose risks to patient health or cause undue stress. Animal waste, sewage, fumes from disinfectant chemicals, vehicle emissions, cigarette smoke, gas heaters, and anesthetic gas are common problems in inadequately ventilated areas.
- 4.1.4 Noise and direct light must be kept to an absolute minimum in areas where animals are housed. There must be no shouting, loud doors, banging cages, smoking, music or other avoidable disturbances.
- 4.1.5 Smoking must be strictly prohibited throughout the clinic area, and in all areas in which animals are housed.
- 4.1.6 Animals awaiting surgery should be kept away from the admission and recovery areas. Admission areas are full of anxious, excited animals and people. Animals recovering from anesthesia behave abnormally, smell abnormally, and make abnormal sounds. This is immeasurably distressing to un-anesthetized animals who observe them. These environments are much too stressful and stimulating for animals who need to be calm prior to anesthesia.

### 4.2 Biosecurity

- 4.2.1 Spay/neuter events and clinics have a high volume of animals moving through the facility. These patients may bring with them a variety of pathogens, particularly if they have not been adequately vaccinated and treated for parasites. The facility must ensure all possible measures to protect patients from contagious disease while at the facility. Aside from the risk to patients and the cost in patient treatments, an outbreak of illness in newly sterilized dogs and cats can have devastating consequences on the trust that the community has in the clinic, and in what may be a fragile confidence in the acceptability of sterilization itself.
- 4.2.2 Biosecurity protocols must be in place and enforced to include:
- Cleaning and disinfection after each patient of cages, tables, and all other surfaces that come in contact with animals



- Cleaning and disinfection of endotracheal tubes, thermometers, and other equipment after use in each patient
  - Daily cleaning and disinfection of premises and major equipment
  - Cleaning and maintenance of anesthetic equipment to ensure that all parts remain clean and in safe working order
  - Personal hygiene to control spread of pathogens on hands, clothing, shoes, and other fomites
  - Lay-out of the facility so that personnel move from “clean” to “dirty” areas, and never the other way
  - Strict adherence to sterile procedure in the surgical theater
  - Isolation of patients who exhibit clinical signs of potentially contagious illness, before such patients come into contact with others
  - Individual housing for each patient. (Littermates and amicable housemates of the same species may be housed together – see below.)
  - Patients with mild illness who are considered appropriate surgical candidates ([Section 5: Pre-surgical evaluation](#)) should be scheduled for surgery after all healthy patients have been done for the day.
- 4.2.3 Prevent exposure of susceptible animals to animals who are ill or who may be infectious. Exposure may occur through direct contact among animals, by indirect contact with excretions and secretions from animals who are shedding pathogens, or transfer of pathogens via fomites (e.g., hands, clothing, shoes, equipment).
- 4.2.4 It may be prudent to house and process animals who arrive from the same area or in groups together, and designate use of supplies, instruments, and equipment accordingly.
- 4.2.5 Ensure that animals are hydrated, warm, dry, clean, and comfortable, and that patient stress is mitigated however possible. Stress plays a strong role in immunocompromise and disease susceptibility. Refer to [Section 2: Patient stress management and animal welfare in veterinary care](#), and [Section 4.1: Environmental stress mitigation](#).
- 4.2.6 Biosecurity measures for infectious disease control may be found in shelter medicine texts such as that of Miller & Zawistowski, 2013.

### 4.3 Housing

- 4.3.1 Littermates, mothers with litters, or amicable housemates of the same species may be housed together until sedation or anesthesia, at the discretion of the veterinarian in charge. Ideally, these individuals are kept together as long as possible to reduce anxiety. All other patients must be housed in a separate cage.
- 4.3.2 Species of animals must be held in separate areas at all times except in the surgical theatre. Cats must be away from dogs, and prey species must be separated from predator species.
- 4.3.3 Cages must provide sufficient space for the animal to stand up, turn around, and lie comfortably.



- 4.3.4 Cages should be covered with cloths or cardboard to reduce visual stimulation.
- 4.3.5 Cages for cats should contain a small cardboard box or other area into which cats can withdraw or hide.

#### **4.4 Restraint and handling**

- 4.4.1 Safety of the patient and personnel is the priority at all times.
- 4.4.2 Animals must be handled and restrained as gently as possible. Even – and especially – when animals are fractious or particularly fearful, a great deal can be achieved with soft tone of voice, slow and gentle approach, steady movements that do not startle the animal, non-threatening body language, and practiced animal handling skills. Cats usually calm down if the head is covered or if they can hide inside of a towel or cloth bag.
- 4.4.3 If an animal is caught in the street or brought to the clinic under stressful conditions, he or she should be allowed to calm down in a covered cage for at least 30 minutes before induction of anesthesia.
- 4.4.4 Animals who are caught with a net must be moved immediately to a cage to calm down before anesthesia. Intractable individuals may be sedated or anesthetized immediately and then moved, per [Section 5.2](#). Animals must never be left in the net under any circumstances.
- 4.4.5 Intractable individuals must be housed in a manner that allows restraint with a minimum of anesthetic and with minimal handling, while allowing for sufficient space for the individual to stand up, turn around, and lie down comfortably. These patients should be removed only once they are sedated. They must be weighed and provided a full physical examination as soon as they can be safely handled.
- 4.4.6 All personnel must be trained to carry animals appropriately. Animals must always be carried in a sternal or lateral position with the torso supported. The head and neck must be supported and aligned to maintain a patent airway. Patients must never be carried by the limbs or by the scruff. Special care must be taken with anesthetized patients to ensure that the airway is patent and protected.

## **5. Pre-surgical evaluation**

### **5.1 Primary veterinary care prior to the sterilization event**

- 5.1.1 Ideally, dogs and cats should be vaccinated and dewormed at least 2 weeks prior to sterilization surgery. It is understood, however, that in many instances, animals are presented for veterinary care for the first time at spay/neuter events. In this case, patients should be vaccinated with core vaccines at the time of surgery, according to current AAHA and AAFP guidelines ([Appendix 3: Vaccination Guidelines](#)). Unless animals have recently been dewormed, this should be done with injectable or topical medication at the time of surgery, or oral de-worming medication sent home with the guardian. Refer to [Section 12: Vaccination and parasite control](#).
- 5.1.2 All dogs and cats must be vaccinated against rabies, either before surgery or at the time of surgery. Previously-vaccinated animals must be current on rabies vaccination status per local laws. [Section 12: Vaccination and parasite control](#).

- 5.2 All animals must undergo a standard physical examination on the day of surgery, before surgery.
- 5.2.1 In extreme instances, when the animal is too dangerous to examine safely prior to anesthesia, he or she may be tranquilized first, as long as no obvious abnormality is observed that makes the patient a poor candidate for anesthesia. The physical examination must be performed as soon as the patient is tractable.
  - 5.2.2 The physical examination must be performed by an IFAW-qualified veterinarian, or by a veterinary student who is supervised by the IFAW-qualified veterinarian.
  - 5.2.3 The physical examination must minimally include assessment of body condition score, body weight, basic vital signs, and all major organ systems according to the physical examination guideline in [Appendix 14: Examples of clinical forms and record sheets](#). The patient's gender and reproductive status must be verified, including indications that the patient may have already been sterilized. Where possible, a health history should be obtained from the animal's guardian.
  - 5.2.4 In areas in which certain diseases are endemic that may compromise the patient's survival under anesthesia or recovery from elective surgery, additional diagnostic tests may be performed prior to surgery wherever possible (e.g., for heartworm infection or babesiosis).
- 5.3 Sterilization is an elective surgery, and must not be undertaken at undue risk to the patient.
- 5.3.1 A patient must not be subjected to elective surgery if the physical examination and/or medical history suggest any undue or unnecessary risk for anesthesia or the surgery.
  - 5.3.2 In some situations, patients are presented for sterilization who have mild disease conditions (upper respiratory disease, parasitic infections, subclinical heartworm disease), or who are otherwise not ideal surgical candidates (pregnant, lactating, in estrus). Under controlled situations, sterilization surgery would be delayed for these patients. However, if it is unlikely that the patient will be sterilized later, then the veterinarian may decide that the risk to the patient is within reason, and that there is justification for proceeding with the elective surgery.
    - Client communication is imperative. He or she must understand that there are greater than normal risks to these patients, and, per standard admission policy, must give informed consent for the surgery ([Section 5.10](#)).
    - The ultimate decision of whether a patient presents a suitable candidate for elective surgery lies with the veterinarian in charge.
  - 5.3.3 Where the decision is made to proceed with anesthesia and surgery in patients with higher than normal risk, additional precautions should be taken. See [Section 7: Preparation for anesthesia](#).
    - Alternative anesthetic protocol, using less cardio-respiratory depressant drugs and reversible anesthetic agents
    - Endotracheal intubation
    - Supplemental oxygen and intravenous fluids
    - Close patient monitoring

- 5.4 Ovariohysterectomy to treat a patient with pyometra is not an elective procedure. The condition constitutes a medical emergency, and patients should be spayed as soon as their vital signs are stabilized. Owners must be informed of the gravity of the condition, and of associated risks.
- 5.5 When the physical examination presents evidence of disease, injury, or malnutrition that is likely to compromise the patient's ability to withstand or recover from anesthesia and surgery:
- 5.5.1 The patient must be evaluated and treated according to available resources, welfare prognosis, and the guardian's agreement.
  - 5.5.2 When clinical history or findings suggest that the patient may risk spreading infectious disease to other animals or to people (e.g., distemper, parvo, rabies, kennel cough), s/he must be handled first and foremost according to human and animal biosecurity standards. Treatment, isolation, and other options depend on available resources.
  - 5.5.3 Humane euthanasia may need to be considered in certain situations: refer to [Section 13: Euthanasia](#).
- 5.6 Female dogs and cats may be spayed at any stage during the reproductive cycle. Additional caution must be used when sterilizing bitches or queens who are in estrus or who are pregnant.
- 5.6.1 The surgeon must be aware that tissues may be more friable and perfusion to the reproductive tissues increased, and take appropriate precautions.
  - 5.6.2 Intravenous fluid therapy may be necessary. An IV catheter should be placed to maintain hydration and blood pressure throughout surgery. Refer to [Section 7.6: Intravenous fluid support during anesthesia](#).
  - 5.6.3 Ideally, and if the option is reasonable, avoid spaying a bitch within 8 weeks after estrus. This is the luteal phase of the estrous cycle, and spaying during this time will cause a precipitous decrease in progesterone, which may induce clinical signs of false pregnancy (pseudopregnancy or pseudocyesis). However, if it is unlikely that there will be another opportunity to spay the bitch, this risk is considered acceptable in favor of ensuring that she is spayed promptly and safely.  
  
NB: a common myth suggests that spaying during pseudocyesis will prolong the clinical signs of false pregnancy. This is incorrect. The clinical signs begin with regression of the corpus luteum and the consequent drop in progesterone production. Removal of the corpus luteum by ovariohysterectomy will not worsen the condition.
  - 5.6.4 Dogs and cats with pyometra must be spayed immediately, as an emergency surgery. Patients must be appropriately stabilized prior to surgery, as they may already be septic and hypovolemic. Surgery must be followed by appropriate antibiotics and supportive care.
- 5.7 Post-partum bitches and queens
- 5.7.1 It is preferable that bitches and queens are not spayed during the first 6 weeks post-partum. This guideline is out of concern for dependent neonates and to give the uterine tissues and associated vasculature time to recover. However, if it is not possible to ensure that the bitch or queen will be safely spayed if surgery is delayed, then she may be spayed during lactation, providing that her offspring are not compromised as a result.
  - 5.7.2 Puppies and kittens who are dependent on their mother's milk must not be away from the mother for more than 4 hours. The mother's surgery must be planned in a way to

ensure that her total time away from the pups is minimized. The neonates must be kept warm, safe, and fed (if necessary) while separated from their mother.

- 5.7.3 The lactating bitch or queen should not be starved for more than 6 hours prior to surgery. Water must always be present and must never be withheld, until she is sedated for anesthesia. This is the standard requirement for all patients prior to surgery. Full-time access to drinking water is particularly critical for a lactating female, as her water requirements are very high.
- 5.7.4 Mother and offspring must be closely monitored post-operatively to ensure that the puppies or kittens are not accidentally injured, or in case the mother has trouble resuming maternal care.
- 5.7.5 Post-partum queens and, where appropriate, bitches ([Section 9.6: Technique for surgical sterilization of dogs and cats](#)), should be spayed by the flank technique, unless there is reason to suspect uterine pathology. This reduces risk of milk leakage into the abdominal incision, and allows the kittens to continue to nurse with less trauma to the surgery site than following a midline incision.
- 5.7.6 Refer to [Appendix 5: Anesthetic and analgesic drugs](#) for recommended anesthetic protocols for lactating bitches and queens.
- 5.8 It is recommended that dogs and cats be sterilized prior to puberty whenever possible. This is recommended on grounds of medical, behavioral, and population management considerations. (Note that healthy kittens may become pregnant as early as 4 months.) Early-age sterilization may be performed as early as 6 weeks of age for puppies and kittens ([Section 11: Early-Age Sterilization](#)).
- 5.9 The patient's guardian should be interviewed about the patient's history, current health, and behavior.
- 5.10 Informed consent for sterilization (or other procedure) must be obtained from the patient's guardian in writing prior to the surgery.
  - 5.10.1 Details of a consent form will vary with the project, and may include:
    - Name and contact information for the animal's guardian
    - Confirmation that the guardian has communicated all known information about the patient's health and prior veterinary procedures
    - Acknowledgement of the risks of anesthesia, surgery, and infectious disease exposure (particularly for those patients who have not been vaccinated previously)
    - Acknowledgement that the patient will not be able to reproduce following sterilization surgery
    - Acknowledgement that the patient will bear a permanent identification marker (tattoo, cropped ear, microchip) indicating that he or she has been sterilized
    - Authorization for the surgery or other procedures
    - Fees
  - 5.10.2 If the patient has no guardian (e.g., roaming community dogs or cats), consent must be sought from a municipal authority or other official.
  - 5.10.3 Examples of consent forms may be found in [Appendix 16: Legal forms for IFAW project participants](#).

5.11 During patient intake, guardianship practices should be reviewed with guardians, and advice provided as needed (Section 3.6: Communication with animal guardians and the community).

## 6. General clinical considerations

- 6.1 A new, sterile, disposable needle must be used for parenteral administration of any drug or vaccine.
- 6.2 If necessary, syringes may be re-used if:
  - 6.2.1 The syringe is not contaminated with any bodily fluids from a previous patient; and
  - 6.2.2 The syringe tip is always protected with a capped needle. If a syringe is left uncapped, it must be discarded (or sterilized before re-use).
- 6.3 Syringes may be washed and autoclaved to re-use them. All contents must be completely washed out with water and a pipe cleaner or test tube brush. The syringe must be rinsed well with clean water and then packaged so that sterility is maintained after autoclaving, until use.
- 6.4 Do not use chemical sterilization (“cold sterilization”) for syringes.
- 6.5 All medical supplies, including drugs, vaccines, and other consumables must be stored according to the manufacturer’s recommendations.
- 6.6 Use of expired drugs and supplies
  - 6.6.1 All medical supplies, including drugs, suture materials, vaccines, sterile materials, and other products with expiry dates should not be used if they are 6 months beyond the manufacturer’s expiry date, or if there is any evidence of breach of sterility, contamination, or reduction in effectiveness or safety (e.g., from exposure to undue heat, cold, or sunlight).
  - 6.6.2 The decision to use a product beyond its expiry date rests with the head veterinarian for the project.
  - 6.6.3 If there is any doubt regarding the expired product’s safety or effectiveness, it should not be used.
- 6.7 When consumable products such as intravenous fluid bags or bottles and tubes containing medicine are opened, the date of their opening should be clearly marked on the package.
- 6.8 Opened products should be discarded if they have been contaminated, or at the head veterinarian’s discretion. Products must be discarded according to manufacturer’s instructions and in a way that meets local laws.
- 6.9 All containers (including syringes) containing a drug or vaccine must be clearly labeled with the contents (name of drug and concentration).
- 6.10 All drugs that are given to animals must be calculated based on the patient’s body weight. Body weight must be measured, rather than estimated. The only exception to this is when a patient is too dangerous to handle prior to anesthesia. In this case, the patient may be tranquilized on the basis of estimated body weight, and weighed as soon as he or she is tractable. All subsequent medications must be calculated on the basis of measured body weight.

- 6.11 Each patient must have an identification marker that matches that patient's clinical record.  
When patients are moved, the record and cage label must be moved together with the patient.

## 7. Preparation for anesthesia

### 7.1 General considerations

- 7.1.1 If the physical examination or medical history of the patient suggest that surgery may cause more than regular risk to the patient, elective surgery such as sterilization should be delayed. Refer to [Section 5: Pre-surgical evaluation](#).
- 7.1.2 Supplies for treating anesthetic complications must be completely prepared before the patient is anesthetized. All veterinary and nursing staff must be thoroughly familiar with emergency protocols and location of supplies. Refer to [Appendix 9: Emergency drugs quick reference drug chart](#), [Appendix 10: Emergency treatment kits](#), [Appendix 11: Management of anesthetic complications, cardiopulmonary resuscitation](#), and [Appendix 12: Emergency treatment for anaphylactic reaction](#).
- 7.1.3 Anesthetic drug doses should be calculated on the basis of measured body weight. Estimated body weights are sometimes used in the event of an emergency, but this should not be done as a matter of routine. As soon as these patients are anesthetized, they must be weighed and subsequent drug doses based on measured weight.
- 7.1.4 It is imperative that anesthesia time be minimized. Calculate all drug doses and prepare all drugs, supplies and equipment before the patient is anesthetized.
- 7.1.5 An anesthetic record must be kept for each patient according to specifications outlined in [Section 3.5: Records and animal identification](#) and [Appendix 14: Examples of clinical forms and record sheets](#).
- 7.1.6 If gas anesthesia is used, the room must have adequate ventilation. A scavenging system or waste gas escape system must be in place to protect the patient and personnel.
- 7.1.7 Prior to anesthetic induction, the animal should be encouraged to empty his or her bladder and bowels. Dogs may be taken on a short walk to encourage this. With cats it may be difficult to achieve this, particularly if they feel stressed.

### 7.2 Preparation for anesthetic emergencies

- 7.2.1 An oxygen source must be on site for supplementation of patients when medically necessary. High-risk patients (e.g., heavily pregnant, brachycephalic, overweight) should receive oxygen supplementation routinely.
- 7.2.2 A manner in which to ventilate patients must be available at all times. This may be in the form of an anesthesia machine (with correct breathing circuit, CO<sub>2</sub> absorbent, and reliable O<sub>2</sub> flow calibration) or Ambu bag. Where available, capnography is helpful for monitoring the adequacy of ventilation and CO<sub>2</sub> absorption. However, machines must never be substituted for standard monitoring procedures ([Section 8.1: Anesthetic monitoring](#)).
- 7.2.3 Emergency drugs and supplies must be readily available and properly stocked for rapid access. See [Appendix 10: Emergency treatment kits](#). Daily clinic protocols must include designation of the responsibility to keep the kit stocked and available.

- 7.2.4 At least one person must be immediately available at all times to areas in which patients are anesthetized or recovering from anesthesia who is trained and practiced in cardiopulmonary resuscitation and other anesthetic emergency protocols. For treatment of respiratory and cardiovascular problems during anesthesia, see [Appendix 11: Management of anesthetic complications, cardiopulmonary resuscitation](#).
- 7.2.5 Emergency protocols must be practiced regularly in order to ensure that staff can respond quickly and effectively when needed.
- 7.2.6 A veterinarian must remain on site at least until all patients are extubated, sternal, alert, and responsive.

### **7.3 Fasting**

- 7.3.1 Water must be always available to animals. Do not withhold water prior to anesthesia.
- 7.3.2 Animals older than 4 months of age should have food withheld before anesthesia for at least 4 hours. It is not necessary to withhold food for more than 6 hours. Overnight fasting is acceptable, but should total no more than 16 hours.
- 7.3.3 Animals less than 16 weeks of age should have a small meal 2-4 hours prior to surgery. Food must not be withheld for more than 4 hours. Refer to [Section 11: Early-Age Sterilization](#).
- 7.3.4 If it is likely that the animal has been fasting too long (according to the guideline above), he or she should be fed immediately and surgery delayed until an appropriate time later. Hypoglycemia is a serious risk, particularly for young animals.
- 7.3.5 Animal guardians who bring dogs and cats for sterilization must be informed in advance of appropriate fasting times for the animal.
- 7.3.6 If feral animals were caught in live traps with food, the food should be removed in due time prior to surgery, but only if it is safe for personnel to do so.
- 7.3.7 Veterinary staff must be prepared that dogs and cats often will have food in their stomachs despite instructions to guardians for fasting or if the animal was trapped from the street. Emesis should be anticipated, particularly with the use of alpha-2 adrenergic drugs.

### **7.4 Intravenous catheters**

- 7.4.1 All patients should have a new, sterile IV catheter placed just before or immediately after induction of anesthesia. This allows rapid administration of emergency drugs, administration of intravenous fluids, and re-dosing of anesthetic drugs.
- 7.4.2 All bitches and queens who are more than 4-6 weeks pregnant must have a new, sterile, intravenous catheter placed prior to surgery. For bitches an 18-22G intravenous catheter, and for queens a 22-24G intravenous catheter are usually appropriate.
- 7.4.3 All pediatric patients undergoing early-age sterilization should have an IV catheter ([Section 11, Early-Age Sterilization](#)). For very small patients, placement of an IV catheter may result in patient stress that is not warranted. This decision must be made by the veterinarian in charge on the basis of personnel skill, patient health, and the team's experience.

7.4.4 To place an IV catheter, the fur must be clipped over the vein (cephalic or saphenous vein) to allow easy visibility of the vein and to avoid adherence of fur to the sterile catheter. The venipuncture site must be cleaned with suitable disinfectant ([Appendix 15: Disinfectants](#)) before the catheter is placed.

## 7.5 Endotracheal intubation (airway management)

7.5.1 Routine endotracheal intubation is not required for patients who present low anesthetic risk, and whose procedure is expected to last no longer than about 20 minutes. However, the ability to perform intubation immediately when needed must be available at all times.

7.5.2 If current protocols include intubation of all patients, and this is working well, then there is no need to change the protocols.

7.5.3 It is strongly recommended that the following patients always be intubated:

- brachycephalic
- overweight
- in advanced stage of pregnancy
- upper respiratory disease (obstructed nares)
- if surgery is anticipated to last longer than 30 minutes.

7.5.4 Endotracheal intubation must be performed with care and skill to avoid trauma to the trachea or intubation of the esophagus. Cats are particularly vulnerable to tracheal trauma. Topical lidocaine must be used to intubate cats (see below).

7.5.5 All endotracheal tubes must be checked prior to each use for patency and an effective cuff.

### Endotracheal tube size guideline

#### Dogs

2 kg	5.0 mm
3.5 kg	5.5 mm
4.5 kg	6.0 mm
6 kg	6.5 mm
8 kg	7.0 mm
10 kg	7.5 mm
12 kg	8.0 mm
14 kg	8.5 mm
16 kg	9.0 mm
18 kg	9.5 mm
20 kg	10 mm
25 kg	11 mm
30 kg	12 mm
40+ kg	14-16 mm

#### Cats

1 kg	2.5-3.0 mm
2 kg	3.5 mm
3.5 kg	4.0 mm
4+ kg	4.5 mm

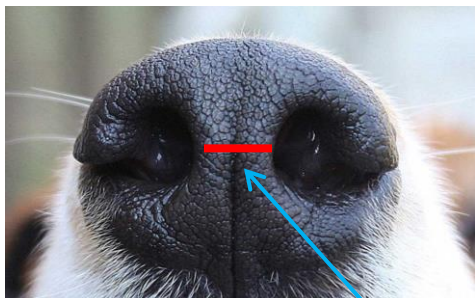
7.5.6 Endotracheal tubes must be thoroughly cleaned after each patient according to the following four steps. Inadequately cleaned tubes must not be used.



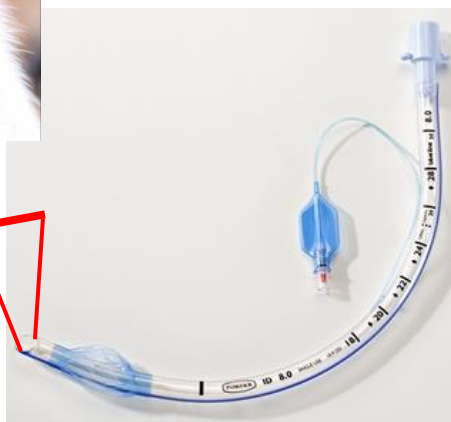
- 1) Wash the tube thoroughly with water and clean the inside with a pipe cleaner or test tube brush to remove all mucus and other material.
- 2) Soak in disinfectant for 15 minutes (see [Appendix 15: Disinfectants](#) for appropriate disinfectant options).
- 3) Rinse thoroughly with drinking water. This is very important to avoid introduction of chemical disinfectant into the airways of the next patient.
- 4) Air-dry or shake off as much water as possible before use in the next patient.

### Endotracheal tube size selection

Measure the length of the endotracheal tube from the tip of the nose to the thoracic inlet.



The diameter of the endotracheal tube should be equal to the width of the dog's nasal septum. The nasal septum correlates with the diameter of the trachea. Note that brachycephalic breeds have narrower tracheas.



#### 7.5.7 Endotracheal tube size selection

- Use an ET tube size guide to select the appropriate tubes. Then measure the tube against the dog to ensure that it is the correct size. If necessary, select the next size larger or smaller.
  - The length of the tube should reach from the tip of the dog's nose to the thoracic inlet (level of the shoulder).
  - Measure the diameter of the tube against the width of the nasal septum. The width of the nasal septum of a dog correlates approximately with the diameter of the trachea (except in breeds with an abnormally small trachea).
- 7.5.8 Endotracheal tubes must be lubricated with a sterile, water-soluble lubricant prior to placement in the patient's airway.
- The lubricant must be free of dyes, perfumes and spermicidal chemicals. Non-spermicidal "personal" lubricants (e.g., K-Y Jelly) are a good choice.
  - Do not use oil-based lubricants (e.g., eye ointment or wound salve).
- 7.5.9 Topical laryngeal anesthesia prior to intubation must be done in cats (and is helpful in some dogs as well).
- Lidocaine is sprayed onto the back of the pharynx, onto the glottis. Wait 1-2 minutes, then intubate.
  - Lidocaine dose  
 Draw up 2% lidocaine solution in a 1-ml syringe. For cats < 2 kg, use 0.1-0.2 ml. For cats 3 or more kg, use 0.2-0.3 ml. Remove the needle and spray the lidocaine directly from the syringe.  
 Note that the commercially available lidocaine sprays deliver too much drug to use safely for most cats. Lidocaine concentration in most sprays is 4%, which must never be used. Pediatric sprays (0.5%) may be used only with extreme caution to ensure that delivered lidocaine does not exceed 3-4 mg (0.4-0.8 ml of pediatric spray).  
 The maximum safe dose of lidocaine is 3-4 mg/kg. Do not use more than one dose.
- Refer to [Appendix 5: Anesthetic and analgesic drugs](#).
- 7.5.10 The use of a laryngoscope greatly aids in the efficiency of intubation, particularly in cats and brachycephalic dogs.
- 7.5.11 Never force an endotracheal tube into the trachea. If it doesn't enter easily, then something is wrong. If patients frequently develop laryngospasm, post-operative cough, or the endotracheal tube has blood on it when it is removed, the intubation technique must be reviewed and re-learned. These are common problems caused by inappropriate intubation methods.
- 7.5.12 Placement of the endotracheal tube must be verified by the anesthetist prior to proceeding with anesthesia or surgery. Hold a few hairs or a glass slide before the tube opening to monitor movement or fogging with the patient's exhalation. Palpate the throat to ensure that only the trachea can be palpated: palpation of an additional firm tube indicates intubation of the esophagus.

- 7.5.13 Endotracheal tubes may remain un-cuffed if the tube is not used for delivery of anesthetic gas. This is particularly important in cats, as the feline trachea is so easily traumatized. If used for delivery of anesthetic gas, the cuff must be securely inflated to prevent escape of gas into the room. When inflating the cuff, be sure that it is not over-inflated.
- 7.5.14 Safety checks must be in place in the operating protocols to ensure that the cuff is deflated before the tube is removed. The trachea can sustain great damage if a tube is removed while cuffed.
- 7.5.15 An endotracheal tube should remain in place until the patient can control his or her airway (begin to swallow or cough). Patients must never be left alone while an endotracheal tube is in place.

## **7.6 Intravenous fluid support during anesthesia**

- 7.6.1 Patients who are in any way compromised or considered to be at higher risk than normal must receive intravenous fluids during surgery and until they are stabilized after recovery. This includes the following patients:
- Pregnant
  - Pyometra
  - Excessive blood loss
  - Surgery times longer than 20-30 minutes
  - Others with higher than normal risk
- 7.6.2 Fluid rates before and after surgery are 2-4 ml/kg/hour (maintenance rate). Dehydrated patients should be rehydrated and stabilized prior to surgery, except in the case of a life-threatening situation. During surgery, fluids are administered at 10 ml/kg/hour. It is particularly critical for EAS patients to ensure that fluids are calculated and delivered accurately ([Section 11.2: Pediatric physiology in anesthesia](#)). Administration of bolus subcutaneous fluids during the pre-surgical preparation period may be an appropriate alternative.
- 7.6.3 Appropriate fluid options for physiologically stable surgical patients include 0.9% NaCl (physiologic saline), lactated Ringer's solution, or Hartmann's solution.
- 7.6.4 If hypothermia is a risk, it is helpful to warm fluids to 37°C.

## **7.7 Eye lubrication**

- 7.7.1 The eyes must be lubricated with a sterile ophthalmic lubricant as soon as possible following induction and intubation. This is particularly important in animals anesthetized with ketamine and in all cats.
- 7.7.2 The lubricant should be a preparation of "artificial tears" ointment. These usually contain hydroxypropyl methylcellulose, lanolin, polyvinyl alcohol or carbomer. If antibiotic eye ointment is the only option available, it may be used, but is not optimal.
- 7.7.3 Avoid touching the tip of the tube onto the cornea. Rather, form a small pocket with the upper or lower eyelid by drawing it gently away from the eyeball. Instill the ointment into the conjunctival pocket, then close the eyelids and gently massage the ointment onto the eye with the eyelids closed.

## 7.8 Thermoregulation

- 7.8.1 Prevention of hypothermia or hyperthermia must begin as soon as the patient is admitted to the clinic, and continue until the patient is discharged.
- 7.8.2 Hypothermia is a common complication in anesthesia, even in warm climates, and has profound physiological consequences. Body temperature falls during anesthesia, and certain drugs such as xylazine disrupt thermoregulatory mechanisms. Even mild hypothermia may delay recovery from anesthesia and cause other, sometimes life-threatening, complications. Refer to [Appendix 11: Management of anesthetic complications, cardiopulmonary resuscitation](#). Refer to [Section 11: Early-Age Sterilization](#) for information on preventing and managing hypothermia and hypoglycemia in pediatric patients.
- 7.8.3 Body temperature must be monitored regularly with a rectal thermometer, from anesthetic induction through recovery from anesthesia. Note that anesthetized patients lose their shivering response to hypothermia, so shivering is not an accurate indication that the patient is feeling cold.
- 7.8.4 Avoid positioning patients in areas with draughts during cool ambient temperatures. In areas with very high ambient temperatures, fans may be needed to prevent hyperthermia during recovery.
- 7.8.5 Avoid excessive wetting of fur and excessive use of alcohol during preparation for surgery. Alcohol should be substituted with another skin disinfectant in pediatric patients and small-bodied animals.
- 7.8.6 Blankets and other methods to prevent heat loss may be necessary even at warm ambient temperatures, particularly for small and immature animals.
- 7.8.7 Supplemental heat sources may be provided in the form of electric heat pads, microwavable gel heat pads, warm water bottles, or socks filled with (uncooked) rice, barley, lentils, or beans and heated in the microwave. Electric heat pads must be checked frequently throughout use. Malfunctions will cause burning or even electric shock of the patient.
- 7.8.8 Care must be taken that the heat source is not so hot that it will scorch the skin. Heat sources should be approximately 38°C. Check the temperature as you would a baby's bottle: hold it against your inner wrist. It should feel pleasantly warm. If you feel the need to remove your hand within 60 seconds, then it is too hot. If it feels cooler than your skin, then it is too cold.
- 7.8.9 A towel or blanket must always be placed between the heat source and the animal's skin.
- 7.8.10 If the animal begins to shiver or rectal temperature falls below 37°C, supplemental heat must be provided to raise body temperature. Patients must be supervised until they are stabilized. If the body temperature fails to recover, it may be necessary to administer warm fluids intravenously. Refer to [Appendix 7: Vital parameters during anesthesia](#).
- 7.8.11 Patients who are provided supplemental heat sources prior to anesthesia and during recovery must have sufficient space to be able to move off the heat source at will.

## 7.9 Anesthetic equipment

- 7.9.1 All anesthetic and monitoring equipment must be checked daily prior to first use. Anesthetic machines must be checked for leaks to ensure the function of seals.
- 7.9.2 Equipment should be maintained per manufacturer's recommendations.
- 7.9.3 Waste gas and CO<sub>2</sub> absorbents must be changed regularly to maintain patient and personnel safety.
- 7.9.4 Waste gas scavenging systems must be used and ensured to function. Active and passive systems are acceptable.

## 8. Anesthesia

### 8.1 Anesthetic monitoring

- 8.1.1 It is imperative to monitor each patient from induction through full recovery to ensure physiologic homeostasis. The most common cause of anesthesia-associated cardiac arrest in dogs and cats is hypoventilation and subsequent hypoxemia. Monitoring to preempt complications is imperative.
- 8.1.2 Drug metabolism, avoidance of drug toxicity, tissue perfusion, and other essential physiologic processes depend on careful monitoring, prevention of problems, and prompt attention to aberrations.
- 8.1.3 Minimum hands-on (not by machine) monitoring parameters must include:
  - 1) heart rate & rhythm
  - 2) perfusion (capillary refill time; if possible, blood pressure)
  - 3) peripheral pulse: quality, rate, rhythm
  - 4) respiratory rate, rhythm, quality
  - 5) plane of anesthesia ([Appendix 8: Guide for monitoring depth of anesthesia](#))
  - 6) analgesia
  - 7) rectal temperature
- 8.1.4 Parameters 1-6 must be monitored at least every 5 minutes from induction through recovery.
- 8.1.5 Rectal temperature must be measured every 5 minutes in pediatric patients (cf. [Section 11: Early-Age Sterilization](#)), every 10-15 minutes in euthermic, healthy adults, and every 5 minutes in adults whose body temperature is abnormal or unstable.
- 8.1.6 A stethoscope must be used for the anesthetic monitoring of patients. Pulse oximeters, capnographs, blood pressure cuffs, and other instruments are useful as supporting tools but must never be used in place of a trained person actively monitoring the patient. Do not rely on the beep of a machine as the sole method of monitoring.
- 8.1.7 The anesthetist must be familiar with the drugs and the effects that they are likely to produce. See [Appendix 5: Anesthetic and analgesic drugs](#).
- 8.1.8 The patient must be in a surgical plane of anesthesia throughout the surgical procedure. See [Appendix 8: Guide for monitoring depth of anesthesia](#).
- 8.1.9 Animals must never be left unobserved while intubated.

8.1.10 Refer to [Appendix 7: Vital parameters during anesthesia](#) and [Appendix 8: Guide for monitoring depth of anesthesia](#) for additional details.

## 8.2 Induction of anesthesia

### 8.2.1 Total intramuscular anesthesia

- Ideally, anesthetic induction is achieved with a single intramuscular injection to achieve sedation, anxiolysis, analgesia, and anesthesia.
- Combining drugs into a single injection where possible reduces pain, handling, and stress to the patient.
- Appropriate combinations in appropriate doses can achieve multimodal analgesia and balanced anesthesia in a single injection.

8.2.2 The patient must be monitored carefully during induction to ensure timely intervention in case of emergency. In addition to risk of respiratory arrest and other problems, patients may become malpositioned during this anesthetic transition and risk obstruction of airways, or may risk self-injury in struggling to restore motor control.

8.2.3 During induction and recovery from anesthesia, it is imperative to minimize stimulation of the patient.

- Light, noise, and movement must be minimized around recovering patients. Patients must not be handled abruptly or exposed to avoidable odors.
- In Plane 2 of anesthesia during induction and recovery ([Appendix 8: Guide for monitoring depth of anesthesia](#)), animals may be hyper-excitabile but do not have normal motor control. Moreover, the gag reflex may not be fully functional. Reaction to stimuli during this transition puts the patient in danger of injuring him or herself or someone else, and of compromising his or her respiration.
- Any stimulation during induction will reduce the effectiveness of anesthetic drugs and the quality of anesthesia. The more quiet and relaxed the animal is before and during induction, the less anesthetic needs to be used. This saves costs to the project and risk to the patient.

8.2.4 Masking or chamber induction is rarely justified. Induction should be done by injectable anesthesia. Masking and induction causes undue stress to the patient, and places personnel at risk of escaped gases.

## 8.3 Recovery from anesthesia

8.3.1 Anesthesia-related deaths occur most commonly in the first 3 hours following surgery, during the period of recovery from anesthesia. In addition to risk of respiratory arrest and other problems, patients may become malpositioned during this anesthetic transition and risk obstruction of airways, or may risk self-injury in struggling to restore motor control. Close monitoring of patients during recovery by trained, vigilant personnel is imperative.

8.3.2 Patients must be monitored continuously, or checked at least every 5 minutes throughout the period of anesthetic recovery.

- Heart rate and pulse quality
- Mucous membrane color

- Respiratory rate, rhythm, and depth
  - Airway patency
  - Signs of pain or anxiety
  - Body temperature
  - Bleeding
  - Ability to coordinate movement and to ambulate
  - Mentation and responsiveness to environment
- 8.3.3 As with induction, the recovery environment should be as unstimulating as possible: minimal noise, reduced light, away from excessive activity.
- 8.3.4 Patients must be positioned to prevent restriction of airways and to prevent injury to self and others.
- 8.3.5 Littermates of puppies or kittens may recover together to reduce anxiety and share warmth. However, these animals tend to pile on top of each other, and vigilance is required to ensure that no one becomes trapped or positioned in a way that compromises respiration.
- 8.3.6 Patients must be on a dry, warm, level surface on which they cannot injure themselves as they struggle to regain cognitive and motor control. In the transition through Plane 2 of anesthesia as patients wake up, hyperexcitable responses to even minor stimuli can place the patient and others in danger. Ideally, they recover in a cage, or in a designated recovery area on the floor, where they cannot fall off.
- 8.3.7 Intractable individuals should be returned to the traps or carriers from which they will be released before they become conscious. This is necessary to reduce risk of injury to staff, and to prevent escape. Cages should be covered to reduce stimulation and anxiety. Cages containing cats should be elevated off of the floor to improve the patient's feeling of security.
- 8.3.8 There should be some type of bedding between the patient and the surface on which he or she is lying. Even a layer of thick cardboard is acceptable if there is no other resource.
- 8.3.9 Even in warm ambient temperatures, patients may require warm bedding or supplemental heat during recovery. This is particularly important for puppies and kittens, and small-bodied animals. Lower than normal body temperature during anesthetic recovery delays recovery time and may result in complications. Refer to [Section 7.8: Thermoregulation](#) and [Section 11.3: Anesthesia for early-age sterilization: general principles](#).
- 8.3.10 Patients must never be left unattended while an endotracheal tube is in place.
- 8.3.11 Removal of the endotracheal tube
- Uncuff the endotracheal tube before removal. Checking the cuff must be an automatic part of handling endotracheal tubes.
  - Dogs: Remove the endotracheal tube when the patient begins to swallow or cough. Other signs that the patient is ready to be extubated include voluntary movement of the limbs or head.



- Cats often begin to move the head, limbs, or tail before they begin to swallow or cough. Remove the endotracheal tube at the first of these signs. Delaying removal of the tube may result in laryngospasm.

8.3.12 Patients must be given the opportunity to toilet on recovery.

- Expressing the bladder before or during surgery helps to prevent patient discomfort from a full bladder immediately on recovery.
- Dogs should be walked outside when feasible.
- Cats must be given absorbent litter.
- Cages or traps containing intractable animals should be placed on an elevated surface so that urine and feces can drain through the cage floor, or lined with plenty of absorbent material that can be safely changed when soiled.
- Soiled bedding must be replaced with clean, dry bedding immediately, providing that it is safe to do so.

8.3.13 Cat litter, food, bowls of water, and all other objects must be placed in the patient's cage only once the patient is sternal, conscious, and fully in control of the head.

8.3.14 Food and water following recovery from anesthesia:

- Offer water as soon as there is no risk that the animal will lose muscle control and accidentally drown in the water bowl. This is usually appropriate once s/he is sitting up steadily or standing.
- Young animals (less than 16 weeks old) should receive water and a small amount of food as soon as possible to avoid hypoglycemia. Food should be soft (e.g., tinned food), easy to consume, and easily digestible.
- Pediatric patients may require encouragement with oral glucose if they appear weak and unwilling to eat right away. Concentrated glucose (dextrose), corn syrup or honey may be applied to the gums to bring up blood sugar levels. Refer to [Section 11.2: Pediatric physiology in anesthesia](#).

8.3.15 A veterinarian competent to address emergencies must remain on site at least until all patients are extubated, sternal, and responsive.

## 8.4 Anesthetic drug protocols

8.4.1 General anesthesia is defined as a loss of consciousness combined with a loss of sensation. This includes hypnosis, loss of reflexes, analgesia, and immobility with muscle relaxation.

8.4.2 There are a variety of suitable anesthetic protocols for use in field and clinic sterilization surgeries. Selection of protocols depends on the number and types of patients, skill and efficiency of the surgeon and other technical staff, and local availability of anesthetic drugs. Options and considerations may be found in [Appendix 5: Anesthetic and analgesic drugs](#).

8.4.3 Regardless of the protocol selected, it must achieve the following criteria:

- 1) Produce a surgical plane of anesthesia for a duration long enough for the surgery. A surgical plane of anesthesia ensures:



- adequate analgesia throughout the entire procedure, including the most painful periods
  - muscle relaxation
  - loss of reflexes
  - no voluntary movement or vocalization
  - safe, controlled, and, ideally, reversible depression of the central nervous system to cause unconsciousness
  - retention of homeostatic cardiovascular and respiratory function
- 2) Present as little risk as possible for causing cardiovascular, respiratory, or neurologic crises
  - 3) Allow the use of as little drug as possible while meeting the conditions above.
- 8.4.4 For anesthetic protocols for early-age sterilization, refer to [Section 11: Early-Age Sterilization](#)
- 8.4.5 Analgesic drugs are required for all patients undergoing surgical sterilization. They must be administered prior to the initial surgical incision.
- 8.4.6 Multimodal analgesia is achieved with the use of agents that work through different pharmacological modes of action. With multimodal analgesia, agents may work synergistically to control pain, and thereby require less drug to achieve effective analgesia. Refer to [Appendix 5: Anesthetic and analgesic drugs](#).
- 8.4.7 Drug dosing must be based on the body weight of each individual animal.
- The patient must be weighed on the day of anesthesia, prior to injection of any drugs. If the patient is not tractable, it is acceptable to administer a tranquilizer based on estimated weight. The patient must be weighed as soon as possible, and all subsequent drugs must be based on measured body weight.
  - For very small and very large patients, it is recommended that drug calculations be based on body surface area rather than weight (see conversion chart in [Appendix 5: Anesthetic and analgesic drugs](#)). Dosing charts are less accurate on either end of the body weight spectrum.
  - Drug dose charts should be written in ml of drug to administer in order to minimize risk of confusion. If different concentrations of drugs are available (e.g., ketamine at 50 and 100 mg/ml), cross-checking precautions must be taken to ensure that doses are accurate.
- 8.4.8 Masking for maintenance anesthesia may be needed occasionally, particularly if patients are not a good risk for intubation. However, if masking is frequently necessary, the injectable anesthetic protocol should be revised to allow appropriate durations of surgical anesthesia.
- 8.4.9 When using gas anesthesia, the vaporizer must be specific for the drug, and all equipment must be installed, calibrated, and maintained according to manufacturer specifications.
- 8.4.10 When using gas anesthesia, the room must have adequate ventilation. A scavenging system or waste-gas escape system must be in place to protect the patient and personnel.

- 8.4.11 Do not anesthetize animals until the surgeon can be ready for them as soon as they have been induced and are prepared for surgery. It is unacceptable to prematurely induce patients before a surgeon can be ready, and thereby cause longer than necessary anesthesia times.

## 8.5 Post-operative analgesia

- 8.5.1 Post-operative analgesia must be provided to all animals subjected to sterilization surgery, and should extend to at least 24 hours after surgery.
- 8.5.2 Post-operative analgesic drug options, doses, and considerations for specific drugs may be found in [Appendix 5: Anesthetic and analgesic drugs](#). This is usually a non-steroidal anti-inflammatory (NSAID). Note that these should be given before the patient wakes up. An analgesic given at the beginning of surgery (before the pain begins) is more effective in controlling post-operative pain than when given after surgery.
- 8.5.3 The need for further analgesic medication should be evaluated on a case-by-case basis. Common indications for the need for further analgesia include inflammation, infection or other complications with the surgical wound, or as adjunct management of the patient licking, scratching, or otherwise traumatizing the wound.
- 8.5.4 Note that licking and chewing at the incision is usually an indication of inadequate post-operative analgesia.

A common misunderstanding is the idea that animals chew at their sutures for fun or out of naughtiness, and then suffer pain from the ensuing wound. To the contrary: it is pain and discomfort that initiates the licking and chewing behavior.
- 8.5.5 Analgesic medication is never a substitute for effective intraoperative analgesia, and for minimally traumatic surgical technique. Effective analgesia must be achieved with a combination of 1) good pre-operative protocols (including analgesia, shaving technique, and patient preparation), 2) good surgical technique, and 3) sufficient post-operative analgesia. None is a substitute for another.
- 8.5.6 Poor shaving technique in preparation of the patient for surgery is a very common cause of pain and discomfort. Careful preparation of the surgical site and avoidance of nicks and scrapes to the skin are imperative. Even microscopic nicks result in discomfort and can be a source of infection and induce chewing and licking.
- 8.5.7 Refer to [Appendix 6: Assessing the need for post-operative analgesia](#) for detailed guidelines.
- 8.5.8 Post-operative care arrangements must include access by the guardian to a veterinarian who can assess the need for analgesia, and who can prescribe and dispense appropriate analgesic medications.
- 8.5.9 Never use corticosteroids to control post-surgical pain or inflammation.
- 8.5.10 If patients frequently exhibit signs of post-operative pain and require more than 24 hours of analgesic medication, the analgesic protocols must be re-evaluated, as must the patient preparation and surgical techniques.

## 9. Surgery

### 9.1 Surgical environment

- 9.1.1 Field spay/neuter surgeries are often done in makeshift surgery areas. Depending on climate and ambient temperatures, the “surgical theater” may be a large indoor room in a community building, for example, or a reasonably sheltered outdoor area, e.g., a temple courtyard or large tent.
- 9.1.2 Outdoor or open-air surgical areas must have reasonable protection from elements, reasonable protection from wind and raised dust, and ambient temperature that does not compromise the survival of animals who are under the stress of anesthesia and surgery. Ideally, this area has some kind of a roof, whether from a tent or other structure.
- 9.1.3 The area where surgery is performed must be well ventilated. Ideally, it will be possible to regulate ambient temperature to prevent extremes.
- 9.1.4 The use of air conditioning must be balanced against the risk of blowing dust, fungal spores, and other air-borne pollutants in the surgical theatre.
- 9.1.5 Surgical areas must be kept clean at all times, and a cleaning protocol should be written and enforced. Elements of a surgical cleaning protocol include the following.
- Keep as few objects as possible in the surgical theater. Every surface is an opportunity for contamination. Ideally, there will be only the necessary surgery tables, lamps, IV stands, and instrument carts. If supplies must be stored in this room, they must be kept in cupboards or in plastic bins that are easily wiped down.
  - At the beginning and end of the surgery day, all surfaces in the surgery room must be washed with disinfectant solution (tables, counters, walls, cupboard doors, table legs, floors, windows, equipment, lamps, etc.).
  - If there are air conditioners in the room, these must be professionally cleaned and vacuumed at least once per month; ideally once per week. Air conditioners are ideal breeding grounds for bacterial and fungal microorganisms.
  - The rubbish bin must be emptied at the end of each day, or more often as it fills.
  - The rubbish bin must be washed at the end of each day and disinfected.
  - The cleaning equipment, e.g., bucket, mop, cloths, must be used only in the surgery room. These items must not be used in any other area.
  - Disinfectants that are appropriate for use in the surgery on inanimate objects are listed in [Appendix 15: Disinfectants](#).
  - Between surgical patients, the operating table, surgical instrument tray, and immediate surrounding surfaces (including floor) must be washed of all organic material (blood, urine, feces, fur, saliva, tissue). The table and instrument tray must be wiped with disinfectant before use for the next patient.
- 9.1.6 Ideally, the patient is prepared for surgery in a room that is separate from the surgical suite, or at least on a table that is not the surgery table.

- 9.1.7 Traffic through the surgical area should be kept to a minimum and should include only personnel who are immediately involved in the surgery or in preparation of the animals for surgery.

## 9.2 Preparation of the patient for surgery

- 9.2.1 All efforts must be made to avoid anesthetized patients having to wait for the surgeon. Prolonged durations of anesthesia due to poorly-timed inductions are not acceptable.

- 9.2.2 The urinary bladder should be voided before the patient is prepared for surgery.

- Dogs should be taken outdoors for the opportunity to void bladder and bowels prior to induction of anesthesia, when feasible.
- If the bladder is found to be full once the anesthesia has been induced, an effort may be made gently to express it manually. This must never be forced and the effort must be abandoned if gentle pressure doesn't result in voiding of urine.
- If the bladder is so distended as to interfere with surgery, it may be expressed gently by the surgeon once the abdomen has been opened.

- 9.2.3 Fur must be removed cleanly down to the skin in the area where the incision will be made. For scrotal castrations in dogs, the fur should remain a short stubble (1-2 mm long), in order that the delicate scrotal skin does not become abraded by shaving.

- 9.2.4 Fur may be removed with electric clippers (#40 blade) or with a disposable razor.

- 9.2.5 Chemical depilatory agents must never be used.

- 9.2.6 Great care must be taken to avoid traumatizing the skin during clipping, as this trauma may encourage the animal to lick or chew excessively after surgery. Rough skin preparation is a common reason for which animals bother their surgical incisions. Even very small clipper wounds or scratches will become uncomfortable or painful and cause the animal to lick.

- 9.2.7 The clipped area must be long and wide enough to ensure that there is no possibility of fur extending into the surgical window of the draped area. In long-haired animals, the fur surrounding the shaved area may need to be trimmed.

- On females undergoing midline ovariohysterectomy, the shaved area should extend from cranial to the umbilicus, caudal to the pubis, and lateral to the teats.
- On female cats undergoing a lateral ovariohysterectomy (flank spay), a square of fur at least 5-6cm long and wide should be shaved from over the ilium and greater trochanter, extending cranially and ventrally.
- On male dogs, the clip should extend from mid-way on the prepuce to the perineum.
- The fur of male cats is removed from the scrotum and the immediately-surrounding perineum. Fur may be plucked or clipped. Plucking often does less damage to the skin, and results in less post-operative licking.

- 9.2.8 All clipped fur must be completely removed from the patient, from on and around the patient, and from the clothing of personnel who will subsequently enter the surgical suite. This may be done with a small, hand-held vacuum cleaner or sticky-tape.

- 9.2.9 The shaved skin must be cleaned with clean cotton wool or gauze swabs and 2-4% chlorhexidine or dishwashing liquid soap (for sensitive skin) until the skin is clean. Avoid scrubbing the skin, as this causes micro-abrasions which later cause post-operative complications.
- 9.2.10 Once the skin is cleaned, the surgical area is disinfected. A standard “outward” skin preparation technique must be used, beginning at the center of the shaved area (where the incision will be made) in a circular fashion outward to the edges of the shaved margin. Do not go back in the other direction.
- Clean gauze or cotton wool is used for application of disinfectant. Cotton wool is preferable to gauze swabs, as it is less abrasive.
  - Disinfectant may be chlorhexidine 2-4%, or alternating swabs of povidone iodine and 70% isopropyl alcohol, or other disinfectants appropriate for skin preparation (cf. [Appendix 15: Disinfectants](#))
  - Alcohol should be avoided on pediatric patients, as it causes rapid loss of body heat.
  - The pre-surgical skin disinfection must be done for a minimum of 8 successive repetitions.
  - Be as gentle as possible. Micro-abrasions of the skin caused by cleaning will result in the animal licking and scratching at the surgical site after surgery, just as rough clipping will.
- 9.2.11 Once the skin is prepared (clipped, cleaned, and disinfected) for surgery, care must be taken that the surgical site is not touched or otherwise contaminated. A clean gauze swab soaked in skin disinfectant should be placed over the disinfected area until the surgeon is ready for the patient. If the delay is longer than 20 minutes, or if anything touches the prepared skin, the skin must be disinfected again.
- 9.2.12 Avoid wetting the animal’s skin or fur excessively, as this contributes to hypothermia.
- 9.2.13 On the surgical table, patients may be placed in a V-tray or other equipment to maintain a position in dorsal recumbency. Where supplemental heat is needed, a warm-water bottle or warmed bags of grain on either side of the patient serves both purposes.
- 9.2.14 The head and neck must be positioned to ensure a patent airway.
- 9.2.15 A blanket, towel, pad, or other insulating material should be placed between the patient and the table to help maintain body temperature.
- 9.2.16 The limbs may be secured to assist in positioning the patient, although with the use of positioning aids (above), this may not be necessary.
- Care must be taken that the ties do not compromise circulation of the distal limbs.
  - Care must be taken that the limbs are not hyperextended. This will compromise respiration by limiting chest excursion, and stress joints. It can also result in increased tension on the suspensory ligaments of the ovary, making surgery difficult and increasing post-operative pain.

### 9.3 Preparation of the surgeon for surgery

- 9.3.1 Clean surgical scrubs or a sterile surgical gown must be worn throughout surgery. Plastic aprons, cleaned or changed between patients, may be used as well. There must not be any fur or other debris on the outer clothing.
- 9.3.2 The surgeon and surgical assistants must wear a surgical cap. This is optional during routine castration of male cats.
- 9.3.3 The surgeon and surgical assistants must wear a surgical mask during surgery. This is optional during routine castration of male cats.
- 9.3.4 A new pair of sterile surgical gloves must be worn for each patient ([Section 9.4: Surgical gloves and drapes](#))
- 9.3.5 Surgeons and technical staff should avoid excessive leaving and entering the surgical suite.
- 9.3.6 Hand disinfection for surgeons and surgical assistants prior to gloving

Option 1: Standard scrub of hands and forearms with soft brush and disinfectant ([Appendix 15: Disinfectants](#)) for 5 minutes. Rinse with clean water (preferably drinking-quality).

Scrub brushes for preparation of the surgeons' hands must be clean and completely immersed in a clean container of an appropriate disinfectant ([Appendix 15: Disinfectants](#)). Brushes should be of a soft material, as stiff brushes abrade the surgeon's skin and result in high bacterial counts. Ideally, a fresh, sterile brush is used for each scrub, but this may be unrealistic in field conditions.

Option 2: Alcohol-based disinfectant hand rubs may be used as an alternative to scrubbing.

Hands must be washed with soap and water and the nails cleaned. An alcohol-based disinfectant gel may then be applied. Application of the hand rub must strictly follow the manufacturer's instructions.

- 9.3.7 Hand disinfection between sequential surgeries
  - If the surgeon performs an uninterrupted series of surgeries, without handling animals between surgeries, the used surgical gloves are removed, alcohol-based disinfectant hand rub is applied, and the next pair of sterile surgical gloves is put on.
  - If the surgeon handles any objects, food, or animals between surgeries, or if the hands have become contaminated by body fluids, the hands are prepared as for the first surgery of the day.
- 9.3.8 Hands may be air-dried or dried with a sterile towel. Do not dry them with non-sterile material. Once the surgeon's hands are disinfected for surgery, they must be kept in front of the body and must not touch a non-sterile surface. If there is any breach of sterility, the hands must be disinfected again.

### 9.4 Surgical gloves and drapes

- 9.4.1 New, sterile, correctly-sized, disposable surgical gloves that are within the factory-specified expiration date must be worn for each surgical patient.

- 9.4.2 Gloves that have been stored in extreme temperatures may be friable and not appropriate to use even if they are still within the expiration date.
- 9.4.3 Fresh, dry, sterile drapes (disposable or autoclaved) must be used for each patient, other than male cats undergoing routine scrotal orchiectomy (castration).
- 9.4.4 Sterile drapes must be handled only by the surgeon after he or she has scrubbed hands and put on sterile gloves. The patient's skin must be cleaned and disinfected as outlined above before the surgical drape is placed.
- 9.4.5 The draped surgical field must be large enough to ensure adequate sterile space for the surgeon to work comfortably without risk of breaking sterility.
- 9.4.6 The fenestration in the drape must allow visualization of the entire length of the incision site, but no more. Fur from the shaved margin must not be visible inside the fenestration.
- 9.4.7 All reasonable precautions must be taken to prevent the drapes from getting wet before or during surgery.

## 9.5 Surgical instruments

- 9.5.1 Sterile instruments that have not been used on another patient must be used for each patient. This may be in the form of a sterile instrument pack opened for each patient, or a set of instruments selected from a tray of instruments that have been sterilized in batches. Instruments that have been used for a patient or that are no longer sterile for any reason must never be used for another patient before proper cleaning and re-sterilization.
- 9.5.2 Instruments used for surgery should be sterilized by autoclave. Some projects use chemically-sterilized instruments. All efforts must be made to advance to the use of autoclaved instruments as a priority in the project's development. Chemical sterilization may be used in the interim, provided that the method has been tested in a controlled clinical setting with good patient follow-up, and that there are no post-operative complications that can be ascribed to failure of sterile technique or to adhesions caused by the chemicals. (cf. [Appendix 15: Disinfectants](#))
- 9.5.3 A complete set of sterile surgical instruments that are in good working condition must be available for each surgery (cf. [Appendix 2: Basic instrument pack for spay and neuter](#)).
- 9.5.4 Instruments must be kept in good condition by ensuring that they are used and cleaned properly. They should be replaced when they cannot be used effectively and safely.
- 9.5.5 After use in surgery, all surgical instruments must be cleaned under cold water with dish soap or instrument cleaning solution to remove all visible organic matter. Particular attention should be paid to the serrated sections and hinges of the instruments to ensure that all organic matter has been removed. A toothbrush works well for this purpose.
- 9.5.6 Instruments are dried and, ideally, sprayed with a surgical instrument lubricant to extend the longevity of moving parts. Instrument packs are assembled in clean cloths, per [Appendix 2: Basic instrument pack for spay and neuter](#).
- 9.5.7 Autoclave indicator tape or a stop tube must be used to ascertain sterilization.

- 9.5.8 The pack must be labeled with the date on which it was autoclaved. Autoclaved surgical packs must be used within 2 weeks of the autoclave date, provided that their shelf-life is that long, and sterility has not been breached. Instruments or packs wrapped in plastic autoclave sleeves may be stored longer, per recommendations of the manufacturer of the plastic sleeves.
- 9.5.9 Autoclaved instrument packs must be stored in a cupboard or closed container in which they are dry and protected from dust and other contaminants.
- 9.5.10 If there is any question that the packs may have become contaminated or remained moist inside, they must be re-sterilized prior to use in surgery.
- 9.5.11 Autoclave machines should be maintained and serviced regularly, to ensure that they are in good working order.
- 9.5.12 Any surgical instrument, swab, blade, suture material, or other sterile object that is contaminated during surgery must be discarded and not used again unless it can be effectively sterilized. It is not acceptable simply to rinse the item with alcohol or disinfectant and re-use it.
- 9.5.13 A fresh, sterile blade must be used for each surgical patient.

## **9.6 Technique for surgical sterilization of dogs and cats**

- 9.6.1 Surgery should be performed in accordance with surgical techniques described in the most recent edition of *Small Animal Surgery* by T.W. Fossum et al. (Mosby). If there is any concern that surgical techniques do not meet acceptable standards, advice should be sought from the IFAW senior veterinary advisor or the CA Project Manager.
- 9.6.2 Each surgeon must be assisted by a person with good animal handling skills and capable of basic veterinary nursing skills to reliably perform such tasks as monitoring anesthesia, drawing up and injecting drugs, maintaining sterility, monitoring patient recovery, and assisting with surgery if necessary.
- 9.6.3 All surgeries must be performed by a veterinarian who has been adequately trained for the procedure and who is licensed to practice in the country, or by a veterinary student who is working under the direct and legal supervision of an IFAW-qualified veterinarian.
- 9.6.4 All surgical procedures must be performed with strict attention to asepsis. Any break in sterility during the procedure must result in immediate measures to rectify asepsis. Subsequent measures must be taken to limit the risk of post-surgical infection or other complications.
- 9.6.5 Strict attention must be given to careful and gentle tissue handling. Surgeons should perform minimally invasive, properly-located incisions that minimize surgical trauma. Surgeons mustn't trim away or undermine tissues unless it is necessary for standard approaches to the surgical procedure per Fossum et al. This is imperative for the minimization of surgical and post-surgical complications.
- 9.6.6 Strict attention must be given to hemostasis and minimization of blood loss. This is particularly important in areas in which many dogs carry subclinical infections of *Ehrlichia* or *Babesia*.
- 9.6.7 Sterilization of female dogs and cats



- Female dogs and cats must receive complete ovariohysterectomy, with removal of both ovaries, both uterine horns, and as much as possible of the uterine body.
- Care must be taken to ensure that ovaries are completely removed, with the capsule intact. If the capsule is broken, an ovarian remnant must be sought before the surgeon closes the abdominal cavity.
- Female cats (but not dogs) may have the ovarian pedicle ligated with a pedicle tie rather than with sutures.
- Ligatures for ovarian pedicles and the uterine body are ideally tied in a modified Miller's knot for optimal security.

#### 9.6.8 Midline vs. flank approach for ovariohysterectomy

- Ovariohysterectomy for bitches should be via a midline approach. A flank approach may be used for small, non-pregnant bitches at the discretion of the surgeon. Some surgeons have found reliable outcomes with a flank approach even in larger dogs<sup>1</sup> but it must be noted that surgical experience is essential to this technique.
- Queens may be spayed via a midline or flank approach.
- All pregnant cats and dogs, or individuals with reproductive abnormalities (e.g., pyometra) must be spayed via a midline approach.

9.6.9 Pregnant uteri should remain clamped at both ends to retain a hypoxic environment. To the best of current scientific knowledge, fetuses are believed to remain unconscious before they die so long as the uterus remains closed and hypoxic. If the uterus and amniotic sac are opened, the fetuses must be individually and humanely euthanized.

#### 9.6.10 Castration of male dogs and cats with both testicles descended

- Both testes must be removed.
- In male cats, bilateral orchiectomy should be done via a scrotal approach.
- Dogs may be castrated by a scrotal or pre-scrotal approach. A scrotal approach is advised for EAS ([Section 11.6: Special surgical considerations for early-age sterilization](#)).
- In a pre-scrotal approach, the wound must be closed, while in a scrotal approach, it is left open to drain in both dogs and cats.
- Communication with guardians is essential when using a scrotal approach, to prepare them for drainage from the wound.

#### 9.6.11 Cryptorchid testes must be removed in all cats and dogs.

- The position of the retained testicle may be anywhere from inguinal, just cranial to the scrotum (where it is palpable beneath the subcutaneous tissue in the groin), to just caudal to the kidney.
- The undescended testicle should be removed first. If the cryptorchid testicle cannot be found, the descended testicle should not be removed.

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<sup>1</sup> Reese et al. 2012 *Veterinary Record* 171:248-252.

- Abdominal testicles are usually located through a paramedian incision, lateral to the prepuce, and by following the vas deferens with the aid of a spay hook.
- Surgical preparation of the abdomen for removal of cryptorchid testicles must be done as for females.

## 9.7 Sutures

### 9.7.1 Suture material

- Suture material must be sterile, of biomedical grade, approved for medical use, and dated for current use. Suture material must be of adequate tensile strength to ensure complete knot security and hemostasis.
- Sutures that are left in the body (e.g., for ovarian pedicles, uterine stump, blood vessels, spermatic cords, muscle or under the skin) must be absorbable material or inert, non-absorbable material, such as stainless steel, nylon, or polypropylene.
- Some practitioners have found the use of chromic surgical gut (“catgut”) suitable, but this must be used only with the recognition that catgut has a relatively rapid break-down time. Animals whose abdominal wall has been closed with catgut should be monitored with particular attention until they can be sure to have healed (7-10 days).
- Suture remnants from an opened pack must not be shared with another patient, and must not be re-sterilized and used in other patients. The only exception to this is stainless steel suture, which must be cleaned and autoclaved prior to use in the next patient, just like surgical instruments.
- Reusable needles must be cleaned and sterilized before use in the next patient, just like surgical instruments.

### 9.7.2 Closure of the abdominal wall

- The abdomen of dogs must be closed in 3 layers (body wall at the linea alba with inclusion of the rectus fascia, subcutaneous layer, and skin sutures (intra-dermal or skin)).
- Cats: midline incisions may be closed in 2 layers (body wall at the linea alba, and skin) if there is little subcutaneous tissue. If there is more subcutaneous tissue, or if skin was undermined, it should be closed in 3 layers as for dogs. Flank incisions are closed in 4 layers (each oblique abdominal muscle layer, the transverse abdominal muscle, and skin).
- The abdominal wall should be closed with a simple interrupted or cruciate suture patterns. A continuous suture pattern is not recommended due to the risk of dehiscence.
- In bitches or queens for whom adequate post-operative observation of the surgical site is questionable, a simple interrupted suture pattern (or cruciate pattern for flank approaches) must be used to close the abdominal wall in order to minimize danger of wound dehiscence.

### 9.7.3 Skin sutures

- The skin may be closed with an intradermal (subcuticular) suture pattern or with skin sutures. Absorbable sutures are ideally placed intradermally.
- Skin adhesive may be applied to the outer surface of a well-opposed surgical skin wound. Surgical glue must not be used within the wound, as it may contribute to granuloma formation.
- Non-absorbable skin sutures must be removed from dogs and cats once the wound has healed and appears normal (usually 10-14 days post-surgery). Such sutures must not be used for animals who are unlikely to be returned for suture removal, or for animals who are difficult to restrain safely.

## 9.8 Identification of sterilized animals

9.8.1 Dogs and cats should be permanently marked as sterilized, so that they are not unnecessarily caught and subjected to surgery again. This is required for animals who roam free and for those who do not have an owner. Communication with guardians is important so that they understand the necessity for the identifying mark.

### 9.8.2 Tattoos

- A partial-thickness skin incision is made in the shape of an X (or other simple symbol) just next to the spay incision and impregnated with tattoo ink. In male dogs, the scored tattoo is placed lateral to the prepuce. In females who were spayed via flank approach, the mark is made where a midline spay incision would have been made.
- Tattoos may be placed inside the ear pinna.
- Tattoos must be made while the patient is still under anesthesia.

### 9.8.3 Ear notching of dogs

- This method has the advantage that it might be visible from a distance without having to restrain the dog. However, in dogs with long fur on their ears, an ear notch may be hard to see. Street dogs may have suffered altercations that tore the pinnae, which then makes it difficult to discern whether the notch is from old trauma or a mark of having been sterilized.
- Ear notching must be done aseptically under general anesthesia at the time of sterilization.
- A 1.5 cm deep x 1 cm wide “V” shaped notch along the distal half of the cranial margin of the left pinna is removed. The size of the notch to be removed should be adjusted according to the size of the ear. Two hemostats (artery forceps) can be placed in a V-shape before the notch is cut with scissors.
- Hemostasis may be achieved by leaving hemostats in place for a few minutes, or by surgical cautery.
- The procedure should be done as soon as possible after induction in order to allow adequate time for hemostasis without having to extend anesthesia.

### 9.8.4 Ear tipping of cats

- This is a widely-used method of marking sterilized male and female community (feral) cats. It allows visualization of sterilized individuals without having to catch and examine them.
- This procedure should be done aseptically during general anesthesia at the time of sterilization for male and female cats.
- A hemostat (artery forceps) is clamped across the distal one-third of the left ear pinna, and the ear tip is removed by cutting straight across with scissors or a blade.
- Hemostasis may be achieved by leaving hemostats in place for a few minutes, or by surgical cautery.
- The procedure should be done as soon as possible after induction in order to allow adequate time for hemostasis without having to extend anesthesia.

## 10. Patient discharge and post-surgical care

- 10.1 Bandaging of the spay or neuter site is usually not necessary if the surgery was done properly. If desired, a bandage may be placed over the surgical site if the cleanliness of the bandage can be ensured. Bandages must be changed at least every 12 hours, or more frequently if they become soiled. If bandages cannot be changed when they are soiled, it is better to not use any.
- 10.2 Elizabethan collars may be necessary for some owned animals to protect the surgical wounds. The aftercare of these animals should be carefully monitored, and their guardians shown how to remove and replace the collar as necessary. Owners must be instructed to ensure that the animal can eat, drink, and rest adequately. Use of E-collars should not be necessary often. If a high proportion of animals require a collar post-surgically, then pre-surgical procedures, surgical technique, and analgesia must be reviewed and improved.
- 10.3 Patient discharge
  - 10.3.1 Prior to discharge, patients must be checked by a veterinarian or trained member of the veterinary team.
    - Ensure that the skin edges of the wound are clean, dry and well apposed.
    - Check that vital signs are normal and stable.
    - Evaluate pain and discomfort – see checklist and [Appendix 6: Assessing the need for post-operative analgesia](#).
  - 10.3.2 Patients must be sternal, conscious, alert, and responsive before they are discharged. Dogs must be ambulatory.
- 10.4 Discharge information for the guardian must be provided verbally and in written and/or illustrated form. Allowance must be made for challenged in literacy in some areas, and that an illustrated format may be more appropriate. The discharge information must include:
  - Summary of the procedure performed
  - Description of normal recovery behavior
  - Signs of discomfort and pain
  - Signs that indicate the need for veterinary assistance
  - Name and contact information of the veterinarian to contact with questions or concerns

- Instructions for monitoring and cleaning the surgical area
- Instructions for administration of any medication
- Instructions for feeding and water
- Instructions for exercise restriction
- Recommendations for ongoing veterinary care (e.g., preventive health care)

#### Checklist: signs that the patient may need additional analgesic medication

- Change in behavior compared with pre-surgery. More quiet, withdrawn, fearful, aggressive
- Reluctant to move
- Holds body hunched up, abdomen tense
- Cries when touched or when moving
- Yawning or licking lips frequently
- Refusal to eat
- Incision site swollen, red, or has discharge
- Snaps, winces or cries when area around incision is touched
- Licking or chewing at or around incision

### 10.5 Post-operative antimicrobials

10.5.1 Many veterinarians for field sterilization projects are in the habit of administering one-time injections of an antibiotic (usually a penicillin) at the time of surgery. Antibiotics should not be routinely necessary in uncomplicated sterilization surgeries that are performed with good surgical technique.

10.5.2 If an antibiotic is used, it should be administered prior to surgery, or as soon as a break in asepsis is observed.

10.5.3 Routine use of antimicrobials must never be substituted for aseptic technique and excellent sanitation practices.

10.5.4 Antimicrobial use should be reserved for specific indications, such as preexisting infection (e.g., pyometra), known break in aseptic technique during surgery, or development of post-operative infection. Therapy should be started prior to surgery when at all possible with an appropriate choice of antimicrobial. Therapy must continue post-operatively at the appropriate dose for the appropriate duration of time.

10.6 Patients may be discharged to their caretakers only once they can walk unassisted, are alert, and vital signs are normal and stable (cardiovascular, respiratory, temperature, analgesia).

- 10.7 Roaming dogs and cats who do not have a specific guardian should be monitored overnight, after they have recovered from anesthesia. Ideally, they should eat and drink before release. These patients must demonstrate full cognitive and muscle control before release.
- 10.8 Post-operative complications
- 10.8.1 The patient's guardian must be told and be given in writing the name and telephone number of a veterinarian or clinic to contact, should the patient develop complications or if the guardian has questions.
- 10.8.2 All instances of infection, inflammation and other painful or untoward reactions or complications in patients post-surgery must be monitored and treated by the responsible veterinarian until they have resolved.
- 10.8.3 The surgical team should address these reactions and complications and undertake steps to reduce their incidence to a minimum. Good records are essential.
- 10.8.4 The project should include data collection on the frequency and types of post-operative complications. Analysis of these data can help the surgical team to reduce complications and improve communication with animal guardians.
- 10.9 Follow-up visits
- 10.9.1 In a spay/neuter campaign, it is valuable to visit each patient or to call the guardian approximately one week after surgery to check on the patient's recovery, assess animal guardianship, answer owners' questions, and to strengthen the bond between community members and project team.
- 10.9.2 These follow-up visits may be perceived as unnecessarily time-consuming. However, it promotes a strong message of animal guardianship and the commitment of the veterinary team and of the entire project to the community. It also provides an invaluable opportunity to observe animal guardianship issues that need to be addressed in future and to discuss animal care with people who may otherwise not come forth to ask questions.
- 10.9.3 Post-operative visits may be made by a trained nurse and volunteers if a veterinarian is unavailable, but with a veterinarian available to the nurse/volunteer by telephone. Ideally, the nurse will have the ability to take photographs of wounds or other lesions to send to the off-site veterinarian (e.g., with a mobile telephone). This can greatly facilitate decisions and instructions. A supply of oral antibiotics, wound cleaning supplies, oral analgesic, and parasite control medications should be taken along to treat those patients who can be managed *in situ* by their guardians. Patients with more serious complications or whose care cannot be ensured should be taken to a clinic.
- 10.9.4 In areas where people have no access to veterinary service, a contingency plan must be made in advance to how follow-up care will be provided in the event that a patient needs post-operative support.
- 10.10 Post-operative monitoring of roaming animals
- 10.10.1 In some projects, roaming dogs of uncertain ownership may be sterilized and released to roam again after they recover from anesthesia. Efforts should be made to engage the community in monitoring these animals post-operatively so that if someone observes an

animal to be ill, behaving abnormally, or exhibiting a wound, they should call the project leader or veterinarian to notify him or her of the problem.

10.10.2 Enlisting the community in this way helps to engage people in the care of roaming animals and a reason to recognize the existence of these animals in a compassionate context. Community members may enjoy the feeling of empowerment to help them. This may be a particularly powerful message for children, who are often highly observant of animals but are traditionally unheard and powerless members of the community.

## 11. Early-Age Sterilization (EAS)

### 11.1 Clinical considerations for early-age sterilization

11.1.1 EAS refers to puppies and kittens 6-16 weeks of age. Minimum weight for kittens to undergo EAS is 500g, for puppies 1kg. Body condition score must be at least 2.5/5 or 4/9 ([Appendix 14: Examples of clinical forms and record sheets](#)).

11.1.2 EAS may be performed so long as the surgical team is familiar with, and prepared for, the special needs of pediatric patients.

11.1.3 All requirements must be met as for older dogs and cats as outlined in the sections above. In addition, the following physiological considerations for young animals must be taken into account.

11.1.4 As with adult dogs and cats, puppies and kittens must receive a full physical examination prior to surgery to ensure that they are in sufficiently good health to undergo surgery. If the patient is underweight, ill, heavily parasitized or otherwise debilitated, the health conditions must be treated and surgery delayed until s/he is in sufficiently good health for surgery to pose no more than a reasonable risk.

### 11.2 Pediatric physiology in anesthesia

#### 11.2.1 Hypoglycemia in pediatric anesthesia

Young animals can become hypoglycemic quickly. This is due to a high metabolic rate and reduced hepatic glycogen stores compared with adult animals. Therefore:

- Anesthesia time must be kept to a minimum.
- A small meal must be fed 2-4 hours before anesthesia. Pediatric patients must not be fasted longer than 4 hours.
- If anesthesia lasts for more than 30 minutes, IV fluids should contain 2.5% glucose or dextrose.
- Provide a small meal of easily-digestible food as soon as the puppy or kitten is sufficiently awake to eat safely. If the patient does not eat right away, give 3-5 ml oral 5% glucose (dextrose) or corn syrup to improve the animal's energy and appetite and to pre-empt hypoglycemia. Dextrose or corn syrup may be applied to the gums for rapid mucosal absorption.
- Do not give glucose/dextrose subcutaneously. This must be given only orally or intravenously.

- Water must be available to animals at all times before anesthesia. Following recovery from anesthesia, water must be provided again as soon as the patient is able to drink. Care must be taken to ensure that the puppy or kitten has adequate motor control to not accidentally fall into the water bowl. The water bowl should be offered periodically throughout recovery and only left in the cage when the patient is fully able to stand on his or her own.
- Keep animals warm throughout anesthesia to prevent excessive energy loss to thermoregulation.

#### 11.2.2 Hypothermia in pediatric anesthesia

- Pediatric patients become hypothermic easily due to their large body surface area-to-volume ratio, reduced ability to shiver, and little subcutaneous fat. Anesthesia further compromises thermoregulation through its interference with normal hypothalamic function.
- Hypothermia contributes to bradycardia, hypotension, and retarded metabolism of drugs. Increased energy use to maintain euthermia increases the risk for hypoglycemia. Consequences include prolonged recovery times, hypoglycemic seizures, and post-shock like responses such as hemorrhagic gastroenteritis.
- Anesthesia time and surgery time must be kept to a minimum.
- Patients must be insulated from the surface on which they are lying (thick towel, blanket, thick cardboard).
- Patients must be kept dry. Avoid the use of alcohol on skin. Use a non-alcohol disinfectant to prepare the skin for surgery (e.g., chlorhexidine).
- Supplemental heat must be provided to pediatric patients throughout anesthesia, e.g., with electric heat pads, microwavable gel pillows, warm water bottles, or warmed grain sacks. The latter can be made by filling socks or small cotton bags with (uncooked) rice, barley, lentils, beans, or other small grains or legumes, which are then heated in the microwave.
- Care must be taken that the heat source is not so hot that it will scorch the skin. Heat sources should be approximately 38°C. Check the temperature as you would a baby's bottle: hold it against your inner wrist. It should feel pleasantly warm. If you feel the need to remove your hand within 60 seconds, then it is too hot. If it feels cooler than your skin, then it is too cold.
- Cloth, cardboard, or layers of newspaper must always be placed between the heat source and the patient's skin as a precaution against burning.
- Rectal temperature must be monitored each time that vital signs are assessed (every 5 minutes). If the paws and ears feel cold, or rectal temperature falls below 37°C, additional heat sources, blankets, and warmed IV fluids may be necessary to raise body temperature. Steps to warm the patient must be taken immediately. Animals must be supervised until they are stabilized.

#### 11.2.3 Hepatic function in pediatric anesthesia



- Hepatic function matures in puppies and kittens at 12-14 weeks of age. Younger animals have low glycogen stores, which predisposes them to hypoglycemia. The measures outlined above to prevent hypoglycemia are critical for pediatric patients.
- Anesthetic drugs that are metabolized by the liver will be excreted more slowly.
- Plasma albumin levels are lower than in adults, so pediatric patients are more sensitive to protein-bound drugs.

#### 11.2.4 Respiratory function in pediatric anesthesia

Pediatric patients have smaller airway diameters and more flexible airway cartilage. The risk of airway obstruction is therefore greater than in adults.

- Care must be taken to prevent airway trauma during intubation, per instructions in [Section 7.5: Endotracheal intubation \(airway management\)](#). Endotracheal tubes must be not too big or small, cuffs must be inflated and deflated with care, and the tubes must be lubricated appropriately prior to placement.
- Kittens up to ca. 1.5 kg will take a 3.0 mm endotracheal tube. For larger kittens, try 3.5 mm. Puppies will usually take 3.5 – 4.5 mm tubes.
- Kittens must always receive topical lidocaine prior to placement of the endotracheal tube, as described for cats in [Section 7.5: Endotracheal intubation \(airway management\)](#).
- The metabolic requirements of pediatric patients are 2-3 times higher than for adults. Together with the functional residual capacity in the airways and smaller tidal volumes, these patients have smaller oxygen reserves and faster respiratory rates than adults. Therefore:
  - Pediatric patients will need oxygen supplementation throughout anesthesia.
  - Respiratory rates should be 2-3 times those of adults dogs and cats.
  - Avoid the use of respiratory depressant drugs (e.g., alpha-2 agonists such as xylazine and dex/medetomidine)
  - Gentle, positive-pressure ventilation (PPV) should be provided intermittently (ca. every 2-3 minutes) throughout anesthesia, particularly to those patients with slow or shallow respiration.

#### 11.2.5 Cardiovascular function in pediatric anesthesia

- A greater portion of the cardiac output in pediatric patients goes to the brain than in adults. Therefore, young animals are more sensitive to intravenous and inhalant anesthetics.
- In very young animals, the ability of the heart to increase cardiac output and the vasoconstriction of blood vessels are less than in adults. Therefore, the physiologic compensation to low blood pressure and the response to fluid therapy to maintain blood pressure will be reduced in comparison to adult animals.
- It is critical that the heart rate in young patients remains above 150 bpm (normal ca. 200) during anesthesia and surgery.

- Shock, particularly hypovolemic shock (e.g., due to hemorrhage) may be very difficult to reverse.
- IV fluid support should be given if surgical procedures last longer than 30 minutes. The rate should be carefully controlled at 10 ml/kg/hour, and respiration monitored closely for evidence of pulmonary edema. Fluids given too quickly may drown the patient. Fluids given too slowly may result in dehydration. Subcutaneous fluid administration prior to surgery may be a good alternative, and may be done as a matter of routine.
- Normal crystalloids (physiologic saline (0.9% NaCl), Hartmann's or Lactated Ringer's solution) are appropriate for normal circumstances. If hypotension is a concern, administration of colloids (Hetastarch) may be valuable (5-10 ml/kg/hr).

#### 11.2.6 Renal function in pediatric anesthesia

- Renal function matures after 8 weeks of age.
- Care must be taken to prevent over-hydration when delivering intravenous fluids (risk of pulmonary edema). Care must also be taken to prevent dehydration of the patient.
- The IV fluid rate during surgery is the standard 10 ml/kg/hour, but must be monitored carefully to ensure that this is the appropriate rate for each patient. Monitor respiration closely and beware of the development of pulmonary edema.
- Sterile 0.9% NaCl (saline) or Lactated Ringer's solution may be given subcutaneously, maximum 10 ml per injection site.

### 11.3 Anesthesia for early-age sterilization: general principles

#### 11.3.1 Stress must be avoided prior to anesthesia and throughout recovery.

- Puppies and kittens should be kept with littermates or in the environment in which they feel most comfortable until they are anesthetized.
- Keep animals warm and comfortable, and handle them very gently.
- Avoid loud noises, excessive activity, isolation, distressed animals nearby, intimidation by other animals, and other sources of stress.
- Pre-anesthetic stress compromises the animal's response to anesthetic drugs.
- Stress predisposes pediatric patients to hypoglycemia and other anesthetic complications.

#### 11.3.2 Duration of anesthesia must be kept to an absolute minimum. All drugs, supplies and equipment necessary for anesthesia and surgery must be prepared fully before the animal is anesthetized.

#### 11.3.3 Pediatric patients should receive supplemental oxygen during anesthesia even if not receiving a gas anesthetic. If this is not possible, gentle, positive-pressure ventilation must be supplied every 2-3 minutes to ensure sufficient ventilation.

#### 11.3.4 All considerations for anesthesia must be followed as outlined in [Section 7: Preparation for anesthesia](#).

11.3.5 Anesthesia must be monitored as described in [Section 8: Anesthesia](#).

#### **11.4 Anesthetic premedication for early-age sterilization**

11.4.1 Phenothiazine tranquilizers (acepromazine) must be avoided in pediatric patients, as they may produce prolonged CNS depression and potentiation of hypotension and hypothermia.

11.4.2 Alpha-2 adrenergic agonists (xylazine, medetomidine) slow the heart rate and suppress respiration. Given the cardiovascular and respiratory concerns in pediatric patients ([Section 11.2: Pediatric physiology in anesthesia](#)), these drugs should be avoided. If they are used, vital signs must be monitored very closely throughout anesthesia and recovery.

11.4.3 Opioids cause sinus bradycardia and respiratory depression. An anticholinergic may be given as premedication, if it is appropriate with the rest of the anesthetic protocol. Adult dose rates of opioids should be halved for pediatric patients. Vital signs must be monitored very closely throughout anesthesia and recovery.

#### **11.5 General anesthesia for early-age sterilization**

11.5.1 Propofol is the induction agent of choice for pediatric patients.

- Patients should be pre-oxygenated prior to receiving propofol.
- Pediatric patients should not receive repeated doses of propofol, as it is metabolized by the liver and repeated doses may prolong recovery.

11.5.2 Isoflurane gas anesthesia is the method of choice for anesthetic maintenance in pediatric patients. Isoflurane is minimally processed by the liver, and allows rapid adjustment of anesthetic depth and rapid recovery.

11.5.3 Barbiturates (pentobarbital, thiopentone) depend entirely on hepatic metabolism for termination of effects and are therefore contraindicated in puppies and kittens less than 12 weeks old.

11.5.4 Recovery from diazepam/ketamine and zolazepam/tiletamine anesthesia depends on hepatic metabolism and renal perfusion. Care must be taken with the use of these drugs in animals younger than 12 weeks of age.

11.5.5 Refer to [Appendix 5: Anesthetic and analgesic drugs](#).

#### **11.6 Special surgical considerations for early-age sterilization**

11.6.1 Puppies normally have more peritoneal fluid than adult dogs. The surgeon must anticipate this.

11.6.2 Tissues are more friable and delicate than those of adults. Gentle tissue handling and surgical experience are imperative.

11.6.3 The abdominal incision in female puppies is made further caudally than in the adult female, as the ovarian suspensory ligaments are not as tight. Alternatively, a flank approach may be used.

11.6.4 Meticulous hemostasis is essential, as even minimal hemorrhage can be significant in a pediatric patient.

11.6.5 Closure of the abdomen is the same as in adults, with buried intradermal skin sutures.

- 11.6.6 It is recommended to avoid the use of polydioxanone (PDS) in subcutaneous and intradermal layers to avoid the development of calcosinosis circumscripta. Polyglactin (e.g., Vicryl®) is a good choice.
- 11.6.7 Male puppies may be castrated by a standard pre-scrotal approach like adult dogs, or through a scrotal approach like male cats.
- 11.6.8 For the scrotal approach:
- The surgical site must be prepared for a sterile procedure (unlike in cats, in which it is a clean procedure.)
  - A single incision can be made to remove both testicles.
  - The cord may be tied on itself or ligated with absorbable suture material. Incisions are not sutured, and are left to heal by second intention as in male cats.
  - The wound is left open, as in male cats.
- 11.6.9 Male kittens are castrated in the same manner as adult toms (one scrotal incision per testicle, clean procedure). The cord may be tied on itself or ligated with suture material.
- 11.6.10 If both testicles are not palpable in the scrotum, castration should be delayed until 6 months of age. At that age, both testicles should be descended; if not, the retained testicle must be retrieved from the inguinal or abdominal area.
- 11.6.11 Retained testicles must be removed.

## **11.7 Post-surgical care for pediatric patients**

- 11.7.1 Pediatric patients must receive a minimum of 24 hours analgesia, per [Section 8.5: Post-operative analgesia](#) and [Appendix 5: Anesthetic and analgesic drugs](#).
- 11.7.2 Provide a small meal of easily-digestible food as soon as the puppy or kitten is sufficiently awake to eat safely. If the patient does not eat right away, give 3-5 ml oral 5% glucose (dextrose) or corn syrup to improve the patient's energy and appetite and to avoid hypoglycemia. Dextrose or corn syrup may be applied to the gums for rapid mucosal absorption if the patient is not sufficiently strong to swallow safely.
- 11.7.3 Provide supplemental warmth until patients are fully recovered and have eaten.
- 11.7.4 For 5-7 days after surgery, puppies and kittens should be kept confined to avoid excessive activity, i.e., avoid running loose outdoors or rough play.
- 11.7.5 Puppies and kittens who are housed together after sterilization surgery must be observed closely to ensure that they don't compromise their own or one another's surgical wounds.

## **12. Vaccination and parasite control**

- 12.1 While vaccination and parasite control are not within the immediate protocol of sterilization surgery, presentation of the animals for sterilization surgery provides an excellent opportunity to provide these basic services, particularly for dogs and cats who may be otherwise unlikely to receive them.

- 12.2 Dogs and cats can be sterilized, vaccinated, and dewormed all in the same day. Ideally, animals are vaccinated and dewormed at least 2 weeks prior to surgery. If this is not feasible, all three can and should be done at once.
- 12.3 All dogs and cats 3 months of age or older and living in rabies-endemic areas must be vaccinated against rabies according to international guidelines or local legislative requirements ([Appendix 3: Vaccination Guidelines](#)).
- 12.4 All dogs and cats should be vaccinated with core vaccines according to recommended schedules outlined in [Appendix 3: Vaccination Guidelines](#).
- 12.5 Project resources may restrict the ability to fully vaccinate animals according to guidelines with core vaccines other than rabies. Under these conditions:
  - 12.5.1 Rabies vaccination for all dogs and cats older than 3 months of age must be considered essential.
  - 12.5.2 Animals less than 1 year old should be vaccinated at least once with core vaccines, immediately on rescue or removal from the dam. As many boosters as possible should be given thereafter according to guidelines ([Appendix 3: Vaccination Guidelines](#)), particularly for puppies and kittens younger than 6 months of age.
  - 12.5.3 If possible, adults should be vaccinated with core vaccines at least once on presentation for sterilization if they have not previously been vaccinated.
  - 12.5.4 Disease outbreak must be expected in the face of substandard vaccination.
  - 12.5.5 Biosecurity measures are always important, and are particularly critical in situations where animals are inadequately vaccinated. Any sign of illness in animals must be immediately addressed with isolation, treatment or removal, disinfection, and control of pathogen spread via fomites.
- 12.6 Modified live vaccines should be avoided for clinically ill, debilitated, or pregnant animals. However, when large groups of animals are rescued all at once, or in shelter medicine protocols, it is strongly advised to vaccinate every animal immediately. These animals must continue to be managed as vulnerable to contagious disease, as their immune response to the vaccination may be sub-optimal. Although the antibody titers in compromised animals may not be as strong as in a healthy animal, vaccination in these cases will still afford a certain level of immunity and will help to mitigate the extent and severity of disease in the group or shelter.
- 12.7 Protocols for the control of endoparasites and ectoparasites must address prophylaxis against parasites endemic in the area. Refer to [Appendix 4: Anti-parasitic drugs](#) for drugs and usage guidelines.

## 13. Euthanasia

- 13.1 Refer to the document “The welfare basis for euthanasia of dogs and cats and policy development” prepared by the International Companion Animal Management Coalition (ICAM). This document provides structured, practical guidance for developing a euthanasia policy, how to decide whether euthanasia is a reasonable option for an individual animal, and for guidelines on how to perform euthanasia. This PDF document may be found at [www.icam-coalition.org](http://www.icam-coalition.org) under “Tools and Resources”.

13.2 The decision regarding euthanasia must be made on the basis of a rational consideration of options available to the individual animal and to the people responsible for the animal's care. These fall into the following five categories.

#### 13.2.1 Medical

- An animal who is suffering from an acute or chronic disease condition or from pain that cannot be alleviated to a satisfactory degree, given the available practical and financial resources. Suffering can be defined here as a restriction of any or all of the five welfare needs.
- An animal who is suffering from a contagious disease that might pose a risk to other animals or to people, particularly if appropriate preventative measures are not in place (e.g., rabies).

#### 13.2.2 Behavioral

- An animal with a behavioral problem that results in suffering due to the animal experiencing fear and distress, and that cannot be successfully treated with behavior therapy considering the constraints on available practical and financial resources.
- An animal with a behavioral problem that presents a risk to him or herself, to other animals, to people or to the environment and that cannot be successfully treated considering the available constraints on practical and financial resources.
- An animal who cannot be re-homed because of a behavioral problem that cannot be corrected considering constraints on available practical and financial resources.

#### 13.2.3 Lack of resources

- An animal who cannot be looked after or treated due to lack of finances, personnel, expertise, suitable equipment or facilities, and who will suffer as a result.
- An animal who is holding space in a shelter over a long period (e.g. because he or she cannot be re-homed) that could be used to benefit a large number of other animals.

#### 13.2.4 Inadequate guardianship

- An animal whose needs (as identified by the five welfare needs) cannot be met due to a lack of owner or adequate guardian.

#### 13.2.5 Legal order

- An animal who has been ordered by law to be euthanized, e.g. for disease control.

## 14. Appendices

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## Appendix 1: Normal clinical parameters for dogs & cats

From the *Veterinary Merck Manual*, 11<sup>th</sup> edition 2016 and *Veterinary Pediatrics* by J.D. Hoskins, 3<sup>rd</sup> ed. 2001.

	Adult dogs	Adult cats
Heart rate (beats per minute) <sup>1</sup>	70-120	120-140
Respiratory rate <sup>2</sup> (breaths per minute)	18-34	16-40
Temperature <sup>3</sup> (rectal) °C	37.9 – 39.9	38.1 – 39.2
Urine specific gravity	1.016 – 1.060 (usually > 1.030)	1.020 – 1.040 (usually > 1.035)
Urine volume (ml/kg/day)	20-100	10-20
PCV (hematocrit), % <sup>4</sup>	35-57	30-45
Hemoglobin g/dL	12-19	10-15
Red blood cells (x10 <sup>12</sup> /L)	5.0-7.9	5-10
White blood cells (x10 <sup>9</sup> /L)	5.0-14.1	5.5-19.5
Neutrophils (% , x10 <sup>9</sup> /L)	58-85, 2.9-12.0	45-64, 2.5-12.5
Band neutrophils (% , x10 <sup>9</sup> /L)	0-3, 0-0.45	0-2, 0-0.3
Lymphocytes (% , x10 <sup>9</sup> /L)	8-21, 0.4-2.9	27-36, 1.5-7.0
Monocytes (% , x10 <sup>9</sup> /L)	2-10, 0.1-1.4	0-5, 0-0.9
Eosinophils (% , x10 <sup>9</sup> /L)	0-9, 0-1.3	0-4, 0-0.8
ALT (U/L)	10-109	25-97
Alkaline phosphatase (U/L)	1-114	0-45
AST (U/L)	13-15	7-38
GGT (U/L)	1-9.7	1.8-12
Creatine kinase (U/L)	52-368	69-214
LDH (U/L)	0-236	58-120
Bilirubin (mg/dL; mmol/L)	0-0.3, 0-5.1	0-0.1, 0-1.7
BUN (mg/dL, mmol/L)	8-28, 2.9-10	19-34, 6.8-12.1
Creatinine (mg/dL, mmol/L)	0.5-1.7, 44-150	0.9-2.2, 80-194
Blood glucose <sup>5</sup> (mg/dL, mmol/L)	76-119, 4.2-6.6	60-120, 3.3-6.7
Total protein (g/dL)	5.4-7.5	6.0-7.9
Albumin (g/dL)	2.3-3.1	2.8-3.9
Globulin (g/dL)	2.4-4.4	2.6-5.1
Ca (mg/dL, mmol/L)	9.1-11.7, 2.3-2.9	8.7-11.7, 2.2-2.9
P (mg/dL, mmol/L)	2.9-5.3, 0.9-1.7	3.0-6.1, 1.0-2.0

- 1: Heart rates in puppies and kittens is ca. 200; in kittens up to 240.
- 2: Respiratory rate for puppies and kittens is 2-3x that of adults due to higher metabolic requirements and smaller tidal volume.
- 3: Body temperature in puppies & kittens younger than 4 weeks of age is lower than in adults, and an external heat source is essential.
- 4: PCV (hematocrit) in puppies and kittens is normally lower than in adult dogs, in the range of 25-34%.



5: In cats, hyperglycemia (10-12 mmol/L, 180-216 mg/dL) as a consequence of acute stress during handling for a blood sample is not uncommon and is not necessarily physiologically abnormal.

## Appendix 2: Basic instrument pack for spay and neuter surgery

Instrument	Number of each
Backhaus towel clamps	4
#3 Scalpel handle (not mandatory, but helpful)	1
#10 Scalpel blade	1
Adson-Brown Tissue forceps or 1 Adson (rat-tooth) tissue forceps + 1 atraumatic (smooth-ended) dressing forceps	1 or 2
Halsted mosquito hemostats (for pinpoint bleeding and small vessels)	2
Kelly or Dunhill hemostats, or Carmalt forceps	4
Scissors (blunt-tipped)	1
Mayo-Hegar or Olsen-Hegar needle holder	1
Ovariohysterectomy (spay) hook (optional but very helpful)	1
Needles, assorted sizes	2 or 3
Gauze sponges (10 x 10 cm)	10
Cloth surgical drape, fenestrated, large enough to cover the animal*	1
Surgical towels (additional draping or drying hands)	1 or 2
Sterile, gauze sponges in separate package in case more are needed	25/pack

\* The cloth surgical drape may be omitted if disposable surgical drapes are used.

Instruments must be wrapped in a clean drape to create the instrument pack. That pack must be wrapped in a second drape and sealed with autoclave indicator tape. The cloth must have the thickness equivalent to 270-thread pima cotton; thin cloth should be used in multiple layers. Alternatively, instruments may be sealed in autoclave bags or packed in a sealed instrument tray.

Autoclave conditions necessary for sterilization are 134°C for 3 minutes or 121°C for 15 minutes at 15 psi (100kPa) above atmospheric pressure.

Packs must dry inside the autoclave before they are removed from the machine. If using a pressure-cooker style autoclave, place a clean brick in the bottom and the surgery packs on top of the brick. The brick will help to absorb moisture and prevent the pack from emerging from the pot dripping wet.

Items that are sterilized by autoclave must have autoclave indicator tape on the outside of the pack, marked with the date on which the pack was autoclaved. Ideally, an autoclave indicator strip is placed inside the pack as well, among the instruments, to verify that the inside of the pack reached sufficient conditions for sterilization.

Autoclaved instrument packs must be stored in a cupboard or closed container in which they are dry and protected from dust and other contaminants. They must be used within 2 weeks of the sterilization date. (Packs wrapped in sealed plastic autoclave sleeves may be stored longer, per

recommendations of the manufacturer of the plastic sleeves.) If there is any question that the packs may have become contaminated or remained moist inside, they must be re-sterilized prior to use in surgery.



Adson-Brown tissue forceps



Adson tissue forceps with teeth



Adson tissue forceps without teeth



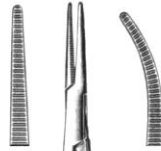
#3 Scalpel handle



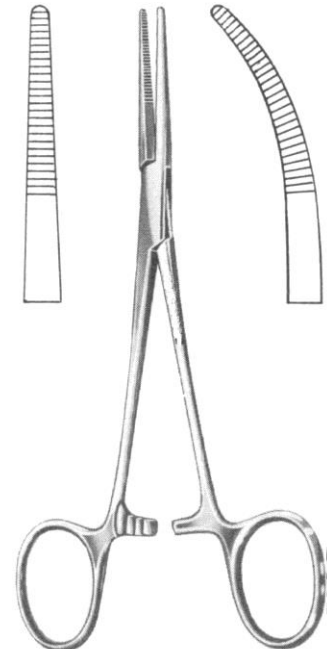
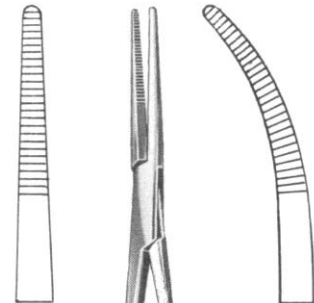
#10 scalpel blade



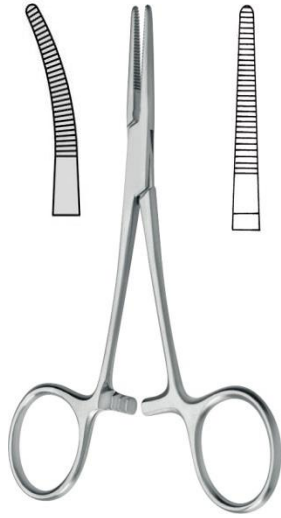
Backhaus towel clamp



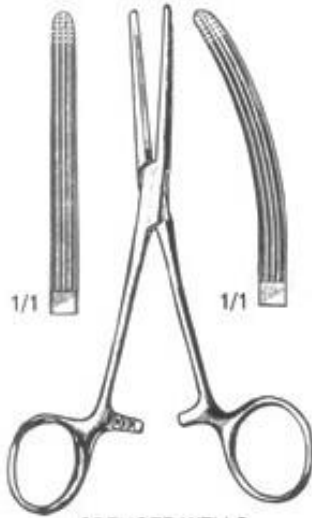
Halstead mosquito hemostatic forceps, straight or curved (12-13 cm)



Kelly forceps, straight or curved (14 cm)



Dunhill forceps, straight or curved (12-13 cm)



Carmalt forceps, ~20 cm.



Mayo scissors, blunt-sharp, ~17 cm



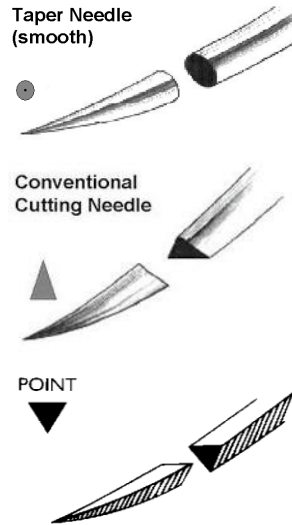
Spay hook, 16 cm



Mayo-Hegar needle holder (not cutting; 15-16 cm)



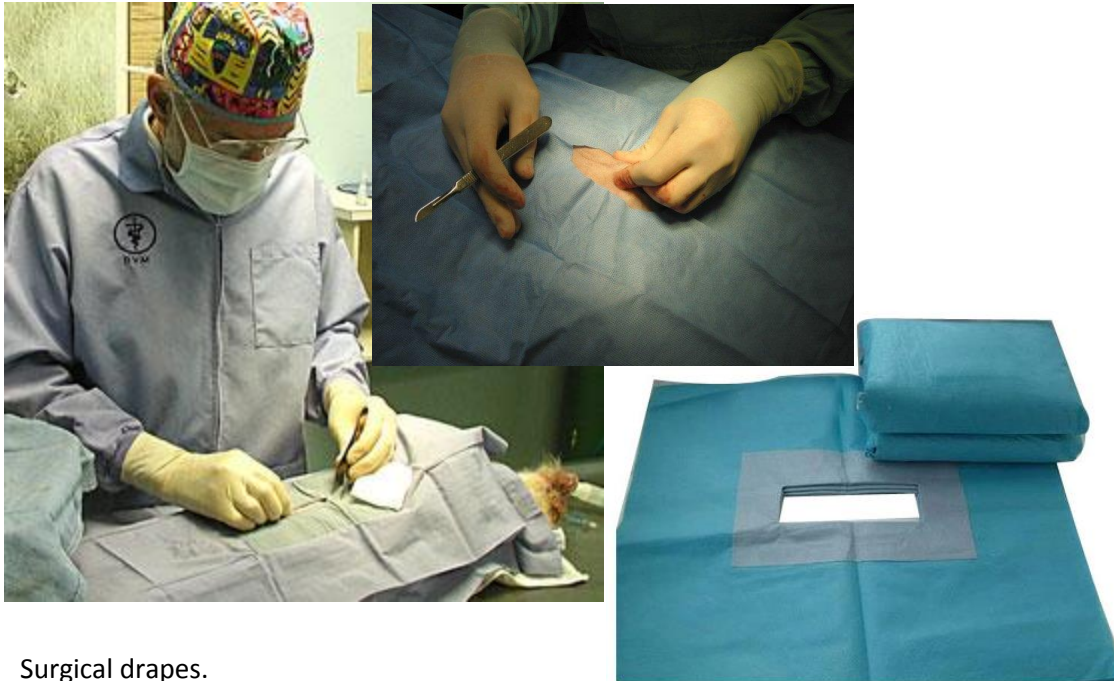
Olsen-Hegar needle holder (cutting)



Suture needles



Gauze sponges, 10x10 cm



Surgical drapes.

Durable, tightly-woven cotton material (minimum 270-thread cotton) or disposable waterproof paper.

Size must be large enough to cover the dog from neck to below the knees when the dog is lying on his or her back on the table. Drape must be wide enough to cover the dog and the table on either side of the dog.

Fenestrated drapes: in the middle of the drape is a narrow opening, ca. 12cm long x 3cm wide. This is where the surgeon will make the skin incision. See image above.

Alternatively, 4 drapes without fenestrations may be used and layered in a square around the incision site.

### Appendix 3: Vaccination Guidelines

Core vaccines are those recommended for all cats and dogs. These are parvo, distemper, adenovirus-2 and rabies for dogs; and herpesvirus-1, calicivirus, parvo (panleukopenia) virus and rabies for cats. Non-core vaccines are administered to animals who are in specific risk categories, either individually or because of the shelter or rescue environment. Evaluation of the need for non-core vaccines must be based on a risk/benefit analysis that includes considerations of individual animal health, herd health, laboratory data, and resource allocation. Vaccination must never be substituted for good biosecurity practices.

The core vaccines with which dogs and cats are immunized are usually live attenuated (modified live, MLV) virus or recombinant vaccines. The notable exception is the rabies vaccine, which must always be killed virus or recombinant vaccine. Other than rabies, killed/inactivated virus vaccines are generally reserved for animals who are immunocompromised (e.g., cats infected with FIV or FeLV) or pregnant.

Vaccination of pregnant dogs and cats is generally not recommended due to the risk that the MLV reverts to virulence and infects the fetuses. A similar risk exists to nursing puppies and kittens with MLV vaccination of the lactating mother. When at all possible, queens and bitches should be properly vaccinated before they become pregnant. However, if the animal first presents when pregnant or lactating and is unvaccinated, or the vaccination history is unknown, as in a rescue situation, the risk of disease exposure in the environment must be assessed and balanced against the need for disease control in the group. Alternatively, killed/inactivated or recombinant vaccines may be used, with awareness that resulting protection may be less than optimal.

As stated, MLV vaccines are not administered to clinically ill, debilitated or pregnant animals. However, when groups of potentially compromised animals of uncertain vaccination status are rescued, and in shelter medicine protocols, it is strongly advised to vaccinate every animal immediately on intake, with the exception of severely ill animals. The latter should be isolated and treated as a biosecurity risk: if an animal is so ill that he or she cannot mount an immune response to vaccine, the patient is most likely not suitable to be admitted into a shelter environment. The MLV core vaccines begin to protect the animal within just a few hours or days of vaccination, well before an antibody titer can be measured in the serum. This rapid immunity can reduce the duration and degree of viral shedding (depending on the virus), and will reduce the severity and duration of disease outbreaks.

The role of vaccination in a rescue or shelter situation is not only to protect the individual animal against disease, but also to prevent the spread of pathogens and disease in the shelter or foster home environment. For this reason, it is imperative that dogs and cats be vaccinated immediately or even before arrival at the shelter. This is necessary even if animals are likely to be euthanized a few days or weeks later due to the shelter's policies on resource and space management. Animals sterilized in a trap-neuter-release (TNR) program should be similarly vaccinated with core vaccines.

If animals are ill or debilitated, they may not be able to mount a full immune response to vaccination. So long as these patients are afebrile and eating, they should still be vaccinated in rescue and shelter situations, but should be managed as "vulnerable" individuals in the shelter's biosecurity paradigm. Although the antibody titers may not be as strong as in a healthy animal, vaccination in compromised animals will still afford a certain level of protective immunity. Revaccination as soon as the animal is healthy (within 2-3 weeks) is particularly important for these individuals. If re-vaccination is delayed for 6 weeks or more, the course of vaccination should be restarted.

Kittens and puppies are generally more vulnerable to infectious diseases than are adult cats and dogs. Animals younger than six months of age are a critical and primary population on which to concentrate vaccination efforts, particularly in a rescue or shelter situation.

A common misconception by local veterinarians in many project areas is that animals should not be vaccinated and dewormed at the same time, or at the time of sterilization. To the contrary: all three can be, and should be, done simultaneously. Ideally, animals are vaccinated at least 2 weeks before being taken to a clinic or sterilization event so that they are properly protected against circulating pathogens there, or so that they do not pose a risk to the other patients by shedding pathogen. But if this is not possible, then vaccination, deworming, ectoparasite treatment and sterilization should all be done at once.

Recent research by vaccine immunologists and shelter veterinarians has advanced the practical application of on-site antibody assays, particularly for the control of disease outbreaks (e.g., see publications of Dr. Ronald Schultz, Professor of Pathobiology, College of Veterinary Medicine, University of Wisconsin, Madison, USA and <http://www.maddiesfund.org>). The assays that have been validated by clinical virologists (VacciCheck™, Biogal and TiterCHEK®, Pfizer) are applicable for canine distemper, parvo and adeno viruses (core vaccine concerns). It is essential that assays are rigorously validated to correlate with “gold standard” assays and with laboratory vaccine-challenge studies. Assays with poor sensitivity (false negatives) or poor specificity (false positives) can be devastating if decisions are made on the basis of their results.

In a shelter or rescue situation, or in the face of a disease outbreak, these antibody assays may be used to quickly determine which individuals must be quarantined or – better yet – sent to a safe foster guardian until they have had time to mount a fully protective immune response to the vaccine (~ 2 weeks). Strong and well-enforced biosecurity protocols and excellent record-keeping are essential to enable such a system to function. Accurate disease diagnosis is also essential to ensure that the assays are being used for the correct diseases. Antibody assays must under no circumstances delay implementation of a vaccination protocol.

The main drawback of the on-site antibody assays are expense and the need for clinicians to be properly trained in how to interpret the assay results and how to apply them to a real-time disease outbreak or high-risk situation. It must be kept in mind that disease outbreaks in shelters or in rescues where animals are severely stressed and debilitated often involve multiple pathogens (e.g., distemper, parvo and respiratory disease together).

Vaccines must be produced by a reputable manufacturer that adheres to internationally-recognized quality control protocols. The vaccines must be kept at the appropriate temperatures (4°C for most vaccines) until they are administered to the patient. Vaccines that become inappropriately cold or warm quickly become inactivated and no longer induce a reliable immune response in the patient. Lyophilized vaccines must be used immediately (within an hour) after reconstitution.

Good records for vaccination are important, both for the management of clinical services and to support the owner or guardian in responsible guardianship practices. Individual countries may require specific vaccination records by law, for example for rabies. Records are also important to document patterns of vaccine failures or vaccine reactions. It is advised to notify the vaccine manufacturer of adverse reactions if local laws don't preclude the necessity of this. Owners and guardians should be advised of clinical signs to report to the veterinarian in the 2-3 days following vaccination of their dog or cat. The risk of vaccination-site sarcomas in cats has prompted the development of vaccination location guidelines according to the diagram below. For further discussion of this issue, refer to the 2013 AAEP feline vaccination guidelines.

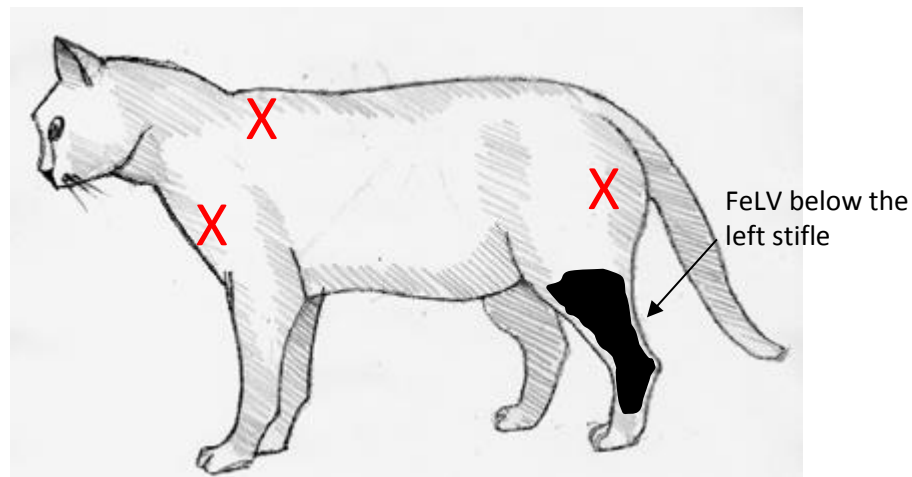
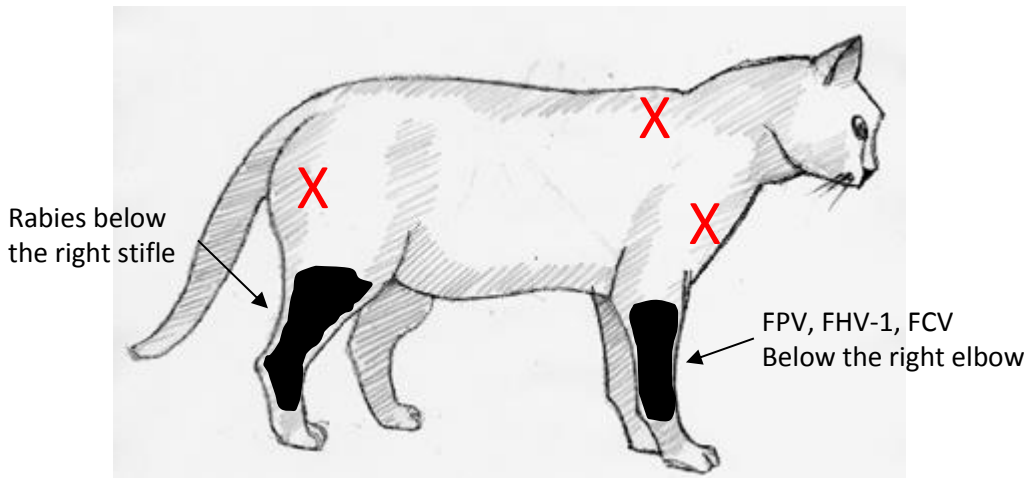


A dose of vaccine consists of the same volume for a puppy or kitten as for an adult dog or cat. Vaccine doses should not be halved or otherwise reduced for young animals or small individuals.

**MLV** = modified live virus    **killed** = killed virus    **parenteral** = SQ or IM administration

**SQ** = subcutaneous    **IM** = intramuscular    **\*** = core vaccines

Vaccines are usually given **SQ** (subcutaneously) unless specifically noted in the charts below. Some vaccines are designed to be administered **intranasally**. Intranasal vaccines must not be injected SQ or IM. Conversely, parenteral vaccines must never be injected intranasally or by any other route. The skin should not be disinfected prior to vaccination, as this may inactivate MLV antigens.



Recommended vaccination sites for cats

**X** areas to avoid



<b>Canine vaccination guideline for general veterinary practice</b> (modified from AAHA 2011 canine vaccination guideline)			
Canine vaccine	Initial puppy vaccine (< 16 weeks) <sup>1</sup>	Initial vaccination for dogs older than 16 weeks	Revaccination
* Canine Parvovirus (CPV2) MLV	Give one dose every 3-4 weeks between the ages of 6 and 16 weeks.	One dose is considered protective and acceptable.	<ul style="list-style-type: none"> <li>• Puppies last vaccinated at 16 weeks of age should be revaccinated one year later, then once every 3 years.</li> <li>• Dogs first vaccinated when older than 4 months are revaccinated 3 years later, then every 3 years.</li> <li>• All commercially-available MLV-CPV2 vaccines currently protect against Canine Parvovirus 2a, 2b and 2c.</li> <li>• In healthy dogs, the protective immune response induced by the MLV-CPV2 vaccine is expected to last for at least 5 years.</li> <li>• Vaccine must be used within one hour of reconstitution, as it loses virulence rapidly. Ideally, it is administered to the patient immediately after reconstitution.</li> </ul>
* Canine Distemper Virus (CDV) MLV or rCDV <sup>2</sup>	Give one dose every 3-4 weeks between the ages of 6 and 16 weeks.	One dose is considered protective and acceptable.	<ul style="list-style-type: none"> <li>• Puppies last vaccinated at 16 weeks of age should be revaccinated one year later, then once every 3 years.</li> <li>• Dogs first vaccinated when older than 4 months are revaccinated 3 years later, then every 3 years.</li> <li>• In healthy dogs, the protective immune response induced by the MLV and rCDV vaccines is expected to last for at least 5 years.</li> <li>• The rCDV and MLV vaccines may be used interchangeably.</li> <li>• Vaccines must be used within one hour of reconstitution, as they lose virulence rapidly. Ideally, they are administered to the patient immediately after reconstitution.</li> </ul>

<b>Canine vaccination guideline for general veterinary practice</b> (modified from AAHA 2011 canine vaccination guideline)			
Canine vaccine	Initial puppy vaccine (< 16 weeks) <sup>1</sup>	Initial vaccination for dogs older than 16 weeks	Revaccination
* Canine Adenovirus-2 (CAV2) <sup>3</sup> MLV	Give one dose every 3-4 weeks between the ages of 6 and 16 weeks.	One dose is considered protective and acceptable.	<ul style="list-style-type: none"> <li>• Puppies last vaccinated at 16 weeks of age should be revaccinated one year later, then once every 3 years.</li> <li>• Dogs first vaccinated when older than 4 months are revaccinated 3 years later, then every 3 years.</li> <li>• In healthy dogs, the protective immune response induced by the CAV2 vaccine is expected to last for at least 7 years.</li> <li>• Vaccine must be used within one hour of reconstitution, as it loses virulence rapidly. Ideally, it is administered to the patient immediately after reconstitution.</li> </ul>
* Rabies 1-year killed	<ul style="list-style-type: none"> <li>• Administer one dose as soon as possible after 12 weeks of age.</li> <li>• The dog is considered to have a protective titer 28 days after vaccination.</li> </ul>	<ul style="list-style-type: none"> <li>• One dose is considered protective and acceptable.</li> <li>• The dog is considered to have a protective titer 28 days after vaccination.</li> </ul>	<ul style="list-style-type: none"> <li>• Revaccinate one year after the first dose, then annually per law.</li> <li>• Booster vaccinations given on schedule to previously vaccinated dogs are considered to be immediately protective, so there is no break in protective antibody titer.</li> <li>• Read vaccine label to determine whether to administer the vaccine IM or SQ.</li> <li>• The use of single-dose vials is recommended to reduce the risk of contamination and to ensure proper mixing and dosage of antigen and adjuvant.</li> </ul>

Canine vaccination guideline for general veterinary practice (modified from AAHA 2011 canine vaccination guideline)			
Canine vaccine	Initial puppy vaccine (< 16 weeks) <sup>1</sup>	Initial vaccination for dogs older than 16 weeks	Revaccination
* Rabies 3-year killed	<ul style="list-style-type: none"> <li>Administer one dose as soon as possible after 12 weeks of age.</li> <li>The dog is considered to have a protective titer 28 days after vaccination.</li> </ul>	<ul style="list-style-type: none"> <li>One dose is considered protective and acceptable.</li> <li>The dog is considered to have a protective titer 28 days after vaccination.</li> </ul>	<ul style="list-style-type: none"> <li>Revaccinate one year after the first dose, regardless of the age of the dog at the time of the first vaccination. Thereafter, administer one dose every 3 years (with the “3-year” vaccine), or every one year (with the “1-year” vaccine), or according to law.</li> <li>Booster vaccinations given on schedule to previously vaccinated dogs are considered to be immediately protective, so there is no break in protective antibody titer.</li> <li>Read vaccine label to determine whether to administer the vaccine IM or SQ.</li> <li>The use of single-dose vials is recommended to reduce the risk of contamination and to ensure proper mixing and dosage of antigen and adjuvant.</li> </ul>
Parainfluenza Virus (CPiV) MLV	Give one dose every 3-4 weeks between the ages of 6 and 16 weeks.	One dose is considered protective and acceptable.	<ul style="list-style-type: none"> <li>CPiV vaccine is available only in combination with other core vaccines. Follow vaccination instructions as for CDV, CPV2 and CAV2.</li> <li>Note that vaccination with CPiV prevents the dog from becoming ill, but does not prevent the dog from becoming infected with the virus and from shedding the virus.</li> </ul>
<i>Bordetella bronchiseptica</i> inactivated cellular antigen extract, for parenteral (SQ) administration	Administer first dose at 8 weeks and the second dose at 12 weeks of age.	Two doses, 2-4 weeks apart. A single dose will not immunize a seronegative dog.	<ul style="list-style-type: none"> <li>Annually, or more often in very high-risk environments in which animals are not protected by annual booster.</li> <li>This vaccine is protective 7-10 days after the second vaccination. The second dose of the initial series should be administered at least 1 week prior to anticipated exposure (e.g., vaccinate 1-2 weeks before exposing the dog to a kennel or other populations of dogs).</li> <li>Do not administer the parenteral vaccine intranasally.</li> </ul>

Canine vaccination guideline for general veterinary practice (modified from AAHA 2011 canine vaccination guideline)			
Canine vaccine	Initial puppy vaccine (< 16 weeks) <sup>1</sup>	Initial vaccination for dogs older than 16 weeks	Revaccination
<i>Bordetella bronchiseptica</i> live avirulent bacteria, intranasal administration	<ul style="list-style-type: none"> <li>Administer one dose at the same time as the core vaccines.</li> <li>The initial intranasal dose may be administered as early as 3-4 weeks of age when exposure risk is high.</li> </ul>	One dose	<ul style="list-style-type: none"> <li>Annually, or more often in very high-risk environments in which surrounding animals are not protected by annual booster.</li> <li>May see transient coughing, sneezing or nasal discharge. Where animals are stressed, tracheobronchitis may develop.</li> <li>Main advantage of intranasal over parenteral vaccine is the speed of onset of protective immunity within 72 hours. Advised if there is insufficient time for a parenteral vaccination to take effect, e.g., in a rescue / shelter situation (see next table).</li> <li>Do not use the intranasal vaccine for parenteral injection.</li> <li>No advantage to using the parenteral and intranasal vaccines together.</li> </ul>
<i>Borrelia burgdorferi</i> (Lyme disease) killed or whole cell bacterin, or rLyme:rOspA	<ul style="list-style-type: none"> <li>Administer 1 dose at 12 weeks of age or later. Repeat 2-4 weeks later.</li> <li>Do not administer to puppies younger than 12 weeks of age.</li> </ul>	Two doses, 2-4 weeks apart. A single dose will not immunize a seronegative dog.	<ul style="list-style-type: none"> <li>Annually, or just before the regional tick season.</li> <li>Note that tick control measures must be used to protect the dog in addition to vaccination.</li> <li>Recommended to be used only for animals with known risk of exposure or in areas where Lyme's disease is endemic.</li> </ul>
<i>Leptospira interrogans</i> killed whole cell or subunit bacterin. Contains 4 serovars: <sup>4</sup> canicola, icterohemorrhagiae, grippotyphosa, pomona.	<ul style="list-style-type: none"> <li>Administer 1 dose at 12 weeks of age or later. Repeat 2-4 weeks later.</li> <li>Do not administer to puppies younger than 12 weeks of age.</li> </ul>	Two doses, 2-4 weeks apart. A single dose will not immunize a seronegative dog.	<ul style="list-style-type: none"> <li>Annual booster.</li> <li>Dogs should be vaccinated only if there is a reasonable risk of exposure.</li> <li>The previous 2-way bacterin is no longer recommended.</li> </ul>

<b>Canine vaccination guideline for general veterinary practice</b> (modified from AAHA 2011 canine vaccination guideline)			
Canine vaccine	Initial puppy vaccine (< 16 weeks) <sup>1</sup>	Initial vaccination for dogs older than 16 weeks	Revaccination
Canine influenza vaccine Killed	Administer one dose after 6 weeks of age, and a second dose 2-4 weeks later.	Two doses, 2-4 weeks apart. A single dose will not immunize a seronegative dog.	<ul style="list-style-type: none"> <li>Do not vaccinate unless both doses can be given.</li> <li>Annual revaccination</li> <li>Use this vaccine in areas in which CIV is endemic, or if animals are transported to or from endemic areas. In most cases, it is not considered a core vaccine.</li> </ul>
Canine Coronavirus (CCoV)	Not recommended, as vaccination does not reduce disease caused by CCoV or CPV-2.		

<b>Canine vaccination guideline for shelter-housed dogs or street dogs</b> (modified from AAHA 2011 canine vaccination guideline)		
Canine vaccine	Initial vaccination <sup>1</sup>	Revaccination & Comments
* CDV + CAV2 + CPV2 ± CPiV Modified-live vaccines (Do not use killed/inactivated vaccines.) <sup>2,3</sup>	<ul style="list-style-type: none"> <li>For all dogs older than 4 weeks of age, administer a single dose immediately before or at the time of admission (shelter dogs) or first contact (street dogs).</li> <li>Exceptions to this are if 1) there is written evidence that the dog has been appropriately and currently vaccinated, or 2) the dog is demonstrated to have protective levels of circulating antibody against CDV and CPV2.</li> </ul>	<ul style="list-style-type: none"> <li>Puppies younger than 18 weeks: vaccinate every 2 weeks until 18-20 weeks of age.</li> <li>Dogs older than 5 months of age: revaccinate at one year of age.</li> <li>Thereafter, revaccinate all dogs every 3 years, per standard recommendation.</li> </ul>
Measles vaccine (available in a 4-way combination with CDV+CAV2+CPiV or in a 2-way combination with CDV.) Administered IM only.	<ul style="list-style-type: none"> <li>Administer one dose between 6-12 weeks of age.</li> <li>Follow every 2-4 weeks with CDV vaccine.</li> </ul>	<ul style="list-style-type: none"> <li>MV provides temporary immunization to puppies against CDV in the presence of maternal antibodies, and has been shown to be effective 2 weeks earlier than the modified-live CDV vaccine. It may be used in environments of high risk for CDV infection for puppies who may have circulating maternal antibodies (younger than 4 months old).</li> <li>This vaccine must be administered IM, and within 1 hour of reconstitution.</li> </ul>

Canine vaccination guideline for shelter-housed dogs or street dogs (modified from AAHA 2011 canine vaccination guideline)		
Canine vaccine	Initial vaccination <sup>1</sup>	Revaccination & Comments
* <i>Bordetella bronchiseptica</i> killed + CPiV, MLV Intranasal	Administer one dose immediately before or at the time of admission (shelter dogs) or first contact (street dogs), as early as 3-4 weeks of age.	<ul style="list-style-type: none"> <li>• Dogs younger than 6 weeks: revaccinate after 6 weeks of age, at least 2 weeks after the first dose. Dogs older than 6 weeks: revaccinate every 6-12 months.</li> <li>• Onset of protective immunity with the intranasal vaccine is within 72 hours.</li> <li>• Vaccination will reduce the severity of disease, but will not protect against infection or shedding of the respiratory disease complex.</li> <li>• This intranasal vaccine is recommended over the parenteral vaccine due to the more rapid onset of protective immunity.</li> <li>• The intranasal vaccine must be administered only intranasally. Do not inject IM or SQ.</li> </ul>
<i>Bordetella bronchiseptica</i> parenteral (SQ) vaccine	<ul style="list-style-type: none"> <li>• Administer one dose at the time of admission (shelter dogs) or first contact (street dogs).</li> <li>• Repeat 2 weeks later. A single dose will not immunize a seronegative dog.</li> </ul>	<ul style="list-style-type: none"> <li>• Regardless of the dog's age, at least 2 vaccinations must be administered, 2 weeks apart, to induce immunity. A single dose will not immunize a seronegative dog.</li> <li>• Dogs who have received two vaccinations within the past 12 months require only one vaccination.</li> <li>• Parenteral <i>B. bronchiseptica</i> vaccine is used only if the intranasal vaccine is not feasible. At least two doses, 2 weeks apart, are necessary to induce immunity; immunity is expected 7-10 days after the <u>second</u> dose.</li> <li>• Do not administer this product intranasally.</li> </ul>
* Rabies 1-year killed	<ul style="list-style-type: none"> <li>• Administer one dose at the time of discharge from the shelter for all dogs 12 weeks of age or older.</li> <li>• Street dogs: administer one dose at 30 weeks of age, or at first contact.</li> <li>• If a longer stay at the shelter is anticipated, vaccinate on arrival at the shelter.</li> </ul>	<ul style="list-style-type: none"> <li>• Revaccinate one year after the initial vaccination, then every 1 or 3 years, per State, provincial, and/or local law.</li> <li>• The use of single-dose vials is recommended to reduce the risk of contamination and to ensure proper mixing and dosage of antigen and adjuvant.</li> </ul>

Canine vaccination guideline for shelter-housed dogs or street dogs (modified from AAHA 2011 canine vaccination guideline)		
Canine vaccine	Initial vaccination <sup>1</sup>	Revaccination & Comments
Canine influenza vaccine (CIV) killed	Administer one dose after 6 weeks of age, and a second dose 2-4 weeks later.	<ul style="list-style-type: none"> <li>• Seronegative dogs must receive two doses, 2-4 weeks apart. A single dose will not immunize a seronegative dog.</li> <li>• Do not vaccinate unless both doses can be given.</li> <li>• Use this vaccine in areas in which CIV is endemic, or if animals are transported to or from endemic areas. In most cases, it is not considered a core vaccine.</li> </ul>

- 1: A dose of vaccine consists of the same volume for a puppy as for an adult dog. Vaccine doses should not be halved or otherwise reduced for young animals or small individuals.
- 2: rCDV (recombinant CDV vaccines) may be used interchangeably with MLV-CDV vaccine. Recent studies have shown that rCDV vaccines are more likely to mount an immune response in puppies who have passively-acquired maternal antibody. Recombinant vaccines also appear to generate a cellular immune response that is not seen with MLV or killed vaccine, and that is not reflected in measurement of a standard antibody titer. The drawback of recombinant vaccines for use in field situations is that they may be more expensive than MLV vaccines. Moreover, most CDV vaccines come in combination with the other core vaccines, and vaccinating for each individually with recombinant vaccine may increase the expense considerably.
- 3: Vaccination with CAV-1 is not recommended due to significant risk of “hepatitis blue-eye” reactions. CAV-2 vaccines effectively cross-protect against CAV-1 and are much safer.
- 4: Note that dominant wild-type *Leptospira* serovars to which animals are exposed may vary regionally. The four that are listed here may not be locally relevant.

<b>Feline vaccination guideline for general veterinary practice (modified from AAFP 2013 vaccination guideline)</b>			
<b>Feline vaccine</b>	<b>Initial kitten vaccine (&lt; 16 weeks) <sup>5</sup></b>	<b>Initial vaccination for cats older than 16 weeks</b>	<b>Revaccination &amp; Comments</b>
<p>* Feline Panleukopenia + Herpesvirus-1 + Calicivirus (FPV, FHV-1, FCV) MLV, SQ injection</p>	<p>Administer first dose as early as 6 weeks of age. Repeat every 3-4 weeks until 16-20 weeks of age.</p>	<p>Administer 2 doses, 3-4 weeks apart</p>	<ul style="list-style-type: none"> <li>• Revaccinate 1 year after initial series, thereafter every 3 years.</li> <li>• Use parenteral vaccine rather than intranasal, particularly in high-risk environments. Do not use parenteral vaccines intranasally or vice versa.</li> <li>• Vaccination against FPV should protect cats very well. Cats vaccinated against respiratory infections may still become ill, but the infection will be relatively mild and shedding of virus reduced.</li> </ul>
<p>* Rabies killed or recombinant SQ or IM, depending on law</p>	<ul style="list-style-type: none"> <li>• Administer 1 dose as early as 12 weeks of age.</li> <li>• The kitten is considered to have a protective titer 28 days after vaccination.</li> </ul>	<ul style="list-style-type: none"> <li>• Administer 1 dose.</li> <li>• The cat is considered to have a protective titer 28 days after vaccination.</li> </ul>	<ul style="list-style-type: none"> <li>• Revaccinate 1 year later. Subsequently, revaccinate every 1-3 years as required by law</li> <li>• The AAFP does not consider rabies a core vaccine for cats. However, rabies vaccination protocols for cats must be followed according to local law. In areas where rabies is endemic, particularly in dogs, it is advisable to vaccinate cats with rabies as a core vaccine.</li> </ul>



Feline vaccination guideline for general veterinary practice (modified from AAFP 2013 vaccination guideline)			
Feline vaccine	Initial kitten vaccine (< 16 weeks) <sup>5</sup>	Initial vaccination for cats older than 16 weeks	Revaccination & Comments
Feline Leukemia virus (FeLV) <sup>6</sup> killed or recombinant SQ injection	<ul style="list-style-type: none"> <li>• Administer first dose as early as 8 weeks of age.</li> <li>• Repeat 3-4 weeks later.</li> </ul>	Administer 2 doses, 3-4 weeks apart.	<ul style="list-style-type: none"> <li>• Cats should be tested and confirmed FeLV-negative before vaccination.</li> <li>• Revaccinate 1 year after the initial series. Thereafter, revaccinate cats at low risk of infection every two to three years; cats at high risk of infection annually.</li> <li>• Kittens younger than 1 year of age should be vaccinated as a matter of routine, provided that they test FeLV-negative.</li> </ul>
Feline Immunodeficiency Virus (FIV) <sup>7</sup> killed, SQ injection	Three doses are required: initial dose as early as 8 weeks of age; two subsequent doses in 2-3 week intervals.	Three doses are required, each 2-3 weeks apart.	<ul style="list-style-type: none"> <li>• May be recommended for outdoor cats or for cats living with FIV-positive individuals.</li> <li>• Vaccination is controversial. See Footnote 7.</li> </ul>
<i>Chlamydomphila felis</i> <sup>8</sup> avirulent live or killed SQ injection	<ul style="list-style-type: none"> <li>• Administer first dose as early as 9 weeks of age.</li> <li>• Administer the second dose 3-4 weeks later.</li> </ul>	<ul style="list-style-type: none"> <li>• Administer first dose as early as 9 weeks of age.</li> <li>• Administer the second dose 3-4 weeks later.</li> </ul>	<ul style="list-style-type: none"> <li>• Neither vaccination or natural infection induce a sterile immunity. Cats may continue to shed <i>C. felis</i> for months.</li> <li>• Ocular inoculation with vaccine will result in typical clinical disease.</li> </ul>

Feline vaccination guideline for general veterinary practice (modified from AAFP 2013 vaccination guideline)			
Feline vaccine	Initial kitten vaccine (< 16 weeks) <sup>5</sup>	Initial vaccination for cats older than 16 weeks	Revaccination & Comments
<i>Bordetella bronchiseptica</i> <sup>8</sup> avirulent live organism intranasal	<ul style="list-style-type: none"> <li>Administer a single dose as young as 4 weeks of age.</li> </ul>	<ul style="list-style-type: none"> <li>Administer a single dose.</li> </ul>	<ul style="list-style-type: none"> <li>Upper respiratory disease following intranasal vaccination may be impossible to distinguish from active infection.</li> <li>Onset of immunity may begin as early as 3 days after inoculation.</li> <li>Do not use the canine <i>Bordetella</i> vaccines in cats.</li> </ul>
Feline Corona Virus (Feline Infectious Peritonitis)	Vaccination against feline coronavirus is generally not recommended.		

Feline vaccination guideline for shelter-housed and street cats (modified from AAFP 2013 vaccination guideline)			
Feline vaccine	Initial kitten vaccine (< 16 weeks) <sup>5</sup>	Initial vaccination for cats older than 16 weeks	Revaccination & Comments
* Panleukopenia + Herpesvirus-1 + Calicivirus (FPV, FHV-1, FCV) MLV, SQ injection	<ul style="list-style-type: none"> <li>Administer first dose at time of admission, as early as 4-6 weeks of age.</li> <li>Repeat every 2-3 weeks until 16-20 weeks of age if still in the shelter.</li> <li>In high-risk environments, kittens should be vaccinated at 4 weeks, and every 2 weeks thereafter until 16-20 weeks of age or rehomed.</li> </ul>	Administer 1 dose at time of admission. Repeat in 2-3 weeks.	<ul style="list-style-type: none"> <li>Do not administer to kittens younger than 4 weeks old due to risk of cerebellar hypoplasia or clinical panleukopenia.</li> <li>Use MLV vaccine in healthy, non-pregnant kittens &amp; cats. For pregnant queens, risk of exposure and protection of the shelter environment must be weighed against the risk to the fetuses.</li> <li>In group-housed, long-term shelters in which vaccinated cats become ill with calicivirus, a multivalent or different strain of calicivirus vaccine may be beneficial.</li> </ul>
Herpesvirus-1 + Calicivirus (FHV-1, FCV) MLV, intranasal	<ul style="list-style-type: none"> <li>Administer first dose at time of admission, as early as 4-6 weeks of age.</li> <li>Repeat every 2-3 weeks until 16-20 weeks of age if still in the shelter.</li> </ul>	Administer 1 dose at time of admission. Repeat in 2-3 weeks.	<ul style="list-style-type: none"> <li>Onset of protection following intranasal vaccination may begin within 4-6 days, and may therefore provide more rapid protection in a high-risk situation.</li> <li>Transient, mild signs of upper respiratory disease may develop following intranasal vaccination.</li> <li>If intranasal vaccine is used to control upper respiratory infection, all cats must receive parenteral FPV vaccine at the same time.</li> </ul>

Feline vaccination guideline for shelter-housed and street cats (modified from AAFP 2013 vaccination guideline)			
Feline vaccine	Initial kitten vaccine (< 16 weeks) <sup>5</sup>	Initial vaccination for cats older than 16 weeks	Revaccination & Comments
* Rabies killed or recombinant SQ or IM, depending on law	<ul style="list-style-type: none"> <li>Administer one dose to cats 3 months of age or older at the time of discharge from the shelter.</li> <li>Cats who will remain in the shelter long-term may be vaccinated at time of admission if rabies exposure is considered a potential risk in the shelter environment.</li> </ul>	<ul style="list-style-type: none"> <li>Administer one dose at the time of discharge from the shelter.</li> <li>Cats who will remain in the shelter long-term may be vaccinated at time of admission if rabies exposure is considered a potential risk in the shelter environment.</li> </ul>	<ul style="list-style-type: none"> <li>Revaccinate one year after the initial vaccination.</li> <li>Subsequent revaccination schedule depends on the risk exposure and local laws. Generally, this is every 1-3 years.</li> </ul>
FeLV <sup>6</sup> killed or recombinant SQ injection	<ul style="list-style-type: none"> <li>Vaccinate as early as 8 weeks of age for group-housed kittens.</li> <li>Repeat vaccination 2-3 weeks later.</li> </ul>	<ul style="list-style-type: none"> <li>Vaccinate on arrival all group-housed cats.</li> <li>Revaccinate 3-4 weeks after the first vaccine.</li> </ul>	<ul style="list-style-type: none"> <li>FeLV vaccine is recommended for cats in long-term shelters or in shelters that house unrelated cats in groups.</li> <li>Individually housed shelter cats may not require vaccination, provided that there are good biosecurity protocols.</li> <li>Vaccination should be done in conjunction with a program of testing and segregating infected cats (see Footnote 6).</li> </ul>
<i>Chlamydophila felis</i> <sup>8</sup> avirulent live or killed SQ injection	<ul style="list-style-type: none"> <li>Administer at the time of admission, as early as 9 weeks of age.</li> <li>Administer the second dose 3-4 weeks later if the kitten is still in the shelter.</li> </ul>	<ul style="list-style-type: none"> <li>Administer at the time of admission. Repeat 3-4 weeks later if the cat is still in the shelter.</li> </ul>	<ul style="list-style-type: none"> <li>Neither vaccination or natural infection induce a sterile immunity. Cats may continue to shed <i>C. felis</i> for months.</li> <li>Ocular inoculation with vaccine will result in typical clinical disease.</li> </ul>

Feline vaccination guideline for shelter-housed and street cats (modified from AAFP 2013 vaccination guideline)			
Feline vaccine	Initial kitten vaccine (< 16 weeks) <sup>5</sup>	Initial vaccination for cats older than 16 weeks	Revaccination & Comments
<i>Bordetella bronchiseptica</i> <sup>8</sup> avirulent live organism intranasal	<ul style="list-style-type: none"> <li>Administer a single dose as young as 4 weeks of age, at the time of admission to the shelter.</li> </ul>	<ul style="list-style-type: none"> <li>Administer a single dose at the time of admission to the shelter.</li> </ul>	<ul style="list-style-type: none"> <li>Sneezing or coughing after intranasal vaccination may be impossible to distinguish from active infection.</li> <li>Onset of immunity may begin as early as 3 days after inoculation.</li> <li>Do not use the canine <i>Bordetella</i> vaccines in cats.</li> </ul>
Feline immunodeficiency virus (FIV) and feline coronavirus (feline peritonitis) (FCoV, FIP)	Vaccination not recommended in shelters. Follow isolation and management procedures to protect uninfected cats.		

- 5: A dose of vaccine consists of the same volume for a kitten as for an adult cat. Vaccine doses should not be halved or otherwise reduced for young animals or small individuals.
- 6: Cats should be tested and confirmed FeLV negative before vaccination. FeLV vaccine is recommended only for FeLV-negative cats who go outdoors, who come into contact with FeLV infected cats, or who live in an environment in which cats frequently are brought into contact with new cats of unknown FeLV status. FeLV vaccination is highly recommended for all kittens, but boosters are not recommended for cats who are strictly confined indoors and who do not come into contact with new or potentially FeLV-positive cats. FeLV-infected cats should be kept indoors and isolated from susceptible cats, and from cats who may carry other infectious pathogens. FeLV-infected cats should be vaccinated with core vaccines, but these cats may not mount an adequate immune response to protect them from challenge.
- 7: FIV vaccine should be used only for cats who are at high risk of infection. Cats at high risk include outdoor cats who fight with other cats and cats who live with FIV-infected cats. Vaccination with FIV induces production of antibodies that are indistinguishable from antibodies produced against naturally-acquired infection. Therefore, vaccination will interfere with all antibody-based diagnostic tests for at least 1 year following vaccination. Cats should be tested and confirmed FIV negative before vaccination. Note that kittens may carry maternally-derived antibodies until ca. 12 weeks of age. FIV-infected cats should be kept indoors and isolated from susceptible cats, and from cats who may carry other infectious pathogens. FIV-infected cats are able to mount an immune response to vaccination with core vaccines until the terminal stages of FIV-associated disease, but the immune response may be delayed or diminished compared with FIV-negative cats.

8: Routine vaccination against *Chlamydophila felis* and *Bordetella bronchiseptica* is not recommended, even for shelter cats. The association between either of these infections and respiratory disease is inconsistent. Vaccination against these pathogens is reserved for cases where it is supported by laboratory diagnostics. *B. bronchiseptica* vaccination may also be considered where there is potential exposure of cats to dogs in shelters with a “kennel cough” problem. Note that even cats vaccinated with these organisms may shed the pathogen for weeks or months, and may pose a risk to other susceptible animals. The objective of vaccination is not to prevent disease, but to lessen the clinical impact of infection.

## Appendix 4: Anti-parasitic drugs

A fecal parasite examination should be done every 6-12 weeks (depending on climate and living conditions), and the animal treated as necessary. In shelters, all animals should be treated for internal and external parasites on arrival. A regular dosing schedule with rotating use of different anthelmintics should be part of the standard shelter operating protocol, with periodic fecal checks on a random selection of animals representing different shared enclosures.

Compliance by animal guardians with preventive veterinary protocols like parasite control may be challenging, particularly in areas in which people have little access to veterinary care. In these areas, the project should include strategies for improving access to primary veterinary care, and for educating animal guardians in the importance of preventive health care for their animals. Zoonotic risk management of parasites is also a consideration, particularly for the protection of children. Preventive veterinary health care is essential for the health and welfare of the individual animal, for other animals in the community, and for the safety and welfare of people in the community.

The following is a summary of common drugs available for treatment of endoparasites and ectoparasites. The list is comprehensive, but not exhaustive. Trade names of drugs will differ among countries, but trade names of some of the common internationally-distributed products (often combinations of drugs) have been listed here.

**PO** = per os (oral); **SQ** = subcutaneous; **IM** = intramuscular **SID** = once per day (once every 24 hours) **BID** = twice per day (every 12 hours)

**q** = every (e.g., q8 hrs = every 8 hours) **Monthly** = once per month

**Topical** or **Topical spot-on** = Solution that is to be applied to the skin of the dog or cat, usually on the dorsal neck between the shoulder blades where the animal cannot reach it with the tongue. Care should be taken to prevent the compound from getting on the skin of the person applying the medication.

**Roundworms** refers to nematodes, including *Toxocara*, *Ascaris*, and lungworms (*Aelurostrongylus*, *Capillaria*, *Filaroides*), but does not necessarily include canine whipworms (*Trichuris vulpis*). **Hookworms**: *Ancylostoma* and *Uncinaria* spp. **Tapeworms / cestodes**: *Dipylidium*, *Taenia*, *Echinococcus*, *Diphilobothrium*, *Spirometra*.

Drug or Product	Application	Dose & comments
Adam's flea products (Farnam pet products) Pyrethrins, piperonyl butoxide, (S)- methoprene, N-octyl bicycloheptene dicarboximide	Topical spray, kills & repels: <ul style="list-style-type: none"><li>• fleas: adults, eggs &amp; larvae</li><li>• ticks</li><li>• lice</li><li>• mosquitoes, gnats, flies</li></ul>	<ul style="list-style-type: none"><li>• Dogs &amp; cats &gt; 3 months old.</li><li>• Avoid use on cats (pyrethrins)</li><li>• May use on bedding</li><li>• Washes off in rain and water.</li></ul>

Drug or Product	Application	Dose & comments
Advantage® (Bayer) Imidacloprid	<ul style="list-style-type: none"> <li>Monthly topical spot-on, flea prevention treatment.</li> <li>Fleas: adults &amp; larvae</li> </ul>	<ul style="list-style-type: none"> <li>Dogs &amp; cats &gt; 7 months old</li> <li>Prevents fleas from biting, and kills those that do bite. The former property makes it useful in management of flea allergies.</li> <li>Not effective against ticks</li> </ul>
Advantage-Multi® / Advocate® (Bayer) Imidacloprid + moxidectin	Monthly topical spot-on: <ul style="list-style-type: none"> <li>fleas: adult &amp; larvae</li> <li>heartworm prevention</li> <li>hookworm</li> <li>roundworm</li> <li>whipworm (dogs)</li> <li>ear mites (cats)</li> </ul>	<ul style="list-style-type: none"> <li>For dogs and cats &gt; 1.5 kg and &gt; 9 weeks old</li> <li>Different formulations for dogs and cats, use per label instructions.</li> <li>Not effective against demodectic mange, although package suggests use for this condition.</li> <li>Moderately effective against sarcoptic mange in dogs, although ivermectin or selamectin may be more effective.</li> <li>Do not bathe after application.</li> </ul>
Advantix K9 (Bayer) Imidacloprid + permethrin	<ul style="list-style-type: none"> <li>Monthly topical spot-on for dogs only</li> <li>Prevention of fleas (adult &amp; larvae), ticks, mosquitoes</li> </ul>	<ul style="list-style-type: none"> <li>Do not use in cats (permethrins)</li> <li>Topical spot-on, applied once per month, dose per label instructions.</li> </ul>
Afoxolaner		<ul style="list-style-type: none"> <li>Active ingredient in Nexgard. See Nexgard.</li> </ul>
Albendazole	<ul style="list-style-type: none"> <li>Roundworms (incl. lungworms)</li> <li><i>Paragonimus</i> (lung flukes)</li> <li><i>Capillaria</i> (dogs)</li> <li><i>Giardia</i></li> </ul>	<ul style="list-style-type: none"> <li>Dogs: <i>Filaroides</i> (lungworms): 50 mg/kg BID, PO x 5 days, repeat in 3 weeks.</li> <li>Dogs: <i>Capillaria</i>: 50 mg/kg BID, PO x 14 days</li> <li><i>Paragonimus</i>: 25-50 mg/kg BID, PO for 14-21 days.</li> <li><i>Giardia</i>: 25-50 mg/kg BID x 5 days</li> <li>Liver flukes in cats: 50 mg/kg SID, PO until ova are gone.</li> <li>May cause bone marrow suppression in dogs &amp; cats.</li> </ul>
Atovaquone + azithromycin	<ul style="list-style-type: none"> <li>Antiprotozoal for treatment of babesiosis in dogs</li> </ul>	<ul style="list-style-type: none"> <li>Atovaquone 13.3 mg/kg PO q8 hr + azithromycin 10 mg/kg PO SID for 10 days</li> <li>See also imidocarb dipropionate and diminazene aceturate</li> </ul>



Drug or Product	Application	Dose & comments
Bravecto® (MSD) fluralaner	<ul style="list-style-type: none"> <li>• Oral, once per 3 months.</li> <li>• Fleas &amp; ticks</li> <li>• Demodecosis</li> </ul>	<ul style="list-style-type: none"> <li>• Dogs &gt;6 mo, &gt;2 kg. Ok for pregnant dogs.</li> <li>• Cats &gt;6 mo, &gt;1.2 kg.</li> <li>• Effect against lone star tick (<i>Amblyomma americanum</i>) only 8 weeks.</li> <li>• Single dose effective for generalized demodecosis (Fourie et al. 2015)</li> </ul>
Capstar® (Novartis) Nitenpyram	<ul style="list-style-type: none"> <li>• Kills adult fleas for up to 24 hours.</li> <li>• For treatment of dogs and cats who are infested with adult fleas, as a first step in flea control</li> </ul>	<ul style="list-style-type: none"> <li>• Oral tablet, dose per package instructions</li> <li>• For dogs and cats &gt; 4 weeks and &gt; 1 kg.</li> <li>• Works within 30 minutes. Within 4 hours, kills all the fleas on the animal. Lasts for 24 hours in killing new fleas.</li> </ul>
Certifect® (Merial) Fipronil, S-methoprene, amitraz	<ul style="list-style-type: none"> <li>• Monthly topical spot-on</li> <li>• Fleas: adults &amp; larvae.</li> <li>• Ticks</li> </ul>	<ul style="list-style-type: none"> <li>• Dogs only</li> <li>• Waterproof formulation</li> <li>• Topical spot-on, applied once per month, dose per label instructions.</li> </ul>
Cestex® (Pfizer)	Dog and cat tapeworms: <i>Dipylidium</i> and <i>Taenia</i>	See Epsiprantel
Comfortis® (Eli Lilly) Spinosad	<ul style="list-style-type: none"> <li>• Monthly flea prevention</li> <li>• Kills adult fleas only.</li> </ul>	<ul style="list-style-type: none"> <li>• Dogs and cats &gt; 14 weeks. Cats &gt; 1 kg, dogs &gt; 1.5 kg.</li> <li>• Oral: dose per package instructions (23-45 mg/kg). Separate formulations for dogs and cats.</li> </ul>
Dichlorvos	Roundworms	<ul style="list-style-type: none"> <li>• Dog &amp; cat: 11 mg/kg PO</li> <li>• Organophosphate drug; dose carefully. Preferable to use a newer, safer compound.</li> </ul>

Drug or Product	Application	Dose & comments
Diethylcarbamazine	<ul style="list-style-type: none"> <li>Daily oral heartworm preventative</li> <li>Ascarids</li> </ul>	<ul style="list-style-type: none"> <li>Dog 6.6 mg/kg PO once per day for heartworm prevention. Now rarely used; replaced with monthly heartworm prevention options.</li> <li>Ascarids, dogs &amp; cats: 55-110 mg/kg PO, once. Repeat in 21 days.</li> <li>Note that there are newer, more broad-spectrum drugs now available for treatment of intestinal parasites.</li> </ul>
Diminazene aceturate	Antiprotozoal <ul style="list-style-type: none"> <li><i>Babesia</i></li> <li><i>Cytauxzoon</i></li> <li><i>Trypanosoma</i></li> </ul>	<ul style="list-style-type: none"> <li><i>Babesia</i> &amp; <i>Trypanosoma</i> (dogs): 3.5-5 mg/kg IM. Repeat in 24 hrs. Increased risk of neurotoxicity if total dose is &gt; 7 mg/kg</li> <li><i>Cytauxzoon</i> (cats): 3-5 mg/kg IM, once, or 2 mg/kg IM and repeat in 1 week.</li> <li>May not clear infections completely; consider imidocarb dipropionate.</li> </ul>
Doramectin	Use and dose similar to ivermectin	See ivermectin
Drontal™ 20 mg Praziquantel + 230 mg Pyrantel embonate per tablet	<ul style="list-style-type: none"> <li>Roundworms</li> <li>Hookworms</li> <li>Tapeworms</li> </ul>	<ul style="list-style-type: none"> <li>Cats &gt; 4 weeks, &gt; 700g: dose per label instructions. One tablet per 4 kg.</li> <li>Dogs: use Drontal-Plus / Drontal Allwormer.</li> </ul>
Drontal-Plus™ or Drontal Allwormer 250 mg febantel + 49.8 mg pyrantel pamoate + 50 mg praziquantel	<ul style="list-style-type: none"> <li>Roundworms</li> <li>Hookworms</li> <li>Whipworms</li> <li>Tapeworms</li> </ul>	<ul style="list-style-type: none"> <li>Dogs &gt; 3 weeks, &gt; 1kg: dose per label instructions. One tablet per 10 kg.</li> <li>Use of Drontal-Plus is not recommended in cats, as febantel is not well tolerated and often causes vomiting in cats.</li> </ul>

Drug or Product	Application	Dose & comments
Effipro® (Virbac) Fipronil	<ul style="list-style-type: none"> <li>• Monthly spot-on flea &amp; tick control</li> <li>• Kills adult fleas &amp; ticks (does not kill eggs &amp; larvae)</li> </ul>	<ul style="list-style-type: none"> <li>• For cats &gt; 8 weeks &amp; 1 kg.</li> <li>• Dogs &gt; 8 weeks &amp; 2 kg</li> <li>• Dose once per month; where there is risk of tick paralysis, dose q2 wks.</li> <li>• Kills adult fleas within 24 hours and ticks within 48 hours after they bite.</li> <li>• Does not prevent fleas &amp; ticks from attaching or biting the animal, hence not effective for flea allergy management.</li> <li>• Tick paralysis has been documented in dogs &amp; cats treated with fipronil.</li> </ul>
Epsiprantel Cestex® (Pfizer)	Dog and cat tapeworms: <i>Dipylidium</i> and <i>Taenia</i>	<ul style="list-style-type: none"> <li>• Dogs and cats &gt; 7 weeks old</li> <li>• Dog: 5.5 mg/kg PO</li> <li>• Cat: 2.75 mg/kg PO</li> </ul>
Fenbendazole Panacur® (Intervet / MSD)	<ul style="list-style-type: none"> <li>• Ascarids</li> <li>• Hookworms</li> <li>• Whipworms</li> <li>• <i>Taenia</i> spp.</li> <li>• Tapeworms</li> <li>• <i>Giardia</i></li> <li>• Drug of choice for giardiasis.</li> </ul>	<ul style="list-style-type: none"> <li>• Requires dosing for 3-5 consecutive days, 50 mg/kg SID. Repeat in 3 wks.</li> <li>• UK allows 100 mg/kg, once. Repeat in 3 wks.</li> <li>• Treatment of <i>Capillaria</i> may need to be extended to 10 days.</li> <li>• For pregnant bitches: 25 mg/kg SID from day 40 gestation until 2 days post-whelping (approximately 25 days).</li> <li>• Lungworms: treat cats 5 consecutive days, dogs 7 days</li> <li>• <i>Giardia</i>: 50 mg/kg PO once daily for 5 days or 20 mg/kg PO once daily for 5 days (cats). Repeat in 3 weeks.</li> </ul>

Drug or Product	Application	Dose & comments
Fipronil	<ul style="list-style-type: none"> <li>• Monthly spot-on or spray flea &amp; tick control</li> <li>• Kills adult fleas &amp; ticks (does not kill eggs &amp; larvae)</li> </ul>	<ul style="list-style-type: none"> <li>• For cats &gt; 8 weeks &amp; 1 kg.</li> <li>• Dogs &gt; 8 weeks &amp; 2 kg</li> <li>• Dose once per month; where there is risk of tick paralysis, dose q2 wks.</li> <li>• Kills adult fleas within 24 hours and ticks within 48 hours after they bite.</li> <li>• Does not prevent fleas and ticks from attaching or biting the animal, hence not effective for flea allergy management.</li> <li>• Tick paralysis has been documented in dogs &amp; cats treated with fipronil.</li> <li>• Active ingredient in Effipro, Frontline, Frontline-Plus, Certifect.</li> </ul>
Flubendazole	<ul style="list-style-type: none"> <li>• Roundworms</li> <li>• Hookworms</li> <li>• Whipworms (<i>Trichuris vulpis</i>; dogs)</li> <li>• Tapeworm (<i>Taenia pisiformis</i>; dog &amp; cat)</li> </ul>	<ul style="list-style-type: none"> <li>• Roundworms &amp; hookworms: 22 mg/kg PO SID x 2 days. Repeat in 3 weeks.</li> <li>• <i>Trichuris vulpis</i> (dogs) &amp; <i>Taenia pisiformis</i> (dogs &amp; cats): 22 mg/kg SID x 3 days. Repeat in 3 weeks.</li> </ul>
Fluralaner Bravecto® (MSD)		See Bravecto®
Frontline® (Merial) Fipronil	<ul style="list-style-type: none"> <li>• Monthly flea &amp; tick control.</li> </ul>	<ul style="list-style-type: none"> <li>• See Fipronil</li> <li>• Available as spray or spot-on</li> <li>• Washes off with water. Do not bathe for 3 days after application.</li> </ul>
Frontline-Plus® (Merial) Fipronil + S-methoprene	<ul style="list-style-type: none"> <li>• Monthly flea &amp; tick control</li> <li>• Fleas: adults &amp; larvae &amp; eggs</li> </ul>	<ul style="list-style-type: none"> <li>• Dogs &amp; cats: use per label instructions.</li> <li>• Addition of S-methoprene to fipronil makes this product effective against immature stages of fleas, hence more effective in controlling flea populations in the environment.</li> <li>• Available as spray or spot-on</li> <li>• Do not bathe for 3 days after application.</li> </ul>

Drug or Product	Application	Dose & comments
Furazolidone	<ul style="list-style-type: none"> <li>• Antiprotozoal and antibacterial</li> <li>• Second-choice drug against protozoa.</li> <li>• <i>Giardia</i>, <i>Trichomonas</i>, coccidia</li> <li>• Some strains of <i>E coli</i>, <i>Enterobacter</i>, <i>Campylobacter</i>, <i>Salmonella</i>, <i>Shigella</i>, <i>Vibrio cholerae</i></li> </ul>	<ul style="list-style-type: none"> <li>• <i>Giardia</i>, dogs &amp; cats: 4 mg/kg PO BID x 7-10 days</li> <li>• Coccidiosis, dogs &amp; cats: 8-20 mg/kg SID PO x 7 days</li> <li>• Amoebic colitis, dogs &amp; cats: 2.2 mg/kg PO q8 hrs x 7 days</li> </ul>
Heartgard® (Merial) Ivermectin, low-dose	<ul style="list-style-type: none"> <li>• Monthly prevention of heartworms</li> <li>• Note: <u>not</u> effective against intestinal parasites, sarcoptic mange or demodexosis.</li> </ul>	<ul style="list-style-type: none"> <li>• Dogs and cats: oral, dose per package instructions.</li> <li>• Ivermectin dose in Heartgard and Heartgard-Plus is 0.006-0.012 mg/kg. Note that this is a heartworm prevention dose only. At this dose, it is not effective against intestinal parasites, <i>Sarcoptes</i>, <i>Demodex</i> or ear mites. See Ivermectin for doses appropriate against these pathogens.</li> </ul>
Heartgard-Plus® (Merial) Ivermectin (low dose) + pyrantel	<p>Oral, monthly prevention of:</p> <ul style="list-style-type: none"> <li>• Heartworm</li> <li>• Hookworms</li> <li>• Roundworms</li> <li>• The low dose of ivermectin in this product makes it ineffective against sarcoptic mange or <i>Demodex</i>.</li> </ul>	<ul style="list-style-type: none"> <li>• Dogs and cats: oral, dose per package instructions.</li> <li>• Ivermectin dose in Heartgard and Heartgard-Plus is 0.006-0.012 mg/kg. Note that this is a heartworm prevention dose only. At this dose, it is not effective against intestinal parasites, <i>Sarcoptes</i>, <i>Demodex</i> or ear mites. See Ivermectin for doses appropriate against these pathogens.</li> <li>• The addition of pyrantel in this product makes Heartgard-Plus® effective against hookworms and roundworms.</li> </ul>
Imidacloprid	<ul style="list-style-type: none"> <li>• Monthly topical spot-on, flea prevention treatment.</li> <li>• Fleas: adults &amp; larvae</li> </ul>	<ul style="list-style-type: none"> <li>• See Advantage, Advantage-Multi, Advantix K9</li> </ul>
Imidocarb dipropionate Imizol® (Schering-Plough)	<ul style="list-style-type: none"> <li>• Antiprotozoal for treatment of babesiosis in dogs and <i>Cytauxzoon felis</i> in cats</li> </ul>	<ul style="list-style-type: none"> <li>• Dogs: 6.6 mg/kg IM or SQ, one dose. Repeat in 14 days.</li> <li>• Cats: 5 mg/kg IM, one dose. Repeat in 14 days.</li> <li>• Supportive care during treatment is essential.</li> </ul>

Drug or Product	Application	Dose & comments
Interceptor® (Novartis) milbemycin oxime	<ul style="list-style-type: none"> <li>• Monthly heartworm prevention</li> <li>• Hookworms (<i>Ancylostoma caninum</i>, <i>Ancylostoma tubaeforme</i>), ascarids (<i>Toxocara canis</i>, <i>Toxascaris leonine</i>, <i>Toxocara cati</i>), whipworms (<i>Trichuris vulpis</i>)</li> <li>• Treatment of sarcoptic or demodectic mange or cheyletiellosis in ivermectin-sensitive breeds of dogs</li> </ul>	See milbemycin oxime
Ivermectin Heartgard®, Heartgard-Plus®, Ivomec® (Merial)	<ul style="list-style-type: none"> <li>• Heartgard and Heartgard-Plus are used for the prevention of heartworm.</li> <li>• For ivermectin-sensitive dogs, use another options for heartworm prevention, such as milbemycin.</li> <li>• Ivermectin (1% solution): roundworms, lungworms, <i>Demodex</i> (need high dose), sarcoptic and otodectic mange</li> </ul>	<ul style="list-style-type: none"> <li>• See Heartgard® and Heartgard-Plus®</li> <li>• Dogs with MDR1 gene defect that causes hypersensitivity to macrolides usually tolerate ivermectin at the heartworm-prophylactic dose (0.006-0.012 mg/kg). They should not receive higher doses.</li> <li>• Used as pre-treatment for control of microfilaria prior to treatment of adult heartworm infection with melarsomine, per AMVA protocol.</li> <li>• Avermectins do not kill adult heartworms. Dogs with adult heartworms must be treated with melarsomine under controlled conditions and appropriate pre- and post-treatment adjunct therapy.</li> <li>• Dog doses <ul style="list-style-type: none"> <li>▪ Heartworm prevention: 0.006-0.012 mg/kg PO once per month (e.g. Heartgard)</li> <li>▪ Ectoparasiticide (<i>Sarcoptes</i>, <i>Otodectes</i>): 0.3 mg/kg SQ or PO once. Repeat once weekly for at least 3-4 weeks until 3 consecutive skin scrapings, 1 week apart, are found negative. See mange treatment protocols.</li> <li>▪ <i>Demodex</i>: 0.3-0.6 mg/kg SID or several times per week, PO or</li> </ul> </li> </ul>

Drug or Product	Application	Dose & comments
		<p>SQ until 3 consecutive skin scrapings, 3 weeks apart, are found negative. Ramp up to full dosage gradually at the beginning of treatment, and taper off dosage gradually at the end of treatment: do not start and end high doses abruptly. At high doses, monitor closely for signs of toxicity. See demodecosis treatment protocol.</p> <ul style="list-style-type: none"> <li>Cats: Heartworm prevention: 0.024 mg/kg PO once per month. <i>Otodectes</i> as for dogs.</li> <li>Roundworms &amp; hookworms, dogs &amp; cats: 0.2-0.4 mg/kg PO or SQ once. Repeat in 3 wks.</li> <li>Lungworm: 0.4 mg/kg SQ, once</li> </ul>
Levamisole	<ul style="list-style-type: none"> <li>Roundworms</li> <li>Lungworms</li> </ul>	<ul style="list-style-type: none"> <li>Used primarily in livestock, rarely in dogs &amp; cats now.</li> <li>Dogs, lungworms: 7-10 mg/kg SID, PO x 7 days (<i>Capillaria</i>) or 45 days (<i>Filaroides</i>).</li> <li>Cats, lungworms: various dosing regimes, highly variable. Refer to Plumb's.</li> <li>Has immune stimulant properties</li> </ul>
Lufenuron	<ul style="list-style-type: none"> <li>Monthly control of flea eggs and larval development</li> </ul>	<ul style="list-style-type: none"> <li>see Program, Sentinel.</li> </ul>
Meglumine antimoniate	<ul style="list-style-type: none"> <li>Leishmaniasis in dogs</li> </ul>	<ul style="list-style-type: none"> <li>May combine with allopurinol.</li> <li>Minimum dose: 100 mg/kg SQ SID 3-4 weeks; better if 4-6 wks</li> <li>Adding allopurinol at 20-40 mg/kg PO SID for several months may reduce relapse rate.</li> </ul>
Melarsomine	<ul style="list-style-type: none"> <li>Treatment of adult heartworms in dogs</li> </ul>	<ul style="list-style-type: none"> <li>Careful pre-treatment clinical evaluation, pre-treatment medications and strict exercise restriction are necessary.</li> <li>Refer to full preparation and monitoring protocols. Three different dosing options are recommended. Most commonly used protocol: 2.5 mg/kg IM on Day 1. Wait 1-3 months, then deliver 2 more doses, 24 hours apart. Pretreat with macrolide to remove microfilaria.</li> </ul>

Drug or Product	Application	Dose & comments
Metronidazole	<ul style="list-style-type: none"> <li>Antiprotozoal: <i>Giardia</i>, <i>Trichomonas</i>, <i>Entamoeba</i>, <i>Balantidium</i>.</li> <li>Anaerobic bacteria</li> </ul>	<ul style="list-style-type: none"> <li><i>Giardia</i>, dogs &amp; cats: 15-30 mg/kg PO once daily x 5-7 days</li> <li><i>Entamoeba</i>, dogs &amp; cats: 25 mg/kg BID PO x 8 days</li> </ul>
Milbemax® (Novartis) Milbemycin oxime + praziquantel	<ul style="list-style-type: none"> <li>Monthly prevention against heartworm, intestinal nematodes &amp; tapeworms for dogs and cats</li> </ul>	<ul style="list-style-type: none"> <li>For dogs more than 2 weeks old and more than 0.5 kg. Dosed at 0.5 – 2.5 mg/kg milbemycin + 5-25 mg/kg praziquantel.</li> <li>For cats and kittens: 2-4 mg/kg milbemycin + 5-10 mg/kg praziquantel.</li> </ul>
Milbemycin oxime	<ul style="list-style-type: none"> <li>Monthly heartworm prevention</li> <li>Hookworms (<i>Ancylostoma caninum</i>, <i>Ancylostoma tubaeforme</i>), ascaridis (<i>Toxocara canis</i>, <i>Toxascaris leonine</i>, <i>Toxocara cati</i>), whipworms (<i>Trichuris vulpis</i>)</li> <li>Treatment of sarcoptic or demodectic mange or cheyletiellosis in ivermectin-sensitive breeds of dogs</li> </ul>	<ul style="list-style-type: none"> <li>Dogs, heartworm prevention: 0.5-2.5 mg/kg PO once per month</li> <li>Cats, heartworm prevention: 2-4 mg/kg PO once per month</li> <li>May be used in ivermectin-sensitive dogs, but dose must be followed precisely. Smaller margin of safety in these dogs than in individuals who do not have the MDR1 gene defect.</li> <li>Considered a quickly-acting microfilaricide. May cause emboli or anaphylactic reactions if used to treat heartworm-positive dogs due to rapid death of microfilaria. For these patients, it is preferable to use “slower” microfilaricides such as ivermectin, moxidectin or selamectin.</li> <li>May be moderately effective against sarcoptic mange or cheyletiellosis if ivermectin or selamectin are not options. 2 mg/kg PO once every 7 days for 3 doses.</li> <li>May be effective against demodectic mange in ivermectin-sensitive breeds. 1-2 mg/kg PO SID 30-60 days.</li> <li>See Interceptor (milbemycin oxime)</li> <li>See Sentinel (Milbemycin oxime + lufenuron)</li> <li>See Trifexis (milbemycin oxime + spinosad)</li> <li>See Milbemax (milbemycin oxime + praziquantel)</li> </ul>



Drug or Product	Application	Dose & comments
Moxidectin	<ul style="list-style-type: none"> <li>Heartworm prevention</li> <li>Hookworms</li> <li>Roundworms</li> </ul>	<ul style="list-style-type: none"> <li>See Proheart and Advantage-Multi / Advocate</li> <li>May be used in ivermectin-sensitive dogs, but dose must be followed precisely. Smaller margin of safety in these dogs than in individuals who do not have the MDR1 gene defect.</li> </ul>
Nexgard® (Merial) afoxolaner	<ul style="list-style-type: none"> <li>Monthly flea &amp; tick prevention</li> <li>Oral</li> <li>Adult fleas</li> <li>Ticks</li> </ul>	<ul style="list-style-type: none"> <li>Dogs. Puppies &gt; 8 weeks, min. 2 kg</li> <li>2.5 mg/kg PO</li> <li>Empirically effective against canine demodecosis, similar to Bravecto (fluralaner).</li> </ul>
Nitenpyram	<ul style="list-style-type: none"> <li>Adult fleas</li> </ul>	<ul style="list-style-type: none"> <li>See Capstar®</li> </ul>
Oxfendazole	<ul style="list-style-type: none"> <li>Lungworm in dogs (<i>Filaroides</i>)</li> </ul>	<ul style="list-style-type: none"> <li>10 mg/kg SID PO x 28 days</li> </ul>
Permethrin	<ul style="list-style-type: none"> <li>Ectoparasite control in dogs</li> </ul>	<ul style="list-style-type: none"> <li>See also Advantix K9, Adams flea products</li> <li>Do not use in cats.</li> </ul>
Piperazine	<ul style="list-style-type: none"> <li>Roundworms &amp; hookworms</li> </ul>	<ul style="list-style-type: none"> <li>Roundworms, dogs &amp; cats: 55-100 mg/kg PO, repeat 10 days later.</li> <li>Hookworms, dogs &amp; cats: 120-240 mg/kg</li> </ul>
Ponazuril	<ul style="list-style-type: none"> <li>Antiprotozoal (<i>Toxoplasma</i>, <i>Neospora</i>, coccidia)</li> </ul>	<ul style="list-style-type: none"> <li><i>Toxoplasma</i>, <i>Neospora</i>, dogs &amp; cats: 7.5-15 mg/kg PO SID x 28 days</li> <li>Coccidia, dogs &amp; cats: 15-30 mg/kg PO once, repeat in 7-10 days</li> </ul>
Praziquantel	<ul style="list-style-type: none"> <li>Cestodes and trematodes</li> </ul>	<ul style="list-style-type: none"> <li>Dogs, cats: 3.5-7.5 (average 5.68) mg/kg SQ, IM or 5 mg/kg PO.</li> <li>See Drontal-Plus® (febantel + pyrantel pamoate + praziquantel)</li> <li>See Milbemax® (Milbemycin oxime + praziquantel)</li> <li>See Profender™ (emodepside + praziquantel)</li> </ul>
Primaquine	<ul style="list-style-type: none"> <li>Drug of choice for <i>Babesia felis</i></li> </ul>	<ul style="list-style-type: none"> <li>Cats: 0.5 mg/kg SID x 3 days or 1 mg per cat q 36 hrs x 4 treatments, then once every 7 days for 4 treatments</li> <li>Monitor CBC weekly. May require repeated courses of treatment to clear the infection.</li> </ul>

Drug or Product	Application	Dose & comments
Profender™ (Bayer) Emodepside + praziquantel	<ul style="list-style-type: none"> <li>• Topical spot-on for cats, monthly</li> <li>• Hookworms</li> <li>• Roundworms</li> <li>• Tapeworms</li> </ul>	<ul style="list-style-type: none"> <li>• Cats &gt; 8 weeks old, &gt; 1 kg.</li> <li>• Minimum dose: 3 mg/kg emodepside + 12 mg/kg praziquantel, topically</li> </ul>
Program® (Novartis) lufenuron	<ul style="list-style-type: none"> <li>• Monthly control of flea egg &amp; larval development</li> </ul>	<ul style="list-style-type: none"> <li>• Dogs &amp; cats &gt; 6 weeks old</li> <li>• Dogs &amp; cats: oral tablets, per package instructions, once per month.</li> <li>• Cats: oral suspension, per package instructions, once per month</li> <li>• Cats: 6-month injectable (do not use in dogs).</li> <li>• Insect growth regulator, stops flea eggs &amp; larvae from developing. Works by transferring drug to the adult flea when it takes a blood meal from the dog or cat. Eggs produced subsequently by the flea are not viable. Does not prevent the flea from biting the dog or cat, hence not preventative against flea allergy dermatitis.</li> </ul>
ProHeart®6, ProHeart®12 (Pfizer) Guardian®SR, Moxidex®SR (Fort Dodge) Moxidectin	<ul style="list-style-type: none"> <li>• Injectable, six- or twelve-month heartworm preventative for dogs</li> <li>• Hookworms</li> </ul>	<ul style="list-style-type: none"> <li>• Sustained-release moxidectin, administered once every 6 months (ProHeart-6) or 12 months (ProHeart-12) by SQ injection at 0.17 mg/kg.</li> <li>• Effective against heartworm microfilaria (heartworm preventative) and hookworms.</li> <li>• For dogs more than 6 months old.</li> </ul>
Pyrantel pamoate	<ul style="list-style-type: none"> <li>• Roundworms</li> <li>• Hookworms</li> <li>• Stomach worm (<i>Physaloptera</i>)</li> </ul>	<ul style="list-style-type: none"> <li>• Dogs and cats &gt; 3 weeks old, 5-10 mg/kg PO, repeat in 3 weeks</li> <li>• See Drontal® (pyrantel + praziquantel)</li> <li>• See Drontal-Plus® (febantel + pyrantel pamoate + praziquantel)</li> <li>• See Heartgard-Plus® (ivermectin + pyrantel)</li> </ul>
Pyrimethamine	<ul style="list-style-type: none"> <li>• Antiprotozoal: <i>Toxoplasma</i>, <i>Hepatozoon</i>, <i>Neospora</i></li> </ul>	<ul style="list-style-type: none"> <li>• Combined with sulfadiazine serves as an alternative to trimethoprim / sulfadiazine</li> <li>• Caution in cats: bone marrow suppression.</li> <li>• Dosing varies with pathogen &amp; protocol</li> </ul>

Drug or Product	Application	Dose & comments
Quinacrine	<ul style="list-style-type: none"> <li>Second-choice drug for <i>Giardia</i>, <i>Leishmania</i>, coccidia</li> </ul>	<ul style="list-style-type: none"> <li>Dogs: 6.6 mg/kg PO BID x 5 days</li> <li>Cats: 9-10 mg/kg PO SID x 5 days; for <i>Giardia</i> up to 10 days.</li> </ul>
Revolution™ (Pfizer) selamectin	<ul style="list-style-type: none"> <li>Monthly topical spot-on for dogs and cats against ectoparasites &amp; endoparasites and heartworm prevention.</li> </ul>	<ul style="list-style-type: none"> <li>See selamectin</li> </ul>
Ronidazole	<ul style="list-style-type: none"> <li>Antiprotozoal for <i>Trichomonas foetus</i> infection in cats</li> </ul>	<ul style="list-style-type: none"> <li>Cats: 30 mg/kg BID PO x 14 days</li> </ul>
Selamectin Revolution™, Stronghold® (Pfizer)	<p>Monthly topical spot-on for dogs and cats:</p> <ul style="list-style-type: none"> <li>Fleas, adult &amp; larvae</li> <li>Heartworm prevention</li> <li>Ear mite treatment</li> <li>Ticks</li> <li>Sarcoptic mange treatment</li> <li>Hookworms</li> <li>Roundworms</li> </ul>	<ul style="list-style-type: none"> <li>Dogs &amp; cats: 6 mg/kg topical, once per month for preventative use.</li> <li>For sarcoptic mange: once every two weeks until 3 consecutive skin scrapings done one week apart are determined negative.</li> <li>Safe for ivermectin-hypersensitive dogs</li> </ul>
Sentinel (Novartis) Milbemycin oxime + lufenuron	<ul style="list-style-type: none"> <li>Monthly heartworm prevention + flea control (flea eggs)</li> </ul>	<ul style="list-style-type: none"> <li>Dogs, cats: 0.5 mg/kg + 10 mg/kg PO, once per month</li> </ul>
Spinosad	<ul style="list-style-type: none"> <li>Monthly flea prevention for dogs.</li> <li>Kills adult fleas only.</li> </ul>	<ul style="list-style-type: none"> <li>See Comfortis, Trifexis</li> </ul>
Stronghold® Pfizer selamectin	<ul style="list-style-type: none"> <li>Monthly topical spot-on for dogs and cats against ectoparasites &amp; endoparasites and heartworm prevention.</li> </ul>	<ul style="list-style-type: none"> <li>See selamectin</li> </ul>

Drug or Product	Application	Dose & comments
Sulfamethoxazole + Trimethoprim	<ul style="list-style-type: none"> <li>Antiprotozoal &amp; antibacterial</li> <li><i>Toxoplasma</i>, <i>Neospora</i>, <i>Hepatozoon</i>, coccidia</li> </ul>	<ul style="list-style-type: none"> <li><i>Toxoplasma</i> &amp; <i>Neospora</i>, dogs &amp; cats: 15 mg/kg PO BID x 28 days</li> <li>Coccidia: 30 mg/kg PO SID x 10 days</li> <li>For <i>Hepatozoon</i> need adjunct therapy with pyrimethamine &amp; clindamycin</li> </ul>
Thiabendazole	<ul style="list-style-type: none"> <li>For dogs, treatment of roundworms, strongyles, lungworm</li> </ul>	<ul style="list-style-type: none"> <li>Dogs: roundworms, strongyles: 50-60 mg/kg PO. Repeat in 3 weeks</li> <li>Dogs: <i>Filaroides</i>: 35 mg/kg PO BID x 5 days, then 70 mg/kg BID x 21 days. Adjunct treatment with prednisolone and other supportive drugs may be necessary.</li> </ul>
Trifexis (Eli Lilly) Milbemycin oxime + Spinosad	<p>Oral monthly treatment for dogs:</p> <ul style="list-style-type: none"> <li>Heartworm prevention</li> <li>Adult fleas only</li> <li>Hookworms</li> <li>Roundworms</li> <li>Whipworms</li> </ul>	<ul style="list-style-type: none"> <li>Dogs, oral dosing once per month.</li> <li>Kills only adult fleas, therefore not effective in management of flea allergy patients.</li> <li>Does not kill ticks</li> </ul>
Tri-Force (Bayer) Cyphenotherin + Nylar insect growth regulator	<p>Monthly topical spot on:</p> <ul style="list-style-type: none"> <li>Fleas: adult and larvae</li> <li>Ticks</li> <li>Mosquito repellent</li> </ul>	<ul style="list-style-type: none"> <li>Once per month topical spot-on</li> <li>Separate formulations for dogs and cats</li> </ul>

## Appendix 5: Anesthetic and analgesic drugs

### Abbreviations

**TZ:** Tiletamine 250mg / zolazepam 250mg (Telazol® in N. America; Zoletil-100® in Europe & Australia)  
**IM:** intramuscular **IV:** intravenous **SQ:** subcutaneous **q:** every (e.g., q 8 hrs = once every 8 hours)  
**CNS:** Central Nervous System

### Fundamentals

For anesthetic considerations and protocols for **Early-Age Neutering**, refer to [Section 11: Early-Age Sterilization \(EAS\)](#)

For key considerations in anesthetic **monitoring** and **preservation of physiological homeostasis**, refer to [Section 7: Preparation for anesthesia](#), [Appendix 7: Vital parameters during anesthesia](#) and [Appendix 8: Guide for monitoring depth of anesthesia](#).

All **emergency** drugs and protocols must be stocked and immediately available, and staff must be trained how to use them appropriately. Refresher training with simulated examples should be done by all staff responsible for cardiopulmonary resuscitation every 6 months. Refer to [Appendix 9: Emergency drugs quick reference drug chart](#); [Appendix 10: Emergency treatment kits](#); [Appendix 11: Management of anesthetic complications, cardiopulmonary resuscitation](#); [Appendix 12: Emergency treatment for anaphylactic reaction](#).

Prior to anesthesia, the animal must be as calm as possible. **Stress** significantly compromises the effectiveness of anesthetic drugs, and can make anesthesia unstable, necessitate the administration of higher doses of drug, and consequently prolong recovery times.

After administration of pre-medication drugs and during **induction**, the patient's environment must be very quiet, and the patient must be checked at least every 5 minutes. Care must be taken to prevent arousal of the animal while s/he is going to sleep (see notes on Plane 2 of anesthesia, [Appendix 8: Guide for monitoring depth of anesthesia](#).)

Once the drugs begin to take effect, the patient must be **continually monitored** and not left alone. The patient may vomit and not be able to protect his or her airway, convulse, or fall into a position that compromises respiration. Similarly, animals must be monitored closely throughout recovery to ensure safety and to manage emergencies immediately. Refer to [Section 8: Anesthesia](#) for details.

All animals must be **intubated** with an appropriately-sized endotracheal tube immediately on induction, according to guidelines in [Section 7.5: Endotracheal intubation \(airway management\)](#).

Periodic assisted **ventilation** throughout anesthesia is advisable (ca. every 3-5 minutes) to prevent hypercarbia (elevated CO<sub>2</sub> levels). If the animal is not connected to an anesthetic machine, ventilation may be performed with an ambu bag.

A variety of anesthetic combinations are used successfully in field spay / neuter projects around the world. IFAW does not promote one protocol over others, so long as the **fundamental tenets of anesthesia** are observed, as outlined below and in [Section 7: Preparation for anesthesia](#). The decision regarding anesthetic and analgesic protocol must be made by the veterinarian in charge of the project on the basis of his or her experience and the availability of drugs and equipment at the project site. It is understood that ideal resources often are not available, and that in field surgeries, risks must be

accepted that are inherent in such work. These limitations are, however, not cause to allow undue suffering or to take undue risks.

Regardless of the drug combination that is chosen, the veterinary team must do all that it can to minimize risk to the patients, and to weigh risk against benefit to individual animals and to the broader implications of the project. Close monitoring of patients and excellent preparation and training for emergency intervention are essential. In all circumstances, the **value and sentience of each individual animal must be respected.**

## Anesthetic drug protocols

**All anesthetic drug protocols for sterilization surgery must ensure:**

1. Safety, taking into account age and physiological predisposition of the patient, drug protocols and environmental conditions.

Close monitoring and preparation with emergency drugs and well-trained emergency intervention protocols are essential. These preparation can allow anesthesia even under less than ideal conditions work well. Anesthetic monitoring procedures are detailed in [Section 8: Anesthesia](#).

2. Full loss of consciousness
3. Visceral analgesia
4. Muscle relaxation
5. Surgical plane (Stage 3) anesthesia throughout the surgical procedure (cf. [Appendix 8: Guide for monitoring depth of anesthesia](#))
6. Post-operative analgesia for a minimum of 24 hours

**Anesthetic drug protocols include the following five stages: 1) Premedication, 2) Induction, 3) Maintenance, 4) Recovery, 5) Post-operative analgesia.**

### 1. Premedication: neuroleptanalgesia

- Premedication should sedate and relax the animal, and provide analgesia. Less anesthetic is subsequently required for induction and maintenance.
- Neuroleptanalgesia is produced by a combination of a neuroleptic drug such as a sedative or tranquilizer with an analgesic. It induces a state of CNS depression (hypnosis) and analgesia. Depending on the drug combination, patients may remain conscious or respond to stimuli. Neuroleptanalgesia is generally used as a premedication for general anesthesia, and may also be useful for short procedures that may be painful such as wound treatment. Depending on the combination, it may be suitable for short surgical procedures such as Caesarian sections (e.g., alpha-2 agonist + opiate + ketamine).
- Examples of common neuroleptanalgesic combinations for premedication:
  - Benzodiazepine + opiate (dogs & cats)
  - Acepromazine + opiate (dogs; not pediatrics)

- Alpha-2 agonist + opiate ± ketamine (dogs & cats; note that dexmedetomidine cannot be mixed in the same syringe with butorphanol.)
- Side effects, depending on drug combination: bradycardia, respiratory depression, ataxia.
- Anticholinergics (atropine, glycopyrrolate) are appropriate for use with opiates, but not with alpha-2 adrenergic drugs. See discussion below.
- Acepromazine by itself is not considered a good premedication. It is hypotensive, causes drowsiness, but is not anxiolytic at normally prescribed doses, and has no analgesic properties. It is not appropriate for use in pediatric patients due to its hypotensive properties. If used as premedication, use at a very low dose and combine with an opiate. See notes below.
- Wait 5-15 minutes until the animal is relaxed and drowsy before administering the induction agent.
- The animal must be as calm as possible before pre-medication drugs are administered. The more stressed and anxious the patient is, the less effective pre-medication and subsequent anesthetic agents will be.
- In some instances, the premedication step is not feasible, e.g., with highly fractious animals. In such cases, animals may be induced directly with, for example, an injection of TZ or ketamine/diazepam mixed with an opiate or alpha-2 adrenergic drug.

## 2. Induction

- Usually achieved with injectable agents (e.g., Propofol, ketamine/diazepam, TZ).
- Induction by inhalant anesthetic (isoflurane, sevoflurane) is not considered appropriate for routine use, and is contraindicated for brachycephalic patients. The agents are irritating to the eyes and nasal passages. The process takes longer than with IV induction, and patients are more stressed and more likely to resist. Gas anesthetic escapes from the mask into the room, increasing exposure to personnel.
- Patient is intubated as soon as the swallowing reflex is relaxed. Topical lidocaine around the glottis and epiglottis aids in intubation and reduces the likelihood of damage due to laryngospasm. This step is essential for cats, and advisable for dogs.

## 3. Maintenance

- Injectable anesthetic may be used for short procedures or if inhalant anesthesia is not possible. Options for injectable anesthetics that are appropriate for use in maintenance anesthesia include pentobarbital, ketamine/diazepam, TZ, other combinations of dissociatives and neuroleptanalgesic cocktails.
- Inhalant anesthetics are advised for longer procedures or for animals who may be a greater anesthetic risk or who need rapid recovery times, e.g., puppies and kittens undergoing Early-Age Sterilization, or lactating queens/bitches.
- Note that TZ or ketamine/diazepam must not be used alone for sterilization surgery. These combinations do not provide sufficient muscle relaxation or analgesia. Animals should be premedicated with a neuroleptanalgesic combination.

- Some protocols combine TZ with an alpha-2 adrenergic drug. Close monitoring is essential to prevent problems due to respiratory depression and bradycardia. This is explained in further detail below.
- The use of line blocks with lidocaine or bupivacaine when closing the abdomen, as a testicular block or when closing the incision following castration may reduce the need for anesthetic top-up. Line blocks are not effective for prevention of pain of ovarian ligament tug during ovariohysterectomy.
- NSAIDs provide good post-operative pain relief, but are not suitable for intraoperative analgesia. Intra-operative analgesia requires opiates or alpha-2 adrenergic drugs. Use of ketamine in the anesthetic cocktail helps with prevention of “wind-up” pain.
- Patients must be in a surgical plane of anesthesia (Stage 3; [Appendix 8: Guide for monitoring depth of anesthesia](#)) throughout the surgical procedure.

#### 4. Recovery

- Recovery of animals from anesthesia must be closely monitored, and animals must not be left alone until they are able to stand and walk on their own.
- Reversal drugs may be used to hasten recovery, e.g., alpha-2 or opiate antagonists. This may be desirable if the patient experiences bradycardia or compromised respiration. It may result in rough recoveries if the effects of, for example, a dissociative are unmasked.
- When reversing drugs, staff and patients must be protected from the excitatory effects that may emerge with rapid arousal. Be aware also that reversal of a drug will remove not only the sedative effects, but also the analgesic effects that the drug had provided (e.g., with opiates).
- The post-operative analgesic must be in effect before the animal wakes up.

#### 5. Post-operative analgesia

- Usually achieved with non-steroidal anti-inflammatory drugs or long-acting opiates (e.g., buprenorphine).
- All animals subjected to sterilization surgery must receive analgesic medication that lasts for at least 24 hours after surgery.
- Analgesia must be in effect before the animal recovers from anesthesia. Do not allow an animal to wake up in pain and then try to subdue pain. In addition to being inhumane, this results in the need for a much higher dose of drug.
- Further discussion of post-operative analgesia are described in the next section, as well as in [Appendix 6: Assessing the need for post-operative analgesia](#).

### Post-operative analgesia

Analgesia must be provided to all animals subjected to surgery and should last for at least 24 hours after sterilization surgery. Some individuals may require longer periods of analgesia if they are experiencing inflammation or pain at the surgical site.

It is important that analgesics are administered before pain begins. Preventing the development of pain is more effective, more cost-effective and more humane than at trying to stop pain once has begun. Lower doses are required to control pain pre-emptively. Non-steroidal anti-inflammatory drugs (NSAID)



should be given during surgery so that the effect has begun before the patient recovers from anesthesia. Opiates may be used in the premedication cocktail; long-acting opiates may be administered to control post-operative pain.

For postoperative analgesia in healthy, non-pediatric, dog and cat spays and neuters, a preferential COX-2 inhibitor NSAID may be used. Analgesia usually lasts for ca. 24 hours, and further doses are usually not required if the surgery was uncomplicated and tissue handling was minimal and gentle. The need for further analgesia should be evaluated on a case-by-case basis ([Appendix 6: Assessing the need for post-operative analgesia](#)), and the choice of drug appropriate for the individual patient.

In Early-Age Sterilization patients, opiates are preferred over NSAIDs for post-operative analgesia. Buprenorphine is often a good choice.

Corticosteroids must never be administered perioperatively (before, during or after surgery).

### **Non-steroidal anti-inflammatory drugs (NSAID)**

- NSAIDs are the most commonly used drugs to control following sterilization surgery. They are not suitable for intra-operative analgesia.
- Whenever possible, use preferential COX-2 inhibitors (discussed below). NSAIDs with selective or equivalent COX-1 activity are associated with higher gastrointestinal side effects (ulceration, vomiting, anorexia).
- Cyclooxygenase inhibitors with anti-thromboxane activity (e.g., aspirin, tolfenamic acid) should be avoided perioperatively because of potential bleeding risk.
- NSAIDs should not be given to patients with the following conditions. An alternative analgesic must be used for these patients.
  - Dehydration, hypovolemia, hypotension
  - Where surgical complications have resulted in cardiovascular or renal compromise.
  - If the animal received any exogenous corticosteroids recently. There must be at least one week interval between the last dose of short/intermediate duration glucocorticoids (prednisone, prednisolone, and triamcinolone) and the start of an NSAID. This interval is called a “washout” period. For long-acting glucocorticoids such as dexamethasone and betamethasone, the washout period must be 3-4 weeks before starting an NSAID. Note that patients who have been recently treated with glucocorticoids are not suitable candidates for elective surgery because of the immunosuppression and compromised healing associated with these drugs.
- Maintenance of normotension and adequate hydration throughout anesthesia (induction through recovery) are imperative to avoid renal toxicity with NSAIDs.
- Switching from one NSAID to another should be done only with an appropriate wash-out period between drugs. A washout period of 3-7 days is recommended between the cessation of the first NSAID and beginning the new one; twice that long following the use of aspirin.
- The advantages of using NSAIDs instead of opioids for controlling post-surgical pain include:
  - Dose needs to be given only once per day

- Less stringent drug control laws than with opioids, and therefore more readily available in some areas.
  - No sedative or dysphoric effects as seen sometimes with opioids. These effects may interfere with the assessment of pain and the determination of whether pain is properly controlled in the patient.
- Carprofen appears to have COX-2 specificity in dogs; less so in cats. It is highly bound to plasma proteins and has a low volume of distribution, with a primarily hepatic metabolism. Therefore, use with care in young animals, in animals with low plasma protein levels, or in animals with compromised liver function. Note that patients in the latter two categories are not suitable candidates for elective surgery such as sterilization. Carprofen may be used in cats as a single dose for control of post-operative pain if meloxicam is not available.
  - Dogs: 2-4 mg/kg SQ. May repeat 24 hrs later with oral administration at 2 mg/kg for up to 5 days.
  - Cats: 2-4 mg/kg, SQ.
- Meloxicam is also a COX-2 preferential NSAID, and is usually well tolerated by cats and dogs.
  - Dogs: 0.2 mg/kg SQ at time of surgery. May continue with 0.1 mg/kg PO (oral suspension, 1.5 mg/ml) q 24 hours for 3-5 days thereafter if needed.
  - Cats: 0.2 mg/kg SQ at time of surgery; half this dose for kittens younger than 4 months. If subsequent doses are necessary, administer the second dose at 0.1 mg/kg SQ or PO 24 hours later, then 0.025 mg/kg q 24-48 hrs.
- Tepoxalin (Zubrin®).
  - Unclear whether preferential COX-2 inhibitor.
  - Available only for oral administration.
  - May be used as an oral NSAID in dogs requiring pain control beyond 24 hours after surgery. However, if dogs were given an injection of another NSAID prior to waking up from anesthesia, they should be continued on the same drug if further doses of an NSAID are needed.
  - Dog: first dose 20 mg/kg PO; subsequent doses should be 10 mg/kg q 24 h if needed.
  - Not approved for use in cats.
- Deracoxib (Deramaxx®)
  - Selective COX-2 inhibitor. Available only for oral administration.
  - May be used as an oral NSAID in dogs requiring pain control beyond 24 hours after surgery. However, if dogs were given an injection of another NSAID prior to waking up from anesthesia, they should be continued on the same drug if further doses of an NSAID are needed.
  - A related drug, fibrocoxib (Previcox®) is recommended for management of osteoarthritic pain only. Deracoxib is recommended for management of post-operative pain as well as for osteoarthritic pain.
  - Dogs: 3-4 mg/kg once per day, maximum 7 days. This is the dose for post-operative pain management. The long-term osteoarthritis pain management dose is half of this.

- Deracoxib has not been sufficiently tested in cats to recommend use in this species.
- Ketoprofen (Ketofen<sup>®</sup>, Kepplin<sup>®</sup> and other trade names)
  - Ketoprofen is COX-1 selective, and therefore not suitable for repeated dosing. It is available as injectable and oral forms.
  - Ketoprofen may be used if an appropriate COX-2 selective NSAID or opiates are not an option.
  - Dogs: 2 mg/kg SQ at the time of surgery. If analgesia is necessary beyond 24 hours, dosing with oral ketoprofen at 1 mg/kg may be repeated once per 24 hours for no more than 5 days total.
  - Cats: 2 mg/kg SQ at the time of surgery. If analgesia is necessary beyond 24 hours, dosing with oral ketoprofen at 1 mg/kg may be repeated once per 24 hours for no more than 3 days total.
- Etodolac (Etogesic<sup>®</sup>, Lodine<sup>®</sup> and other trade names)
  - Selective COX-2 inhibitor. Available only for oral administration.
  - May be used as an oral NSAID in dogs requiring pain control beyond 24 hours after surgery. However, if dogs were given an injection of another NSAID prior to waking up from anesthesia, they should be continued on the same drug if further doses of an NSAID are needed.
  - Dose for dogs: 10-15 mg/kg q 24 h.
  - Etodolac has not been sufficiently tested in cats to recommend use in this species.

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**NSAID Recommendations for Postoperative Pain Control in Dogs (2 to 3 days' duration)<sup>1</sup>**

<b>Drug</b>	<b>Formulations</b>	<b>Dose<sup>2</sup></b>	<b>Frequency</b>
Carprofen	Oral tablets and injectable (SQ)	4.4 mg/kg (first dose), thereafter 2 mg/kg	q 24 hr
Meloxicam	Oral suspension and injectable (SQ)	0.2 mg/kg (first dose), thereafter 0.1 mg/kg	q 24 hr
Ketoprofen	Injectable (SQ, IM)	2.0 mg/kg (first dose), thereafter 1.0 mg/kg	q 24 hr up to 5 days (dog) or 3 days (cat)
Deracoxib	Oral tablets	3.0-4.0 mg/kg	q 24 hr up to 7 days
Etodolac	Oral tablets	10.0-15.0 mg/kg	q 24 hr

1: All dose recommendations are based on manufacturer guidelines for oral dosing except where otherwise indicated.

2: Following the initial dose, assessment of analgesic efficacy should be continued and subsequent dosing adjusted to achieve the minimum effective dose.

Table adapted from: Tranquili, W.J. and Grimm, K.A. 2003. Pain management alternatives for common

## Notes on specific drugs and drug combinations

### **Acepromazine (phenothiazine)**

- Acepromazine produces sedation and muscle relaxation, but does not relieve anxiety at normally prescribed doses. If patients are stressed or anxious, acepromazine may make them feel even worse, as they no longer have good control over their muscles but are still anxious. Anecdotal evidence suggests that there may be an anxiolytic function at very low doses, e.g., 0.001 – 0.05 mg/kg.
- Acepromazine must not be used for transporting dogs and cats.
- The sedative effect of acepromazine can be overwhelmed with stimuli and anxiety. It is important to keep the animal in a quiet, darkened place with minimal activity during sedation.
- Only the injectable form of acepromazine should be used, either by subcutaneous injection or for topical application on the oral mucosa, from which it is readily absorbed. Unpredictable pharmacokinetic properties of the oral (tablet) form of acepromazine make it unsuitable for use.
- Antiemetic.
- No analgesic effect, though may potentiate analgesic effects of other drugs.
- Do not use alone as a premedication agent. See list above for appropriate premedication options, ideally combined with an opiate.
- Hypotensive, particularly in apprehensive or excited animals; usually results in tachycardia as a result.
- Metabolized by the liver: avoid use in pediatric patients and in patients with compromised hepatic function.
- Lowers seizure thresholds on animals with epilepsy, but may inhibit chemically-induced seizures, e.g., from ketamine.
- Phenothiazine tranquilizers should not be used in animals younger than 12 weeks of age. In immature animals, phenothiazines produce prolonged CNS depression and potentiation of hypotension and hypothermia. Some practitioners have found it acceptable administered at 0.001-0.05 mg/kg SQ in animals older than 12 weeks of age.

### **Alpha-2 agonists (xylazine, medetomidine, dexmedetomidine)**

- Pronounced sedation. Good muscle relaxation. Analgesia varies with product and combination.
- Alpha-2 agonists and opiates produce synergistic sedative and analgesic effects. In such combinations, even low doses of alpha-2 agonists may be clinically useful with reduced cardiovascular effects.
- Lower doses of alpha-2 agonists will result in shorter duration of effect. Cardiovascular side effects may occur even at low doses.

- Analgesic effects of alpha-2-agonists have a shorter duration than sedative effects. Pain control must not be assumed only because a patient shows signs of sedation.
- May cause vomiting in dogs & cats (especially in cats). Reduction of salivation, gastrointestinal motility and swallowing reflex.
- Respiratory depression
- Bradycardia and decreased cardiac contractility secondary to increased peripheral vascular resistance. May last longer with dexmedetomidine than with xylazine. Be careful with anticholinergics – see next point.
- The use of anticholinergic drugs (atropine or glycopyrrolate) is now generally contraindicated with alpha-2 agonists. The decreased blood pressure caused by alpha-2 agonists results in a reflexive increase in peripheral vascular resistance (hence the typical pale mucous membranes with this group of drugs). The mechanism to protect the heart from having to work against such resistance is to slow the heart rate (compensatory bradycardia). Atropine works against this compensatory bradycardia. It forces the heart rate to stay high in the face of increased peripheral resistance, and thereby increases the risk of myocardial ischemia.

In the clinical setting, the bradycardia induced by alpha-2 agonists is monitored closely, together with blood pressure and pulse. If blood pressure falls and the patient cannot tolerate the bradycardia, the alpha-2-agonist should be reversed.

- Peripheral vasoconstriction combined with respiratory depression results in pale, purplish or gray mucous membranes. This is concerning, but be aware that it is an expected consequence of alpha-2 agonist activity. Monitor cardiovascular status closely.
- Periodic assisted ventilation throughout anesthesia is advisable (ca. every 5 minutes) to prevent hypercarbia (elevated CO<sub>2</sub> levels).
- Disruption of thermoregulatory mechanisms. Hypothermia or hyperthermia may occur; more commonly, a decrease in body temperature.
- Metabolized by the liver: avoid use in pediatric patients and in patients with compromised hepatic function.
- Dexmedetomidine is not licensed for use in the lactating bitch or queen; it is transmitted in the milk in humans. It may have an adverse effect on the offspring.
- Dexmedetomidine is described as the active enantiomer of medetomidine. In some areas, dexmedetomidine has completely replaced medetomidine, while in others dexmedetomidine is less readily available. In principle, dexmedetomidine is to be used at half the dose of medetomidine; the concentration of dexmedetomidine is half that of medetomidine, so dosed at similar volumes.
- Avoid use of alpha-2 agonists in pediatric patients due to cardiovascular effects & hepatic metabolism – cf. [Section 11: Early-Age Sterilization \(EAS\)](#).
- Dexmedetomidine dose for pre-anesthetic medication:
  - Dog: 0.125-0.375 mg/m<sup>2</sup> IM  
Note that the canine dosage for dexmedetomidine is given in mg/m<sup>2</sup> body surface area rather than mg/kg body weight. A dose chart is provided at the end of this appendix.
  - Cat: 0.01-0.04 mg/kg IM
  - In combination with an opioid, use 0.003-0.005 mg/kg (3-5 mcg/kg) IM for dogs & cats.

- Dexmedetomidine cannot be mixed in the same syringe with butorphanol. This is a difference from medetomidine, which is often combined with butorphanol as a pre-med.
- Medetomidine dose for pre-anesthetic medication:
  - Dog: 375 mcg/m<sup>2</sup> IV, 500 mcg/m<sup>2</sup> IM
  - Cat: 50-150 mcg/kg M or SQ, depending on the anesthetic agent with which it will be combined. This dose provides moderate to deep sedation.
- Xylazine dose for pre-anesthetic medication:
  - Dog: 0.5-1.5 mg/kg
  - Cat: 0.5-1.5 mg/kg
- Reverse with yohimbine, tolazoline, or atipamezole – see section on Drug Reversal, below.
- Accidental human exposure  
Dexmedetomidine, medetomidine, and atipamezole can be absorbed through skin abrasions and mucous membranes. As little as 0.1 ml of dexmedetomidine can cause hypotension and sedation in humans. If dexmedetomidine or atipamezole is spilled onto human skin or mucous membranes, it must be washed off immediately. If accidental exposure or injection occurs, medical attention should be sought immediately.

#### **Barbiturates: Pentobarbital (Nembutal®), Thiopental (Pentothal®)**

- Pentobarbital is a short-acting barbiturate (20-30 minutes); thiopental is ultra-short acting (5-15 minutes). Used for short procedures, or for induction of anesthesia and followed by maintenance with inhalant anesthesia.
- Note that pentobarbital is now outdated as an anesthetic. Its principal use today is as an ingredient in euthanasia solutions. It may still be used as an anesthetic in some developing areas of the world.
- Barbiturate drugs are good sedatives but do not have intrinsic analgesic activity. If performing surgery, it is essential to use a maintenance anesthetic with analgesic properties.
- Barbiturates do not produce good muscle relaxation on their own. Maintenance anesthesia should contain a good muscle relaxant, as well as analgesic drug.
- Premedicate with atropine or glycopyrrolate to decrease salivary secretions, laryngospasm and vagal activity (hypotension).
- Dose-dependent respiratory and cardiovascular depression. Apnea is most common with rapid IV administration. If a patient is already in a surgical plane of anesthesia, small additional doses of barbiturate may cause a profound drop in blood pressure. Top up with care and monitor patient closely.
- Cardiovascular effects: hypotension, tachycardia, reduced stroke volume.
- Perivascular injection is extremely painful and causes tissue necrosis. An intravenous catheter should be placed for injection of barbiturates.
- Periodic assisted ventilation throughout anesthesia is advisable (ca. every 3-5 minutes) to prevent hypercarbia (elevated CO<sub>2</sub> levels).

- Not to be used for Caesarean sections, as barbiturates readily cross the placenta and cause fetal respiratory arrest at doses that do not produce anesthesia in the mother.
- Patients are usually depressed for several hours after recovery from barbiturate anesthesia (even with an ultra-short acting barbiturate), depending on the dose. Repeated doses are cumulative.
- Barbiturates have a small margin of safety. Pentobarbital dose varies from 10-30 mg/kg; minimum lethal dose in dogs is 50 mg/kg. For euthanasia, use at a minimum of 150 mg/kg.
- Pentobarbital depends on hepatic metabolism for clearance. Do not use in pediatric patients or for patients with compromised liver function. Repeated doses are cumulative.
- Thiopental: use at 6-12 mg/kg IV for induction of anesthesia. Do not use at concentrations greater than 10% solution, as these cause severe tissue damage.
- Thiopental (1.25% solution) may be used with great care in puppies and kittens older than 12 weeks. For pediatric patients, it is preferable to use thiopental only as an induction agent, followed by an inhalant anesthetic for maintenance.
- Barbiturates are the principal component of euthanasia solutions, as they induce cardiac and respiratory arrest at high doses.

#### **Benzodiazepines (diazepam, midazolam)**

- Muscle relaxation, anticonvulsant, anxiolytic. Benzodiazepines are not used for analgesia.
- Little cardiopulmonary effects unless given rapidly IV.
- Benzodiazepines result in minimal sedation when used alone. In cats, may see paradoxical anxiety leading to aggression. However, when added to an opiate, benzodiazepines appear to produce a synergistic sedative effect (neuroleptanalgesia) and, when added to ketamine, will improve muscle relaxation.
- Absorption of diazepam is slower than that of midazolam, so onset of action will be slower. Diazepam should be given only IV or orally. IM injection of diazepam is painful due to the propylene glycol carrier, and is absorbed slowly from the injection site. Midazolam is appropriate for IM injection.

#### **Dissociative anesthetics: ketamine and tiletamine (tiletamine is always in combination with zolazepam – Telazol® or Zoletil®)**

- Dissociative anesthetics interrupt communication between areas of the brain that control conscious and unconscious activity. The resulting cataleptic state is characterized by a loss of appropriate response to external stimuli, muscle rigidity, and loss of muscle control.
- Used for restraint, induction of anesthesia, and minor, short procedures that do not require visceral analgesia.
- When used for sterilization surgeries, dissociatives must be combined with neuroleptanalgesic premedication. Alone, ketamine and TZ do not produce sufficient muscle relaxation and do not produce sufficient visceral analgesia.

- Dissociative anesthetics reduce “wind-up” pain and can be an effective component of the anesthetic cocktail for this reason. Wind-up pain refers to the neuropathological phenomenon in which spinal cord neurons amplify the pain signals that are communicated from afferent peripheral nociceptors. This happens particularly with a bombardment of nociceptive impulses from insulted tissue, as in trauma or surgery.
- Oral, ocular and swallowing reflexes remain intact with ketamine. Eyes remain open; eye position usually is rotated.
- It is important to instill an ocular lubricant (artificial tear ointment) into the eyes during anesthesia with dissociative anesthetics to protect corneas.
- Seizures are common with ketamine, particularly in high doses. (Some species other than domestic cats and dogs are prone to seizures with ketamine even at lower doses.) “Ketamine shakes” occur in ca. 30% of dogs and cats at induction if ketamine is not used in combination with a benzodiazepine or opiate.
- Apneustic breathing (long inhalation phase), particularly on IV induction with ketamine. Monitor closely to ensure sufficient oxygenation, and that the breathing pattern returns to normal within a few minutes. As always, ensure that the animal is intubated immediately following induction.
- Periodic assisted ventilation throughout anesthesia is advisable (ca. every 5 minutes) to prevent hypercarbia (elevated CO<sub>2</sub> levels).
- Cardiovascular effects: heart rate and blood pressure increase with concomitant decrease in cardiac contractility. Contraindicated in animals with pre-existing heart disease. Take care with anticholinergics (see next point).
- The routine use of anticholinergics as a pre-med with TZ is controversial. If TZ is used in combination with an alpha-2 agonist, and the bradycardic effect compromises blood pressure, the alpha-2 agonist effect should be reversed or partially reversed. The use of atropine is no longer recommended in these instances. See comment above with regard to alpha-2 agonists.
- Animals are ataxic and hyper-responsive during recovery from dissociative anesthesia. It is critical to maintain a quiet, dark environment during recovery. Animals must be confined in a manner that prevents self-injury during recovery, and must be monitored closely to provide immediate intervention if necessary.
- There is no reversal drug for dissociative anesthetics.
- Metabolized by the liver, excreted via kidneys. Not advisable for use in animals less than 12 weeks of age, or in animals with compromised hepatic or renal function.
- Dogs tend to have more problems with TZ than cats: poor muscle relaxation, respiratory depression and “hangover” post-recovery. Keep dose to a minimum by combining with appropriate other drugs and minimizing repeated doses.
- Generally, the IV dose for TZ is 20-50% of the IM dose.

### **Inhalant anesthetics (isoflurane, sevoflurane)**

- Advantages of gas anesthetics over injectable anesthetics:
  - Depth of anesthesia is more quickly and easily regulated, hence safer to use



- Induction and recovery are usually smooth and rapid
  - Oxygen is delivered simultaneously
  - Inhalant anesthetic drugs are minimally processed by liver and kidney
  - Generally fewer undesirable effects
- Periodic assisted ventilation throughout anesthesia is advisable (ca. every 3-5 minutes; more frequently for pediatric patients) to prevent hypercarbia (elevated CO<sub>2</sub> levels).
  - Excreted primarily from lungs, little biodegradation, hence safer option than injectable anesthetics for pediatric patients and for patients with hepatic or renal compromise.
  - Note that induction by masking an animal down or in a chamber is not appropriate. The animal experiences a high degree of stress during this kind of induction. The process is associated with severe sympathomimetic effects, bronchial irritation, and increased risk of aspiration of gastric contents.
  - Isoflurane: excellent muscle relaxation, hypotensive effects are dose-dependent, readily crosses placenta. Induction is facilitated by premedication with a neuroleptanalgesic combination, or with an injectable induction agent (e.g., Propofol). Maintenance dose is generally 1-3%.
  - Sevoflurane: blood-gas partition coefficient is ca. ½ that of isoflurane, hence more rapid induction and recovery, requiring less drug. Other than this, its properties and clinical use are similar to those of isoflurane. Dose for maintenance is usually 3%-4%.
  - Sevoflurane should not be used with soda lime as absorption compound: produces potentially toxic product on interaction with soda lime.
  - Note that each drug requires a dedicated and properly-calibrated vaporizer. Do not fill an isoflurane vaporizer with sevoflurane, or vice versa. Vaporizers must be maintained and calibrated per manufacturer's instructions.

#### **Local anesthetics (lidocaine, bupivacaine)**

- These drugs work on sodium channels that are active in pain and inflammation. In addition to analgesia, lidocaine and bupivacaine cause vasodilation, which promotes healing and counteracts inflammation.
- Local anesthetics are reported to be antimicrobial, immunomodulating, and can diminish postoperative maladaptive pain states. The AAHA/AAFP pain management guidelines state that because of their safety and significant benefit, local anesthetics should be utilized, insofar as possible, with every surgical procedure.
- Bupivacaine has a longer duration to onset of action than lidocaine (20-30 min vs. 5-10 min), but has a longer duration of effect (6-8 hours vs. 1-2 hours). Mixing the 2 together will result in a longer time to onset of effect than when using lidocaine alone, and a shorter duration of action than when using bupivacaine alone, thereby diluting the desirable properties of each drug.
- Care must be taken to avoid exceeding maximum dose, beyond which toxicity (cardiac arrhythmias) may occur. Bupivacaine maximum dose is 1-2 mg/kg per 8 hours. Lidocaine maximum dose for dogs is 4 mg/kg; for cats 2-3 mg/kg.

- Often beneficial to use as line block at closing the abdomen, as a testicular block, or when closing the incision at castration.
  - Splash block when closing spay incisions, applied after closure of abdominal wall, 0.5 ml of 2% lidocaine for dogs is usually an appropriate dose (dogs > 3 or 4 kg). Mix lidocaine or bupivacaine with saline, squirt into incision and close over it (don't need to inject into tissue).
  - Intratesticular blocks: calculate 1 mg/kg lidocaine 2%, and divide equally between the two testicles. Dilute in saline if necessary to increase volume. Wait 2-3 minutes for effect.
- Note that topical lidocaine will not provide analgesia for ovarian tug in spays.
- Do not inject bupivacaine IV: may precipitate severe cardiac arrhythmias that are not responsive to treatment. Lidocaine should be injected IV only if intentionally used to stop ventricular arrhythmias (in which case the patient should be connected to an ECG machine).
- Lidocaine for treatment of ventricular arrhythmias, in emergency situations.
  - This drug is well suited for acute treatment because of its rapid onset of action and short half-life (ca. 1 hour in dogs), which allows rapid titration to effect.
  - Metabolized by the liver.
  - Low serum potassium levels (hypokalemia) impairs effect of lidocaine in stabilizing arrhythmias.
  - Do not infuse lidocaine through the same IV catheter as used for other medications.
  - Typical clinical approach for dogs: 2 mg/kg IV boluses delivered over 1 minute while monitoring heart rhythm. Stop administration once rhythm has normalized from ventricular arrhythmia to a sinus rhythm.
  - IV bolus delivered too rapidly may result in hypotension.
  - Constant rate infusion (CRI) may be needed to maintain normal rhythm, administered at 25-75 mcg/kg/min (0.025 – 0.075 mg/kg/min).
  - Normally not used in cats for this purpose, as ventricular arrhythmias are rare in this species. If needed, dose at a bolus of 0.1–0.4 mg/kg IV bolus over ca. 1 minute. If no response, increase to a total dose of 0.25–1 mg/kg slow IV slowly. If necessary, maintain with CRI (10–20 mcg/kg/min).
- Toxicity of lidocaine
  - Signs of toxicity in dogs usually involve the gastrointestinal and central nervous systems. At high plasma concentrations, signs may progress to drowsiness or agitation, muscle twitching, and convulsions.
  - Cats are more susceptible to toxicity, and demonstrate signs of cardiac suppression and central nervous system excitation.

### **Opiates (e.g., butorphanol, buprenorphine, morphine, oxymorphone, fentanyl)**

- Opiates produce analgesia and sedation without loss of proprioception or consciousness. Different types of opiates have varying affinities for different opiate receptors (mu, kappa, delta, sigma). Some are full agonists (morphine), others partial agonists (buprenorphine), or agonists/antagonists (butorphanol), with associated advantages and disadvantages.
- Opiates may induce paradoxical excitatory effects, especially full agonists (morphine, oxymorphone), and especially in cats. If given rapidly IV, may induce excitation in dogs as well.
- Use in a neuroleptanalgesia cocktail (opiate combined with acepromazine, benzodiazepine or alpha-2 agonist):
  - Synergistic effect with alpha-2 agonists, reducing the necessary dose for both to achieve neuroleptanalgesia.
  - Avoids excitatory or dysphoric effects, particularly in cats.
  - Use as a premedication or with anesthetics to produce balanced anesthesia.
- Butorphanol and buprenorphine have fewer excitatory side effects than morphine, are less sedating than morphine, and have better analgesic properties (buprenorphine 25-30 times; butorphanol 4-7 times)
- Cardiovascular effect: depending on the drug and dose, may see bradycardia, hypotension.
- Respiratory depression (rate & tidal volume) is dose-dependent. Normally not seen at low doses unless patient is already depressed or unconscious.
- Periodic assisted ventilation throughout anesthesia is advisable (ca. every 3-5 minutes) to prevent hypercarbia (elevated CO<sub>2</sub> levels).
- Body temperature may decrease in dogs and increase in cats.
- Gastrointestinal effects: salivation, vomiting, ileus.
- Butorphanol is rapid-onset, short acting (2-4 hrs), while buprenorphine has slower onset but longer duration of action (4-12 hrs). It is possible to give butorphanol as premedication and buprenorphine for post-operative analgesia. When using both drugs, deliver them at least 45 minutes apart.
- It is not advisable to mix butorphanol and buprenorphine together. The result would be a combination that has a slower onset of action than butorphanol and a shorter duration of action than buprenorphine, thereby diluting the desirable properties of each drug.

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#### Parenteral Opioid Recommendations for Perioperative Pain Management

Drug	Canine Dose <sup>1</sup>	Feline Dose <sup>1</sup>
Butorphanol	0.2-0.4 mg/kg q 1-2 hr SQ IM lower dose IV	0.1-0.4 mg/kg q 1-2 hr SQ IM lower dose IV
Buprenorphine <sup>2</sup>	0.005-0.02 mg/kg q 4-12 hr IM SQ IV	0.005-0.01 mg/kg q 4-12 hr IM SQ IV May be squirted into open mouth at 0.02 mg/kg in fractious cats.
Fentanyl	5.0-10.0 mcg/kg/hr IV or CRI	2.5-5.0 mcg/kg/hr IV or CRI

Hydromorphone	0.05-0.2 mg/kg q 2-6 hr IM SQ IV	0.05-0.1 mg/kg q 2-6 hr IM SQ IV
Methadone	0.1-0.5 mg/kg q 4-6 hr IM SQ	0.05-0.5 mg/kg q 4-6 hr IM SQ
Morphine	0.5-1.0 mg/kg q 2-6 hr IM SQ	0.1-0.3 mg/kg q 4-8 hr IM SQ
Oxymorphone	0.05-0.2 mg/kg q 2-4 hr IM SQ	0.05-0.1 mg/kg q 2-6 hr IM SQ

IM = intramuscular SQ = subcutaneous IV = intravenous CRI = constant rate infusion

1: Doses should be halved for pediatric patients. Note pediatric considerations for opiates (cf. [Section 11: Early-Age Sterilization \(EAS\)](#))

2: Higher doses of buprenorphine (0.02-0.03 mg/kg) may achieve a longer duration (10 hours) of effect, but will not necessarily improve analgesia.

Table adapted from: Tranquili, W.J. and Grimm, K.A. 2003. Pain management alternatives for common surgeries. Pain Management Symposium, North American Veterinary Conference and the American Animal Hospital Association Annual Meeting, Orlando, FL.

### Propofol

- Rapid-acting, ultra-short duration, non-barbiturate anesthetic. Produces sedation-hypnosis similarly to thiopental.
- Good muscle relaxation, rapid recovery with little “hangover effect”
- Dose-dependent respiratory depression and hypotension.
- Poor analgesia.
- Generally used as induction agent prior to maintenance with gas anesthesia. If used for general anesthesia for short procedures (e.g., Caesarean section), must combine with opioid analgesics or other neuroleptanalgesic combinations.
- Delivered intravenously (despite milky color). Some pain on initial injection.
- Biotransformed by liver; excretion hepatic and extrahepatic. Repeated doses are relatively non-cumulative compared with barbiturates.
- Propofol is the induction agent of choice for young patients. However, animals with immature hepatic function should not receive repeated doses, as this may prolong recovery.
- Expensive.
- Dose: 3-6 mg/kg IV. Deliver 25% of the calculated dose every 30 seconds until the desired effect is achieved. Premedication with tranquilizer or sedative will reduce the dose needed for induction.

### Tramadol

- The M1 metabolite of tramadol is a mu-agonist. The difficulty with this drug in dogs is the large variation among individuals in the bioavailability and metabolism of the drug to produce the active product, particularly with oral dosing. Some patients experience effective or minor analgesia, others none at all. This variation in effect is less prominent with intravenous dosing.
- Some patients may experience dysphoria and sedation. It can be difficult to differentiate sedation from analgesia; with a sedative effect, one may overlook the needs of an animal in pain.
- If there is any possibility of brain disease or injury, tramadol must be avoided due to anecdotal evidence that the drug potentiates seizures in these patients.
- Production of the M1 metabolite in cats appears to be more consistent than in dogs, but dose titration, toxicity and safety data are lacking in both dogs and cats.
- Oral tramadol may be an effective component of multimodal analgesia for dogs who experience chronic pain, such as with osteoarthritis. For full analgesic effect in those dogs who metabolize sufficient active compound, full effect may take several weeks of dosing.
- Oral tramadol must not be used as part of a routine protocol for post-operative analgesia. Its effects are too unreliable, and many animals would have insufficient pain control with such a protocol. A well-tolerated NSAID is a more appropriate choice for post-operative analgesia in routine spay/neuter patients.
- Intravenous tramadol administered preoperatively together with (or immediately following) the anesthetic cocktail may result in adequate surgical analgesia. For example, where ketamine + xylazine are used for anesthesia, intravenous tramadol with a non-steroidal anti-inflammatory drug will provide adequate analgesia for sterilization surgery. Ideally, a splash block or intratesticular block with lidocaine are used as well.
- Appears to be well tolerated in dogs. Be careful with use in cats due to feline hypersensitivity to opiates. Cats may suffer narcotizing effect with tramadol.
- Dogs & cats: 2-4 mg/kg SQ, IM or IV. Oral dosing: 2-4 mg/kg PO q8-12 hours. Experienced critical care experts advise a minimum dose of 4 mg/kg TID PO in dogs, maximum 6 mg/kg.

### Drug reversal

- Alpha-2 adrenergic drugs may be reversed if a rapid recovery is desirable, e.g., if the patient is experiencing problems with anesthesia, or if recovery from anesthesia is prolonged.
- Drug reversal will result in loss of the analgesic, anxiolytic, and sedative effects that had been achieved with the drug. Preparations must be in effect for this contingency.
- Yohimbine for reversal of xylazine (or to counter the effects of amitraz dips): 0.11 mg/kg slow IV or 0.2 mg/kg IM (dogs)
- Tolazoline: for reversal of xylazine. Alpha-1 & alpha-2 adrenergic antagonist activity. Reversal effect for sedation, heart rate and rhythm may be partial and transitory. Short duration of action. In U.S., use in dogs & cats is extra-label. Dose 4 mg/kg slow IV.
- Atipamezole (Antisedan®): reversal of medetomidine, dexmedetomidine and xylazine
  - Atipamezole to reverse dexmedetomidine:

- The optimal atipamezole dose for dogs is 10 times the dose of dexmedetomidine. This means 5 mg (1 ml) atipamezole for each 0.5 mg (1 ml) dexmedetomidine that was given.
    - The dose for cats is half that used for dogs.
    - Note that dosage for atipamezole to reverse dexmedetomidine is calculated according to body surface area ( $\text{mg}/\text{m}^2$ ).
  - Atipamezole to reverse medetomidine:
    - The optimal atipamezole dose for dogs is 5 times the dose of medetomidine. This means 5 mg atipamezole (1 ml) for each 1 mg (1 ml) medetomidine that was given.
    - The dose for cats is half that used for dogs.
  - Atipamezole to reverse xylazine:
    - As a general rule, use 1 mg atipamezole per 10 mg xylazine that were administered. Atipamezole is much more selective for the alpha-2 receptor than are yohimbine and xylazine.
    - Start with 0.05 mg/kg atipamezole IM. If no response or insufficient response after 10-15 minutes, repeat. Maximum dose 0.2 mg/kg (= 4 doses).
- Opiate agonist reversal
  - Effects of opiate agonists (e.g., morphine, oxymorphone) may be reversed with opioid antagonists.
  - Naloxone, 0.005-0.015 mg/kg IV
  - Naltrexone, 0.05- 0.1 mg/kg SQ

Dexmedetomidine dosing chart for **DOGS**, taken from manufacturer's package insert. Dose is calculated by body surface area, so dose per kg decreases as body weight increases, albeit not in a linear relationship. The manufacturer states that it is not possible to accurately dose animals weighing less than 2 kg. For **CATS** use 10-40 mcg/kg (0.01-0.04 mg/kg) IM for sedation and pre-anesthesia.

Dexmedetomidine, 0.5 mg/ml <b>SEDATION &amp; ANALGESIA IN DOGS</b>					
Body weight kg range		Dexmedetomidine 375 mcg/m <sup>2</sup> IV		Dexmedetomidine 500 mcg/m <sup>2</sup> IM	
		mcg/kg	Total ml	mcg/kg	Total ml
2.0	3.0	28.1	0.12	40	0.15
3.1	4.0	25.0	0.15	35	0.2
4.1	5.0	23.0	0.20	30	0.3
5.1	10	19.6	0.29	25	0.4
10.1	13	16.8	0.38	23	0.5
13.1	15	15.7	0.44	21	0.6
15.1	20	14.6	0.51	20	0.7
20.1	25	13.4	0.60	18	0.8
25.1	30	12.6	0.69	17	0.9
30.1	33	12.0	0.75	16	1.0
33.1	37	11.6	0.81	15	1.1
37.1	45	11.0	0.90	14.5	1.2
45.1	50	10.5	0.99	14	1.3
50.1	55	10.1	1.06	13.5	1.4
55.1	60	9.8	1.13	13	1.5
60.1	65	9.5	1.19	12.8	1.6
65.1	70	9.3	1.26	12.5	1.7
70.1	80	9.0	1.35	12.3	1.8
>80		8.7	1.42	12.0	1.9

Dexmedetomidine, 0.5 mg/ml <b>PRE-ANESTHESIA IN DOGS</b>					
Body weight kg range		Dexmedetomidine 125 mcg/m <sup>2</sup> IM		Dexmedetomidine 375 mcg/m <sup>2</sup> IM	
		mcg/kg	Total ml	mcg/kg	Total ml
2.0	3.0	9.4	0.04	28.1	0.12
3.1	4.0	8.3	0.05	25.0	0.15
4.1	5.0	7.7	0.07	23.0	0.20
5.1	10	6.5	0.10	19.6	0.29
10.1	13	5.6	0.13	16.8	0.38
13.1	15	5.2	0.15	15.7	0.44
15.1	20	4.9	0.17	14.6	0.51
20.1	25	4.5	0.20	13.4	0.60
25.1	30	4.2	0.23	12.6	0.69
30.1	33	4.0	0.25	12.0	0.75
33.1	37	3.9	0.27	11.6	0.81
37.1	45	3.7	0.30	11.0	0.90
45.1	50	3.5	0.33	10.5	0.99
50.1	55	3.4	0.35	10.1	1.06
55.1	60	3.3	0.38	9.8	1.13
60.1	65	3.2	0.40	9.5	1.19
65.1	70	3.1	0.42	9.3	1.26
70.1	80	3.0	0.45	9.0	1.35
>80		2.9	0.47	8.7	1.42

## Conversion from body weight to body surface area

### Dogs

kg body weight	BSA (m <sup>2</sup> )	kg body weight	BSA (m <sup>2</sup> )	kg body weight	BSA (m <sup>2</sup> )	kg body weight	BSA (m <sup>2</sup> )
0.5	0.064	11	0.500	31	0.997	51	1.389
1.0	0.101	12	0.529	32	1.018	52	1.407
1.5	0.132	13	0.558	33	1.039	53	1.425
2.0	0.160	14	0.587	34	1.060	54	1.443
2.5	0.186	15	0.614	35	1.081	55	1.461
3.0	0.210	16	0.641	36	1.101	56	1.478
3.5	0.233	17	0.668	37	1.121	57	1.496
4.0	0.255	18	0.694	38	1.142	58	1.513
4.5	0.275	19	0.719	39	1.162	59	1.531
5.0	0.295	20	0.744	40	1.181	60	1.548
5.5	0.315	21	0.769	41	1.201	61	1.565
6.0	0.333	22	0.793	42	1.220	62	1.582
6.5	0.352	23	0.817	43	1.240	63	1.599
7.0	0.370	24	0.840	44	1.259	64	1.616
7.5	0.387	25	0.864	45	1.278	65	1.633
8.0	0.404	26	0.886	46	1.297	66	1.649
8.5	0.421	27	0.909	47	1.315	67	1.666
9.0	0.437	28	0.931	48	1.334	68	1.683
9.5	0.453	29	0.953	49	1.352	69	1.699
10	0.469	30	0.975	50	1.371	70	1.715

### Cats

kg body weight	BSA (m <sup>2</sup> )	kg body weight	BSA (m <sup>2</sup> )
0.5	0.063	5.0	0.292
0.75	0.083	5.5	0.312
1.0	0.100	6.0	0.330
1.25	0.116	6.5	0.348
1.5	0.131	7.0	0.366
1.75	0.145	7.5	0.383
2.0	0.159	8.0	0.400
2.5	0.184	8.5	0.416
3.0	0.208	9.0	0.433
3.5	0.231	9.5	0.449
4.0	0.252	10	0.464
4.5	0.273		

Equation for calculating conversion from body weight in grams (kg x 1000) to body surface area (m<sup>2</sup>) for dogs:

$$m^2 = \frac{(10.1) \times (\text{body weight in grams})^{2/3}}{10,000}$$

For cats, substitute 10.1 with 10.0.



## Appendix 6: Assessing the need for post-operative analgesia

Surgery causes trauma to tissues. Tissue trauma results in inflammatory reactions that cause pain. By definition, therefore, surgery results in pain post-operatively. When performing any kind of surgery, it is essential to:

- a) Ensure non-traumatizing pre-operative technique (shaving, skin prep)
- b) Gentle tissue handling and strict adherence to asepsis
- c) Prevent pain with appropriate anesthetic and analgesic protocols
- d) Observe the patient very closely during surgery and afterwards, and treat pain promptly

A key principle to pain management is that it is much more efficient to prevent the development of pain than to diminish pain once it has begun. Prevention of pain requires less drug and causes less stress to the animal than treatment of pain once it has begun.

Analgesia begins with a good anesthetic protocol that includes multimodal analgesia. Multimodal analgesia is achieved with the use of agents that work through different pharmacological modes of action. With multimodal analgesia, agents may work synergistically to control pain, and thereby require less drug to achieve effective analgesia.

For example, an NMDA-receptor antagonist such as ketamine prevents wind-up pain, combined with an opiate (e.g., buprenorphine), and a non-steroidal anti-inflammatory to reduce inflammation and control pain for 24 hours post-operatively.

Provision of medication to prevent post-operative pain is an essential element of surgery. Post-operative analgesia must be ensured at least through 24 hours after surgery, and extended if the patient continues to demonstrate signs of discomfort.

Careful tissue handling and strict observation of aseptic technique are also essential during surgery. The more trauma a surgeon causes to tissues, the more inflammation will develop. Inflammation results in pain, and potentially compromised healing and post-surgical complications.

Trauma is caused by such things as over-handling tissues, tissues dehydrating, rough handling of tissues, tearing, tugging, squeezing or otherwise stressing organs or muscle, cutting unnecessarily large incisions, cutting through muscle instead of the linea alba to enter the abdominal cavity, undermining tissue where it is not necessary, and rubbing tissue with gauze (gently blot instead). Muscle and skin sutures must place tissue edges in secure, close apposition, but not tied so tightly that tissue is strangulated.

Patients lick and chew at their surgery site because they are in pain, and because the skin is irritated from rough clipping or shaving of fur. Careful, atraumatic patient preparation techniques are essential. Rough clipping or clipping with a dirty, blunt clipper blade or razor blade results in nicked skin which becomes itchy and uncomfortable. The skin nicks may not be overtly visible: just because there aren't bleeding gashes doesn't necessarily mean that the clippers didn't do harm. In cats and immature animals one must be particularly careful to avoid nicking a nipple. The skin on and around the scrotum is soft and sensitive, and requires particularly gentle handling.

Some dogs and cats return to normal behavior almost immediately after sterilization surgery, and others seem to take a bit longer to recover. Most healthy animals who undergo sterilization surgery by a skilled, careful surgeon do not require more than 24 hours of post-operative analgesia. Others may need pain medication for several days after surgery. Differences in age, breed, genetics, reproductive status at the time of sterilization, difficulty of the surgery, and prior life experience explain some of these

differences. The bottom line is that each animal responds individually, and must be assessed, monitored, and treated individually.

Daily assessment of pain is an essential aspect of patient monitoring. Each routine physical examination must include a pain assessment score. The Colorado State University pain assessment scoring system is widely used, although there are others. The important thing is to use a consistent method that adequately reflects a patient's pain level. (The CSU acute pain scale charts for dogs and cats may be downloaded from the internet, or found in [Appendix 14: Examples of clinical forms and record sheets.](#))

Pain may be difficult to recognize in animals. Most animals are stoic and have evolved to hide signs of pain. The most consistent sign of pain in an animal is a change in behavior, or expression of unusual behaviors (Table 1). The observations of someone who knows the individual (e.g., guardian) are invaluable for assessing pain.

Signs of pain may include any of the following:

- Reduction in normal behavior, e.g., lethargy, reduced activity, depressed, not meeting members of the household at the door, not playing, failing to groom (especially in cats)
- Expression of abnormal behaviors or personality change, e.g., more aggressive, short-tempered, reclusive, restless, or “clingy”. Cats usually withdraw and hide if they are feeling unwell or painful.
- Reluctance to move, or moving stiffly and awkwardly. With abdominal pain, animals may hold the abdominal muscles very tense and tuck up the abdomen and arch the back.
- Crying or trying to bite or scratch when touched
- Licking, chewing, scratching, or otherwise traumatizing the site of the surgery or elsewhere on their own bodies. Note that animals may sometimes traumatize an area of the body that isn't the direct source of pain, e.g., chewing or excessive licking of the penis when experiencing back pain or abdominal pain.

Even animals who do not show overt signs of pain as described above should be evaluated daily for at least one week after surgery for evidence of pain and to assess the surgical wound. Guardians must be instructed in how to do this.

Evaluating a patient for pain after sterilization surgery:

1. First understand the patient's normal disposition and level of anxiety. Some animals normally snap or scratch when one gets near or tries to touch them, regardless of whether they are healthy or experiencing pain. Alternatively, anxiety or stress may mask signs of pain.
2. Observe the animal as s/he walks, stands, sits, or lies down. Does he look comfortable and relaxed? Is she anxious and nervous? Is he holding his body tensely, tummy tucked up, walking stiffly and gingerly? Does she stretch her hind limbs abnormally as though trying to relieve pain in the abdomen? Has the cat been crouched in one position in her litter box for the last 24 hours without eating, drinking, or urinating? A comfortable animal who is not in pain will lie in a relaxed position, will be alert and responsive (unless sleeping), with regular, relaxed respiratory and heart rates.
3. Before examining the animal, try to make friends with her and touch her gently on the back or scratch her under the chin or behind the ears – somewhere where you do not expect anything to hurt. If the patient is very tense and nervous and tries to snap, it may be difficult to accurately evaluate pain. Feral animals who are not accustomed to being handled may be very nervous.

4. Perform a standard physical examination that includes auscultation of heart and lungs. Elevated heart rate and respiratory rate are signs of pain, but also of stress.
5. Gently palpate the abdomen, beginning on the sides.
  - a. Pressure should be minimal. A good way to know how much pressure is appropriate is by testing it on oneself. Close your eyes and push a finger against an eye. If it hurts, you are pressing too hard. Apply the same degree of comfortable pressure when examining an animal.
  - b. Signs of pain include tensing of the abdominal muscles, snapping at your hand, quickly turning the head, or vocalization. If this is a strong reaction, then something is wrong and requires immediate attention. A moderate or mild response may indicate the need for a day or two additional pain relief medication, with continued careful observation. A lack of response either means that the animal is too nervous to show a response, or that he is very stoic, or that he is indeed not feeling pain in response to your palpation. Monitor the other indicators of pain and try to reassess when the patient may be more calm.
6. Examine the area of the surgical incision. If it is swollen, inflamed, or producing discharge, two things are necessary:
  - a. Continue pain relief medication
  - b. Figure out what is causing the inflammation and address the cause. Is it infected? Is the patient traumatizing the skin or wound? Is there a suture reaction?

All the criteria in Steps 1-6 must be considered together, in the context of the animal's normal behavior and the stress or anxiety that the animal experiences during the examination. The presence or absence of a single element does not necessarily rule out or indicate pain – unless the surgery site or the surrounding skin are inflamed. In that case, additional pain medication and addressing the underlying cause of the problem are essential.

If in doubt, it is usually better to err on the side of treating pain that may not be present, rather than risking the neglect of pain. Give pain medication and re-evaluate the animal's behavior a few hours later. If the patient is more relaxed and less reactive to being touched or handled, then he was probably in pain.

**Table 1: Signs of pain\***

General signs	Specific signs
Loss of normal behavior	Decreased ambulation or activity, lethargic attitude, decreased appetite, decreased grooming (cats). Harder to assess in hospital than by guardian at home.
Expression of abnormal behaviors	Inappropriate elimination, vocalization, aggression or decreased interaction with other pets or family members, altered facial expression, altered posture, restlessness, hiding (especially cats)
Reaction to touch	Increased body tension, flinching, vocalizing or snapping in

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response to gentle palpation of injured area and palpation of regions likely to be painful, e.g., neck, back, hips, elbows (cats) and areas recently subjected to surgery.

Physiologic parameters

Elevations in heart rate, respiratory rate, body temperature, and blood pressure; pupil dilation.

\*From: Hellyer et al., 2007. Note that many of these are also signs of stress, particularly the physiologic parameters. See text above for interpretation of signs of pain or stress.

**Checklist: signs that the patient may need more analgesic medication**

- Change in behavior compared with pre-surgery. More quiet, withdrawn, fearful, aggressive
- Reluctant to move
- Holds body hunched up, abdomen tense
- Cries when touched or when moving
- Yawning or licking lips frequently
- Refusal to eat
- Incision site swollen, red, or has discharge
- Snaps, winces or cries when area around incision is touched
- Licking or chewing at or around incision

## Appendix 7: Vital parameters during anesthesia

	Normal (anesthetized)		Requires treatment		Critical level	
	Dog	Cat	Dog	Cat	Dog	Cat
Respiratory rate (breaths per minute)	8 - 20	10 - 28	< 8	< 10	< 6	< 7
Heart rate (beats per minute)	60 - 120	140 - 200	<60 or >140	<100 or >200	<40 or >175	<90 or >225
Temperature (°C)	37.5 - 39.2	37.8 - 39.5	<37 & >39.5	<37.5 & >39.5	<36 & >40	<36 & >40
Temperature (°F)	99.5 - 102.5	100 - 103	<99 or >103	<99.5 & >103	<97 & >104	<97 & >104
Capillary refill time (seconds)	< 2	< 2	> 2	> 2	> 3	> 3

Values may vary in animals given alpha-2 agonists: see [Appendix 5: Anesthetic and analgesic drugs](#).

The respiratory rate of pediatric patients should be 2-3 times the adult respiratory rate (cf. Section [11.2: Pediatric physiology in anesthesia](#)).

Mucous membrane color should be healthy pink. Membranes should remain moist. They should be moistened regularly during anesthesia with a damp gauze sponge. Note effects on mucous membrane color with alpha-2 agonists ([Appendix 5: Anesthetic and analgesic drugs](#)).

## Appendix 8: Guide for monitoring depth of anesthesia

Plane	Characteristics	Laryngeal reflexes	Respiration	Jaw & tongue	Eyes
1: Sedation	<ul style="list-style-type: none"> <li>Sedation, possible disorientation</li> </ul>	Swallowing reflex intact, can maintain own airway	Normal	Strong jaw & tongue tone	Drowsy but all reflexes intact
2: Unconscious, Delirium	<ul style="list-style-type: none"> <li>Loss of consciousness</li> <li>Hyper response to stimulation</li> <li>Irregular respiration</li> <li>Vocalization</li> <li>Uncontrolled movement</li> <li>Retching, vomiting</li> </ul>	Swallowing reflex intact, can maintain own airway	Irregular but using intercostal muscles and diaphragm	<ul style="list-style-type: none"> <li>Strong jaw tone</li> <li>Tongue voluntarily retracted when pulled</li> </ul>	Palpebral reflex intact Pupils dilated
3: Surgical	<ul style="list-style-type: none"> <li>No vocalization or voluntary movement</li> <li>Muscle relaxation</li> <li>Analgesia, but painful stimuli cause ↑HR, RR, BP</li> </ul>	See sub-planes	See sub-planes	<ul style="list-style-type: none"> <li>Loss of jaw tone</li> <li>Tongue relaxed, does not retract when pulled</li> </ul>	Pupillary constriction
Surgical sub-plane 1	<ul style="list-style-type: none"> <li>Light surgical anesthesia</li> <li>Sensitive to pain</li> </ul>	Swallowing reflex intact, can maintain own airway	Regular with strong chest movement & diaphragm function	<ul style="list-style-type: none"> <li>Minimal or no jaw tone</li> <li>Tongue relaxed, does not retract when pulled</li> </ul>	<ul style="list-style-type: none"> <li>Palpebral reflex intact</li> <li>Eyeball centrally positioned</li> </ul>
Surgical sub-plane 2	<ul style="list-style-type: none"> <li>Best plane for most surgeries, except for particularly painful surgeries</li> </ul>	Loss of swallowing reflex, must protect airway	Regular with strong chest movement & diaphragm function	<ul style="list-style-type: none"> <li>No jaw tone</li> <li>Tongue relaxed</li> </ul>	<ul style="list-style-type: none"> <li>Loss of palpebral reflex</li> <li>Pupils fixed (usually central)</li> <li>Eyeball usually rotates down</li> </ul>
Surgical sub-plane 3	<ul style="list-style-type: none"> <li>Deep surgical anesthesia: for very painful surgeries</li> <li>Decreased BP</li> </ul>	No swallowing reflex, must protect airway	<ul style="list-style-type: none"> <li>Diaphragmatic breathing only</li> <li>Breathing shallow</li> <li>Assist ventilation</li> </ul>	<ul style="list-style-type: none"> <li>No jaw tone</li> <li>Tongue relaxed</li> </ul>	<ul style="list-style-type: none"> <li>No palpebral reflex</li> <li>Pupils fixed</li> <li>Eyeball usually central</li> <li>Cornea dry (no lacrimation)</li> </ul>

Plane	Characteristics	Laryngeal reflexes	Respiration	Jaw & tongue	Eyes
Surgical sub-plane 4	<ul style="list-style-type: none"> <li>• Too deep, crisis imminent</li> </ul>	No swallowing reflex, must protect airway	<ul style="list-style-type: none"> <li>• Requires assisted ventilation</li> <li>• Respiration close to ceasing altogether</li> </ul>	<ul style="list-style-type: none"> <li>• No jaw tone</li> <li>• Tongue relaxed</li> </ul>	<ul style="list-style-type: none"> <li>• No palpebral reflex</li> <li>• Pupils fixed</li> <li>• Cornea dry</li> </ul>
4: Medullary depression	<ul style="list-style-type: none"> <li>• Anesthetic crisis: death imminent</li> <li>• Pulse weak (BP too low)</li> <li>• Reverse anesthesia and begin cardio-pulmonary support immediately.</li> </ul>	No swallowing reflex, should be intubated	<ul style="list-style-type: none"> <li>• Respiratory arrest</li> </ul>	<ul style="list-style-type: none"> <li>• No jaw tone</li> <li>• Tongue relaxed</li> </ul>	<ul style="list-style-type: none"> <li>• No palpebral reflex</li> <li>• Pupils dilated</li> <li>• Cornea dry</li> </ul>

Note that in Plane 2 of anesthesia (during induction and arousal), animals may be hyper-responsive to stimuli, but may not have good motor control. During this plane of anesthesia, it is critical to avoid stimulation of the animal (sounds, movements, light) and to protect the animal from injuring him or herself. Refer to [Appendix 5: Anesthetic and analgesic drugs](#).

## Appendix 9: Emergency drugs quick reference drug chart

Drug	Use	Dose	Route
0.9% NaCl, Lactated Ringer's, or Hartmann's	Fluid therapy – hypovolemic shock, rapid rehydration	Bolus 20-30 ml/kg IV, reassess, repeat as needed.	IV
Adrenaline 1:1000 = 1 mg/ml Adrenergic agonist	cardiopulmonary arrest	0.01 mg/kg 0.1-0.2 mg/kg	IM, IV, IT IT dose double IV; dilute in 1-3 ml saline
	Anaphylactic shock	0.01 mg/kg	IM, IV
Atropine	Bradycardia	0.04 mg/kg	SQ, IM, IV
Calcium gluconate, 10%	Hypocalcemia, e.g., eclampsia	0.5-1.5 ml/kg	IV <u>slowly</u> , to effect. Monitor heart for arrhythmia & bradycardia.
Dexamethasone	Anaphylaxis Prednisolone is preferable	0.25-1.0 mg/kg	IV
Diazepam or midazolam	Seizures	0.25-0.5 mg/kg IV 2 mg/kg rectal	IV or rectal, to effect
Diphenhydramine Antihistamine	Anaphylaxis	2.0 mg/kg	PO, SQ, IM
Doxapram	Respiratory stimulant. Combine with manual ventilation in respiratory arrest.	Adult & pediatric: 5 mg/kg. Repeat in 15-20 minutes as needed	IV slowly, or IM
		Neonate: 1-5 mg/puppy 1-2 mg/kitten	SQ, into umbilical vein or sublingual
Glucose or Dextrose, 5%	Hypoglycemia	20 ml/kg	IV slowly
Hydrogen peroxide, 3%	Induction of vomiting*	1-5 ml/kg	PO
Lidocaine	Ventricular arrhythmia (verify with ECG)	Dog: 1-2 mg/kg Cat: 0.2-1 mg/kg	IV or 2x dose IT
Mannitol	Post-CPR; head injury	1-2 g/kg q4h	IV slowly
Prednisolone (injectable)	Anaphylaxis	2-4 mg/kg	IV



<b>Drug</b>	<b>Use</b>	<b>Dose</b>	<b>Route</b>
Sodium bicarbonate 8.4% solution = 1 mmol/ml = 1 mEq/ml	Metabolic acidosis associated with cardiac arrest	1.0 mEq over 1-2 min, then 0.5 mEq at 10 min intervals as needed	IV slowly
Terbutaline	Bronchodilator, e.g., for anaphylaxis or feline asthma	0.01 mg/kg	SQ, IM, IV

\*H<sub>2</sub>O<sub>2</sub>: If possible, use xylazine to induce vomiting in cats, and apomorphine eye drops for dogs instead of H<sub>2</sub>O<sub>2</sub>. Apomorphine IV dose for dogs: 0.03 mg/kg IV. Ipecac to induce vomiting in dogs is given at 1-2 ml/kg PO.

**IM:** intramuscular **IV:** intravenous **SQ:** subcutaneous **PO:** oral **q:** every (e.g., q8h = every 8 hours) **IT:** intratracheal **CPR:** cardiopulmonary resuscitation

## Appendix 10: Emergency treatment kits

An emergency treatment kit, together with dosage charts, should be stored in a secure location and must be readily available within the surgical facility. Refer to [Appendix 9: Emergency drugs quick reference drug chart](#).

The kit should be checked and re-stocked after each use. The date of the checks should be recorded on the kit. The responsibility for doing this should be assigned to a specific individual (in most instances a veterinarian or a veterinary nurse).

The emergency kit should be used for immediate intervention treatment of shock, cardiac distress, respiratory distress, seizures, anaphylactic reactions or other emergency situations.

### Drug and supply stock for Emergency Kit

#### Drugs

Adrenaline	Heparin (for flushing IV catheter)
Antihistamine (injectable)	Hydrogen peroxide 3%
Alcohol (75% isopropanol)	Iodine / Betadine
Anesthetic drugs	Lidocaine
Atropine	Mannitol
Butorphanol or buprenorphine	Prednisolone or Dexamethasone, injectable (for anaphylactic reactions)
Calcium gluconate 10%	Reversal drug for anesthetic (e.g., atipamezole, yohimbine, tolazoline, naloxone)
Charcoal (activated, for poisoning)	Sodium bicarbonate
Diazepam	Terbutaline (injectable)
Diphenhydramine	Wound ointment (silver sulfadiazine or triple antibiotic)
Doxapram	
Euthanasia solution	
Flea spray	
Fluids (Saline (0.9% NaCl), LRS or Hartmann's)	
Glucose 50% or 5%	

#### Veterinary supplies

Chorhexidine, 4%	IV catheters: 24, 22, 20G
Cotton balls	Injection port caps for IV catheters
Cotton buds (Q-tips)	Lubricant for endotracheal tubes
Cotton roll	Needles: 22, 20, 18G
Dog treats (e.g., dried liver strips)	Rabies vaccine
Endotracheal tubes, assorted sizes	Surgery pack (basic laceration pack, autoclaved)
Eye lubricant (ointment)	Suture material, absorbable, 0, 2-0, 3-0
Fluids giving sets (for IV fluids)	Syringes: 1, 3, 5, 10, 20, 60 ml
Food, dry: dog & cat	Tape (bandage): 1 cm & 2.5 cm wide
Gauze squares	Water (drinking quality), 2L
Gauze bandage	VetWrap® or similar bandaging material
Gloves, latex examination, S, M, L	

#### Equipment

Ambu bag	Calculator
Batteries for flashlights & laryngoscope	Cat cages
Bowls for drinking water	Catch pole, Y-pole

Clippers, charged	Pens and permanent-marker pens
Cloth sack, e.g., pillow case (for catching/holding cats)	Plastic rubbish bags
Dog cages	Record forms & clipboard
Drug dosage charts for quick reference	Refractometer
Duct tape	Rubbish bin
Flashlights or head lamps	Scissors (multipurpose)
Glucometer	Sharps container (empty water bottle with cap)
Hemostat forceps, for general use	Stethoscope
Laryngoscope	Thermometer (rectal)
Leashes and collars	Towels or fleeces
Muzzles or rope to fashion muzzles	Tube for gastric lavage
Net for catching dogs / cats	

### Notes for drug list.

Refer also to:

[Appendix 9: Emergency drugs quick reference drug chart](#)

[Appendix 11: Management of anesthetic complications, cardiopulmonary resuscitation](#)

[Appendix 12: Emergency treatment for anaphylactic reaction](#)

1. Adrenaline (adrenergic agonist) 1:1000 solution (1 mg/ml).  
Cardiac arrest and anaphylactic shock normally require a dose of 0.01 – 0.02 mg/kg, given IV. For intratracheal administration, increase the dose 2-10 fold.
2. Atropine  
For the treatment of bradycardia (refer to [Appendix 5: Anesthetic and analgesic drugs](#)).
3. Calcium gluconate  
For treatment of hypocalcemia, e.g., eclampsia.
4. Diazepam or midazolam  
For control of seizures: 0.25 – 0.5 mg/kg as intravenous bolus. Wait for 5 minutes, if seizures persist, repeat the bolus.  
Diazepam can be given rectally if intravenous access is not possible. Avoid giving diazepam IM. Use midazolam instead.
5. Diphenhydramine (antihistamine)  
For control of acute allergic (Type I hypersensitivity) reactions. Following initial emergency injectable dose, subsequent oral doses may be given at 2 mg/kg PO as often as every 8 hours if needed. (Human tablets are usually 25 mg.)  
Cats may demonstrate paradoxical excitement in response to diphenhydramine.
6. Doxapram (respiratory stimulant)  
For treatment of respiratory suppression or respiratory arrest during anesthesia. Combine with positive-pressure ventilation with an anesthesia machine or with an Ambu bag.  
Administer IV slowly (over 3-5 minutes) or IM, 5 mg/kg
7. Fluids: 0.9% NaCl (isotonic saline), Lactated Ringer's solution or Hartmann's solution

Fluids should be administered as a continuous intravenous infusion at controlled rates, via a securely placed sterile intravenous catheter.

8. Glucose or dextrose

Dextrose (glucose) solution 5%: best added to crystalloid fluids (0.9% NaCl, Lactated Ringer's solution or Hartmann's solution).

Glucose is given to treat, or to prevent, hypoglycemia. It is not used for treatment of hypovolemic or toxic shock.

May deliver up to 40-50 ml/kg every 24 hours intravenously; monitor requirement with blood glucose measurements.

9. Hydrogen peroxide (H<sub>2</sub>O<sub>2</sub>)

For induction of vomiting in case the patient has ingested something poisonous. Xylazine (0.5 mg/kg IM or IV; works particularly well in cats) may be preferable, or apomorphine eye drops for dogs.

10. Lidocaine

For treatment of ventricular arrhythmias. Diagnosis must be accurate, ideally verified by ECG. See further information in [Appendix 5: Anesthetic and analgesic drugs](#).

11. Mannitol

Following resuscitation for cardiopulmonary arrest (CPR), to prevent brain swelling and post-CPR neurologic complications.

Mannitol may precipitate in the bottle if not kept warm. If crystals are present, use an in-line filter to clear during administration.

12. Prednisone or prednisolone, injectable.

For treatment of anaphylactic reactions, e.g., vaccine reaction or penicillin reaction.

Short-acting glucocorticoids such as prednisone or prednisolone are preferred for treatment of anaphylaxis. If these are not available, use dexamethasone instead (long-acting).

Note that glucocorticoids are no longer recommended for treatment of hypovolemic, cardiogenic, or distributive shock. Solu-Delta Cortef® (prednisolone sodium succinate) may be recommended for treatment of spinal trauma, if treatment is initiated within 12 hours of the traumatic event (1-2 mg/kg IV). Glucocorticoids are contraindicated in head trauma. Solu-Delta Cortef® is purchased as a lyophilized powder that can be stored only for 3 days after it is reconstituted, or stored in frozen aliquots at or below -20°C immediately following reconstitution.

13. Sodium bicarbonate 8.4% solution (8.4% = 1 mEq/ml = 1 mmol/ml)

For treatment of metabolic acidosis, e.g., associated with cardiac arrest or other crises.

Do not use with Lactated Ringer's solution.

The administration of an alkalinizing agent may not be efficacious for short-duration cardiac arrests but may improve survival in long-duration cardiac arrests.

Recommendation in the treatment of cardiac arrest: ideally, monitor electrolytes and blood pH. If this is not possible, an empirical suggestion is to provide 1-2 mEq/kg NaHCO<sub>3</sub> in IV fluids if cardiac arrest lasted for more than 10-15 minutes. If it is known or suspected that metabolic acidosis predated the cardiac arrest, then the bicarbonate dosing should start right away.

14. Terbutaline (beta-adrenergic agonist, bronchodilator)

For use in allergic reactions and for feline allergic bronchitis (feline bronchial asthma syndrome requires emergency intervention).

Once the crisis has been managed and the animal is stable, terbutaline can subsequently be given orally if needed (e.g., asthmatic cats).

## Appendix 11: Management of anesthetic complications, cardiopulmonary resuscitation

The following parameters must be monitored throughout anesthesia, from induction to full recovery.

1. Heart rate & rhythm (auscultation)
2. Breathing: rate, depth
3. Perfusion: capillary refill time, blood pressure, hydration
4. Temperature (rectal)
5. Analgesia

An intravenous catheter should be placed in each patient, either prior to induction or immediately thereafter. Similarly, each patient must be intubated immediately following induction.

Aberrations in physiological parameters must be detected early in order to intervene effectively, before they escalate to a crisis. Changes must be interpreted in the context of the anesthetic drugs that were administered and in terms of overall homeostasis – e.g., with alpha-2 agonists.

### Administration of emergency medications

- Intravenous or intraosseous routes are preferred for administration of most emergency drugs.
  - During anesthesia, an intravenous catheter should be in place. In case a patient arrests at other times, or if the IV catheter becomes dysfunctional, an IO catheter may be placed.
  - Placement of an IO catheter may be achieved more quickly, particularly if the patient's blood pressure is low and a peripheral vein is difficult to catheterize.
- Intratracheal administration of adrenaline, atropine, or vasopressin
  - Measure a clean rubber catheter or IV tubing from the end of the endotracheal tube to the level of the carina.
  - Insert the tube through the endotracheal tube.
  - The medication should be diluted with sterile saline or sterile water to ca. 1 ml
  - Inject the medication. Flush the tube with air to force out all medication.
  - Withdraw the tube and resume ventilation through the endotracheal tube.
- Intramuscular administration may be appropriate for certain drugs if perfusion to large muscle bodies (injection sites) is adequate.
- Subcutaneous administration of drugs is rarely appropriate in an emergency situation due to slow time to onset of effect. Moreover, if the patient's peripheral circulation is compromised, absorption of the drug will be limited.

**Slow heart rate** that compromises blood pressure, but in the face of normal respiration, may be treated with atropine, 0.04 mg/kg IV. Monitor all parameters closely. Consider reversal of anesthetic, if possible, or reduction of gas anesthesia.

Note that a slowed heart rate associated with administration of alpha-2 adrenergic drugs should be monitored by patient blood pressure and perfusion. If bradycardia is not tolerated by the patient, the alpha-2 adrenergic drug should be reversed or partially reversed, and not treated with a cholinergic. Refer to [Appendix 5: Anesthetic and analgesic drugs](#).

**Slow or shallow respiration** with normal cardiovascular parameters should first result in a check of anesthetic depth.

- Ventilate at 10 breaths /minute. Neonates: 20-40 breaths per minute, gently. Do not hyperventilate, as this will reduce blood flow to the heart. Squeeze the bag for only 1-1.5 seconds. Longer squeezing results in reduced blood flow to the heart.
- Provide supplemental oxygen if possible. Ideally, ventilate with 100% oxygen.
- If normal respiration does not resume on its own within 2-3 minutes, doxapram may be administered slowly IV (5 mg/kg, administer slowly over 3-5 minutes) while continuing assisted respiration. Note that doxapram must NOT be administered in cardiopulmonary arrest.

**Hypothermia** must be prevented, and promptly treated if it does occur.

Anesthesia predisposes patients to hypothermia through loss of hypothalamic thermoregulatory control and loss of a shivering response. Animals experience increased heat loss through exposed skin in areas of clipped fur, use of alcohol for preparation of surgical sites, heat conduction through cold metal tables, and open body cavities during surgery. Certain drugs (e.g., propofol, acepromazine) cause vasodilation and further heat loss, while cold inspired anesthetic gas contribute further temperature reduction.

Hypothermia reduces the minimum alveolar concentration (MAC) of inhalant anesthetics, which reduces the patient's anesthetic requirements and risks the patient falling into an inappropriately deep plane of anesthesia.

Cardiac output is decreased. Together with peripheral vasoconstriction, this reduces tissue perfusion and predisposes the patient to lactic acidosis. Hypothermia shifts the hemoglobin-oxygen dissociation curve to the left, further contributing to tissue hypoxia.

Renal and hepatic perfusion are reduced, and hepatic enzyme activity is reduced. These contribute to prolonged drug action and delayed recovery of the patient from anesthesia.

Platelet count and platelet aggregation are also reduced, while fibrinolysis increases, thereby compromising hemostasis and increasing blood loss during surgery.

In effect, hypothermia results in slow recovery from anesthesia, predisposes patients to hypoglycemia, and risks cardiac morbidity and delayed wound healing. Some animals may experience post-shock type responses (e.g., hemorrhagic gastroenteritis) following hypothermia.

## **Cardiopulmonary resuscitation (CPR) when heart and breathing have stopped**

The following guidelines are based on the most recent RECOVER guidelines (2012).

### **Basic Life Support (C-A-B: Chest Compression – Airway – Breathing)**

1. Assessment
  - a. Assess the patient quickly. CPR must begin within 10-15 seconds of cardiopulmonary arrest.
  - b. If the patient is unconscious, and no breathing or pulse are readily evident, begin Basic Life Support.

2. Chest compression
  - a. Place the patient in lateral recumbency (some dogs may require dorsal recumbency)
  - b. Begin chest compressions at 100-120 compressions per minute.
  - c. Continue for two minutes (120 seconds).
  - d. Pause to check for pulse or ECG, no more than a few seconds. Resume the next two-minute cycle of compressions
  - e. See below for detailed instructions on correct chest compression technique (*Patient position and chest compression technique*). Chest compressions are the most important element of successful CPR. It is imperative that they are done correctly.
3. Establish airway
  - a. A second person intubates the patient immediately following initiation of chest compressions.
  - b. If no endotracheal tube is in place, perform mouth-to-snout ventilation. Hold the animal's mouth closed. Cover the nares with your mouth and blow into them. Keep the patient's neck straight. Do not hold up or turn the head, as this will result in diversion of your breath into the esophagus.
4. Ventilation
  - a. Ventilate at 10 breaths / minute while compressions are underway. Ideally, use 100% oxygen. Squeeze the bag in 1 or 1.5 seconds. Longer compressions compromise cardiac circulation. Tidal volume should be 10 ml/kg, with 10-15 cm H<sub>2</sub>O pressure.
  - b. If CPR is being done by one person alone administer, compressions and breaths in a cycle of 30 compressions followed by 2 breaths.

### **Advanced Life Support**

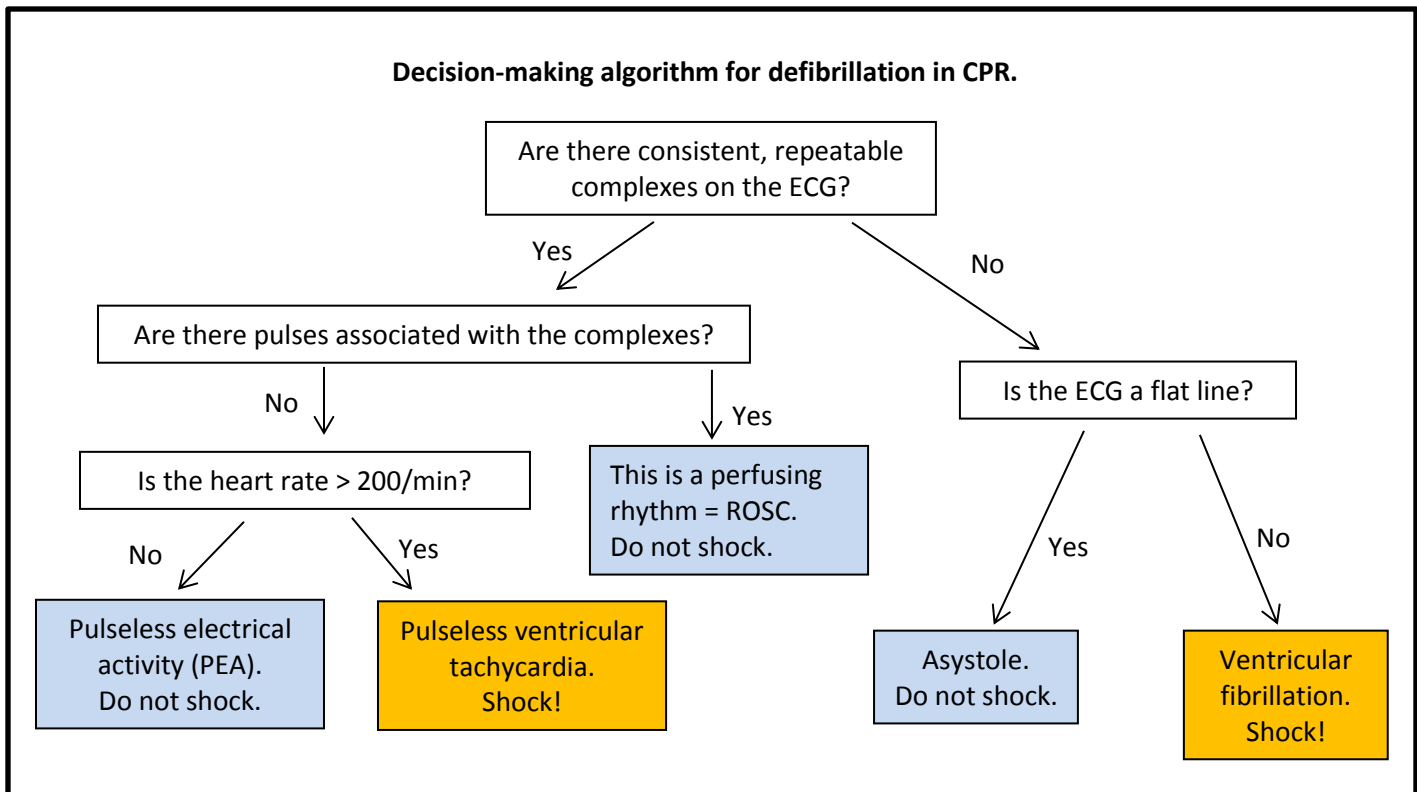
Advanced life support includes monitoring, drug therapy and defibrillation. Initiate monitoring as soon as Basic Life Support is underway, and assess need for drug therapy and defibrillation. These must not interfere with continued administration of Basic Life Support.

1. Monitoring
  - a. Goal is to determine **return of spontaneous circulation (ROSC)** and to identify cardiac arrhythmias that require medication or defibrillation.
  - b. End-tidal CO<sub>2</sub> (ETCO<sub>2</sub>) monitors (capnography) and electrocardiogram (ECG) are the most useful tools for monitoring CPR. Pulse oximeters and indirect blood pressure monitoring devices are of little use in this situation.
    - i. ETCO<sub>2</sub> is proportional to pulmonary blood flow. Thus, it is an indicator of the efficiency of chest compressions. ETCO<sub>2</sub> rises dramatically on ROSC, and is therefore an early indicator of successful resuscitation. During CPR, ETCO<sub>2</sub> must be greater than 15 mm Hg; the best that one can usually achieve with compressions is ~30 mm.
    - ii. ECG may be read in the few seconds between two-minute chest compression cycles. The objective is to diagnose rhythms indicative of cardiac arrest: asystole, pulseless electrical activity, or ventricular fibrillation. Chest compressions must not be delayed for lengthy monitoring.
2. Drug therapy
  - a. Objectives of drugs in CPR are:
    - to move blood from the periphery to the core in order to maximize blood delivery to the heart and brain (catecholamines)
    - to correct arresting arrhythmias (amiodarone, lidocaine)



- to reverse compromising anesthesia or sedation, if possible
- b. Catecholamines: adrenaline (epinephrine).
    - i. 0.01 mg/kg IV or IO, administered in every other two-minute cycle of chest compressions as necessary until ROSC.
    - ii. Use 2-10 times this for intratracheal administration.
    - iii. This comes to a dose every 4 minutes, which aligns with the recommended rate of administration every 3-5 minutes.
    - iv. After prolonged CPR, the dose may be increased to 0.1 mg/kg, but generally, if it adrenaline going to work, the low dose will achieve this.
  - c. Vasopressin. Use like adrenaline, 0.8 IU/kg IV or IO.
  - d. Atropine.
    - i. There are few data that indicate whether or not atropine helps in CPR, but it is considered not to be harmful.
    - ii. Administer together with, or at alternating intervals with, adrenaline at 0.04 mg/kg IV or IO. Use double this dose for intratracheal administration.
  - e. Amiodarone.
    - i. Patients with non-perfusing ventricular fibrillation that is not responsive to defibrillation may respond to amiodarone at 2.5 – 5.0 mg/kg IV or IO.
    - ii. Dogs may exhibit an anaphylactic reaction and hypotension to this drug. Prepare to administer diphenhydramine (2 mg/kg IM) or anti-inflammatory dose of short-acting corticosteroid (prednisolone sodium succinate, 2-4 mg/kg IV).
  - f. Lidocaine may be tried if amiodarone is not available, at 2.0 mg/kg IV or IO, administered slowly. Note that this drug may raise the defibrillation threshold. Ideally, the patient should be monitored by ECG during administration. See further information in [Appendix 5: Anesthetic and analgesic drugs](#).
  - g. Reversal agents
    - i. Naloxone to reverse opioids (0.01 mg/kg IV or IO)
    - ii. Flumazenil to reverse benzodiazepines (0.01 mg/kg IV or IO)
    - iii. Atipamezole to reverse alpha-2 agonists. Dexmedetomidine reversal: 5 mg (1 ml) atipamezole for each 0.5 mg (1 ml) dexmedetomidine that was given. Medetomidine reversal: 5 mg atipamezole (1 ml) for each 1 mg (1 ml) medetomidine that was given. Xylazine reversal: 1 mg atipamezole per 10 mg xylazine that were administered.
    - iv. Yohimbine (0.1 mg/kg slow IV or IO) to reverse alpha-2 agonists
    - v. Tolazoline for reversal of xylazine, 4 mg/kg slow IV. See notes in [Appendix 5: Anesthetic and analgesic drugs](#).
  - h. High-dose corticosteroids are not appropriate in management of cardiopulmonary arrest, unless there is need for treatment of anaphylaxis.
  - i. Doxapram is no longer recommended for use in treatment of cardio-pulmonary arrest because it increases metabolic activity of the brain (stimulant). An increased oxygen demand in the brain during a period of no blood flow risks greater problems following ROSC. Doxapram may be used for treatment of apnea during induction of anesthesia, but not with CPR.
3. Defibrillation
    - a. The objective of defibrillation is to stop all electrical activity in the heart and allow the endogenous pacemaker to re-set.
    - b. Ensure that the arrhythmia calls for defibrillation.

- i. Only ventricular tachycardia and ventricular fibrillation warrant defibrillation.
    - ii. Pulseless electrical activity and asystole must not be shocked.
    - iii. Follow the algorithm below.
  - c. Defibrillation is appropriate if:
    - i. The patient went into ventricular fibrillation under observation with an ECG during anesthesia: shock immediately without trying compressions first.
    - ii. Basic Life Support was initiated and the first two-minute cycle completed. Check ECG. Resume compressions while an agreement is reached among the team regarding the ECG result. If everyone agrees that it is a rhythm that may be treated with shock, prepare defibrillator and shock after the second two-minute cycle of compressions.
- 4. Intravenous fluids in CPR
  - a. IV fluid administration is appropriate if the patient is hypovolemic. Administer at an appropriate rate for the needs of the patient, e.g., mild dehydration or shock.
  - b. Administration of fluids to euvoletic patients is not advisable, as it risks raising central venous pressure, which in turn raises the resistance against which the heart must work.



**Patient position and chest compression technique**

*See drawings below.*

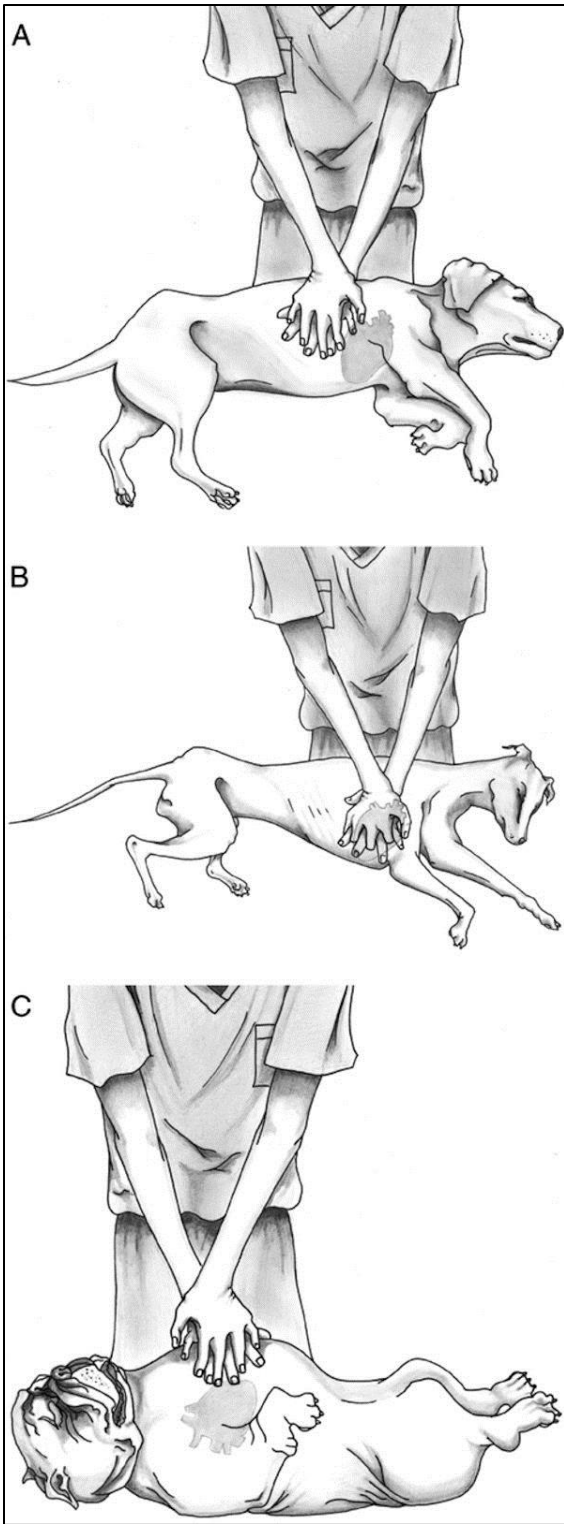
1. Chest compression achieves at best 30% of normal cardiac output, so proper technique is imperative. The quality of compressions are the most important determinant of successful CPR.
2. Position of patient for chest compressions
  - a. Most dogs and cats – lateral recumbency. The animal's back should face the compressor.
  - b. Dogs whose chest is wider than deep (e.g., bulldogs) – dorsal recumbency
3. The position of the compressor should be such that the core body muscles are used rather than the arm muscles.
  - a. Dogs  
The compressor's waist is positioned above the level of the patient's chest, e.g., kneeling before the patient on the floor or standing on a stool next to the patient on the table. Place one hand on top of the other, locking fingers. Lock elbows, shoulders positioned over hands. Administer compressions by moving torso and shoulders with core muscles, bending at the waist. Avoid using arm muscles for compression, as these fatigue quickly, even in very fit individuals.
  - b. Cats and small dogs  
Chests are usually a bit deeper than wide. May use both hands or a single-hand technique in which the chest is compressed between the thumb and the other fingers.
  - c. If at all possible, the compressor should be switched following each 2-minute cycle. Even very fit individuals quickly become fatigued in administration of chest compressions.
4. Hand placement for chest compressions
  - a. Dogs whose chests are roughly as deep as they are wide (most dogs): with the dog in lateral recumbency, the compressor's hands are placed over the highest, widest point of the chest. See Illustration A, below.
  - b. Dogs with deep, narrow chests such as Doberman pinchers or sighthounds: with the dog in lateral recumbency, hands are placed directly over the heart, just behind the normal point of the elbow. See Illustration B, below.
  - c. Barrel-chested dogs such as bulldogs, with chest wider than it is deep: with the dog in dorsal recumbency, hands are placed over the heart on the sternum. See Illustration C, below.
  - d. Cats and small dogs: compressions directly over the heart, using either a one- or two-handed technique. See Illustrations D and E, below.
  - e. The rationale for hand placements lies in the physics of pump mechanisms. If the heart lies close to the chest wall (small patients, narrow-chested dogs), chest compressions may directly compress the heart, and thereby empty and fill the heart in a manner similar to the normal activity of the heart, if it were pumping on its own (cardiac pump theory). If the heart is protected by a stiff chest and wide chest walls, the thoracic pump theory prevails. In the latter, compressions raise intrathoracic pressure, forcing blood through thoracic vessels and through the heart, with the heart as a passive conduit.
5. Compression force and rate
  - a. Compressions must reduce the width of the chest by 1/2 to 1/3, at a rate of 100-120 compressions per minute, regardless of the animal's size.

- b. Allow full chest recoil between compressions. As a compressor begins to fatigue, a common error is inadvertently to lean on the chest of the dog, and the chest cannot fully recoil.
- c. Music with the appropriate rhythm has been found to improve the accuracy of chest compression rates. (These can be downloaded from the American Heart Association's Be the Beat web site. A favorite is the Bee Gee's "Stayin' Alive".)
- d. Compressions must continue uninterrupted for two full minutes. This is based on the duration of time that it takes for coronary perfusion pressure to reach its maximum.

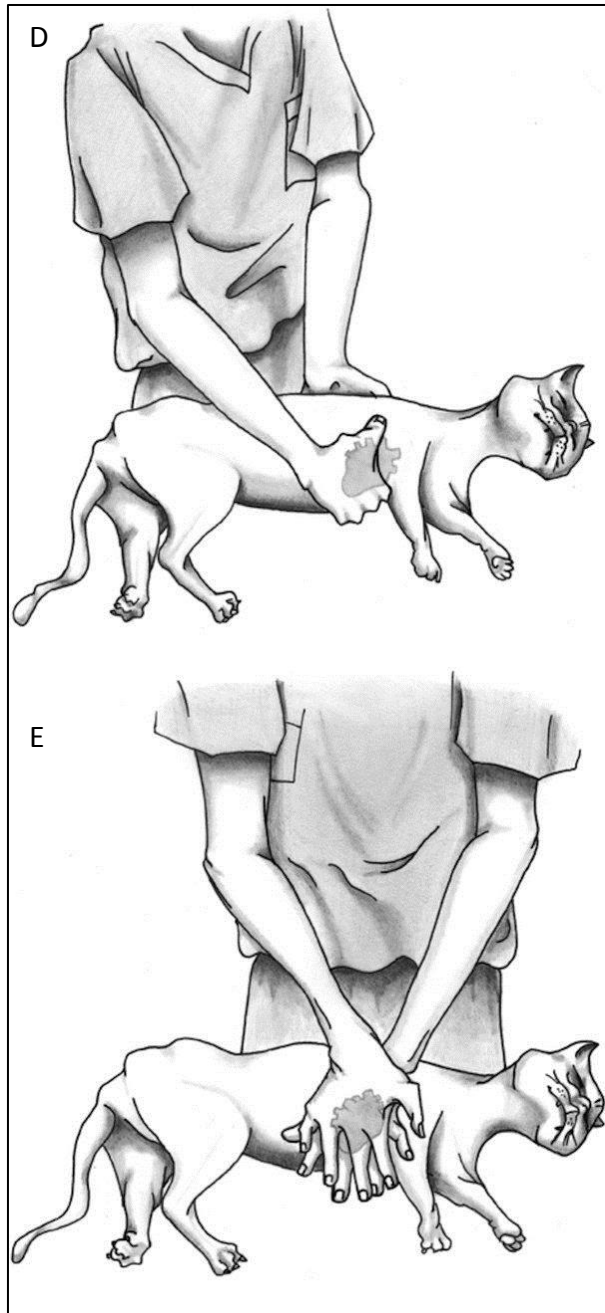
### **Post-resuscitation support**

1. Maintain ventilation, ideally with oxygen supplementation. Monitor oxygenation with pulse oximeter, if available.
2. Continue to monitor ECG if possible.
3. Maintain normal body temperature.  
In humans, hypothermia is now induced in some CPR protocols. However, anesthetized animals have to metabolize drugs, which requires maintenance of normal body temperature.
4. Seizures and blindness are the most common conditions seen post-CPR due to perfusion injury and apoptosis. On necropsy, see cerebral edema. Therefore, pre-emptive mannitol and phenobarbital may be appropriate.
  - a. Mannitol to reduce brain swelling, 1-2 grams/kg q 4 hrs, beginning right after ROSC.  
NB: Mannitol precipitates out if not kept warm. Either keep warm, or use an in-line blood filter to clear the crystals during delivery.
  - b. Phenobarbital pre-emptively, 2 mg/kg BID x 14 days
5. Sodium bicarbonate
  - a. Metabolic acidosis develops with prolonged resuscitation, 10-15 minutes after cardiopulmonary arrest.
  - b. Best to monitor blood pH and electrolytes to determine if alkalinizing therapy is needed. Once circulation is restored, acidosis usually resolves itself rapidly. If necessary, NaHCO<sub>3</sub> may be administered at 1-2 mEq/kg into IV fluids.

Reference: Reassessment Campaign on Veterinary Resuscitation (RECOVER) guidelines. 2012. *Journal of Veterinary Emergency and Critical Care*, 22(S1).



Hand placement for chest compressions in dogs



Hand placement for chest compressions in cats and small dogs

Illustrations credited to the *Journal of Veterinary Emergency and Critical Care*.

## Appendix 12: Emergency treatment for anaphylactic reaction

Acute anaphylaxis may follow vaccination, administration of certain drugs (e.g., penicillin), insect stings or other allergens. Reactions may occur within minutes or over the following few days. When vaccinating animals, one should monitor them for 15 minutes to make sure that they will not have an acute anaphylactic response. Clinical signs include:

- Dyspnea
- Vomiting
- Diarrhea
- Abdominal pain
- Hypersalivation
- Cyanosis (blue mucous membranes)
- Swollen face, tongue or throat
- Urticaria (hives)
- Distributive shock: pale mucous membranes; capillary refill time >2 sec; bradycardia (particularly in cats) or rapid, thready pulse; weak peripheral pulse; altered consciousness or loss of consciousness
- Death

### Treatment

1. Adrenaline at 0.01 – 0.02 mg/kg IV (use 2-10 times the IV dose if administered intra-tracheally) if the animal is having trouble breathing, or if the face or throat are swelling rapidly.
2. Response to adrenaline should be seen immediately. Repeat adrenaline dose if the patient is still showing signs of distress 5 minutes after first injection. If the adrenaline was given IM, response will be slower, so wait 7-10 minutes between injections.
3. Adrenaline may result in cardiac arrhythmias, particularly following multiple or high doses.
4. Prednisolone sodium succinate (Solu-Delta Cortef®, 2-4 mg/kg IV, one dose) or dexamethasone (0.25-1 mg/kg IM, one dose).
5. Diphenhydramine (antihistamine): 1-2 mg/kg IM
6. If the patient is showing evidence of cardiovascular collapse (shock), administer IV fluids (NaCl or LRS) as recommended for shock treatment (see [Appendix 11: Management of anesthetic complications, cardiopulmonary resuscitation](#)).
7. If the animal is suffering inspiratory dyspnea due to bronchoconstriction: aminophylline (4-8 mg/kg IM or slow IV) or terbutaline (0.2 mg/kg IV or IM)
8. Prevent the development of gastric ulcers that often occur after a massive release of histamine, particularly in dogs.
  - Follow treatment for anaphylaxis with a few days of sucralfate (0.5-1 gram, every 6-12 hrs) or famotidine: 0.5 mg/kg PO, IM, SQ, every 12-24 hours.

- Intermittent nausea and vomiting may be controlled with maropitant (Cerenia®, 1 mg/kg SQ or 2 mg/kg PO, once per 24 hours). Alternatively, ranitidine (0.5 mg/kg IM, BID) or metoclopramide (0.2 mg/kg SQ, BID) may be used.

### **Prophylaxis**

1. Animals with a history of anaphylactic reactions to vaccines may be pre-treated 20-30 minutes prior to administration of the vaccine.
2. Diphenhydramine: 1-2 mg/kg SQ or IM.
3. Dexamethasone: 0.25 mg/kg SQ or IM
4. Monitor the patient closely for 15 minutes after vaccination and be prepared to intervene with emergency treatment as outlined above.



## Appendix 13: Supply list for field sterilization events

The following is a list of supplies recommended for field spay/neuter projects, including drugs, consumable veterinary supplies, and equipment. The list takes into consideration potentially challenging conditions, e.g., where running water may not be available, and in which surgical drapes and instruments may need to be washed on site for re-sterilization. Electricity must be available if surgical instrument packs are to be washed, repacked and autoclaved on site. Alternatively, a pressure-cooker style autoclave machine may be used with a portable gas cooker. Specific items may be omitted or added to this list for various areas or situations.

### Drugs

Adrenaline	Glucose 50% or 5%
Antihistamine (injectable, vaccine reactions)	Heparin (for flushing IV catheter)
Anesthetic drugs (cf. <a href="#">Appendix 5: Anesthetic and analgesic drugs</a> )	Hydrogen peroxide 3%
Antibiotic, broad-spectrum, long-acting, e.g., 3- or 5-day penicillin	Lidocaine
Atropine	Maropitant, metoclopramide or ranitidine
Calcium gluconate 10%	NSAID for 24-hour post-operative pain management, injectable
Charcoal, activated, for incidental poisoning cases that may be presented on site	Parasite treatment drugs: endoparasites and ectoparasites. Refer to <a href="#">Appendix 4: Anti-parasitic drugs</a>
Diazepam	Povidone iodine / Betadine
Doxapram	Prednisolone or Dexamethasone, injectable (vaccine reactions)
Drugs to treat commonly-seen conditions other than common parasites and minor wounds	Reversal drugs for anesthetic
Ear cleaning solution	Sodium bicarbonate
Ear ointment – bacterial / fungal infection	Terbutaline or aminophylline (injectable)
Euthanasia solution	Vaccine – rabies, feline complex, canine complex
Eye lubricant (artificial tears ointment)	Wound ointment with antimicrobial activity
Flea spray	
Fluids (Saline (0.9% NaCl), LRS or Hartmann's)	

### Veterinary supplies

Alcohol (75% isopropanol)	Disinfectant hand gel (surgeons & support staff)
Autoclave indicator tape	Endotracheal tubes, sizes 3.0 - 14
Bandaging material	Gauze bandage rolls
Benzalkonium 5%, for cold sterilization & hand scrub, or chlorhexidine 4%	Gauze squares – sterile and non-sterile
Caps for surgery (cloth or disposable)	Gloves, non-sterile examination gloves, sizes small, medium, large
Chlorhexidine 4% for cold sterilization and pre-surgical hand scrubbing, or benzalkonium	Gloves, sterile surgical gloves, appropriate sizes
Bleach (sodium hypochlorite) for washing blood stained cloths & sterilization of inanimate surfaces	Gown, surgical (sterile cloth or disposable)
Cotton buds (Q-tips)	Injection port caps for IV catheters
Cotton wool (rolls or balls)	IV catheters, 24G, 22G, 20G
	IV fluid giving sets. If working with cats and small dogs, these must include a container



that allows filling of ~200 ml (pediatric giving sets).

Laryngoscope with 2 or 3 different blade sizes  
Lubricant for endotracheal tubes. (e.g., KY Jelly or other sterile, water-based lubricant free of perfumes or dyes.)  
Nail clippers  
Needles, 18G, 22G, 24G  
Scalpel blades (#10 or 15)  
Space heater for recovery areas in cold temperatures  
Stethoscopes  
Styptic powder  
Surgery packs (cf. [Appendix 2: Basic instrument pack for spay and neuter surgery](#))

### Equipment & general supplies

Ambu bag  
Autoclave machine  
Basin for washing surgical drapes, towels, hands  
Batteries, various sizes for relevant equipment  
Blankets or large towels for bedding in cages. In dire situations, can at least use cardboard to place under animals.  
Bowls for animals to eat & drink  
Calculators  
Camera  
Catch pole, Y-pole  
Cloths for cleaning tables and other surfaces  
Clip boards  
Clippers with chargers  
Clipper blades, additional sets, clean  
Clock with second hand for surgery & examination room areas  
Cloth sack (e.g., pillow case or similar), for restraining cats  
Clothes line and clothes pins for drying surgical laundry  
Clothing for veterinary staff – scrub tops, scrub trousers  
Cooler with ice packs, or refrigerator for vaccine  
Cages: various sizes as needed  
Duct tape  
Fan for animal holding area, in hot temperatures  
Flash light: small & bright, for improving surgeon's visibility & intubation

Surgical drapes, sterile cloth or disposable  
Suture material, 3-0, 2-0 and 0 size range usually suffices for dogs and cats  
Syringes (1, 3, 5, 10, 20, 60 ml)  
Tape, bandaging 1 cm & 2.5 cm  
Tattoo ink  
Thermometers, rectal  
Trays, stainless steel, for cold sterilization & instrument washing  
Water: drinking water for dilution of disinfectant, washing surgeons' hands if tap water is not of drinking quality  
Water for washing instruments, drapes, tables, etc. A running water source is ideal, but may not always be available.

Food for dogs & cats, including soft, palatable food for young patients post-recovery  
Food & drink for staff  
Freezer packs to keep vaccine cool  
Gas anesthesia machine  
Gasoline, if reserve may be needed for vehicles  
Head lamps, for additional surgical lighting or in case of power failure  
Heating pads, warm water bottles, microwavable sacks of rice or lentils or other individual heat source for each surgery table + additional for recovery area  
IV fluid stands  
Hemostat forceps for general use  
Lamp, surgical; one per surgery table  
Leashes (slip leads)  
Leather gauntlets or gloves for handling fractious cats  
Measuring tape  
Microwave oven, if using microwavable heat source bags or to warm fluids in cold temperatures  
Mobile telephones or 2-way radios  
Muzzles, or rope to fashion muzzles  
Net for catching dogs & cats  
Oxygen tank (1 per anesthesia machine, or at least 1 for emergency use)  
Pens: writing pens & permanent marker pens  
Pipe cleaners, for washing endotracheal tubes  
Pitchers for diluting disinfectant, with lid

Pots for alcohol and iodine swabs  
Pulse oximeter, capnograph and other monitoring machines, if available  
Record forms (cf. [Appendix 14: Examples of clinical forms and record sheets](#))  
Rope or cloth strips of very soft material, to tie limbs for positioning of patient on surgery table  
Rubbish baskets (one per surgery table + additional)  
Rubbish bin liners (plastic bags – small and large)  
Scissors, general purpose  
Scrub brushes or sponges for surgeon hand scrubbing  
Sharps containers (empty plastic water bottles with caps will do)  
Surgery tables

Sink with running water (or basins if no running water)  
Spray bottles for disinfectant  
Tray for holding each patient's medication - 14x14 cm square plastic dish works well  
Treats for dogs & cats  
Vacuum cleaner: small, hand-held vacuum cleaner for clipped fur  
V-tray or cushions with washable surface, for maintaining animal's position during surgery. A warm water bottle or warmed bean bag on either side of the patient works well for this instead of a V-tray, and usually removes the need to tie down limbs.  
Washing powder, if surgical laundry is washed on site  
Water drums if water is carried to location  
Weigh scale: must be able to read up to 50kg, in 0.1 kg increments

## Appendix 14: Examples of clinical forms and record sheets

1. Guidelines for caring for your pet before and after spay/neuter surgery
2. Clinical Evaluation Record (physical examination form)
3. Pain assessment forms
4. Body condition scoring chart
5. Anesthesia record
6. Patient hospitalization record

## Guidelines for caring for your pet before and after spay/neuter surgery

### Preparing your dog or cat for spay/neuter surgery:

- ❖ The veterinarian will check your pet before surgery to make sure he or she is healthy, but your observations about your pet are very important. Be sure to tell the veterinarian of any recent changes in behavior, appetite, activity, urination, defecation or anything else that you think may be abnormal.
- ❖ If your pet has not been vaccinated or dewormed in the past year, s/he should be vaccinated and dewormed two weeks before the surgery. If this is not possible, this may be done on the day of surgery.
- ❖ If possible, bathe your dog or cat on the day before surgery, and keep him or her clean and warm. But don't risk him or her getting cold.
- ❖ If your dog or cat is pregnant or in estrus, she may be spayed if she is healthy. Discuss this with the veterinarian.
- ❖ On the day of surgery:
  - Dogs and cats 6 months or older: do not give any food in the morning. Make sure he or she has water.
  - Puppies and kittens less than 4 months old: feed as normal. Make sure he or she has water.
  - Make sure that your pet always has clean drinking water available.

### Taking care of your pet after spay/neuter surgery

- ❖ Your dog or cat has had surgery to remove the reproductive organs. This ensures that there will be no unwanted puppies or kittens.
- ❖ Provide a warm, soft, quiet area for your pet to rest after surgery. Your pet might seem a bit quiet for a day or two, and that is normal. Give him or her time to rest and sleep, and lots of love.
- ❖ Food: offer half of a normal meal in the evening after your pet comes home. Provide normal meals beginning the day after surgery. He or she may not want to eat fully for the first day or two, but it is important to offer food.
- ❖ Water: Your pet must have drinking water available at all times.
- ❖ Sutures will dissolve on their own in a few weeks. They do not have to be cut out.
- ❖ Do not touch the incision site or wash it unless instructed to do so by the veterinarian.
- ❖ If the veterinarian sent medicine home with you, give the medicine every day according to instructions.
- ❖ Observe your pet every day for any abnormal behavior. Call the veterinarian immediately if your pet vomits, has diarrhea, cries when trying to move, refuses food for more than 1 day, seems unusually aggressive or dull, chews at the sutures, or any other unusual behavior.
- ❖ Check the surgical area every morning and evening. Look for signs of swelling, redness, discharge, the incision opening, or sutures coming out. Call the veterinarian immediately if you see any of these changes.
- ❖ Prevent your pet from licking or scratching the surgical area. The veterinarian can provide Elizabethan collars or medicine if necessary.
- ❖ Prevent your pet from being too active and jumping for 7 days following surgery. Walk your dog only on a leash (do not allow him or her to run loose outside). Keep your cat indoors for 7-10 days after surgery.
- ❖ Do not bathe your pet or allow him or her to go swimming for 2 weeks following surgery.
- ❖ If you have any questions or concerns, please call Dr. \_\_\_\_\_, tel. no. \_\_\_\_\_.

## Caring for your dog after surgery



Plenty of rest in a comfortable place.

Drinking water at all times.  
Good food 2 or 3 times a day.



Give the medicine as instructed by the veterinarian.

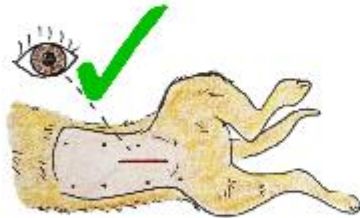
No bath or swimming for 2 weeks.



No licking of the wound.



Call the veterinarian if the dog is licking the wound.



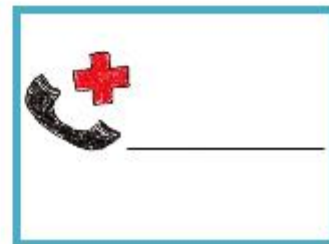
Look at the wound twice a day.



Do not touch the wound.



If the incision is inflamed, open, or bleeding, call the veterinarian right away.



K. Loeffler / IFAW

## CLINICAL EVALUATION RECORD

Date : \_\_\_\_\_ Species: \_\_\_\_\_ Sex: \_\_\_\_\_ Animal ID/name: \_\_\_\_\_

Weight: \_\_\_\_\_ kg  estimated  actual Birth date: \_\_\_\_\_  estimated  actual

Description: \_\_\_\_\_

Veterinarian: \_\_\_\_\_ Guardian: \_\_\_\_\_ Tel: \_\_\_\_\_

**History** (where & when found, previous illness, any other known information)

**Physical examination** Temp \_\_\_\_\_ °C Body condition score \_\_\_\_/\_\_\_\_ Pain score \_\_\_\_/4

Attitude (e.g., alert, depressed, aggressive, lethargic, unresponsive, unconscious, fearful, anxious)

General appearance (e.g., emaciated, thin, fat, good body condition, healthy, sick, mangy, soiled)

Skin (e.g., healthy, inflamed, raw, describe lesions)

Fur (e.g., thick, sparse, dull, shiny, patchy, clumps falling out)

Eyes (e.g., discharge (describe), inflamed, sunken, protruding, lesion on cornea, holding eye closed or blinking too much, eyeball twitching, wounds, symmetry, eyelashes rubbing against cornea, eyelid rolled inward or drooping, pupillary light reflex)

Left

Right

Ears (e.g., smell, dirty, wax, discharge (describe), wounds, swelling in ear canal or pinna)

Left

Right

Mouth & gums (e.g., color, dry/moist, smell, inflamed, wounds, capillary refill time)

Teeth (e.g., fractured, missing, exposed dental canal, tartar)

Lymph nodes (size & firmness: submandibular, pre-scapular, axillary, sub-lumbar, inguinal, popliteal)

Digestive system (e.g., appetite, color & quality of feces, vomit, bloated abdomen, flatulence, burping, abdominal masses)

Respiratory system (e.g., cough, nasal discharge (describe), breath sounds, difficulty breathing) RR \_\_\_\_/min

Cardiovascular system (heart rate, rhythm, murmurs, pulse strength, pulse coordination with heart beat) HR \_\_\_\_ bpm

Legs and joints (e.g., fractures, joint mobility, paw pads, wounds, nails)

Nervous system (e.g., facial symmetry, convulsions (describe detail, frequency, duration), tremors, twitching (which body part?), head tilt, poor balance, pressing head against wall, weak (which body part?), paralyzed (which body part?))

Urinary & genital systems (e.g., wounds or discharge from penis or vulva, quality and frequency of urine, presence of both testicles, growths in vagina or on penis, female reproductive status)

Scars, wounds, lumps (e.g., location, size, what they look like)

Assess hydration

Dehydration	Mucous membranes	Loss of skin turgor	Eyes	Pulse	Consciousness
4-5%	Slightly dry	Mild	Moist, normal	Strong	Normal
6-7%	Dry	Moderate	Moist, normal	Strong	Normal
8-10%	Dry	High	Dry, retracted	Weak, rapid	Weak, depressed
12% +	Very dry	Complete	Severely retracted	weak, rapid	Unconscious or abnormal

Diagnosis of illnesses (list possibilities)

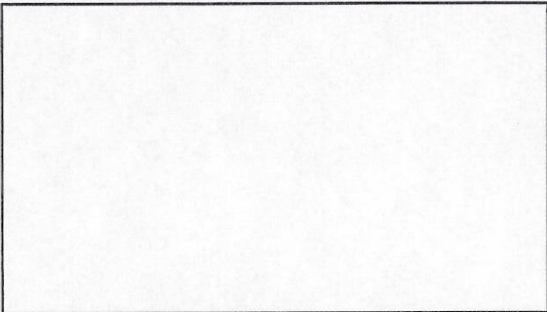
Laboratory tests needed (type of test, test result, test date, where test was done)

Medications & treatment given (use fluid calculation sheet to calculate fluid requirement):

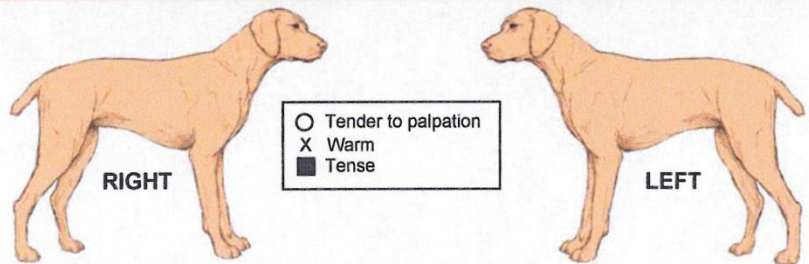
Additional medical & nursing care required: (type, frequency, duration)



## Colorado State University Veterinary Medical Center Canine Acute Pain Scale



Pain Score	Example	Psychological & Behavioral	Response to Palpation	Body Tension
No Score		<input type="checkbox"/> Animal is sleeping and cannot be evaluated		
0		<input type="checkbox"/> Comfortable when resting <input type="checkbox"/> Happy, content <input type="checkbox"/> Not bothering wound or surgery site <input type="checkbox"/> Interested in or curious about surroundings	<input type="checkbox"/> Nontender to palpation of wound or surgery site, or to palpation elsewhere	Minimal
1		<input type="checkbox"/> Content to slightly unsettled or restless <input type="checkbox"/> Distracted easily by surroundings	<input type="checkbox"/> Reacts to palpation of wound, surgery site, or other body part by looking around, flinching, or whimpering	Mild
2		<input type="checkbox"/> Looks uncomfortable when resting. <input type="checkbox"/> May whimper or cry and may lick or rub wound or surgery site when unattended <input type="checkbox"/> Droopy ears, worried facial expression (arched eye brows, darting eyes) <input type="checkbox"/> Reluctant to respond when beckoned <input type="checkbox"/> Not eager to interact with people or surroundings but will look around to see what is going on	<input type="checkbox"/> Flinches, whimpers cries, or guards/pulls away	Mild to Moderate <b>Reassess analgesic plan</b>
3		<input type="checkbox"/> Unsettled, crying, groaning, biting or chewing wound when unattended <input type="checkbox"/> Guards or protects wound or surgery site by altering weight distribution (i.e., limping, shifting body position) <input type="checkbox"/> May be unwilling to move all or part of body	<input type="checkbox"/> May be subtle (shifting eyes or increased respiratory rate) if dog is too painful to move or is stoic <input type="checkbox"/> May be dramatic, such as a sharp cry, growl, bite or bite threat, and/or pulling away	Moderate <b>Reassess analgesic plan</b>
4		<input type="checkbox"/> Constantly groaning or screaming when unattended <input type="checkbox"/> May bite or chew at wound, but unlikely to move <input type="checkbox"/> Potentially unresponsive to surroundings <input type="checkbox"/> Difficult to distract from pain	<input type="checkbox"/> Cries at non-painful palpation (may be experiencing allodynia, wind-up, or fearful that pain could be made worse) <input type="checkbox"/> May react aggressively to palpation	Moderate to Severe <b>May be rigid to avoid painful movement</b> <b>Reassess analgesic plan</b>

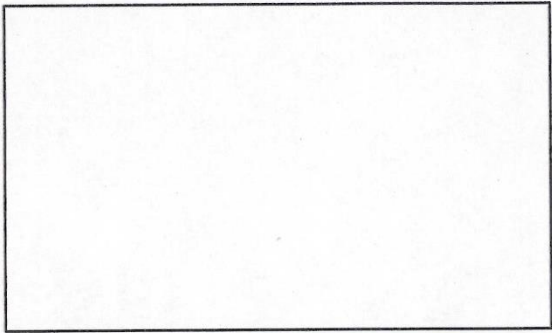


Comments \_\_\_\_\_



Date \_\_\_\_\_

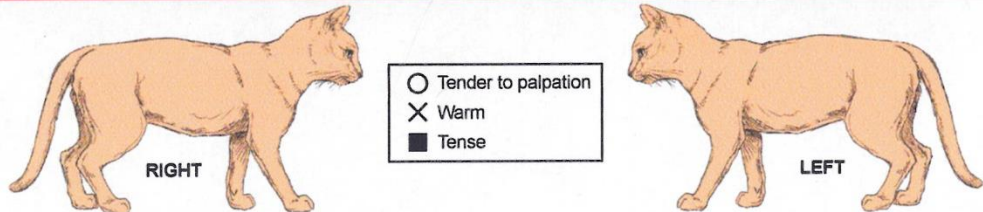
Time \_\_\_\_\_



**Colorado State University  
Veterinary Medical Center  
Feline Acute Pain Scale**

Rescore when awake  Animal is sleeping, but can be aroused - Not evaluated for pain  
 Animal can't be aroused, check vital signs, assess therapy


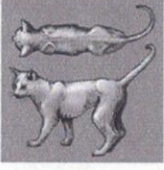

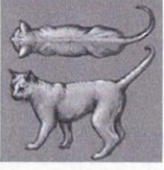
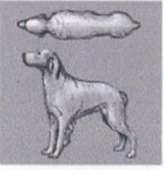
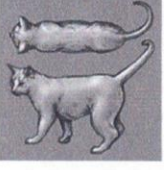
Pain Score	Example	Psychological & Behavioral	Response to Palpation	Body Tension
0		<input type="checkbox"/> Content and quiet when unattended <input type="checkbox"/> Comfortable when resting <input type="checkbox"/> Interested in or curious about surroundings	<input type="checkbox"/> Not bothered by palpation of wound or surgery site, or to palpation elsewhere	Minimal
1		<input type="checkbox"/> Signs are often subtle and not easily detected in the hospital setting; more likely to be detected by the owner(s) at home <input type="checkbox"/> Earliest signs at home may be <u>withdrawal from surroundings or change in normal routine</u> <input type="checkbox"/> In the hospital, may be content or slightly unsettled <input type="checkbox"/> Less interested in surroundings but will look around to see what is going on	<input type="checkbox"/> May or may not react to palpation of wound or surgery site	Mild
2		<input type="checkbox"/> Decreased responsiveness, seeks solitude <input type="checkbox"/> Quiet, loss of brightness in eyes <input type="checkbox"/> Lays curled up or sits tucked up (all four feet under body, shoulders hunched, head held slightly lower than shoulders, tail curled tightly around body) with eyes partially or mostly closed <input type="checkbox"/> Hair coat appears rough or fluffed up <input type="checkbox"/> May intensively groom an area that is painful or irritating <input type="checkbox"/> Decreased appetite, not interested in food	<input type="checkbox"/> Responds aggressively or tries to escape if painful area is palpated or approached <input type="checkbox"/> Tolerates attention, may even perk up when petted as long as painful area is avoided	Mild to Moderate Reassess analgesic plan
3		<input type="checkbox"/> Constantly yowling, growling, or hissing when unattended <input type="checkbox"/> May bite or chew at wound, but unlikely to move if left alone	<input type="checkbox"/> Growls or hisses at non-painful palpation (may be experiencing allodynia, wind-up, or fearful that pain could be made worse) <input type="checkbox"/> Reacts aggressively to palpation, adamantly pulls away to avoid any contact	Moderate Reassess analgesic plan
4		<input type="checkbox"/> Prostrate <input type="checkbox"/> Potentially unresponsive to or unaware of surroundings, difficult to distract from pain <input type="checkbox"/> Receptive to care (even mean or wild cats will be more tolerant of contact)	<input type="checkbox"/> May not respond to palpation <input type="checkbox"/> May be rigid to avoid painful movement	Moderate to Severe May be rigid to avoid painful movement Reassess analgesic plan

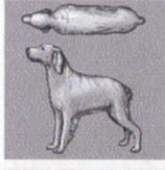
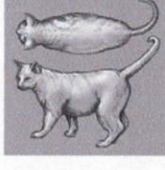
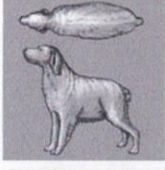



Comments \_\_\_\_\_



# Body Condition Scoring (BCS) Systems

5 Point	9 Point	Description
1/5	1/9	<p><b>Dogs:</b> Ribs, lumbar vertebrae, pelvic bones and all bony prominences evident from a distance. No discernible body fat. Obvious loss of muscle mass.</p>  <p><b>Cats:</b> Ribs visible on short-haired cats; no palpable fat; severe abdominal tuck; lumbar vertebrae and wings of ilia obvious and easily palpable.</p> 
1.5/5	2/9	<p><b>Dogs:</b> Ribs, lumbar vertebrae and pelvic bones easily visible. No palpable fat. Some evidence of other bony prominence. Minimal loss of muscle mass.</p> <p><b>Cats:</b> Shared characteristics of BCS 1 and 3.</p>
2/5	3/9	<p><b>Dogs:</b> Ribs easily palpated and may be visible with no palpable fat. Tops of lumbar vertebrae visible. Pelvic bones becoming prominent. Obvious waist.</p>  <p><b>Cats:</b> Ribs easily palpable with minimal fat covering; lumbar vertebrae obvious; obvious waist behind ribs; minimal abdominal fat.</p> 
2.5/5	4/9	<p><b>Dogs:</b> Ribs easily palpable, with minimal fat covering. Waist easily noted, viewed from above. Abdominal tuck evident.</p> <p><b>Cats:</b> Shared characteristics of BCS 3 and 5.</p>
3/5	5/9	<p><b>Dogs:</b> Ribs palpable without excess fat covering. Waist observed behind ribs when viewed from above. Abdomen tucked up when viewed.</p>  <p><b>Cats:</b> Well proportioned; waist observed behind ribs; ribs palpable with slight fat covering; abdominal fat pad minimal.</p> 

5 Point	9 Point	Description
3.5/5	6/9	<p><b>Dogs:</b> Ribs palpable with slight excess fat covering. Waist is discernible viewed from above but is not prominent. Abdominal tuck apparent.</p> <p><b>Cats:</b> Shared characteristics of BCS 5 and 7.</p>
4/5	7/9	<p><b>Dogs:</b> Ribs palpable with difficulty; heavy fat cover. Noticeable fat deposits over lumbar area and base of tail. Waist absent or barely visible. Abdominal tuck may be present.</p>  <p><b>Cats:</b> Ribs not easily palpable with moderate fat covering; waist poorly distensible; obvious rounding of abdomen; moderate abdominal fat pad.</p> 
4.5/5	8/9	<p><b>Dogs:</b> Ribs not palpable under very heavy fat cover, or palpable only with significant pressure. Heavy fat deposits over lumbar area and base of tail. Waist absent. No abdominal tuck. Obvious abdominal distension may be present.</p> <p><b>Cats:</b> Shared characteristics of BCS 7 and 9.</p>
5/5	9/9	<p><b>Dogs:</b> Massive fat deposits over thorax, spine and base of tail. Waist and abdominal tuck absent. Fat deposits on neck and limbs. Obvious abdominal distention.</p>  <p><b>Cats:</b> Ribs not palpable under heavy fat cover; heavy fat deposits over lumbar area, face and limbs; distention of abdomen with no waist; extensive abdominal fat pad.</p> 



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# Anesthesia record

Date: \_\_\_\_\_

Species: \_\_\_\_\_ Sex: \_\_\_\_\_ Date of birth: \_\_\_\_\_ Name / ID: \_\_\_\_\_

Weight: \_\_\_\_\_ kg  measured  estimated Microchip number: \_\_\_\_\_

Description: \_\_\_\_\_

Guardian: \_\_\_\_\_ Tel: \_\_\_\_\_

Surgeon: \_\_\_\_\_ Anesthetist: \_\_\_\_\_

Attitude:  calm  excited  aggressive  anxious / nervous

History & reason for surgery: \_\_\_\_\_

### Vital signs before anesthesia:

HR	RR	Temp
CRT	MM	Hydration

### Drugs used

Drug	Concentration (mg/ml)	Amount administered (ml)	Route IM, SC, IV	Time of administration

**Fluids:** Type: \_\_\_\_\_ Start time: \_\_\_\_\_ End time: \_\_\_\_\_

Total volume administered: \_\_\_\_\_ ml Drops/min: \_\_\_\_\_

**Endotracheal tube:** Size: \_\_\_\_\_ Intubation time: \_\_\_\_\_ Extubation time: \_\_\_\_\_

**Recovery:** Time head up: \_\_\_\_\_ Time sternal: \_\_\_\_\_ Time standing: \_\_\_\_\_

Smooth  Slow  Rapid Difficult (describe) \_\_\_\_\_

Gauze count \_\_\_\_\_

<b>Checklist:</b>			
<input type="checkbox"/> Tramadol	<input type="checkbox"/> Lidocaine	<input type="checkbox"/> Tattoo	<input type="checkbox"/>
<input type="checkbox"/> Carprofen / meloxicam	<input type="checkbox"/> Vaccine	<input type="checkbox"/> Ear tag	<input type="checkbox"/>
<input type="checkbox"/> Antibiotic	<input type="checkbox"/> Microchip	<input type="checkbox"/>	<input type="checkbox"/>



### PATIENT HOSPITALIZATION RECORD

Date : \_\_\_\_\_ Species: \_\_\_\_\_ Sex: \_\_\_\_\_ Birth date: \_\_\_\_\_  
 Weight: \_\_\_\_\_ kg  estimated  actual Animal ID/name: \_\_\_\_\_  
 Description: \_\_\_\_\_ Microchip number: \_\_\_\_\_  
 Owner/Guardian: \_\_\_\_\_ Tel.: \_\_\_\_\_  
 Date of surgery \_\_\_\_\_ Type of surgery \_\_\_\_\_

Release date:  
 Release location:

#### Daily assessment

Date	Time	Temp	HR-RR-CRT	Pain score	Attitude	Feces	Urine	Appetite

#### Medications

Date	Time	Drug name	Concentration (mg/ml, mg/pill)	Amount given	Route given PO, IM, SQ, IV

Medications sent home & instructions for recheck:



## Appendix 15: Disinfectants

### Important principles

When cleaning a room or cage with disinfectant, always be sure to remove the animal before you clean. Return the animal to the cage or room once all 7 steps have been completed.

Disinfectants must be allowed contact time of at least 10 minutes before being rinsed with water. Some disinfectants require longer contact times. Be sure to read instructions on the container.

Following disinfection of equipment, surfaces must be rinsed well with water and dried before an animal comes into contact with them.

Avoid use of phenolic products (e.g., Dettol®) for cat areas, as these products are toxic to cats.

Disinfection of cages, floors, tables, walls, or other surfaces is done in 7 steps:

1. Remove the animal from the cage or room.
2. Remove all organic material thoroughly (feces, urine, blood, vomitus, soil, food, etc.).
3. Wash with a detergent.
4. Rinse with water.
5. Apply the disinfectant. Cover the entire surface, making sure to get into cracks and corners. Leave the disinfectant on for the required contact time. For most chemicals, this is 10 minutes.
6. Rinse away the disinfectant with clean water.
7. Dry the surface – air dry or with a cloth or paper.

### Properties and uses of common disinfectants

**Benzalkonium** chloride, 2.7-3.3% stock concentration.

- Quaternary ammonium compound
- For disinfection of equipment, e.g., cages, floors, endotracheal tubes, feeding tubes, chemical sterilization of surgical instruments, use at 1:500 = 33 parts stock solution + 467 ml water (total 500 ml)
- For use as skin scrub, use at 1:750 = 22 parts stock solution + 478 ml water (total 500 ml)

### **Chlorhexidine gluconate**

- For hand scrub before surgery, use the 4% soap preparation.
- For cleaning countertops, floors, walls, surgery tables, etc., use as a 2% dilution, diluted in clean tap water.
- For cleaning an animal's skin prior to surgery, use 2-4% solution (not the soap preparation). Dilute in water that is clean enough to drink.
- For cleaning wounds, use 0.5% solution, diluted in sterile water or drinking water. Be sure to rinse with sterile water after using chlorhexidine – it should not be left on skin or mucosa.
- Chemical sterilization of instruments and endotracheal tubes:

1. Wash instruments or tubes thoroughly in cold water to remove all organic material. A toothbrush works well for instruments; pipe cleaners or laboratory brushes are needed to clean the inside of endotracheal tubes.
2. Prepare a mixture of 3 parts chlorhexidine (4%, not containing soap) and 1 part alcohol (75% isopropanol). For example: 75 ml chlorhexidine + 25 ml alcohol.
3. Soak instruments or tubes for at least 15 minutes.
4. Rinse thoroughly with water before use. Endotracheal tubes may be rinsed in drinking water. Instruments must be rinsed with sterile water or sterile saline (0.9% NaCl) if they are to be used for sterile procedures.

**Chlorine bleach** (sodium hypochlorite, 8-11% w/v NaOCl = 8-11g/L available chlorine).

- Use only on inanimate surfaces: floors, counter tops, tables, walls, cages surfaces.
- Do not use for instruments, endotracheal tubes, feeding tubes or other items that contact an animal's mucosa or internal structures. Never apply bleach to an animal's body directly.
- Dilutions:
  - Quarantine, Isolation and Surgery rooms: 50 ml/L water (1:20)
  - To decontaminate ringworm areas: 100 ml/L water (1:10)
  - Food utensils: 30 ml/L water (1:33)
  - Laundry: 10 ml/L water (1:100)
  - General areas, floors: 30 ml/L water (1:33)
- Bleach is quickly inactivated when it comes in contact with organic material. Soil, mud, feces, etc., will inactivate bleach.
- Bleach in foot baths
  - Change foot bath as often as necessary to keep it clean from organic material.
  - Place another foot bath containing only water in front of the bleach footbath. Here, soil can be removed before the shoes / boots are placed in the bleach foot bath.
  - Bleach will corrode leather, cloth and rubber. Use only for plastic boots.

**Deciquan**, stock concentration 10%.

- Glutaraldehyde compound
- Use only on inanimate surfaces: floors, counter tops, walls, tables, cage surfaces.
- Do not use for instruments, endotracheal tubes, feeding tubes or other items that contact an animal's mucosa or internal structures. Do not apply to the animal directly.
- Use at final dilution of 0.15 – 0.5%: dilute stock solution at 7.5 – 25 ml in 500 ml water.

**Dettol®** (chloroxyleneol 4.8%)

- Phenolic compound
- Dilute at 1:20 (50 ml stock solution in 1 liter water).
- Appropriate for Quarantine or Isolation Units
- Use only on inanimate surfaces: floors, counter tops, tables, walls, cages surfaces.



- Do not use for instruments, endotracheal tubes, feeding tubes or other items that contact an animal's mucosa or internal structures. Do not apply to the animal directly.
- Do not use in areas housing cats.

#### **F10**

- Quaternary ammonium compound. Effective against bacteria, fungi, some viruses and fungal spores.
- Used for cleaning inanimate surfaces.
- May be used medically in nebulizers (e.g., to treat respiratory aspergillosis) at recommended dilutions.
- Use according to manufacturer's instructions.
  1. For general disinfection: 1:500 dilution (2 ml per liter of water).
  2. Disinfection against bacteria, fungi and some viruses: 1:250 or 1:125 dilution (4-8 ml per liter of water)

#### **Glutaraldehyde**

- For cold sterilization of endotracheal tubes or surgical instruments.
- Use per manufacturer's instructions.

#### **Povidone iodine** (e.g., Betadine®)

- 7.5% w/v solution
- May be used as hand scrub if surgeon is allergic to chlorhexidine, or if 4% chlorhexidine is not available.
- May be used as a skin scrub on the surgical area prior to surgery. Usually alternated with alcohol (see [Section 9.2: Preparation of the patient for surgery](#)).

#### **Virkon®-S** (DuPont)

- Active ingredient: potassium peroxymonosulfate, 20.4%
- Controls bacteria, fungi and many viruses (including some activity against parvoviruses)
- Continues to work in presence of organic matter (unlike bleach)
- Dissolve tablets per manufacturer instructions (2 tablets per litre water).
- Use only on inanimate surfaces: floors, counter tops, tables, walls, cages surfaces.
- Do not use for instruments, endotracheal tubes, feeding tubes or other items that contact an animal's mucosa or internal structures. Do not apply to the animal directly.

#### **VIROCID® or CID20®** (CID Lines)

- Composed of a quaternary ammonium compound, glutaraldehyde, and isopropanol.
- Dilute per manufacturer instructions.
- Appropriate for Quarantine or Isolation Unit (inanimate surfaces only).
- Use only on inanimate surfaces: floors, counter tops, tables, walls, cages surfaces.



- Do not use for instruments, endotracheal tubes, feeding tubes, food containers, water dishes or other items that contact an animal's mucosa or internal structures. Do not apply to the animal directly.

## Appendix 16: Legal forms for IFAW project participants

(following pages)

1. Volunteer registration form  
Includes points of agreement to adhere to respectful and safe conduct.
2. IFAW Liability Release and Assumption of Risk form
3. Consent to surgery for spay / neuter
4. Consent to euthanasia



## VOLUNTEER REGISTRATION FORM

Volunteer Information		
Name:	Address:	City/State/Zip:
Home phone:	Work phone:	Cell phone:
Email address:		

Emergency Contact Information	
Name:	Relationship:
Home phone:	Alternate phone:

Medical Information		
Do you have medical insurance? <input type="checkbox"/> Yes <input type="checkbox"/> No <b>Note:</b> IFAW is not responsible for covering any medical costs for volunteers.	Carrier:	Policy number:
Do you have a current tetanus vaccination? <input type="checkbox"/> Yes (date) _____ <input type="checkbox"/> No <b>Note: You must have a current tetanus vaccination. Proof of vaccination is required to volunteer.</b>		
Do you have a current rabies pre-exposure vaccination? <input type="checkbox"/> Yes (date) _____ <input type="checkbox"/> No <b>Note: Rabies pre-exposure vaccination is recommended. By signing this form you are aware of this recommendation.</b>		
Are you on long term medications? <input type="checkbox"/> Yes <b>Note:</b> It is recommended that you inform your team leader of any long term medications you are on. <input type="checkbox"/> No		
Do you have any medical conditions that IFAW should be aware of in the event of an emergency? <input type="checkbox"/> Yes (explain) _____ <input type="checkbox"/> No		
Do you have any allergies? <input type="checkbox"/> Yes (list) _____ <input type="checkbox"/> No	Are you allergic to any animals? <input type="checkbox"/> Yes (list) _____ <input type="checkbox"/> No	Are you afraid of any animals? <input type="checkbox"/> Yes (list) _____ <input type="checkbox"/> No

- As a volunteer, I agree to the following:**
- To represent IFAW in a professional manner;
  - To follow the rules and procedures set up by IFAW for this project, including all veterinary protocols and emergency procedures;

- To respect IFAW's right to terminate me as a volunteer should it be determined that I am in conflict with the goals of the Organization to help animals during the project or if I am perceived to be a deterrent or threat to other volunteers and their well-being;
- To return to IFAW any property belonging to the Organization upon request;
- To use equipment and facilities belonging to, or being used by, IFAW in a manner not to damage or destroy them. Volunteers are responsible for replacing and/or repairing any property they intentionally damage or destroy;
- Not to represent IFAW to the media without approval;
- I give IFAW permission to use videos and photographs taken during the course of the project and other activities that include images of me for use in broadcast videos, educational programs, newsletters, and advertisements. I understand I will receive no compensation in any form;
- Not to abuse or neglect any animal;
- Not to cause bodily harm to any other volunteers, IFAW staff, or other individuals cooperating with the project;
- Not to bring weapons of any type to an IFAW project;
- Illegal drugs are not permitted to be used at any time when volunteering for IFAW.

**I have read the above mentioned conditions and agree to abide by them while volunteering for IFAW.**

Volunteer signature: \_\_\_\_\_ Date: \_\_\_\_\_

## IFAW LIABILITY RELEASE AND ASSUMPTION OF RISK

**NOTICE:** Participation in animal rescue and welfare projects can be a potentially dangerous activity. This Agreement prevents the bringing of a claim against IFAW or the IFAW Group (as defined below) in the event of death, illness or injury.

As a condition to, and in consideration of, being permitted to participate with a project (hereafter referred to as IFAW Project) associated with the International Fund for Animal Welfare Inc. (hereafter referred to as IFAW), the undersigned represents, acknowledges and agrees as follows, all for the benefit of IFAW and its affiliates in all forums, and their respective shareholders, members, directors, trustees, officers, employees, agents, representatives, insurers, successors and assigns (collectively, the “IFAW Group”).

### ***Fitness to Participate***

I represent and verify that I am at least eighteen (18) years old, in good health, and aware of no physical problem or condition that will impair my ability to participate in the IFAW Project activities, including emergency response. I acknowledge and understand that IFAW is NOT in any way responsible for determining whether I am fit to participate in this program. I further represent that I will not use or possess drugs (including prescription medications which could impair my ability to participate in the IFAW Project), alcoholic, controlled substances or firearms while participating in the IFAW Project.

I understand that, prior to participating in the IFAW Project, it is recommended that I have a complete medical examination with a qualified physician, including the administration of such vaccinations for Hepatitis B, Tetanus and Rabies and other medical treatment as such qualified physician may deem necessary or advisable prior to or subsequent to the handling of animals.

### ***Volunteer Status***

I understand that, as a volunteer, I shall not receive any compensation whatsoever (including wages, salaries, benefits, unemployment insurance, workers compensation insurance or medical insurance) for my participation in the IFAW Project.

### ***Assumption of Risk***

I understand that participation in the IFAW Project involves a high degree of risk of injury to my person and/or death and injury to and destruction of my property. These risks may include, but are not limited to: strenuous physical activity and contact with animals that can be violent, carry disease and otherwise cause injury. I am voluntarily participating in the IFAW Project, with full knowledge and appreciation of this risk, and I understand and duly accept the potentially inherent dangers associated with the IFAW Project.

### ***Medical Treatment***

I give IFAW the right, in its sole discretion, but without any obligation to do so, to seek, authorize or approve medical treatment on my behalf, in the event that I am unable to do so; and I

agree to pay or reimburse IFAW for all costs associated with such medical treatment. No member of the IFAW Group shall be liable for the failure to seek or approve such medical treatment or for any damage, loss or injury resulting from any medical treatment provided on my behalf.

***Insurance***

I understand that IFAW does not carry or maintain health, medical, disability or life insurance coverage for any participant. Each participant is expected and encouraged to obtain his or her own health, medical, disability or life insurance coverage.

***Release of Liability***

On behalf of myself and my family members, companions, dependents, executors, administrators, heirs, assigns and representatives (collectively, the “Releasers”), I hereby release, discharge and hold harmless all members of the IFAW Group from all damages, losses, injuries, liabilities, claims, demands and causes of action for personal injury, death or damage to personal property (“Claims”), in each case suffered by me, by any Releaser or by any other person, arising from or occurring in connection with my participation or the participation of any other party or person in the IFAW Project, including, without limitation, injury, death or damage caused in whole or in part by the negligence or wrongdoing of any member of the IFAW Group, and any injury, death or damage arising out of any medical treatment or first aid provided or procured by IFAW. I agree that neither I nor any of other Releaser will ever assert in any forum any such Claim, and I shall indemnify and hold harmless all members of the IFAW Group from and against any such Claim (including reasonable attorneys’ fees and costs incurred in defending such a Claim of any nature) brought against them by me or any Releaser.

***Applicable Law; Jurisdiction; etc.***

This IFAW Liability Release and Assumption of Risk is governed by the substantive laws of the Commonwealth of Massachusetts as if executed and to be formed in Massachusetts, without regard to conflict of law principles. I agree that all disputes arising under, in connection with or incident to, or related in any way to the IFAW Project or to this IFAW Liability Release and Assumption of Risk shall be litigated, if at all, in a state or federal court sitting in Massachusetts and I consent to the exclusive jurisdiction of such courts and waive, to the fullest extent permitted by law, any objection to the laying of the venue or that any such dispute has been brought in an inconvenient forum. If any provision contained in this IFAW Liability Release and Assumption of Risk shall be deemed invalid or unenforceable in whole or in part, this IFAW Liability Release and Assumption of Risk shall be enforced to the fullest extent allowed by law.

***Miscellaneous***

I represent to IFAW that I have advised my family members, companions and dependents of my participation in the IFAW Project, of the risks associated with such participation, and that I have assumed all such risks and released IFAW from any liability pertaining to such risks.

This document contains all of the agreements of the parties with respect to the subject matter hereof and supersedes all prior dealings of any nature between them with respect to such subject matter.

**I have read and understand this IFAW Liability Release and Assumption of Risk and I am executing this IFAW Liability Release and Assumption of Risk voluntarily, without coercion and without reliance on any representation, expressed or implied, by any member of the IFAW Group. I understand that this IFAW Liability Release and Assumption of Risk waives important legal rights. I have had an adequate opportunity to consider this IFAW Liability Release and Assumption of Risk and to obtain such legal or other advice in regard to it as I considered advisable.**

**VOLUNTEER:**

Full Name (Printed) \_\_\_\_\_

Street Address of Legal Residence \_\_\_\_\_

City, State, and Zip Code \_\_\_\_\_

Telephone \_\_\_\_\_

Signature & Date \_\_\_\_\_

**WITNESS:**

Full Name (Printed) \_\_\_\_\_

Street Address of Legal Residence \_\_\_\_\_

City, State, and Zip Code \_\_\_\_\_

Telephone \_\_\_\_\_

Signature & Date \_\_\_\_\_

## Surgery consent form

Animal name: \_\_\_\_\_ Identification: \_\_\_\_\_

Species: \_\_\_\_\_ Sex: \_\_\_\_\_ Date of birth: \_\_\_\_\_

Description of animal: \_\_\_\_\_

Surgical procedure(s) to be performed: \_\_\_\_\_

I give consent for the procedure/s listed above to be performed and understand that there is a slight element of risk involved with the administration of the anesthesia and the surgical procedure. I understand that the best possible care and techniques will be used to prevent any problems. In the event of any problems, I will not hold IFAW responsible in any way.

Furthermore, I verify that:

1. I understand that the veterinarian will clip some fur to make the site clean for the procedures. This fur will grow back within a few weeks following the surgery.
2. I understand that the veterinarian may not perform the procedure if he/she believes that the surgery will pose an unreasonable risk to the animal's health.
3. I understand that following spay or neuter surgery, my dog/cat will not be able to have puppies/kittens.
4. I understand that my pet will have a small tattoo on the belly to indicate that s/he has been sterilized.
5. I understand the instructions for taking care of my pet following surgery.
6. I have disclosed all information about my pet's health and medical history to the veterinary staff.
7. If my pet requires post-operative care by a veterinary professional, it is my responsibility to seek the appropriate care and to pay for it.

Printed name of owner/guardian: \_\_\_\_\_

Signature of owner/guardian: \_\_\_\_\_

Date: \_\_\_\_\_ Telephone no. \_\_\_\_\_

Printed name of Witness: \_\_\_\_\_

Signature of Witness: \_\_\_\_\_ Date: \_\_\_\_\_





## Consent for euthanasia

Animal name: \_\_\_\_\_ Identification: \_\_\_\_\_

Species: \_\_\_\_\_ Breed: \_\_\_\_\_ Sex: \_\_\_\_\_

Date of birth: \_\_\_\_\_  estimated  actual

Description of animal: \_\_\_\_\_

Guardian: \_\_\_\_\_ Tel: \_\_\_\_\_

Reason for euthanasia: \_\_\_\_\_

By signing below, I agree for the veterinarian to euthanize the animal listed at the top of this form for reasons that I understand and with which I agree. The animal will be euthanized in a gentle and humane manner.

Printed name: \_\_\_\_\_

Relationship to animal: owner \_\_\_ rescuer \_\_\_ guardian \_\_\_ other \_\_\_\_\_

Signature: \_\_\_\_\_

Date: \_\_\_\_\_

Printed name of Witness: \_\_\_\_\_

Signature of Witness: \_\_\_\_\_ Date: \_\_\_\_\_



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