PROTOCOL
QUICK REFERENCE GUIDE

Abdominal/hepatic
Brachycephalic
Caesarean section
Cardiac
Dental prophylaxis
Diabetic (stable)
Emergency
Geriatric
Obese (stable)
Onychectomy (medically necessary)
Orthopedic
Pediatric
Renal/post-renal
Respiratory compromise
Soft tissue (elective)
Stressed/fractious

ANESTHESIA and ANALGESIA
for the Veterinary Practitioner: Canine and Feline

INTRODUCTION

Protocols have been developed from an evaluation of the current literature and the consensus of board-certified veterinary specialists (anesthesiology and internal medicine). Protocols are never meant to be followed blindly and the anesthesia team remains responsible for making decisions in the best interest of the patient.

Below are considerations for all pets, and included within each unique protocol is a quick reference with specific recommendations and risks for each anesthetic protocol. Please see *Anesthesia and Analgesia for the Veterinary Practitioner: Canine and Feline* for complete details and information on protocol selection and individualized patient care.

GENERAL CONSIDERATIONS FOR ALL PROTOCOLS

Always reference individual protocol for patient-specific doses and actions

INDUCTION AND INTUBATION

Drug	Dose	Route
Propofol	1.0 mg/kg slowly over 15 seconds	IV
	Increments of 0.5 mg/kg over 15 seconds until intubation	

- Preoxygenate if possible, based on patient tolerance and clinical stability
- **Induce with lowest possible dose of propofol**
  - **May cause apnea if given rapidly**
- **Bradycardia, hypotension and respiratory depression may develop after rapid administration**

TRANSITION PHASE
Post-induction Inhalant Rates

Inhalant	Rates	Miscellaneous
Oxygen	50 - 100 mL/kg/minute (rebreathing)	For first 15 minutes after induction
	150 - 300 mL/kg/minute (NRB)	
Sevoflurane	3% for 3 minutes	Large dogs may need higher rates

- Monitor anesthetic depth and oxygenation closely

ANESTHETIC MAINTENANCE

Drugs	Rates
Oxygen	20 - 30 mL/kg/minute (rebreathing)
	200 mL/kg/minute (average rate, NRB)
Sevoflurane	1 - 4% to effect with oxygen

- Be prepared to adjust oxygen flow rates in response to patient clinical parameters
- Amount of sevoflurane will vary with patient health, analgesic therapy and local blocks used
- If 4% or more sevoflurane is required:
  - Check the anesthesia system for leaks
  - Ensure appropriate analgesia
  - Consider:
    - Inadequate premedication
    - Improper endotracheal intubation, etc.
      - See *Equipment* chapter for more details

ANESTHETIC RECOVERY

Parameter	Range
Normothermic	Temp 100 - 102.5° F
Normotensive	MAP 80 - 100 mm Hg
Oxygenating normally on room air	SpO_2 95 - 100%
Sternal recumbency	
Pain controlled	Pain score <2

GENERAL CONSIDERATIONS FOR ALL PROTOCOLS

Always reference individual protocol for patient-specific doses and actions

PREMEDICATION

Drug	Dose	Route
See specific protocol		

- **Maximum acepromazine dose of 2 mg in dogs and 1 mg in cats.** Dose should be reduced for Boxers, sighthounds and dogs positive for ABCB1 (MDR1) gene (Collies and others)
  - See *The Individualized Anesthesia and Analgesia Plan* chapter for details
- Consider if additional analgesic therapy is warranted, based on:
  - Signalment
  - Anesthetic indication
  - Physical examination
  - Surgical intervention planned
- If additional analgesic therapy is warranted, replace butorphanol in the premedication with another opioid listed in Additional Analgesic Therapy

ADDITIONAL ANALGESIC THERAPY

Drug	Dose		Route
Hydromorphone	0.05 - 0.1 mg/kg		IM, SC
Buprenorphine	0.01 - 0.02 mg/kg		IM, IV
Buprenorphine – long acting	**Feline**	0.24 mg/kg (dose on lean body weight)	**SC only**

PERIOPERATIVE ANESTHETIC SUPPORT

Intravenous Fluids	Rate		Miscellaneous
Crystalloids	**Canine**	5 mL/kg/hour	Rate may need to be adjusted per individual patient
	Feline	3 mL/kg/hour	
Colloids	**Canine**	20 mL/kg/day OR Bolus of 5 mL/kg	If medically indicated
	Feline	20 mL/kg/day OR Bolus of 2.5 mL/kg	

Anticholinergics

Drug	Dose	Route
Atropine	0.02 - 0.04 mg/kg	IV
Glycopyrrolate	0.005 - 0.01 mg/kg	IV

- Intraoperative analgesia as indicated by patient clinical status
  - See *The Individualized Anesthesia and Analgesia Plan* chapter for details
- Anticholinergics as clinically indicated for bradycardia accompanied by hypotension

POSTOPERATIVE CARE AND PAIN MANAGEMENT

Drug	Dose		Route
NSAID			
Carprofen	**Canine**	4 mg/kg	SC (initial dose)
Meloxicam	**Canine**	0.2 mg/kg	SC (initial dose)
Robenacoxib	**Feline**	2 mg/kg	SC (initial dose)
OPIOID			
Butorphanol	0.2 - 0.4 mg/kg		IM
Buprenorphine	**Canine**	0.005 - 0.02 mg/kg	IM
	Feline	0.01 - 0.02 mg/kg	IM, Transmucosal
Buprenorphine – long acting	**Feline**	0.24 mg/kg (dose on lean body weight)	**SC only**
Hydromorphone	**Canine**	0.01 - 0.2 mg/kg	IM, SC
		0.005 mg/kg	IV every 2 - 4 hours
	Feline	0.05 - 0.1 mg/kg	IM, SC
		0.05 mg/kg	IV every 2 - 6 hours

- NSAIDs and/or opioids are most commonly used as indicated for patient analgesia
- Adequate pain management must follow through postoperative period and facilitates anesthetic recovery
- Consider premedication utilized when choosing postoperative analgesics
- Pain scores of 2 and greater should be treated with analgesic medications
- Watch for potential hyperthermia in cats with opioid therapy
- Do not confuse pain with dysphoria
  - Refer to *Induction, Monitoring and Recovery* chapter for details

Note: For dogs already on an NSAID, do not change to a different NSAID without observing the recommended number of half-lives. Maintain on the same NSAID or use an analgesic with a different mechanism of action (*e.g.*, opioid or tramadol). See *The Individualized Anesthesia and Analgesia Plan* chapter for details.

- Use NSAIDs only if patient is well-hydrated, has received intraoperative fluids and is not hypotensive or bleeding

ANALGESIA TO GO HOME

Drug	Dosage		Route
NSAID			
Carprofen	**Canine**	4 mg/kg	PO once daily or divided into 2 doses for 3 - 5 days
Meloxicam	**Canine**	0.1 mg/kg	PO, every 24 hours
Robenacoxib	**Feline**	1 mg/kg	PO once daily for a maximum of 3 **total** doses over 3 days. Do not exceed 1 dose per day.
OPIOID			
Tramadol	**Canine**	5 mg/kg	PO, every 6 hours
	Feline	2 - 4 mg/kg	
Buprenorphine	**Feline**	0.01 - 0.02 mg/kg	Transmucosal, every 8 hours

- NSAID and/or opioid as appropriate for health status
- **Dispense the same NSAID that was utilized postoperatively**

ABDOMINAL/HEPATIC

What is different about this patient?

- Patients may require a large number of stabilizing procedures before becoming anesthetic candidates.
- Analgesic plans should be individualized to each patient.
- Anti-emetics should be considered when medically indicated
- Close attention should be paid to potential indicators of hepatic dysfunction

EXAMPLES	
Hepatic Dysfunction	**Intervention**
Hypoglycemia	Dextrose CRI
Hypoalbuminemia	Colloid support
Coagulopathy	Vitamin K or transfusion therapy

PREMEDICATION

Drug	Dose		Route
Hydromorphone	**Canine**	0.05 - 0.2 mg/kg	IM, SC
	Feline	0.05 - 0.1 mg/kg	
Midazolam	0.1 - 0.3 mg/kg		IM, SC
OR if there is a history of vomiting:			
Midazolam	0.1 - 0.3 mg/kg		IM, SC
Butorphanol	0.2 - 0.4 mg/kg		IM, SC

PERIOPERATIVE ANESTHETIC SUPPORT

- Depending on preanesthetic blood glucose (BG) readings, BG may need to be checked intraoperatively and postoperatively
- IV dextrose infusion at 2.5 - 5% may be utilized to support BG in the hypoglycemic patient

ANESTHETIC MAINTENANCE

- Prevent/treat hypothermia associated with a large, open abdomen (see *Induction, Monitoring and Recovery* chapter for details)

ANESTHETIC RECOVERY

- If recovery is slow, recheck BG concentrations

POSTOPERATIVE CARE AND PAIN MANAGEMENT

Drug	Dose		Route
OPIOID			
Butorphanol	0.2 - 0.4 mg/kg		IM
Buprenorphine	**Canine**	0.005 - 0.02 mg/kg	IM
	Feline	0.01 - 0.02 mg/kg	IM, Transmucosal
Buprenorphine – long acting	**Feline**	0.24 mg/kg (dose on lean body weight)	**SC only**
Hydromorphone	**Canine**	0.01 - 0.2 mg/kg	IM, SC
		0.005 mg/kg	IV every 2 - 4 hours
	Feline	0.05 - 0.1 mg/kg	IM, SC
		0.05 mg/kg	IV every 2 - 6 hours
Fentanyl	See *Appendix* chapter for details		IV as CRI

- Opioids are most commonly used
  - Avoid NSAIDs when possible

ANALGESIA TO GO HOME

Drug	Dosage		Route
Tramadol	**Canine**	5 mg/kg	PO, every 6 hours
	Feline	2 - 4 mg/kg	
OR			
Buprenorphine	**Feline**	0.01 - 0.02 mg/kg	Transmucosal, every 8 hours

- Use opioid as appropriate for health status
- Avoid NSAIDs when possible

BRACHYCEPHALIC

What is different about this patient?

- Small nares, elongated soft palates and hypoplastic tracheas create a very abnormal upper airway.
- Stress increases respiratory rate and can cause serious complications such as hyperthermia or respiratory collapse.
- All sedatives and anesthetic drugs impair respiratory function by central (neurologic) depression and relaxation of muscles needed for maintaining an airway. Patients must be carefully monitored from premedication through recovery.

EXAMPLES	
ANY pet with a shortened snout	
Boston Terrier	Boxer
Bulldog	Himalayan
Lhasa Apso	Persian
Pug	Shih Tzu
OR	
ANY pet with a functional or anatomic abnormality of the larynx, pharynx, esophagus or trachea	
Labrador Retriever with laryngeal paralysis	Shar Pei

PREMEDICATION

Drug	Dose	Route
Butorphanol	0.2 - 0.4 mg/kg	IM
Midazolam	0.1 - 0.3 mg/kg	IM
OR		
Hydromorphone	0.1 mg/kg	IM
Midazolam	0.1 - 0.3 mg/kg	IM

- Never muzzle or restrict the airway in any brachycephalic patient and use minimum physical restraint necessary
- Anxiolytics may be helpful but should not be used in place of safe patient handling practices
  - Cautious use of acepromazine at low-dose (0.01 mg/kg) may be considered if patients are significantly anxious
- Butorphanol may be preferred as a premedication since it produces less panting (and may be less likely to produce vomiting) than hydromorphone
  - Patient analgesic needs should be considered
- Maropitant may also be considered for brachycephalics to reduce the risk of vomiting
- **Preoxygenation is very important for these patients if they will tolerate it, but stress should be kept at a minimum**

PERIOPERATIVE ANESTHETIC SUPPORT

- **Brachycephalic patients may have high vagal tone with profound respiratory sinus arrhythmias and may benefit from anticholinergic therapy**

INDUCTION AND INTUBATION

- It is important to have a range of endotracheal tube sizes available in the case of a hypoplastic trachea
- The average Bulldog may take a 6.5 mm tube (approximate size), instead of the 9 mm tube one might anticipate based on body size

ANESTHETIC RECOVERY

- **Extubation should be as late as possible and oxygen should be provided until the patient can maintain normal SpO_2 without assistance**
  - **It is not unusual to allow the patient to sit in sternal, moving his/her head around with the endotracheal tube still in place**
- Extubate when the patient starts chewing on the tube; continue to monitor closely after extubation (and provide oxygen as necessary) until normal SpO_2 readings are sustained
- Since the airway is so compromised, even a small amount of edema caused by intubation can be catastrophic
  - Neosynephrine nasal drops (one drop per nostril and one on the soft palate) may help with swollen, edematous nasal and soft palate mucosae
- **Reintubation may be necessary if serious respiratory distress occurs after extubation**
  - **Have propofol and a clean endotracheal tube available**
- Consider supplemental O_2 via mask/flow by/oxygen cage/nasal oxygen tubes
  - An example procedure for placement of nasal oxygen is provided in the *Respiratory Compromise* protocol

CAESAREAN SECTION

What is different about this patient?

- Anticipate and prepare for fluid/blood losses.
- Minimize fetal exposure to inhalant agents.
- A large, gravid uterus compromises respiration.
- Avoid the use of:
  - Acepromazine
  - Ketamine
  - Benzodiazepines (midazolam, zolazepam)
  - Alpha-2 agonists (dexmedetomidine)

PREMEDICATION

Drug	Dose	Route
Butorphanol	0.2 - 0.4 mg/kg	IM, SC

- Premedication analgesia may not be required for very quiet or depressed patients
  - May be given IV after puppies/kittens are removed if medically indicated based on stability and response to anesthesia and surgery
- As much patient preparation as possible should occur before induction and may include:
  - Gathering all drugs and supplies needed for resuscitation
  - Calculating and filling syringes for line blocks
  - Collecting supplies and medications anticipated for CRIs (*e.g.*, dobutamine, etc.)
  - Clipping and initial cleaning of surgical fields
- Preoxygenate if possible, based on patient tolerance, to help avoid maternal and fetal hypoxia

INDUCTION AND INTUBATION

Drug	Dose	Route
Propofol	1.0 mg/kg slowly over 15 seconds	IV
	Increments of 0.5 mg/kg over 15 seconds until intubation	
OR		
Alfaxalone	1 - 4 mg/kg incrementally over 60 seconds until intubation can be achieved	IV

- Alfaxalone may be associated with better neonatal vitality upon delivery and in the immediate postoperative period

- **Induce with lowest possible dose of induction agent**
  - **Both propofol and alfaxalone may cause apnea if given rapidly**
- **Bradycardia, hypotension and respiratory depression may develop after rapid administration of propofol or alfaxalone**

ANESTHETIC MAINTENANCE

- Prevent/treat hypothermia associated with a large, open abdomen (see *Induction, Monitoring and Recovery* chapter for details)

LOCAL BLOCKS AND ANTIBIOTICS

- **Reduce lidocaine/bupivacaine dosage by 50 - 75%**

ANESTHETIC RECOVERY

Resuscitation of pups/kits:

- Provide warmth and gentle stimulation
- Provide supplemental oxygen
- If spontaneous respiration is not occurring:
  - Consider intubation, depending on size
  - Administer oxygen
  - If dam was given opioid prior to delivery, apply one drop of naloxone sublingually to each pup or kit
  - **DO NOT administer doxapram**
  - **DO NOT swing/sling pups or kits**
  - Gentle suction of nose, mouth and airways may be performed
- Place pups/kits with dam as soon as complete recovery is attained
  - Ensure patient is fully recovered before leaving pups/kits unattended

POSTOPERATIVE CARE AND PAIN MANAGEMENT

Drug		Dose	Route
Buprenorphine	**Canine**	0.005 - 0.02 mg/kg	IM
	Feline	0.01 - 0.02 mg/kg	IM, Transmucosal

- Opioids are most commonly used
  - Avoid NSAIDs when possible

ANALGESIA TO GO HOME

Drug	Dosage		Route
Tramadol	**Canine**	5 mg/kg	PO, every 6 hours
	Feline	2 - 4 mg/kg	
OR			
Buprenorphine	**Feline**	0.01 - 0.02 mg/kg	Transmucosal, every 8 hours

- Use opioid as appropriate for health status
- Avoid NSAIDs when possible

What is different about this patient?

- Increased risk for clinical decompensation, fluid overload and cardiac arrhythmias.
- Thorough evaluation for comorbidities is essential.

CANINE EXAMPLES	
Breeds with known risk of cardiac arrhythmias ▶ ECG	Doberman Pinscher Boxer
Breeds with increased incidence of mitral valve disease ▶ Thoracic radiographs	King Charles Cavalier Spaniel
FELINE CONSIDERATIONS	
Potential presence of subclinical cardiac disease (HCM)	See *Physiology* chapter for details

PREMEDICATION

Drug	Dose		Route
Midazolam	0.1 - 0.3 mg/kg		IM, SC
Butorphanol	0.2 - 0.4 mg/kg		IM, SC
OR			
Midazolam	0.1 - 0.2 mg/kg		IM, SC
Hydromorphone	**Canine**	0.05 - 0.2 mg/kg	IM
	Feline	0.05 - 0.1 mg/kg	SC

- **Pay attention to heart rate after premedication administration**
  - **It is expected that heart rate will decrease as the onset of action of premedication is reached**

INDUCTION AND INTUBATION

Drug	Dose	Route
Propofol	1.0 mg/kg slowly over 15 seconds	IV
	Increments of 0.5 mg/kg over 15 seconds until intubation	

- **Preoxygenation is very important for these patients if they will tolerate it, but stress should be kept at a minimum**
- **Monitor ECG closely throughout anesthetic induction**
- **Induce with lowest possible dose of propofol**
  - **May cause apnea if given rapidly**
- **Bradycardia, hypotension and respiratory depression may develop after rapid administration**

ANESTHETIC MAINTENANCE

- **If lidocaine CRI is utilized for control of arrhythmias, remember to decrease sevoflurane to 0.5 - 1% when CRI is started**

ADDITIONAL ANALGESIC THERAPY

Drug	Dose		Route
Buprenorphine	0.01 - 0.02 mg/kg		IM, IV
Buprenorphine – long acting	**Feline**	0.24 mg/kg (dose on lean body weight)	**SC only**

- Thoroughly evaluate cardiovascular parameters after premedication administration
- Any worsening or refractory parameter warrants aborting elective procedures

PERIOPERATIVE ANESTHETIC SUPPORT

Intravenous Fluids	Rate		Miscellaneous
Crystalloids	**Canine**	4 mL/kg/hour	Monitor closely for signs of fluid overload
	Feline	2 mL/kg/hour	
Anticholinergics			
Drug	**Dose**		**Route**
Atropine	0.02 - 0.04 mg/kg		IV
Glycopyrrolate	0.005 - 0.01 mg/kg		IV

- Fluid rates for patients with cardiac disease are decreased due to concerns of possible fluid overload
  - Monitor patient cardiovascular parameters closely and change fluid rate as indicated
- Intraoperative analgesia as indicated by patient clinical status
  - See *The Individualized Anesthesia and Analgesia Plan* chapter for details
- Anticholinergics as clinically indicated for bradycardia accompanied by hypotension
  - **Use with caution in patients with cardiac disease**
  - If anticholinergics are administered, continuous ECG monitoring for cardiac arrhythmias is critical

DENTAL PROPHYLAXIS

What is different about this patient?

- Patients may often have comorbidities or be geriatric that prompt additional considerations for their care and protocol selection.
  - Use *Dental Prophylaxis* protocol only when patient comorbidities are not present.
- Performing sterile procedures under the same anesthesia as a dental prophylaxis is not recommended due to concerns of contamination.
- Unique risks to the patient undergoing a dental prophylaxis include:
  - Hypothermia
    - Length of time of procedure
    - Potential for fur to become soaked with flushing solution
  - Aspiration
    - Potentially large volume of oral flushing solutions
    - Incorrect or incomplete ET cuff inflation
  - Thermal burns
    - Potentially saturated fur and prolonged recumbency on warming devices
    - Be especially cautious in older patients/patients with thin body condition

PREMEDICATION

Drug	Dose	Route
Midazolam	0.1 - 0.3 mg/kg	IM, SC
Butorphanol	0.2 - 0.4 mg/kg	IM, SC
OR		
Acepromazine	0.02 - 0.05 mg/kg	IM, SC
Butorphanol	0.2 - 0.4 mg/kg	IM, SC

Note: Routine dental prophylaxis (with no extractions and with minimal periodontal disease) is not anticipated to require additional analgesic therapy

INDUCTION AND INTUBATION

- Ensure appropriate seal on endotracheal cuff due to high volumes of oral flush solution

LOCAL BLOCKS AND ANTIBIOTICS

Local Block			
Dental nerve block(s)	Bupivacaine	**Canine**	2 mg/kg
		Feline	1.5 mg/kg
Antibiotics			
As medically indicated	See *Medical Quality Standards* chapter		

- Dilute local anesthetic as needed to obtain adequate volume for administration
  - Pay attention to maximum cumulative doses

ANESTHETIC MAINTENANCE

- High volumes of water may be used to rinse and flush the oral cavity during dental prophylaxis
  - Ensure patient fur does not become saturated with water
  - This may predispose to hypothermia and potentially thermal burns (especially if thin body condition)
    - Keep patients as dry as possible

DIABETIC (stable)

What is different about this patient?

This patient should have the normal evening meal and insulin dose at the regular time the night before anesthesia, then proceed with the following recommendations.

1. Give half morning feeding and half morning insulin two to three hours prior to anesthesia.
2. Schedule anesthesia as early in the day as possible.
3. Ensure preoperative BG 150 - 250 mg/dL
   - If BG is less than 50 or greater than 600 mg/dL do not proceed with anesthesia.
   - IV infusions of 2.5 or 5% dextrose may be used to support BG when levels are less than 100 mg/dL.
   - If BG levels are greater than 300 mg/dL, IV dextrose support is not indicated.
4. Consider antiemetic administration prior to premedication to help prevent nausea and vomiting with the shorter than normal fast.
5. Discharge from the hospital as quickly as possible after complete recovery.
6. Provide normal evening meal with a full insulin dose after anesthesia if the procedure was performed early in the day.

Unstable patients should not be anesthetized unless a medical emergency

PREMEDICATION

Drug	Dose	Route
Acepromazine	0.02 - 0.05 mg/kg	IM, SC
Butorphanol	0.2 - 0.4 mg/kg	IM, SC
OR		
Midazolam	0.1 - 0.3 mg/kg	IM, SC
Butorphanol	0.2 - 0.4 mg/kg	IM, SC

- If patient is very relaxed or elderly, butorphanol alone may be appropriate
- If additional analgesic therapy is warranted, replace butorphanol in the premedication with another opioid listed in Additional Analgesic Therapy

ANESTHETIC MAINTENANCE

- BG should be measured after induction and at 30-minute intervals or more frequently if medically indicated. If glucose is under 100 mg/dL, IV fluids should be supplemented with dextrose at calculated fluid rate. Dextrose administration should be discontinued if BG is greater than 300 mg/dL.

ANESTHETIC RECOVERY

- Patient should be offered a small amount of food as early as possible when fully awake and able to eat **without risk of aspiration**

ANALGESIA TO GO HOME

- NSAID and/or opioid as appropriate for health status
- **Dispense the same NSAID that was utilized postoperatively**

What is different about this patient?

Intensive preparation and stabilization is required:

- Identify and differentiate patients that require emergency surgery from patients with critical illness requiring medical intervention.
- Calculate emergency drug doses and draw up medication.
- Prepare other equipment that may be necessary (*e.g.*, chest tubes, tourniquets, etc.).
- Place a second IV catheter.
- Prepare anticipated CRIs (*e.g.*, dopamine, fentanyl, lidocaine, etc.).

True emergencies are surgical cases that require immediate anesthesia (within 15 minutes) to save the patient's life. These situations are rare and thus this protocol should be infrequently used.

EXAMPLES	
Airway obstruction, bilateral pneumothorax	Life-threatening acute hemorrhage

PREMEDICATION

Drug	Dose	Route
Midazolam	0.1 - 0.3 mg/kg	IM, SC
Butorphanol	0.2 - 0.4 mg/kg	IM, SC

- Preoxygenate if possible, based on patient tolerance and clinical stability
- Consider if additional analgesic therapy is warranted, based on:
  - Signalment
  - Anesthetic indication
  - Physical examination
  - Surgical intervention planned
- If additional analgesic therapy is warranted, replace butorphanol in the premedication with another opioid listed in Additional Analgesic Therapy

PERIOPERATIVE ANESTHETIC SUPPORT

- Treat hypotension and prevent/treat hypothermia as aggressively as possible in the critical patient.
- See *Induction, Monitoring and Recovery* chapter for details regarding colloid and transfusion support.
- Depending on preanesthetic BG readings, BG may need to be checked intraoperatively and postoperatively. IV dextrose infusion at 2.5 - 5% may be utilized to support BG in the hypoglycemic patient.
- **If a lidocaine CRI is utilized during surgery, turn the vaporizer down to 0.5 - 1%.**

POSTOPERATIVE CARE AND PAIN MANAGEMENT

Drug	Dose		Route
OPIOIDS			
Butorphanol	0.2 - 0.4 mg/kg		IM
Buprenorphine	**Canine**	0.005 - 0.02 mg/kg	IM
	Feline	0.01 - 0.02 mg/kg	IM, Transmucosal
Buprenorphine – long acting	**Feline**	0.24 mg/kg (dose on lean body weight)	**SC only**
Hydromorphone	**Canine**	0.01 - 0.2 mg/kg	IM, SC
		0.005 mg/kg	IV every 2 - 4 hours
	Feline	0.05 - 0.1 mg/kg	IM, SC
		0.05 mg/kg	IV every 2 - 6 hours

- **Critical or unstable patients, or patients that require continuous monitoring, should be referred to an overnight/24-hour facility for continued care**
- Opioids are most commonly used
  - Avoid NSAIDs when possible

ANALGESIA TO GO HOME

Drug	Dosage		Route
Tramadol	**Canine**	5 mg/kg	PO, every 6 hours
	Feline	2 - 4 mg/kg	
OR			
Buprenorphine	**Feline**	0.01 - 0.02 mg/kg	Transmucosal, every 8 hours

- Use opioid as appropriate for health status
- Avoid NSAIDs when possible
- Tailor to the individual patient as clinically indicated

What is different about this patient?

- Carefully evaluate for, and consider, all other medication that may interact with anesthesia.
- Patients often have physiologic decline in most organ functions; titrate drug doses accordingly.
- Additional considerations:
  - Use only when no concurrent disease conditions are identified or suspected.
  - If concurrent disease is identified in a geriatric patient, then the protocol specific to that disease should be utilized.

EXAMPLES		
Reasonable estimates for geriatric ages	**Canine:** >8 years (adjust for size/breed) **Feline:** >12 years	No concurrent disease

PREMEDICATION

Drug	Dose	Route
Low dose Acepromazine	0.01 mg/kg	IM
Butorphanol	0.2 mg/kg	IM
OR		
Midazolam	0.1 mg/kg	IM
Butorphanol	0.2 mg/kg	IM

- If the patient is very stressed by the hospital environment or the procedure warrants additional analgesic needs, hydromorphone may replace butorphanol
  - Alternatively, the opioid may be used alone
- If additional analgesic therapy is warranted, replace butorphanol in the premedication with another opioid listed in Additional Analgesic Therapy

ANESTHETIC MAINTENANCE

- **Hypotension should not be tolerated** (*i.e.,* two consecutive low readings should prompt notification of the veterinarian and treatment as directed)
  - **A fluid bolus, usually the first treatment for hypotension, should be used with caution if there is concurrent heart disease**

PERIOPERATIVE ANESTHETIC SUPPORT

- **Avoid anticholinergics unless extremely bradycardic, accompanied by hypotension, as geriatric patients may be hypersensitive to anticholinergics.**
- Remember that fluid rates and the use of anticholinergics may need to be altered for concurrent disease conditions. See specific protocols for guidelines.

ANESTHETIC RECOVERY

- Careful auscultation of lungs for evidence of pulmonary edema should be performed if additional fluids were required at any time during or after the procedure
- Patients with preexisting arthritis may have difficulty moving around after surgery and may benefit from additional padding and pillows
- Patients with chronic respiratory disease may have SpO_2 levels below and $EtCO_2$ levels above the normal range
  - Upon recovery, SpO_2 levels should return to preoperative levels
- Supplemental oxygen may be of benefit to these patients in the recovery phase and can be provided by mask/flow by/oxygen cage (where available)/instillation of nasal oxygen tubes
  - Note that there are multiple methods described to place nasal oxygen catheters
  - The medical record should contain accurate documentation of the step-by-step procedure utilized
    - An example procedure is provided in the *Respiratory Compromise* protocol

POSTOPERATIVE CARE AND PAIN MANAGEMENT

- **Consider potential drug interactions**
- Pain management can be the same as for healthy (nongeriatric) patients if renal function (as investigated by preanesthetic minimum data base) is normal
  - If abnormal renal function is present, NSAIDs should not be used

ANALGESIA TO GO HOME

- NSAID and/or opioid as appropriate for health status
- **Dispense the same NSAID that was utilized postoperatively**

OBESE (stable)

What is different about this patient?

- Obese patients are those with a body weight 20 - 30% or more above ideal.
- Determine ET tube size, size of rebreathing circuit and bag, tidal volume to be delivered and IV catheter size based on lean body weight.
- Consider IV or IM injections as SC injections may lead to variable absorption.
- Patient may not be able to ventilate well, monitor oxygenation closely.
- For optimal patient safety in elective procedures, postpone general anesthesia and institute a directed weight loss program.

Calculate all drug doses and IV fluids rates on lean body weight

PREMEDICATION

Drug	Dose	Route
Midazolam	0.1 - 0.3 mg/kg	IM, SC
Butorphanol	0.2 - 0.4 mg/kg	
OR		
Acepromazine	0.02 - 0.05 mg/kg	IM, SC
Butorphanol	0.2 - 0.4 mg/kg	

- Provide flow-by oxygen prior to induction (preoxygenate for 5 minutes prior if patient will tolerate)
- If additional analgesic therapy is warranted, replace butorphanol in the premedication with another opioid listed in Additional Analgesic Therapy

PERIOPERATIVE ANESTHETIC SUPPORT

- **Calculate fluid rates based on lean body weight**

ANESTHETIC MAINTENANCE

- Remember that obesity will have a major impact on the patient's ability to ventilate adequately, especially when placed in dorsal recumbency
  - Monitor oxygenation closely and be ready to assist ventilation
- **Obese patients may have ineffective cooling mechanisms and may be prone to hyperthermia**
  - **Monitor temperatures closely**

ANESTHETIC RECOVERY

- If drugs have been carefully administered in minimal dosages, recovery of the obese patient should be fairly rapid
- Obese patients may not ventilate well; place them in sternal recumbency and give oxygen by facemask or flow by (post-extubation) until they are able to maintain saturation (SpO_2 above 95%) by themselves and temperature is above 100 ° F
- Extremely obese patients might have difficulty righting themselves if they fall into lateral recumbency
  - Ensure complete visual observation until patient is mobile

ANALGESIA TO GO HOME

- NSAID and/or opioid as appropriate for health status
- **Dispense the same NSAID that was utilized postoperatively**

ONYCHECTOMY (feline)

What is different about this patient?

Consider performing an onychectomy procedure as a last resort and only if it meets one or more of the following criteria:

- Determined to be medically necessary as part of a comprehensive treatment plan to relieve pain or illness.
- The pet poses a danger or physical health risk to family members.
- Attempts to employ behavior modification or environmental modification have been unsuccessful and euthanasia or relinquishment is imminent due to the destructive use of claws.

Always follow your state and local regulatory requirements if applicable to this procedure

PREMEDICATION

Drug	Dose	Route
Midazolam	0.1 - 0.3 mg/kg	IM, SC
Butorphanol	0.2 - 0.4 mg/kg	
OR		
Acepromazine	0.02 - 0.05 mg/kg	IM, SC
Butorphanol	0.2 - 0.4 mg/kg	

- If additional analgesic therapy is warranted, replace butorphanol in the premedication with another opioid listed in Additional Analgesic Therapy

POSTOPERATIVE CARE AND PAIN MANAGEMENT

Drug	Dose	Route
NSAID		
Robenacoxib	2 mg/kg	SC (initial dose)
OPIOID		
Buprenorphine	0.01 - 0.02 mg/kg q 6 - 12 hours	IM
Buprenorphine – long acting	0.24 mg/kg (dose on lean body weight)	**SC only**
Hydromorphone	Should not be administered immediately postoperatively due to duration of action	

Aftercare

- If these patients are to remain unmonitored in the hospital overnight, patients must have adequate analgesic therapy, have all nursing needs met (bedding, food, water, litter) and bandages must be clean and dry
- Clients must be made aware of the unmonitored hospitalization and given the option to transport the patient to a 24-hour, overnight facility for monitored care
- If clients elect to take patient home for the evening, clear directions on the home environment and monitoring must be given
  - Owners must also agree to bring patient back the following day for reassessment, analgesic therapy and bandage care

DAY TWO ANALGESIA Administer prior to removing bandages		
Buprenorphine	0.005 - 0.01 mg/kg every 6 - 12 hours	Transmucosally, every 6 - 12 hours
Robenacoxib	1 mg/kg daily	Continue PO every 24 hours

LOCAL BLOCKS AND ANTIBIOTICS

Local Block	
Regional carpal block (AKA ring block) once patient is under general anesthesia	Bupivacaine (1 - 1.5 mg/kg)
Antibiotics	
Cefazolin 22 mg/kg over 3 - 5 minutes at induction	IV

- Dilute local anesthetic as needed to obtain adequate volume for administration
  - Pay attention to maximum cumulative doses
- Perform blocks once patient is under general anesthesia

ANALGESIA TO GO HOME

Drug	Dosage	Route
NSAID		
Robenacoxib	1 mg/kg	PO once daily for a maximum of 3 **total** doses over 3 days. Do not exceed 1 dose per day.
OPIOID		
Tramadol	2 - 4 mg/kg	PO, every 6 hours
Buprenorphine	0.01 - 0.02 mg/kg	Transmucosal, every 8 hours

- Adult and/or overweight cats may require more extensive analgesic therapy and bandaging
- Tailor therapy to the individual patient

What is different about this patient?

- Unique aspects include the use of perioperative antibiotics and the anticipation of more significant analgesic requirements.
- Anesthesia team should pay close attention to signs of pain.
- Additional considerations:
  - **Ensure patient has not received corticosteroids prior to the procedure as these could impact postoperative NSAID therapy.**
  - Ensure that if NSAIDs have been given preoperatively, type, dose and duration of therapy are known.
    - ☐ Do not combine different NSAIDs and wait appropriate half-life if changing NSAIDs.

PREMEDICATION

Drug	Dose		Route
Acepromazine	0.02 - 0.05 mg/kg		IM, SC
Hydromorphone	**Canine**	0.05 - 0.2 mg/kg	
	Feline	0.05 - 0.1 mg/kg	
OR			
Midazolam	0.1 - 0.3 mg/kg		IM, SC
Hydromorphone	**Canine**	0.05 - 0.2 mg/kg	
	Feline	0.05 - 0.1 mg/kg	

- If additional analgesic therapy is warranted, consider one of the options listed in Additional Analgesic Therapy.

LOCAL BLOCKS AND ANTIBIOTICS

Local block and/or epidurals	
As medically indicated	Pay attention to maximum cumulative doses
Antibiotics	
Cefazolin 22 mg/kg over 3 - 5 minutes at induction	IV Repeat every 90 minutes until skin closure is complete

- For more local and regional analgesia options see *The Individualized Anesthesia and Analgesia Plan* chapter

ANALGESIA TO GO HOME

Drug	Dosage		Route
NSAID			
Carprofen	**Canine**	4 mg/kg	PO once daily or divided into 2 doses for 3 - 5 days
Meloxicam	**Canine**	0.1 mg/kg	PO, every 24 hours
Robenacoxib	**Feline**	1 mg/kg	PO once daily for a maximum of 3 **total** doses over 3 days. Do not exceed 1 dose per day.
OPIOID			
Tramadol	**Canine**	5 mg/kg	PO, every 6 hours
	Feline	2 - 4 mg/kg	
Buprenorphine	**Feline**	0.01 - 0.02 mg/kg	Transmucosal, every 8 hours
Fentanyl patch	Follow dosing chart		Transdermal

- Hospital teams are reminded that if analgesic needs cannot be met with multimodal analgesia, referral to an overnight (24-hour) facility for additional care is warranted and should be recommended
- NSAID and/or opioid as appropriate for health status
- **Dispense the same NSAID that was utilized postoperatively**

PEDIATRIC (under 16 weeks of age)

What is different about this patient?

Always consider patient size and physiology on drug metabolism, thermoregulation, cardiac output and compensation and monitoring or critical values and interventions (IVC placement).

Do not fast weaned puppies or kittens for longer than 2 - 3 hours prior to anesthesia

PREMEDICATION

Drug	Dose	Route
Midazolam	0.1 - 0.3 mg/kg	IM
Butorphanol	0.2 - 0.4 mg/kg	
PLUS		
Glycopyrrolate	0.01 mg/kg	IM
OR		
Atropine	0.02 - 0.04 mg/kg	May be used in place of glycopyrrolate in case of back orders

- **Remember that cardiac output depends primarily on cardiac rate in pediatric patients because of decreased stroke volume**
- Consider preemptive warming post premedication due to increased risk for hypothermia

INDUCTION AND INTUBATION

Drug	Dose	Route
Propofol	1.0 mg/kg slowly over 15 seconds	IV
	Increments of 0.5 mg/kg over 15 seconds until intubation	
OR		
Alfaxalone	1 - 4 mg/kg incrementally over 60 seconds until intubation can be achieved	IV

- **Intubation may be difficult in small patients**
  - **Extreme care must be taken to avoid laryngeal trauma, which may induce swelling**
- **Induce with lowest possible dose of induction agent**
  - **Both propofol and alfaxalone may cause apnea if given rapidly**
- **Bradycardia, hypotension and respiratory depression may develop after rapid administration of propofol or alfaxalone**

POSTOPERATIVE CARE AND PAIN MANAGEMENT

Drug		Dose	Route
OPIOID			
Butorphanol		0.2 - 0.4 mg/kg	IM or IV
Buprenorphine	**Puppies**	0.005 - 0.02 mg/kg	IM
	Kittens	0.01 - 0.02 mg/kg	Transmucosal

- Opioids are most commonly used

ANESTHETIC MAINTENANCE

- Bradycardia is defined as a heart rate under 150 bpm and should be addressed immediately as cardiac output depends primarily on heart rate in pediatric patients
- Hypothermia may be of particular concern in pediatric patients
- High respiratory rates, which are normal to meet the higher oxygen demand of puppies and kittens, will result in rapid changes in anesthetic depth
  - Extra care in continuous monitoring must be taken to keep the patient at the appropriate depth of anesthesia
- High metabolic rates also mean that pediatric patients are frequently hypercapnic
  - Intermittent positive pressure ventilation may be needed to prevent hypoventilation and atelectasis
    - Airway pressures should not exceed 15 cm H_2O since lung compliance should be very good in young patients
- Hypoglycemia can occur in young patients especially if inadvertently fasted for longer than one to two hours
  - BG should be checked after induction (so that dextrose can be added to IV fluids if needed) and at 30-minute intervals during the procedure and at recovery

ANESTHETIC RECOVERY

- Pediatric patients should recover fairly quickly if proper attention has been paid to prevent hypothermia, hypoglycemia and hypoventilation
- It is also important to feed pediatric patients as early as possible, once they are able to eat without risk of regurgitation or aspiration

ANALGESIA TO GO HOME

Drug		Dosage	Route
NSAID			
Carprofen	**Puppies**	4 mg/kg	PO once daily or divided into 2 doses for 3 - 5 days
OPIOID			
Butorphanol	**Puppies**	0.2 - 0.4 mg/kg	PO, every 4 - 6 hours
Buprenorphine	**Kittens**	0.01 - 0.02 mg/kg	Transmucosal, every 8 hours

- NSAID and/or opioid as appropriate for health status
  - Carprofen label indicates approved for use on puppies >6 weeks of age
  - Use NSAID only if patient is well-hydrated, has received intraoperative fluids and is not hypotensive or bleeding

RENAL/POST-RENAL (urinary/urethral obstruction)

What is different about this patient?

Extreme electrolyte and acid/base abnormalities can severely impact anesthetic plan and patient status.
- Potassium should be less than 6.0 mEql/L to proceed.

EXAMPLES	
Urethral obstruction	Chronic renal disease
Acute renal injury	Presence of ureteroliths

PREMEDICATION

Drug	Dose	Route
Midazolam	0.1 - 0.3 mg/kg	IM, SC
Butorphanol	0.2 - 0.4 mg/kg	

- Consider giving atropine (0.2 - 0.4 mg/kg) IM if HR is under 120 bpm (feline)

PERIOPERATIVE ANESTHETIC SUPPORT

Intravenous Fluids	Rate		Miscellaneous
Crystalloids	**Canine**	5 mL/kg/hour	Higher fluid rates may be needed if patient is not adequately hydrated when anesthesia begins
	Feline	3 mL/kg/hour	
Colloids	**Canine**	20 mL/kg/day OR Bolus of 5 mL/kg	If medically indicated
	Feline	20 mL/kg/day OR Bolus of 2.5 mL/kg	

Perfusion Support

Drug	Dose		Route
Dobutamine	**Canine**	1 - 10 **mcg/kg/minute**	IV CRI if medically indicated
	Feline	1 - 10 **mcg/kg/minute**	

Anticholinergics

Drug	Dose	Route
Atropine	0.02 - 0.04 mg/kg	IV
Glycopyrrolate	0.005 - 0.01 mg/kg	IV

- Monitor fluid input and urine output closely and evaluate frequently for signs of over hydration
  - Consider measuring patient ins and outs to best individualize fluid therapy
- Additional support to assist and maintain renal perfusion with colloids and dobutamine CRIs may be indicated

LOCAL BLOCKS AND ANTIBIOTICS

Local Block	
Consider caudal epidural block for patients with urethral obstruction	Use preservative-free lidocaine/ bupivacaine

ANESTHETIC MAINTENANCE

- Be cautious with vaporizer settings
  - Sick patients may require a vaporizer setting of 1% or less for maintenance
  - **If the patient is hypothermic prior to anesthesia, anesthetic requirements will be decreased**
  - Pay close attention to the ECG and heart rate in these patients
- **Hypotension cannot be tolerated and must be treated promptly and aggressively as hypotension will exacerbate renal function**

ANESTHETIC RECOVERY

- Throughout recovery, continue to monitor fluid input and urine output
- Frequently assess hydration and blood pressure to determine needs for ongoing fluid therapy
- Patients may be slow to recover and good support is essential
- Supportive measures include:
  - Provide heat as necessary
  - Monitor temperature and ECG continuously
  - Administer IV fluids as medically indicated and recheck electrolytes every 2 hours until normal

POSTOPERATIVE CARE AND PAIN MANAGEMENT

- **Avoid NSAIDs in patients with renal disease**
- Adequate pain management must follow through postoperative period and facilitates anesthetic recovery
- Opioids are most commonly used
- Consider premedication utilized when choosing postoperative analgesics
- Watch for potential hyperthermia in cats with opioid therapy
- Pain scores of 2 and greater should be treated with analgesic medications

ANALGESIA TO GO HOME

- Opioid as appropriate for health status

RESPIRATORY COMPROMISE

What is different about this patient?

- May decompensate rapidly.
  - Stabilize as much as possible prior to anesthesia.
  - Always control and maintain airway.
- Anesthetic and analgesic agents tend to depress respiration and administration of these agents could result in worsening of patient status and potentially be fatal.

EXAMPLES	
Chronic Conditions	**Acute Respiratory Distress**
Collapsing trachea	Pleural effusion
Asthma	Diaphragmatic hernia

PREMEDICATION

Drug	Dose	Route
Midazolam	0.1 - 0.3 mg/kg	IM, SC
Butorphanol	0.2 - 0.4 mg/kg	

- **Preoxygenate if possible, based on patient tolerance and clinical stability**
- Consider if additional analgesic therapy is warranted, based on:
  - Signalment
  - Anesthetic indication
  - Physical examination
  - Surgical intervention planned
- If additional analgesic therapy is warranted, replace butorphanol in the premedication with another opioid listed in Additional Analgesic Therapy

TRANSITION PHASE
Post-induction Inhalant Rates

- **Be prepared to perform manual ventilation**
  - **Closely watch the manometer to ensure pressures do not exceed 12 - 15 cm H_2O as lung compliance may be reduced**
- Monitor anesthetic depth and oxygenation closely

INDUCTION AND INTUBATION

- Take extra caution with intubation in patients with preexisting tracheal disease
  - The presence of an ET tube may irritate tracheal mucosa, causing coughing and inflammation, exacerbating clinical signs
  - **Intubate as quickly and as gently as possible**

ANESTHETIC RECOVERY

- Patients with chronic respiratory disease may have SpO_2 levels below and $EtCO_2$ levels above the normal range
  - Upon recovery, SpO_2 levels should return to preoperative levels
- Supplemental oxygen may be of benefit to these patients in the recovery phase and can be provided by flow by/mask/oxygen cage (where available)/instillation of nasal oxygen tubes

METHOD FOR NASAL OXYGEN TUBE PLACEMENT

1. Instill one to two drops of lidocaine into each nostril if needed, based on patient level of consciousness and tolerance.
2. Premeasure and mark an appropriately-sized red rubber catheter from the end of the nose to the medial canthus. A tape butterfly may be placed at the mark to assist with securing the tube.
3. Coat the end of the catheter with a small amount of water soluble lubricant.
4. Aiming medially and dorsally, advance the tube into the nose to the level of the mark on the tube.
5. Secure the tube under the alar fold (when possible, based on patient anatomy).
6. Using suture, staple or tissue glue, secure the tube as close as possible to end of nostril.
7. Provide additional attachments on midline of muzzle and at top of head.
8. Attach end of red rubber tube to oxygen line.
9. Administering oxygen at 100 mL/kg/min unilaterally should increase FiO_2 to 37%.
10. If needed, place an Elizabethan collar or similar device to prevent patient dislodgement of tube.

SOFT TISSUE (elective)

What is different about this patient?

Elective soft tissue surgery patients would include those with normal organ function as determined by clinical pathology data and unremarkable physical examination results, undergoing planned anesthesia.

- Patients should have an ASA status of I – II.
  - An age-specific protocol (*Geriatric* or *Pediatric*) should be utilized if applicable.

Premedication and additional analgesic choices should reflect patient requirements and anticipated surgical interventions.

- Routine ovariohysterectomy (OVH) with elective gastropexy might be expected to require more analgesic therapy than a routine OVH alone.
- Consider the use of multimodal therapy for analgesic needs, including the use of local and regional analgesia.
  - See *The Individualized Analgesia and Anesthesia Plan* chapter for details.

Additional considerations:

- Due to concerns of potential surgical site contamination with bacteremia associated with dental prophylaxis, **sterile soft tissue procedures should not be combined with elective dental prophylaxis.**
- All sterile soft tissue surgeries are to be performed in the surgical suite.

EXAMPLES
Castration
Laceration repair
Mass removal
Ovariohysterectomy

PREMEDICATION

Drug	Dose	Route
Midazolam	0.1 - 0.3 mg/kg	IM, SC
Butorphanol	0.2 - 0.4 mg/kg	
OR		
Acepromazine	0.02 - 0.05 mg/kg	IM, SC
Butorphanol	0.2 - 0.4 mg/kg	

- If additional analgesic therapy is warranted, replace butorphanol in the premedication with another opioid listed in Additional Analgesic Therapy

LOCAL BLOCKS AND ANTIBIOTICS

Local Block	
Required: Intratesticular (castration) and line block (OVH) As medically indicated: Field/regional blocks	Lidocaine (2 mg/kg) OR Bupivacaine (1.5 mg/kg)
Antibiotics	
Not applicable to healthy patient, elective soft tissue procedures	See *Medical Quality Standards* chapter

- Dilute local anesthetic as needed to obtain adequate volume for administration
  - Pay attention to maximum cumulative doses
- Perform blocks once patient is under general anesthesia and the first of 3 sterile skin preps has been performed

STRESSED/FRACTIOUS

What is different about this patient?

This patient will have extremely high levels of circulating catecholamines (epinephrine, norepinephrine), which can make the patient prone to sudden cardiovascular collapse (*e.g.*, hypotension, cardiac arrhythmias, shock, organ dysfunction), especially when sedatives and anesthetics are added.

Additional considerations:

- Stressed/fractious patients may be impossible to handle for a physical exam.
- The presence of serious disease may be masked by this physiologic "fight or flight" state, making these patients prone to crash after sedation or induction when the full extent of underlying disease becomes known.
- **Most aggressive behavior is a result of underlying fear or pain.** Provide analgesic therapy as medically indicated.
- If the patient struggles for more than three seconds, release and reposition. If struggling for more than three seconds occurs two to three times, consider chemical restraint or abort the procedure.
- **Do not use the *Stressed/Fractious* pet protocol if acepromazine has already been administered.**

PREMEDICATION

Drug	Dose	Route
CANINE		
Tiletamine, Zolazepam	2 - 4 mg/kg	IM
Butorphanol	0.2 - 0.4 mg/kg	
OR		
Dexmedetomidine	2 - 5 **mcg/kg**	IM
Ketamine	1 - 2 mg/kg	
Butorphanol	0.2 - 0.4 mg/kg	
FELINE		
DKT	See *Appendix* chapter for dosing charts	IM
OR		
DKT mixture for oral administration	0.2 mL of each drug for a 5 kg cat Allow 10 - 15 minutes for effect	Administer orally as the cat is hissing and the mouth is open Consider using open-ended tom cat catheter to assist with administration

Note: Unique DKT dosing and directions for use in both canines and felines

- Perform physical examination if not able to be completed prior to premedication
- Place IV catheter if medically indicated or length of procedure is anticipated to be longer than 10 minutes
- Obtain necessary clinical pathology samples
- Perform diagnostic or therapeutic procedures as planned
- Proceed to general anesthesia as medically indicated:
  - Procedure lasting longer than 10 minutes
  - Procedure requiring deeper plane of anesthesia
  - Intubation and oxygenation are required (brachycephalic patient) or medically indicated

INDUCTION AND INTUBATION

- Propofol: Anticipate need for lower dose and **may not be needed** for intubation

TRANSITION PHASE
Post-induction Inhalant Rates

Inhalant	Rates	Miscellaneous
Oxygen	50 - 100 mL/kg/minute (rebreathing)	For first 15 minutes after induction
	150 - 300 mL/kg/minute (NRB)	
Sevoflurane	**1 - 2% for 3 minutes**	Large dogs may need higher rates

- Monitor anesthetic depth and oxygenation closely

Caution: Dexmedetomidine may cause significant bradycardia (heart rate below 50 bpm). This is a REFLEX bradycardia in response to peripheral vasoconstriction and baroreceptor-mediated decrease in heart rate. **Use anticholinergics with caution.**

ANESTHETIC RECOVERY

- The addition of butorphanol or midazolam may assist with recovery from tiletamine, zolazepam in dogs
  - See *The Individualized Anesthesia and Analgesia Plan* chapter for additional details

Anesthesia Monitoring

Intervene with specific critical values AND with any trending towards abnormal

BLOOD PRESSURE

Monitor continuously:
Blood pressure
Peripheral pulse, MM/CRT

HYPOTENSION

SAP <90
OR
MAP <60 mm Hg

1. Assess anesthetic depth
If too deep:
- Decrease inhalant
- Increase O_2 flow to 50 mLs/kg/min (rebreathing)
  - 200 - 300 mLs/kg/min (NBR)

2. Assess HR
Give anticholinergic if:
Med - lg canine ..... <60 bpm
Small canine ..... <80 bpm
Feline ..... <90 bpm

3. Asses volume status
If hypovolemic:
Administer IV fluid bolus
Canines ..... 10 mL/kg
Felines ..... 5 mL/kg

4. Assess volume status
If still hypovolemic:
Administer colloid solution
Canines ..... 5 mL/kg
Felines ..... 2.5 mL/kg
(max 20 - 40 mL/kg)
If normovolemic:
Administer ephedrine

5. Assess for hemorrhage
Transfuse if indicated:
Administer dopamine + dobutamine
(See text for dosing details and instructions)

END TIDAL CO_2

Monitor continuously:
$EtCO_2$

HYPERCARBIA

$EtCO_2$ >55 mm Hg

Assess anesthetic depth
If too deep:
- Decrease inhalant

Ventilate patient

OXYGENATION

Monitor continuously:
SpO_2
Respirations

HYPOXEMIA

SpO_2 <95%

Assess probe placement
- Use wet gauze with lingual probe

During induction:
- Preoxygenate and monitor
- Intubate quickly
- Provide 100% O_2
- IPPV at 2 - 4 bpm

If SpO_2 worsens, abort procedure and recover patient

During maintenance:
See text for causes and treatment

During recovery:
Provide O_2 support
If intubated:
50 - 100 mLs/kg/min via breathing circuit
150 - 300 mLs/kg/min via NRB circuit
If extubated:
Flow-by/mask/nasopharyngeal – See text for details on partial reversal and brachycephalic recovery

TEMPERATURE

Monitor continuously:
Rectal or esophageal temperature

HYPOTHERMIA

T <100 °F

Mild ..... 98 - 99° F
Moderate ..... 96 - 98° F
Severe ..... 92 - 96° F
Critical ..... less than 92° F

Prior to induction:
- Place patient on warm surface
- Abort procedure if T worsens before induction

During maintenance:

1. Utilize pet warming device
- Circulating warm water or forced air patient warming blankets

2. Warm IV fluids
- Place IV fluid warmer as close to patient as possible

3. Warm saline lavage in open body cavity
- Measure fluid T (104 - 109° F)

4. Assess response

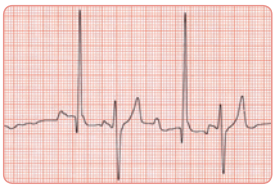
5. Abort procedure and recover patient

ECG

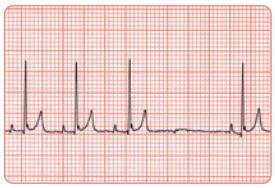
Monitor continuously

Common Deviations from Normal Sinus Rhythm

VPC



Second Degree Heart Block



Check for underlying causes and address:

Causes: Pain, hypercarbia ($EtCO_2$ >60 - 70), severe hypoxemia, cardiac disease, ischemia, drugs, etc.

Treatment criteria (see text for details):
- HR >150 - 180 bpm
- Pulse deficits
- Hypotension
- Abnormal VPC configurations
- 3 VPCs in a row, etc.

Consider lidocaine bolus, followed by CRI if indicated

HEART RATE

Monitor continuously:
Heart rate,
Peripheral pulse

TACHYCARDIA

Large canines..... >100 bpm
Medium canines... >120 bpm
Small canines ..... >120 bpm
Felines..... >160 bpm

1. Confirm manual HR and ECG match

2. Assess anesthetic depth
If too light:
- Increase inhalant (and O_2 flow rate)

3. Administer additional analgesics

4. Assess for hemorrhage
Transfuse if indicated

BRADYCARDIA

Large canines..... <60 bpm
Medium canines.. <60 - 80 bpm
Small canines ..... <80 bpm
Felines..... <90 bpm

NO dexmedetomidine given:

1. Confirm manual HR and ECG match

2. Assess anesthetic depth
If too deep:
- Decrease inhalant

3. Assess BP (see *hypotension*)
Administer anticholinergic if indicated:
- Bradycardia
- Heart block
- HYPOtension

4. Assess for hemorrhage
Transfuse if indicated

YES dexmedetomidine given:

1. Confirm manual HR and ECG match

2. Assess BP
Consider anticholinergic if:
- Bradycardic
- HYPOtensive (MAP <60 mm Hg)
- See text for details

3. *Consider dexmedetomidine reversal if:*
- Emergency situation
- HR <30 bpm
- Procedure can be aborted

Banfield PET HOSPITAL

Any parameter that is continuing to worsen or is refractory to treatment warrants aborting elective anesthesia procedures and recovering the patient as quickly as possible.Content is derived from *Anesthesia and Analgesia for the Veterinary Practitioner: Canine and Feline*

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