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**1. PURPOSE**

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This Standard Operating Procedure (SOP) describes methods for anesthetizing cats.

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**2. RESPONSIBILITY**

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Principal Investigators (PIs) and their research staff, veterinarians, and veterinary care staff.

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**3. INTRODUCTION**

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- 3.1. Perform a thorough physical exam and obtain an accurate body weight.
- 3.2. Withdraw food (not water) for 12 hours prior to anesthesia in order to reduce the risk of aspiration of stomach contents. Very young animals (less than 10 weeks) and/or small animals (less than 2 kg) should be fasted for only 1 to 2 hours due to the risk of hypoglycemia.
- 3.3. Monitor animals closely during induction, maintenance, and recovery from general anesthesia. Monitoring must be documented.
  - 3.3.1. Never leave an anesthetized animal unattended.
  - 3.3.2. Monitor animal every 5 minutes; record the following parameters every 15 minutes:
    - 3.3.2.1. Anesthetic depth: absence of reflexes, e.g., pedal/eyelid/eyelash/palpebral, absence of movement, muscle relaxation (jaw tone).
    - 3.3.2.2. Respiratory function (ventilation): respiratory rate, oxygen saturation (SpO<sub>2</sub>), thoracic wall or rebreathing bag movements, and auscultation. End-tidal carbon dioxide (ETCO<sub>2</sub>) should be included where capnography equipment is available. Blood gas analysis may be indicated for critical patients or procedures.
    - 3.3.2.3. Cardiovascular function (circulation): capillary refill time (CRT), mucous membrane color, pulse quality, heart rate and rhythm, and blood pressure. Electrocardiography (ECG) should be included where equipment is available.
    - 3.3.2.4. Body temperature: rectal or esophageal temperature.
- 3.4. Apply ophthalmic ointment to prevent corneal desiccation. Reapply as needed, every 30 minutes at a minimum.
- 3.5. Keep animals warm by providing a heat source until the animal has recovered from anesthesia. Care should be taken to not overheat or burn the animals.
- 3.6. Maintain records of each anesthesia procedure and include:
  - 3.6.1. Date and time of procedure
  - 3.6.2. Principal investigator and Animal Use Protocol (AUP)
  - 3.6.3. Species and animal's identification
  - 3.6.4. Animals' weight
  - 3.6.5. Name, dose, route, and time of administration of each drug
  - 3.6.6. Description of the procedure
  - 3.6.7. Measurements of the animal's anesthetic depth and vital signs
  - 3.6.8. Time of recovery
  - 3.6.9. Name of the individual monitoring the animal and of the surgeon

## 4. MATERIALS

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- 4.1. Material or equipment to provide or conserve body heat, e.g., warm water circulating pad
- 4.2. Ophthalmic ointment (natural tears)
- 4.3. Gas anesthesia machine (calibrated within the last 12 months) with adequate gas scavenging system or charcoal filter
- 4.4. Tight-fitting mask
- 4.5. Monitoring equipment, e.g., stethoscope, thermometer, pulse oximeter, capnograph, ECG
- 4.6. Isoflurane
- 4.7. Buprenorphine (0.3 mg/mL) \*Controlled drug
- 4.8. Acepromazine (10 mg/mL)
- 4.9. Glycopyrrolate (0.2 mg/mL)
- 4.10. EMLA cream
- 4.11. Intravenous catheter
- 4.12. Ketamine (100 mg/mL) \*Controlled drug
- 4.13. Diazepam (5 mg/mL) \*Controlled drug
- 4.14. Dexmedetomidine (0.5 mg/mL)
- 4.15. Atipamezole (5 mg/mL)
- 4.16. Propofol (10 mg/mL)
- 4.17. Alfaxan (10 mg/mL)
- 4.18. Sterile isotonic saline (0.9% saline) or Lactated Ringer's Solution (LRS)
- 4.19. Xylocaine spray
- 4.20. Sterile lubricant (e.g. water soluble jelly)
- 4.21. Endotracheal tubes, cuffed, size 3.0, 3.5 or 4.0.
- 4.22. Laryngoscope
- 4.23. Plain gauze rolls

## 5. PROCEDURES

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- 5.1. Premedication:
  - 5.1.1. Administer, intramuscularly (can be mixed in the same syringe):
    - 5.1.1.1. Buprenorphine: 0.05-0.1mg/kg
    - 5.1.1.2. Acepromazine: 0.05 to 0.1mg/kg
    - 5.1.1.3. Calculate the dose of glycopyrrolate (0.01 to 0.02mg/kg) and administer if the heart rate goes below 80bpm during anesthesia.
- 5.2. Intravenous (IV) catheter placement:
  - 5.2.1. To provide IV fluid therapy and venous access during surgery.
  - 5.2.2. Apply EMLA cream and cover with plastic cling wrap (e.g., Saran® wrap) over the venipuncture site at least 15 minutes prior to placing the catheter. Observe the cat or apply a device (e.g., Elizabethan collar) to prevent the cat from removing or swallowing the plastic.
  - 5.2.3. Insert IV catheter and secure in either the cephalic or saphenous vein.
- 5.3. IV fluid administration:
  - 5.3.1. Administer isotonic saline (0.9% saline) or Lactated Ringer's Solution at a rate of 2-3 mL/ kg/hour.

5.4. Injectable anesthesia:

5.4.1. Can be used alone for short, non-invasive procedures.

5.4.2. Used for induction prior to use of isoflurane anesthesia for smooth and rapid induction and to facilitate intubation.

Drug	Dose	Route	Duration of Effect	Notes
Ketamine-Diazepam	3mg/kg - 0.3mg/kg	IV	20 minutes	May be mixed in same syringe, Laryngeal reflexes preserved.
Dexmedetomidine	0.005 to 0.02mg/kg	IV	Dose dependant	Profound drop in heart rate. Can be reversed with atipamezole by administering the same volume of Dexmedetomidine used.
Propofol	2 to 8mg/kg (dose to effect)	IV, slowly	Until discontinued	May cause breath holding.
Alfaxalone	5 mg/kg	IM, IV	15-30 minutes	May cause respiratory depression and apnea

5.5. Endotracheal intubation:

5.5.1. Placement of an endotracheal tube is recommended for delivery of isoflurane anesthesia when:

5.5.1.1. Profound sedation, preventing protective airway reflexes, is required. As a guide, light sedation should last under 30 minutes and is performed for less invasive procedures.

5.5.1.2. Surgical level anesthesia is required.

5.5.1.3. Head or airway cannot be accessed readily due to position, equipment, etc.

5.5.2. Use cuffed endotracheal tubes as they reduce the possibility of aspiration of saliva or stomach contents.

5.5.3. Intubation:

5.5.3.1. Lubricate endotracheal tube with sterile lubricant.

5.5.3.2. With the animal in sternal recumbency, extend the neck and head so that they are in a straight line.

5.5.3.3. While holding the upper jaw, pull the tongue forward and down so that the epiglottis is visible.

5.5.3.4. Use the laryngoscope to disengage the epiglottis from the soft palate, exposing the glottis and vocal chords.

5.5.3.5. The laryngeal folds may be sprayed with 2% xylocaine to help decrease laryngospasm (spasmodic closing and opening of the glottis)

5.5.3.6. Insert the endotracheal tube (with the convex side facing upwards) gently into the proximal larynx.

5.5.3.7. Gently rotate the endotracheal tube 180° and apply gentle pressure to insert into the trachea. Confirm proper placement by checking for the animal's breath as it exits the endotracheal tube during exhalation.

5.5.3.8. Secure the endotracheal tube by tying a piece of gauze around the tube then behind the animal's head.

5.5.3.9. Inflate the cuff of the endotracheal tube.

5.5.3.10. Verify adequate ventilation of both lungs by auscultation.

5.6. Isoflurane anesthesia:

5.6.1. Induction (if injectable anesthetics cannot be used; the animal needs to be premedicated to reduce stress of induction):

5.6.1.1. Use a tight-fitting mask.

5.6.1.2. Adjust the oxygen flowmeter to 0.8 to 1.5 L/min.

- 5.6.1.3. Adjust the isoflurane vaporizer to 3% to 5%.
- 5.6.2. Maintenance:
- 5.6.2.4. Use the endotracheal tube or mask connected to the Bain circuit.
- 5.6.2.5. Adjust the flowmeter to 0.4 to 0.8 L/min.
- 5.6.2.6. Adjust the Isoflurane vaporizer to 1.5 to 2.0% (dose to effect).
- 5.6.2.7. Apply ophthalmic ointment (natural tears) to both eyes to prevent dryness and damage to the cornea.
- 5.6.2.8. When not under automatic assisted ventilation (respirator), animal should be manually ventilated or “bagged” every 5-10 minutes to ensure proper air exchanges.
- 5.6.3. Recovery:
- 5.6.3.1. Turn off the Isoflurane vaporizer but keep the animal on oxygen for 2 to 5 minutes or longer if oxygen saturation levels are low.
- 5.6.3.2. Remove the endotracheal tube as soon as the animal shows signs of impending arousal, i.e., when the animal starts swallowing on its own and reflexes begin to return.
- 5.6.3.3. Provide supplemental heat until the animal’s temperature is consistently rising and approaching normal values.
- 5.6.3.4. Monitor the animal in his home cage until it is ambulatory to ensure it regains full consciousness.

## SOP REVISION HISTORY

DATE	NEW VERSION
2016.03.16	<b>5.6.2.3</b> Adjust the isoflurane vaporizer to 1.5 to 2.0% ( <b>dose to effect</b> ).
2016.03.16	5.6.3.1. Turn off the isoflurane vaporizer but keep the animal on oxygen for <b>2 to 5 minutes or longer if oxygen saturation levels are low</b> .
2016.03.16	5.6.3.2 Remove the endotracheal tube as soon as the animal shows signs of impending arousal, i.e., <b>when reflexes begin to return</b> .
2016.03.16	<b>5.7 Sevoflurane anesthesia:</b> <b>5.7.1. Induction (if injectable anesthetics not previously administered):</b> <b>5.7.1.1. Use a tight-fitting mask.</b> <b>5.7.1.2. Adjust the oxygen flowmeter to 0.8 to 1.5 L/min.</b> <b>5.7.1.3. Adjust the isoflurane vaporizer to 5% to 8%</b> <b>5.7.2. Maintenance:</b> <b>5.7.2.1. Use the endotracheal tube or mask connected to the Bain circuit.</b> <b>5.7.2.2. Adjust the flowmeter to 0.8 to 1.5 L/min.</b> <b>5.7.2.3. Adjust the isoflurane vaporizer to 1.0 to 3.0% (dose to effect).</b> <b>5.7.2.4. Apply ophthalmic ointment (natural tears) to both eyes to prevent dryness and damage to the cornea.</b> <b>5.7.3. Recovery:</b> <b>5.7.3.1. Turn off the isoflurane vaporizer but keep the animal on oxygen for 2 to 5 minutes or longer if oxygen saturation levels are low.</b> <b>5.7.3.2. Remove the endotracheal tube as soon as the animal shows signs of impending arousal, i.e., when reflexes begin to return.</b>
2020.05.13	3.3. Keep animals warm by providing a heat source until the animal has recovered from anesthesia. <b>Care should be taken to not overheat or burn the animals.</b>
2020.05.13	<b>4.16. Atipamezole (5mg/mL)</b>
2020.05.13	5.1.1. Administer, <del>subcutaneously</del> <b>intramuscularly</b> (can be mixed in the same syringe):
2020.05.13	5.5.3.6. Insert the endotracheal tube ( <b>with the convex side facing upwards</b> ) <del>gently past the vocal folds into the trachea (this can be timed with exhalation)</del> <b>gently into the proximal larynx.</b> 5.5.3.7. <b>Gently rotate the endotracheal tube 180° and apply gentle pressure to insert into the trachea.</b> Confirm proper placement by checking for the animal’s breath as it exits the endotracheal tube during exhalation. 5.5.3.8. Secure the endotracheal tube by tying a piece of gauze around the tube then behind the animal’s head. 5.5.3.9. Inflate the cuff of the endotracheal tube <b>5.5.3.10. Verify adequate ventilation of both lungs by auscultation.</b>
2020.05.13	<b>5.6.2.5. When not under assisted ventilation, animal should be manually ventilated or “bagged” every 5-10 minutes to ensure proper air exchanges.</b>
2020.05.13	<b>5.6.3.3. Monitor the animal in his home cage to ensure it regains full consciousness and able to stand in a sternal position.</b>
2020.05.13	<b>5.7.2.5. When not under assisted ventilation, animal should be manually ventilated or “bagged” every 5-10 minutes to ensure proper air exchanges.</b>
2020.05.13	<b>5.7.3.3. Monitor the animal in his home cage to ensure it regains full consciousness and able to stand in a sternal position.</b>

2023.08.14	2. Responsibility Principal Investigators (PIs) and their research staff, <b>veterinarians</b> and veterinary care staff.
2023.08.14	<del>4.5. Appropriately sized induction chamber constructed of a see-through material (glass, polycarbonate, etc.)</del>
2023.08.14	<del>4.6. Sevoflurane</del>
2023.08.14	<del>4.17. Thiopental sodium (Pentothal) powder *Controlled drug</del>
2023.08.14	5.2.3. Insert IV catheter and secure in <b>one of the following locations:</b> <del>5.2.3.1. For peripheral IV access sites: use either the cephalic or saphenous vein.</del> <del>5.2.3.2. For central venous access site: use the external jugular vein.</del>
2023.08.14	5.5.2. <del>Use</del> cuffed endotracheal tubes <del>are preferred</del> as they reduce the possibility of aspiration of saliva or stomach contents.
2023.08.14	5.5.3.5. The <del>Spray</del> laryngeal folds <b>may be sprayed</b> with 2% xylocaine to help decrease laryngospasm (spasmodic closing and opening of the glottis)
2023.08.14	5.6.1.1. <del>Place the animal in the induction chamber or</del> Use a tight-fitting mask.
2023.08.14	5.7.2.5. When not under <b>automatic</b> assisted ventilation ( <b>respirator</b> ), animal should be manually ventilated or “bagged” every 5-10 minutes to ensure proper air exchanges .
2023.08.14	5.6.3.2. Remove the endotracheal tube as soon as the animal shows signs of impending arousal, i.e., when <b>the animal starts swallowing on its own and reflexes begin to return.</b>
2023.08.14	<b>5.6.3.3. Provide supplemental heat until the animal’s temperature is consistently rising and approaching normal values.</b>
2023.08.14	5.6.3.4. Monitor the animal in his home cage <b>until it is ambulatory</b> to ensure it regains full consciousness <del>and able to stand in a sternal position.</del>
2023.08.14	5.7. Sevoflurane anesthesia: 5.7.1. Induction (if injectable anesthetics not previously administered): 5.7.1.1. <del>Use a tight fitting mask.</del> 5.7.1.2. <del>Adjust the oxygen flowmeter to 0.8 to 1.5 L/min.</del> 5.7.1.3. <del>Adjust the vaporizer to 5% to 8%.</del> 5.7.2. Maintenance: 5.7.2.1. <del>Use the endotracheal tube or mask connected to the Bain circuit.</del> 5.7.2.2. <del>Adjust the flowmeter to 0.8 to 1.5 L/min.</del> 5.7.2.3. <del>Adjust the vaporizer to 1.0 to 3.0% (dose to effect).</del> 5.7.2.4. <del>Apply ophthalmic ointment (natural tears) to both eyes to prevent dryness and damage to the cornea.</del> 5.7.2.5. <del>When not under assisted ventilation, animal should be manually ventilated or “bagged” every 5-10 minutes to ensure proper air exchanges.</del> 5.7.3. Recovery: 5.7.3.1. <del>Turn off the vaporizer but keep the animal on oxygen for 2 to 5 minutes or longer if oxygen saturation levels are low.</del> 5.7.3.2. <del>Remove the endotracheal tube as soon as the animal shows signs of impending arousal, i.e., when reflexes begin to return.</del> 5.7.3.3. <del>Monitor the animal in his home cage to ensure it regains full consciousness and able to stand in a sternal position.</del>
2023.09.01	<b>3.3. Monitor animals closely during induction, maintenance, and recovery from general anesthesia. Monitoring must be documented.</b>
2023.09.01	3.3.2. Monitor animal every 5 minutes; record the following parameters every 15 minutes: 3.3.2.1. Anesthetic depth: absence of reflexes, e.g., pedal/eyelid/eyelash/palpebral, absence of movement, muscle relaxation (jaw tone). 3.3.2.2. Respiratory function (ventilation): respiratory rate, oxygen saturation (SpO2), thoracic wall or rebreathing bag movements, and auscultation. End-tidal carbon dioxide (ETCO2) should be included where capnography equipment is available. Blood gas analysis may be indicated for critical patients or procedures. 3.3.2.3. Cardiovascular function (circulation): capillary refill time (CRT), mucous membrane color, pulse quality, heart rate and rhythm, and blood pressure. Electrocardiography (ECG) should be included where equipment is available. 3.3.2.4. Body temperature: rectal or esophageal temperature.
2023.09.01	3.4. Apply ophthalmic ointment to prevent corneal desiccation. Reapply as needed, every 30 minutes at a minimum.
2023.09.01	3.6. Maintain records of each anesthesia procedure and include: 3.6.1. Date and time of procedure 3.6.2. Principal investigator and Animal Use Protocol (AUP) 3.6.3. Species and animal’s identification 3.6.4. Animals’ weight 3.6.5. Name, dose, route, and time of administration of each drug 3.6.6. Description of the procedure 3.6.7. Measurements of the animal's anesthetic depth and vital signs 3.6.8. Time of recovery 3.6.9. Name of the individual monitoring the animal and of the surgeon
2023.09.01	4.5. Monitoring equipment, e.g., stethoscope, thermometer, pulse oximeter, capnograph, ECG
2023.09.01	5.4.2. Alfaxan, dose: 5 mg/kg, route: IM, IV, duration or effect: 15-30 minutes, notes: May cause respiratory depression and apnea.
2023.09.01	5.5.1. Placement of an endotracheal tube is recommended for delivery of isoflurane anesthesia <b>when:</b> 5.5.1.1. Profound sedation, preventing protective airway reflexes, is required. As a guide, light sedation should last under 30 minutes and is performed for less invasive procedures. 5.5.1.2. Surgical level anesthesia is required. 5.5.1.3. Head or airway cannot be accessed readily due to position, equipment, etc.
2023.09.06	5.3.1. Administer isotonic saline (0.9% saline) or Lactated Ringer’s Solution at a rate of <del>10</del> 2-3 mL/ kg/hour.