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## **Rabbit Anaesthesia**

The intent of this Standard Operating Procedure (SOP) is to describe commonly used methods to anesthetize rabbits at Comparative Medicine (CM). This SOP is intended for use by CM staff and investigators who anesthetize rabbits. This procedure is approved by the NUS Institutional Animal Care and Use Committee (IACUC). Any deviation must be approved by the IACUC prior to its implementation.

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### **1. INTRODUCTION**

This SOP presents commonly used anesthetic regimes in rabbits.

### **2. MATERIALS**

- a. Anesthetic agents
  - i. Gas anesthesia machine, connecting tubing, inhalant (e.g., isoflurane), oxygen supply and anaesthesia waste gas scavenging system
  - ii. Injectable anaesthetic drugs
- b. Support materials
  - i. Weighing Scale
  - ii. Laryngoscopes
    1. Rabbit weighing 1-2 kg; Wisconsin laryngoscope blade size 0
    2. Rabbit weighing 2- 5 kg; Wisconsin laryngoscope blade size1
  - iii. Endotracheal tubes
    1. Rabbit weighing 1-3 kg; 2-3mm outside diameter (OD)
    2. Rabbit weighing 3- 7 kg; 3-6 mm OD
  - iv. Anaesthesia monitoring devices to measure, Heart Rate (HR), Respiratory Rate (RR), Body temperature, Blood oxygen partial pressure (SpO<sub>2</sub>), End tidal CO<sub>2</sub> and Blood pressure
  - v. Plain gauze roll
  - vi. Sterile eye lubricant
  - vii. Lactated Ringer's Solution (LRS)
  - viii. Needles and syringes

- ix. Anaesthetic reversal drugs for injected anaesthetics
- x. Other veterinary drugs e.g. emergency drugs

### 3. PROCEDURES

- a. Prerequisite to IACUC approval is pre-surgical planning. As part of the pre-surgical/procedural planning, consult a CM Veterinarian to discuss factors when choosing an anaesthetic. These include:
  - i. Breed, age, health status, concurrent medication, and demeanor/disposition.
  - ii. Invasiveness, complexity and duration of procedure.
  - iii. Possible effect of the anesthesia on the scientific objectives of the study.
  - iv. Special facilities and equipment required (e.g., volatile anesthetics).
  - v. Knowledge, experience, preference and skill with available agents.
- b. Rabbits < 3 kg should not have food withheld for > 12 hours due to development of metabolic acidosis and decline in blood glucose concentration. In general, 1 to 6 hours of fasting is acceptable. Water should not be withheld for more than several hours preoperatively.
- c. Perform a physical examination of the rabbit as part of the pre-anaesthetic evaluation and obtain an accurate weight. At a minimum, perform a thoracic auscultation and abdominal palpation and assess for capillary refill time (CRT), HR, RR.
- d. Pre-anaesthetic medication (**Table 1**): Rabbits are easily stressed; hence tranquilizer or sedative should be given while the animal is in its familiar surroundings whenever possible. The sedated rabbit can then be transported to the operating area. Administer premedication 0 - 5 minutes before induction if given intravenous injection (IV) and 10 - 20 minutes before induction if given subcutaneous injection (SC) or intramuscular injection (IM). Support the hind limbs when handling rabbits as trauma to the lumbar spine at L6 or L7 is the most common reason for loss of neurological function to the hind limbs.

**NOTE:** An analgesic must be administered preoperatively for procedures that may result in pain.

- i. Intravenous injection (IV) locations:
  - 1. Auricular vein
  - 2. Lateral saphenous vein
  - 3. Cephalic vein
- ii. Intramuscular injection (IM) locations:
  - 1. Cranial thigh (quadriceps)
  - 2. Lumbar spinal epaxial muscles
  - 3. Caudal thigh muscles (point the needle posteriorly)

**NOTE:** Sciatic nerve damage can occur if the needle is pointed medially or cranially for a caudal thigh muscle injection. Avoid injecting into areas of pathology or surgical implants.

- iii. Subcutaneous injections (SC): administer subcutaneous injections in the interscapular region, the lateral thoracic, or lumbar dorsal region.

**Table 1:** Sedatives, Tranquilizers, Analgesics, and other drugs

Drug	Dose & route	Effect
Acepromazine	0.75 – 1 mg/kg IM	Moderate sedation
Acepromazine + Butorphanol	1 mg/kg + 1 mg/kg IM	Moderate to heavy sedation and moderate analgesia
Medetomidine	0.25 mg/kg IM	Moderate sedation. Sedation completely reversed by Atipamezole 1 mg/kg IM
Midazolam	0.5-2 mg/kg IM, IV	Light to moderate sedation
Carprofen	4 mg/kg SC q 24 h	Moderate analgesia
Buprenorphine	0.05 mg/kg SC, IV q 8-12 h	Moderate analgesia
Atipamezole	1 mg/kg IM	Medetomidine reversal
Meloxicam	1mg/kg PO, SC	

- e. Place an intravenous catheter to maintain venous access and administration of intravenous fluids.
  - i. Clip or pluck and aseptically prepare the catheter site.
  - ii. Cannulate and secure IV catheter in one of the following locations: See SOP# 406.01 Vascular Access in Pigs, Rabbits, Rodents (mice, rats, guinea pigs)
    - 1. For peripheral vein access, use the auricular vein or cephalic vein.
    - 2. If central vein access is required, place a jugular catheter.
  - iii. Administer 0.9% saline or Lactated Ringer's Solution at an average rate of 10 ml/kg/hour. For procedures longer than 2 hours, the rate of fluid administration should be reduced to 5-8 ml/kg/hour to prevent hemodilution and excessive fluid accumulation within the interstitial space. 20 drops are equivalent to 1 ml of fluid when an adult drip set is used or use fluid pumps.
  - iv. For arterial blood collection, central ear artery is recommended for ease of collection. See SOP# 402.01 Recommended Blood Collection Volume and Frequency.
- f. Injectable anesthesia:
  - i. Can be used alone for short, non-invasive procedures.
  - ii. Used for induction prior to intubation and the use of inhalant anesthesia.
  - iii. Table 2 lists commonly used drug combinations at CM to induce anesthesia.

**Table 2:** Injectable anaesthetics

General Anaesthetic	Dose & route	Duration of effect	Effect
Ketamine + Xylazine	35 mg/kg + 5 mg/kg IM	25 – 40 minutes	Surgical anaesthesia
Ketamine + Medetomidine	15 mg/kg + 0.25 mg/kg IM, SC	20 – 30 minutes	Surgical anaesthesia
Ketamine + Xylazine + Butorphanol	35 mg/kg + 5 mg/kg + 0.1 mg/kg IM	60 - 90 minutes	Surgical anaesthesia
Ketamine + Xylazine + Acepromazine	35 mg/kg + 5 mg/kg + 1 mg/kg IM, SC	45 -75 minutes	Surgical anaesthesia

g. Inhalant anesthetics for induction and/or maintenance of anesthesia.

- i. Following induction by injectable anesthetics, place an endotracheal tube to maintain a level plane of anesthesia.
- ii. If induction with an inhalational agent is required, a sedative E.g. Acepromazine or midazolam should be administered. After 5 – 10 minutes, the animal should receive 100% oxygen for 2 minutes using a tight fitting facemask, followed by a gradually rising concentration of isoflurane. To avoid prolonged apnoea during induction, remove face mask temporarily.
- iii. Endotracheal intubation
  1. Intubation by direct visualization of the larynx
    - Place the animal in dorsal or lateral recumbency. Open the mouth and pull the tongue forward into the diastema. Advance the laryngoscope from the diastema on the other side of the mouth until the epiglottis and soft palate are visualized. Use the introducer to position the epiglottis in front to the soft palate if necessary.
    - Spray or inject the end of the endotracheal tube with local anesthetic e.g. 0.1 ml of 10% Lignocaine. Extreme caution should be exercised when spraying topical anesthetics to avoid overdosage. Thread the ET tube onto the end of the introducer and advance into the trachea.
    - Look for condensation on the inside of the tube during expiration or movement of a tissue paper placed at the end of the tube to ensure correct placement. Secure endotracheal tube using roll gauze around the tube and behind the animal's head.

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2. Blind intubation

- Does not require visualization of the larynx
- Rabbit is placed in sterna recumbency, head gripped firmly and extended and animal lifted so its forelegs are just touching the operating table.
- Endotracheal tube is inserted over the tongue towards the larynx.
- Condensation or a loud breath indicates that the tube is close to the larynx.
- As the rabbit breathes in the tube is advanced.
- Secure the tube as described for 1 above.

iv. Gas anesthesia machine: A Bain's coaxial breathing circuit is commonly used.

1. Definitions:

- a. Tidal volume: the volume of air drawn into the respiratory tract with each breath.
- b. Minute volume: the volume of air drawn into the respiratory tract in 1 minute.

2. Isoflurane induction is set at 4 – 5 % and maintenance is 2 -3%. The fresh gas flow settings for a Bain's semi-breathing circuit are provided in **Table 3**. These are guidelines and adjustments should be made using examination and monitoring devices depending on depth of anesthesia.

**Table 3:** Fresh gas flow rate settings

Body Weight (kg)	Estimated tidal volume (ml)	Minute volume (l)	Flow rate (l/minute) Bain's circuit
1	10-15	0.4-0.6	1.5 – 2.5
3	30-45	0.5-1	2.5-3.5
6	60-90	1.5-3	3.5-7.5

i. Maintenance of Anesthesia:

- i. Keep rabbit warm by providing a homeothermic heat source for the duration of the anesthesia and until the rabbit has fully recovered from anesthesia. A temperature of approximately 35°C should be maintained. This could be reduced to 26 - 28°C as the animal recovers consciousness.
- ii. Intraoperative monitoring devices are used to assess vital signs and anesthetic depth (e.g. reflexes, Capillary refill time, mucous membrane colour, pulse oximetry, blood pressure, rectal temperature, heart rate, respiratory rate). See **Table 4** for normal physiological parameters in rabbits.
- iii. Never leave the anesthetized rabbit unattended.

**Table 4:** Normal physiological parameters in the rabbit

Adult body weight (kg)	Body temperature ° C (F)	Respiratory rate (per min)	Resting heart rate (per min)	Oxygen saturation via pulse oximetry (%)
3-6	38.5 – 39.5 (101.3-103.1)	32-60	200-300	95 - 98

j. Recovery and Postoperative Care

- i. Turn off gas anesthetic vaporizer but keep oxygen running for 5 minutes.
- ii. Remove endotracheal tube when the rabbit begins to swallow.
- iii. Observe rabbit during recovery until fully awake.
- iv. It is advisable to provide warm (37°C) lactated ringer's saline subcutaneously at a dose of 10-17 ml/kg the end of surgery and analgesics as outlined in the IACUC protocol.
- v. Provide 24 hours of quiet recovery time in a warm, dry area.
- vi. Supply food as soon as the animal is fully awake to promote gastrointestinal motility and prevent stasis. Motility stimulant; Metoclopramide (0.2-1mg/kg P/O, SC, IM every 6-12 hours) or Cisapride (0.5-1 mg/kg p/o every 12-24 hours). Palatable high fiber diets i.e. fresh hay, carrots, celery, and apples should be provided to encourage eating. Supplemental fluids and syringe-feeding is provided in consultation with a veterinarian.

#### 4. PERSONNEL SAFETY

- i. Use only anesthetic machine with valid maintenance and calibration certificate (<12 months).
- ii. Avoid vapors from volatile drugs such as anesthetics, by proper use of scavenging equipment.
- iii. When working with animals wear appropriate PPE, observe proper hygiene, and be aware of allergy, zoonosis, and injury risks.

#### 5. ANIMAL RELATED CONTINGENCIES

- i. Please call the Emergency veterinary phone 90013073 for veterinary related contingencies after office hours or the duty veterinarian during office hours.

#### 6. REFERENCES

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