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Marmoset-Specific Anesthesia

I. Purpose:

This document has been designed by the ARC veterinary staff as a guideline for Marmoset anesthesia. This is not intended to be an inclusive list of all possible drug combinations that can be used in marmosets. Instead, these guidelines are general recommendations. Consequently, they do not include reference to specific research-associated concerns. If you have questions about the use of anesthetics for your particular situation, please work with your area veterinarian to develop the most effective anesthetic plan.

Anesthesia is the loss of feeling in all or part of the body, with or without loss of consciousness. Animals may be anesthetized for surgery, for non-surgical procedures that may be painful, or for non-painful procedures that require immobilization. Steps must be taken before, during, and after anesthesia to ensure the safety of the animal and efficacy of anesthesia. These are listed in the General Guidelines section below.

Anesthetic drugs can be administered parenterally or by inhalation. Commonly used anesthetic agents are described below. The choice of anesthetic agent will depend on the procedure to be performed, research aims, and other factors. Consult your area veterinarian with questions about drug selection.

II. General considerations:

- Prior to anesthesia, marmosets should be only be fasted for 4-8 h to avoid perioperative hypoglycemia. Water should not be restricted.
- Most anesthetic drugs cause hypotension and hyperthermia. Provide supplemental heat under anesthesia. Regardless of the heat source used, do not place animals directly on the heat.
- Following sedation, place an indwelling catheter for administration of anesthetic drugs, emergency drugs, and intravenous fluid support. The most common sites for catheter placement are the lateral tail vein and saphenous veins. 22-24 guage catheters are commonly used.
- It is important to provide supplemental fluid support in animals that will be under anesthesia for longer than 30 minutes. The appropriate fluid rate is generally 4 mls/kg/hour, but may vary

based on the anesthetic combination used. Anesthetists must guard against overhydration, volume overload, and pulmonary edema.

- Standard mammalian monitoring techniques are applicable to marmosets. The goal of monitoring should be to maintain cardiovascular homeostasis and core body temperature. Understanding the basic physiologic effects of the anesthetics used is paramount to correctly interpreting monitoring parameters (see “Description of anesthesia agents” document for details).
- Parameters to be monitored in anesthetized marmoset include: Anesthetic depth, heart rate, respiratory rate, oxygen saturation, expired CO₂ (EtCO₂), temperature, mucous membrane color.
 - Normal ranges (without anesthesia)
 - Temperature = 98.0 - 101.0 F
 - Heart Rate (beats/min) = 230-400 (with manual restraint)
 - Respiratory Rate (breaths/min) = 100 (manual restraint)
 - Blood pressure: Systolic blood pressure >90 mm Hg and mean >60 mm Hg
 - Oxygen saturation= >95%
 - EtCO₂: 35-45
 - Mucous membranes= pink not pale, white, gray, or blue
 - Normal ranges (under anesthesia)
 - A 20% drop in HR and RR is normal, and can be more significant depending on the anesthetic drug being used.
- For more involved procedures, EKG, and blood pressure monitoring may be indicated. For long procedures, mechanical ventilation is recommended.

III. Stages of Anesthesia:

1. Marmoset anesthesia is generally broken into premedication (sedation), anesthetic induction, and anesthetic maintenance. As with other species, anesthesia (maintenance) can be accomplished via inhalation or parenteral methods, though inhalation anesthesia is recommended.
 - A. **Sedation:** Drugs administered to decrease excitement, and cause relaxation to allow for placement of indwelling catheters (for IV drug and fluid administration), or allow for intubation (for inhalation anesthesia). Often induction (see below) is required in addition to sedation to provide a level of sedation/anesthesia sufficient for intubation.
 - i. Alfaxalone (10-14 mg/kg) is the most common agent used for chemical restraint of marmosets.

- ii. The anticholinergics atropine (0.02-0.1 mg/kg) or glycopyrrolate (0.005-0.01 mg/animal) can be administered to control tracheobronchial secretions when inhalant anesthesia will be used

Anesthetic:	Route:	Dose:	Notes:
Alfaxalone	IM	10-14 mg/kg	- Lasts ~40-45 minutes of sedation; 7-10 mg/kg can be used for minor procedures like blood collection Injection volumes should be limited to 0.25 mls per site.
Alfaxalone + Midazolam	IM	10 mg/kg	30-45 minutes of sedation
Ketamine +Midazolam +Acepromazine +Dexmedetomidine +Xylazine	IM	10-20 mg/kg 0.1-0.4 mg/kg 0.1-0.5 mg/kg 0.02-0.03 mg/kg 1-3 mg/kg	30-45 45 minutes of sedation Can be reversed with an equal volume of atipamezole.

- B. **Induction:** Anesthetic administered to place animal in an unconscious state and allow for tracheal intubation.

Anesthetic:	Route:	Dose:	Notes:
Isoflurane	Inhalation	2-4% by facemask	

- C. **Maintenance:** Drugs administered to keep animals unconscious and allow for surgical (or other) procedures to be performed.

- i. Inhalation anesthesia may be delivered by a facemask, but is generally delivered via endotracheal intubation.
- Marmosets can be intubated with the use of a laryngoscope. A Macintosh laryngoscope blade size 0 or Miller blade size 00 are recommended.
 - 1.00- 1.5 mm silicone endotracheal tubes with a stylet work well for intubation.
 - Endotracheal intubation may be attempted under direct visualization with the animal restrained vertically and the mouth held open by using the thumb and index finger to grasp the zygomatic arch on either side of

the head (other methods, including the tilt-table technique are also utilized).

- d. A cotton tip applicator can be used to depress the base of the tongue, which is drawn forward, facilitating visualization of the larynx. A drop of lidocaine can be placed on the laryngeal cartilages to prevent laryngospasms.
 - e. Application of sterile surgical lubricant to the tip of the endotracheal tube will help facilitate intubation.
 - f. The ET tube should extend approximately from outside of the mouth to the thoracic inlet. This can be used as a guide for how far the tube should be inserted upon intubation.
 - g. Verify proper placement of the ET tube by auscultating all lung fields for strong breath sounds. If no breath sounds are heard, back the tube out until sounds are heard in all lung fields.
 - h. Facemasks and intubation require a gas anesthesia machine with an oxygen source and a precision vaporizer. For marmosets, a non-rebreathing system should be used
 - i. An oxygen flow rate of 500-800 mls/minute is appropriate for marmosets.
 - j. If there is an orotracheal tube in place, artificial ventilation can be used. A respiratory rate of 40-50 breathes per minute and a tidal volume of 7-10 mL/kg good starting points for ventilation.
- ii. When using inhalant anesthesia, use an anesthetic system equipped with a gas scavenging system to minimize occupational exposure to exiting gases.
 - iii. For anesthetic events lasting greater than 5 minutes and whenever facemasks are used, use an ophthalmic ointment (e.g., Paralube® or Lacrilube®) to the eyes to prevent corneal drying and trauma.

Anesthetic:	Route:	Dose:	Notes:
Isoflurane	Inhalation	1-2% by endotracheal tube	

D. Post-operative Recovery

1. In the immediate postoperative period, thermal support is vital for rapid recovery. Keep animals on external heat support until they are nearly fully recovered.
2. Provision of stimulation and frequent switching of position will encourage recovery.
3. If animals are intubated, do not extubate until animals is observed swallowing.

4. Post-anesthetic animals are often less interested in eating. Provision of appealing supplements will aid in post-operative caloric consumption.
5. For information on what should be monitored during the post op please reference the IACUC Guidelines for Surgical Procedures in Non-Rodent Mammals (https://research.utexas.edu/wp-content/uploads/sites/3/2019/03/GUIDELINE_06-Surgical_Procedures_in_Non-Rodent_Mammals_030419.pdf)

References:

1. APV NHP Formulary <http://www.marmosetvets.org/Formulary.xls> Flecknell, P. (1996)
2. Fox JG, Anderson LC, Loew FM, Quimby FW eds. Laboratory Animal Medicine 2nd Ed. Academic Press, London England, 2002.
3. Anesthesia and Analgesia in Nonhuman Primates. In Anesthesia and Analgesia in Laboratory Animals (D.F. Kohn, S.K. Title: Nonhuman Primate Anesthesia and Analgesia) .
4. Anesthesia and Select Surgical Procedures In The Common Marmoset in Captivity and Biomedical Research. Academic Press, London England, 2019.