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ANIMAL RESOURCES CENTER

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Rabbit-Specific Anesthesia

I. Purpose:

This document has been designed by the ARC veterinary staff as a guideline for rabbit anesthesia. This is not intended to be an inclusive list of all possible drug combinations that can be used in rabbits. 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 the Animal Resources clinical veterinarians 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 such as animal age. Consult your area veterinarian with questions about drug selection.

II. Species-specific considerations:

- Non-SPF rabbits may be infected with *Pasteurella multocida*. Underlying lung damage from this pathogen may lead to respiratory distress/arrest under anesthesia. Have animals with any sign of respiratory disease clinically evaluated by the area veterinarian prior to anesthesia.
- Rabbits cannot vomit, therefore fasting is not mandatory. However, they do accumulate food and fluid within the oral cavity and oropharynx. Thus, a pre-anesthetic fast of 1-4 hours is recommended. Fasting also reduces the overall volume of the gastrointestinal tract thus reducing pressure on the diaphragm while under anesthesia. Fasting for longer periods of time may predispose them to post-operative ileus and may decrease blood glucose levels.
- Tilting the surgical table to slightly elevate the head will reduce pressure from the gastrointestinal tract on the diaphragm.

- If parasympatholytic drugs are used to prevent bradycardia or decrease secretions, it is important to remember that rabbits may produce atropine esterase, which degrades atropine into inactive products. Use of Atropine in rabbits is not recommended. Glycopyrrolate (0.01-0.02 mg/kg) appears to maintain effectiveness in rabbits with atropine esterase.
- Rabbits are obligate nasal breathers. As such, it is important not to obstruct the nares for any reason during anesthesia.
- Rabbit eyes will remain open under anesthesia. As such, it is important to lubricate the eyes to prevent drying and corneal damage.

III. General considerations:

- Do not use newly arrived animals for experimental procedures until 72 hours after entry into the facility, though a one-week acclimation period is recommended. This stabilization period is not required for animals used acutely (anesthetized and euthanized at the end of the procedure) although it is recommended. This provision is to allow animal to acclimate to the facility and reduce the chance of stress-induced disease, including anesthetic death.
- Rabbits are easily stressed. Habituate animals to handling before beginning any studies involving anesthesia.
- Because rabbits have a large surface area and most anesthetic agents lower body temperature, they are extremely susceptible to hypothermia during anesthesia. In order to prevent hypothermia, which slows recovery and further stresses the animal, provide supplemental heat during anesthetic procedures and during recovery. Regardless of the heat source used, do not place animals directly on the heat.
- Following sedation, the placement of indwelling catheters may be needed for administration of additional anesthetic drugs, emergency drugs, and intravenous fluid support. The lateral (marginal) ear veins are easily accessed and are the preferred site. The application of lidocaine-prilocaine (EMLA®) cream to the ear 30 minutes before venipuncture reduces discomfort. A tranquilizer or sedative (such as Acepromazine (0.25-1.0 mg/kg IM) can also be used prior to catheter placement to help decrease the rabbit's stress level.
- Regardless of the anesthetic administered, monitor rabbits to avoid excessive depression of cardiac and respiratory functions, or insufficient anesthesia.
- Parameters to be monitored in an anesthetized rabbit include anesthetic depth (toe pinch), respiratory rate and pattern (normal undisturbed rate = 30-60/min, mucous membrane color (should be pink not blue or grey), heart rate (120-325/min) and body temperature (should be maintained around 101 degrees F).

IV. Stages of Anesthesia:

1. Rabbit anesthesia can be broken into premedication (sedation), anesthetic induction, and anesthetic maintenance. As with other species, anesthesia (maintenance) can be accomplished via inhalation or parenteral methods.

A. **Sedation/Induction:** 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). For some procedures, the sedation and maintenance are covered by the initial drug administration.

- i. The injectable anesthetics of choice are ketamine combinations with either Xylazine or Diazepam. If additional anesthesia is needed, re-dose with 1/3 the original calculated dose of ketamine. Do not re-dose Xylazine due to its hypotensive effects.

Drug	Dose (mg/kg)	Route	Comments
Ketamine + Xylazine (Rompun®) Recommended	(10-40 Ket)+ (3-5 Xyl) Recommended starting point is 10 mg/kg Ketamine and 3 mg/kg Xylazine	IM	Thermal support is crucial. To prolong anesthesia, supplement with 1/3 dose of ketamine only. Xylazine can be reversed with an equal volume of Atipamazole or Yohimbine 0.2-1.0 mg/kg IV
Ketamine + Xylazine + Acepromazine Recommended	(10 Ket) +(3 Xyl) +(0.25-0.75 Ace)	IM	Thermal support is crucial. To prolong anesthesia, supplement with 1/3 dose of ketamine only. Xylazine can be reversed with an equal volume of Atipamazole or with Yohimbine at 0.2-1.0 mg/kg yohimbine IV or IM
Ketamine, Xylazine Butorphanol Recommended	(15 Ket)+ (5 Xyl),+ (0.1 But)	IM	Thermal support is crucial. To prolong anesthesia, supplement with 1/3 dose of ketamine only. Xylazine can be reversed with an equal volume of Atipamazole or with Yohimbine at 0.2-1.0 mg/kg yohimbine IV or IM
Ketamine + Diazepam (Valium®)	(20-40 Ket) + (1-5 Dia)	IP, IM	
Ketamine + Dexmedetomidine	15-25 Ket +0.25 Dex	IM, SQ	Dexmedetomidine can be reversed with an equal volume of Atipamazole.

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

Drug	Dose (mg/kg)	Route	Comments
Propofol bolus	3-10	IV	Propofol should be used with caution in rabbits as extended use may lead to propofol infusion syndrome*. Propofol causes respiratory depression- any animal receiving propofol should be intubated following administration.
Isoflurane	3-5%	inhalation	Pre-sedation is recommended if using an induction chamber in order to prevent distress to the rabbit. Rabbits that are

			not deep enough will breathe-hold when exposed to Isoflurane. Induction via a facemask on a non-sedated animal can lead to distress and injury and is strongly discouraged.
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* Propofol infusion syndrome is characterized by acute bradycardia progressing to asystole. Other features that have been described include lipemic plasma, fatty liver, metabolic acidosis, rhabdomyolysis and/or myoglobinuria.

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, laryngeal mask, or endotracheal tube.
 - a. The narrow mouth diameter, large tongue, limited range of jaw opening, and prominent incisors make placement of an endotracheal tube challenging.
 - b. If an endotracheal tube is used, generally a size 2.0-3.5 **UNCUFFED** tube is appropriate depending on the size of the rabbit.
 - c. 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.
 - d. 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.
- ii. Facemasks and intubation require a gas anesthesia machines with an oxygen source and a precision vaporizer. Due to the small respiratory capacity, use a non-rebreathing system.
 - a. If ventilation is required, it is important to keep in mind that rabbits have a small tidal volume (4-6 ml/kg) compared to other species. Please consult with the clinical veterinarian for appropriate respiratory rates and volumes if ventilation is required.
 - b. When using inhalant anesthesia, use a fume hood or an anesthetic system equipped with a gas scavenging system to minimize occupational exposure to exiting gases.
 - c. For anesthetic events lasting greater than 5 minutes and whenever facemasks are used, use an ophthalmic ointment (e.g., Paralube® or Lacrilube®) to prevent corneal drying and trauma.

Drug	Dose	Comments
Isoflurane Recommended	1-3% maintenance, up to 5% as needed for acquisition of a surgical plane of anesthesia	Use of isoflurane as the sole agent of anesthesia induction may be associated with breath-holding and distress.

V. Post-operative considerations

1. During the immediate post-anesthetic period, remove food and water from the cage. Do not replace food, hay, and water until the animal is fully awake and ambulatory.
2. It is important to maintain body temperature during anesthesia and if the temperature has dropped during anesthesia to heat rabbits slowly back to their pre-anesthetic body temperature.
3. Provision of stimulation to the rabbit with frequent switching of position will encourage recovery.
4. If rabbits are intubated, do not extubate until rabbit is observed swallowing.
5. It is important that rabbits eat as soon as possible post-operatively to decrease the occurrence of ileus. Hay should be offered as soon as possible post-operatively. A small amount of high value treat food (e.g. apples, carrots, kale) can also be offered post-operatively, as they may help to encourage post-operative eating. If animals are unwilling to eat post-operatively, contact the veterinary as they may initiate syringe-feeding of Critical Care diet to prevent post-operative ileus.

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