

GUIDELINES ON ANESTHESIA AND ANALGESIA IN LABORATORY ANIMALS

University of South Florida provides the following guidelines for use by IACUC-certified faculty and staff.

CONTENTS	PAGE
A. Background.....	1
B. Definitions.....	2
C. General Considerations.....	3
D. Controlled Substances.....	3
E. Pre-Anesthetic Treatments.....	4
F. General Anesthetics.....	4
G. Neuromuscular Blocking Agents.....	5
H. Monitoring Anesthesia.....	6
I. Analgesics.....	7
J. Comments regarding Anesthetics and Anad ()T9S0527.2(n)-11. 0 TT9S0527.2(n)-4.Z(A).	

infusion of local anesthetics, can control mild to moderate pain, in some species, though is contraindicated in others. Selection of an appropriate route of administration also involves consideration of the recipient species. For example, oral analgesic drug delivery to rodents (e.g., acetaminophen elixir added to the drinking water of rats) may not afford detectable analgesia.

7. In addition to the avoidance and alleviation of pain and discomfort, adequate post-procedural /post-operative animal care also includes efforts to prevent and/or treat post-anesthetic complications, (e.g., aspiration, hypostatic pneumonia, cardiovascular and respiratory depression, dehydration, and infection).
8. Reducing the potential for laboratory animal pain, distress, or discomfort is required by the *U.S. Government Principles for the Utilization and Care of Vertebrate Animals Used in Testing, Research and Training*, the *Guide for the Care and Use of Laboratory Animals (2012 ed.)*, and the *Animal Welfare Act (Public Law 89-*

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for days after administration. Therefore, it is important to check animals for signs of anorexia, fever, vomiting, or abnormal respiration or heart rate.

7. Indications of Anesthetic Overdose – r

J. Comments Regarding Anesthetics and Analgesics

1. Several commonly used or historically used anesthetics and analgesic medications are described briefly below. However, numerous additional agents are available for use in a variety of species. Contact a University of South Florida laboratory animal veterinarian for additional information on drugs not listed here. A veterinary drug formulary and a number of veterinary anesthesia textbooks are available in the Comparative Medicine library.
2. **Acepromazine Maleate** (formerly acetylpromazine), a phenothiazine derivative, is a potent neuroleptic agent with relatively low toxicity. Acepromazine induces tranquilization, muscle relaxation, and a decrease in spontaneous activity. At high doses, sedation occurs. Preanesthetic administration decreases the amount of general anesthetic required. Acepromazine possesses antiemetic,

10. **Volatile anesthetics** include halothane, enflurane, isoflurane, sevoflurane, and desflurane. These agents should be used only with adequate ventilation or scavenging systems. Precision vaporizers should be used for these anesthetic agents because lethal concentrations can easily be reached using the open drop method, or us

Table II. Commonly Used Anesthetics and Analgesics for Mice

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Anesthesia in Mice	Dose & Route	Comments
Isoflurane (Forane®)	To effect. In general, 3-4% induction, 1-3% maintenance; inhalation	Precision vaporizer, adequate ventilation or scavenging essential
Ketamine + Xylazine	100 mg/kg (K) + 10 mg/kg (X) IP	If animals appear to be responding to touch or awakening, re-dose with 30% of the initial dose of ketamine alone (no additional xylazine).
Ketamine + Xylazine + Acepromazine	100 mg/kg (K) + 20 mg/kg (X) + 3 mg/kg (A) IP	

Ketamine + Dexmedetomidine

Table IV. Commonly Used Anesthetics and Analgesics for Gerbils

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Anesthesia in Gerbils	Dose & Route	Comments
Isoflurane (Forane®)	To effect. In general, 1-4%	

Table V. Commonly Used Anesthetics and Analgesics for Hamsters

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Anesthesia in Hamsters	Dose & Route	Comments
Isoflurane (Forane®)	To effect. In general, 3-4% induction, 1-2% maintenance; inhalation	Precision vaporizer, adequate ventilation or scavenging essential
Pentobarbital	70 – 90 mg/kg IP	Caution! Potentially significant cardiovascular and respiratory depression, variable response
Ketamine + xylazine	80 – 200 mg/kg (K) + 5 – 10 mg/kg (X) IP	30 – 60 minutes duration

Ketamine + medetomidine

Table VIII. Commonly Used Anesthetics and Analgesics for Dogs

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Table IX. Commonly Used Anesthetics and Analgesics for Cats

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Anesthesia in Cats	Dose & Route	Comments
Isoflurane (Forane®)	To effect. In general, 3-4% induction, 1-2% maintenance; inhalation	Precision vaporizer, adequate ventilation or scavenging essential
Pentobarbital	20 – 30 mg/kg IV	Caution! Divide dose and administer ½ as bolus and ½ to effect; between 30 – 45 minutes of anesthesia
Ketamine + Diazepam	10 mg/kg (K) + 0.5 mg/kg (D) IV (anesthesia for minor procedures)	Premedicate with an anticholinergic
	5.5 mg/kg (K) + 0.3 mg/kg (D) IV (induction of anesthesia)	Anesthesia can be maintained with inhalant anesthetic (e.g., isoflurane)
Ketamine + Medetomidine	7.0 mg/kg (K) + 0.08 mg/kg (M) IM	Minor procedures; up to 45 minutes anesthesia
Analgesia in Cats		
Morphine	0.1 mg/kg IM or SC	Up to 4 hours analgesia; caution, mania and excitation with overdose
Buprenorphine (Buprenex®)	0.005 – 0.01 mg/kg SC or IM	Up to 12 hours analgesia
Buprenorphine SR/ER	0.12 mg/kg	Up to 72 hours (unknown)
Oxymorphone	0.05 – 0.15 mg/kg IM, SC or IV	Between 3 – 5 hours analgesia; Minimal respiratory depression
Carprofen	4.0 mg/kg SC or IV	Up to 24 hours analgesia
Meloxicam	0.05 mg/kg PO (perioperative pain) 0.1 once, then 0.05 mg/kg (acute pain)	Up to 24 hours
Fentanyl patch	<2.5 kg body weight = ½ of 25 µg/hr patch; >2.5 kg bdy wt = 25 µg/hr patch	Each up to 5 days analgesia; place 8 hours prior to anticipated pain; do not apply heat to patch (e.g., from heating pads)
Sedation in Cats		
Butorphanol + Acepromazine	0.1 – 0.4 mg/kg (B) SC, IM or IV + 0.02 – 0.05 mg/kg (A) SC, IM or IV	
Ketamine	10 – 20 mg/kg (K) IM	
Acepromazine	0.05 – 0.1 mg/kg IM or SC	
Chlorpromazine	1.0 – 2.0 mg/kg IM	
Midazolam	0.2 – 0.4 mg/kg IV or IM	
Diazepam	0.2 – 0.4 mg/kg IV or IM	
Xylazine	0.4 – 0.9 mg/kg SC or IM	

Note: Acetaminophen (Tylenol) may be toxic in cats and should be used with extreme caution in this species. Cats are also sensitive to the toxic effects of aspirin, and fatalities have been reported. Although aspirin can be used in cats, other agents should be considered. Normal values: body temperature 38.0-39.5°C (100.4-103.1°F); heart rate 110-140/min; respiration rate, 20-30/min. Anticholinergic medication (e.g., atropine @ 0.02-0.04 mg/kg SC, IM, or glycopyrrolate @ 0.02 mg/kg IM, SC) may be helpful in anesthetized cats to support the heart rate and reduce bronchial secretions, consult a USF veterinarian.

TableX. Commonly Used Anesthetics and Analgesics for Pigs

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Anesthesia in Pigs	Dose & Route	Comments
Isoflurane (Forane®)	To effect. In general, 3-4% induction, 1-2% maintenance; inhalation	Precision vaporizer, adequate ventilation or scavenging essential

Table XIII. Commonly Used Anesthetics and Analgesics for Birds