University of Cincinnati
Institutional Animal Care and Use Committee

Rodent Anesthesia Guidelines

These guidelines provide general recommendations for anesthesia of laboratory rodents at the University of Cincinnati.

Questions or Schedule training- contact LAMS veterinary staff at 558-5171 or LAMS@uc.edu.

Considerations when performing rodent anesthesia
- **Acclimation period** - at least 48 hours for newly arrived use to minimize affects from shipping stress.
- **Age, strain, gender & body weight** – selection of anesthetic protocol to use.
- **Corneal drying and trauma** - for procedures lasting greater than 5 minutes or when using a facemask, an ophthalmic ointment (e.g., Paralube®) must be used.
- **Hypothermia** – significant effects on heart rate and blood pressure resulting in increased morbidity and/or mortality.
- **Hypoxia** – when oxygen is not delivered, all rodents develop varying degrees of significant effects on heart rate and blood pressure.

Anesthetic delivery mechanisms
- **Inhalation** – preferred method due to safety, anesthetic plane stability, and prevention of hypoxia.
  - **Isoflurane**
    - Anesthetic agent of choice for both short and long procedures.
    - Rapid and reliable recovery.
    - Use of a precision vaporizer gas anesthesia machine with oxygen source to deliver anesthetic is recommended.
    - For induction, turn on vaporizer up to 4% (mice), 5% (rat), and turned down to 2% for maintenance. Oxygen flowmeter should be turned up to 1L/min.
    - Due to the small respiratory capacity in rodents, a non-rebreathing system should be used.
    - Drop box method discouraged - creates high concentrations of isoflurane in the chamber which causes:
      1) Extreme irritation of the nasal mucosa leading to discomfort and distress.
      2) Uncontrolled delivery and potential to reach toxic concentrations - increase risk for anesthetic death.
      3) Human health hazard - use of a fume hood or an anesthetic system equipped with a gas scavenging system should be used.
    - Anesthesia chambers and facemasks are available from LAMS by service request.
- **Injectable** – Intraperitoneal is the most common and preferred route.
  - Other routes include subcutaneous, intramuscular (rats only), and intravenous (catheter placement required).
• Combination of inhalation and injectable anesthetics can be used

Preemptive Analgesia - prevention of pain before the actual pain insult occurs.
• Lowers the amount of general anesthetic needed to maintain a surgical plane of anesthesia.
• Helps prevent the development of ‘wind up’ – painful response to a non-painful stimulus.
• Common preemptive analgesic classes
  o Opioids (Buprenorphine)
  o Non-steroidal anti-inflammatory drugs (Meloxicam)
  o Local anesthetics-Most common - Lidocaine and bupivacaine
    1) Can be diluted in sterile saline to increase volume of injection.
    2) Due to potential cardiovascular effects (e.g., hypotension, dysrhythmias) and/or CNS depression, each animal should be weighed and the maximum safe dosage calculated.

Neonatal Rodent Anesthesia
• Neonatal rodent - mouse or rat < 10 days of age.
• Anesthetic methods – inhalation, physical, and parenteral.
  o Physical – Hypothermia (ONLY for neonates < 6 days of age and short procedures [30 minutes or less])
    1) Proposed mechanism of action - decreases neural conduction and synaptic transmission.
    2) May be painful so avoid direct contact with cooling agent.
    3) Procedure
      a) Place neonates on a latex covered bed of crushed ice/ice water OR in a cut off finger of a latex glove placed in ice water (animal’s head must be held above water to prevent aspiration and death).
      b) Monitor for loss of pedal reflex (no response to toe pinch).
      c) Remove from ice bath and maintain on a chilled cold pack or bed of ice.
      d) Following anesthesia, re-warm slowly (rapid warming can cause tissue damage) using either Circulating water heating pad (40 ºC) or Incubator (33 ºC)
      e) Return to dam when able to crawl.
  o Inhalation
    1) Safe and effective.
    2) Induction time may be longer.
  o Parenteral – not recommended
    1) Increased sensitivity to most injectable anesthetic agents.
    2) Associated with a high anesthetic mortality.
• Parental Cannibalism
  o Common problem with neonatal rodent anesthesia.
  o To minimize:
    1) Ensure neonate is fully recovered before returning to the dam.
    2) Transfer scent of dirty bedding to neonate by gently rubbing/rolling neonate with soiled bedding from the mother’s cage.
3) Place neonate back in the middle of the litter.

- Following any procedure where neonate is removed from dam – ensure neonate nurses within 2 hours. If not, then contact LAMS veterinary staff for immediate assistance.

**Anesthesia Monitoring and Recovery**

- **Parameters to be monitored while under anesthesia**
  - Respiratory rate and pattern
    1) Normal undisturbed awake animal respiratory rate
      a) Mice – 180 breaths/min
      b) Rats - 70-110 breaths/min
      c) During anesthesia - a slow rate drop of 50% is acceptable.
    2) Mucous membrane color - pink (not blue or grey).
    3) Assessment of respiratory rate - movement of chest wall and observation of abdominal movements.
  - Response to stimuli
    1) Loss of pedal withdrawal reflex
    2) Loss of eye blink reflex
    3) Lack of response to a surgical stimulus (e.g., incision)
  - Muscle relaxation

- **Depth of Anesthesia**
  - If too deep
    1) Injectable anesthetics
      a) Appropriate Reversal agent (see references) can be used
      b) Supplemental oxygen via facemask or nose cone
    2) Inhalation anesthesia
      a) Turn of isoflurane vaporizer (leave oxygen on) until condition improves; then turn vaporizer back on.
    3) Ensure normal body temperature

- **Prevention of hypothermia**
  - Use of a recirculating warm water blanket or isothermal heat source.
    1) Place towel or sterile drape between animal and heat source.
    2) Electric heating pads discouraged.
      a) Uneven heating.
      b) Increased risk of thermal injury.
  - Cover animal with sterile drape or gauze helps to conserve body heat.
  - Additional methods
    1) Administration of warmed sterile 0.9% sodium chloride or lactated ringers
      a) Subcutaneous or intraperitoneal
      b) 5-10 ml/kg/hr

- **Recovery**
  - Recover in a separate clean cage without bedding (use sterile paper towel).
  - Continually monitor until sternal.
  - Do not place back in home cage with other animals until fully ambulatory.
  - If needed, provide food and fluid supplements on cage floor.
Recommended Anesthetics in Rodents—see RAP anesthesia standard procedure for recommendations and dosage

REFERENCES