

<b>Institutional Animal Care &amp; Use Program - UTEP</b>	
<b>Title:</b> Veterinary Recommendations for Anesthesia and Analgesia	
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<b>In Effect</b> <input checked="" type="checkbox"/> <b>Rescinded</b> <input type="checkbox"/>	<b>Date Rescinded:</b>

**A. RESPONSIBILITIES**

It is the responsibility of all personnel using animals at The University of Texas at El Paso (UTEP) to abide by this policy. It is the responsibility of the Institutional Animal Care and Use Committee (IACUC) to review for approval, properly justified requests for an exception to this policy.

**B. POLICY**

Compliance with these guidelines is mandatory unless a written exception is approved by the UTEP IACUC for scientific objectives.

**C. BACKGROUND**

Proper anesthetic and analgesic agents must be used to minimize pain and distress during the perioperative period. Withholding anesthesia or analgesia requires scientific justification and IACUC approval. A **multimodal analgesia approach** is recommended, combining different classes of analgesics to address multiple pain pathways (e.g., local anesthetic at incision site + NSAID + opioid).

Reference: Guide for the Care and Use of Laboratory Animals, 8th Edition (NRC).

**D. ANESTHESICS****1) Inhalant Anesthetics**

- **Common agents:** isoflurane, sevoflurane.
- **Preferred method:** Delivery by mask or endotracheal tube via a precision vaporizer.
- Pre-emptive analgesia is necessary.
- Requires an anesthetic machine and scavenging system (active preferred).
- Maintain distance from waste gas resources and ensure proper PPE.
- **Drop jar method:**
  - a) This method is imprecise and does not offer scavenging of anesthetic waste gas.
  - b) Before deciding to use the open-drop method, consider more precise methods.
  - c) Method can only be used for short (30-60 seconds), non-surgical procedures under a certified, up-to-date, chemical fume hood (e.g., genotyping, injections, and tumor, drug pellet, or microchip implantation). The animal must not come into contact with the anesthetic.
- **Advantages:** Rapid control of depth, safe, and does not use controlled substances.
- **Disadvantages:** Requires equipment, training, and proper scavenging.

## 2) Injectable Anesthetics

- **Common agents:** ketamine/xylazine, pentobarbital (IP route).
- **Local anesthetics:** lidocaine, bupivacaine for incision site or nerve blocks.
- **Advantages:** No specialized equipment, portable, and cost-effective.
- **Disadvantages:** Longer recovery, limited depth control, and controlled substance regulations/management (DEA license required).

## 3) Monitoring and Anesthetic Depth

- Depth must be assessed before any surgical manipulation and during the procedure.
- Assess the animal before and during surgery (every 10-15 minutes minimum).
- If procedure lasts >5 minutes, the use of ophthalmic lubricants is required to prevent corneal drying in rodents.
- Thermal support is required for procedures that last >5 minutes.
- **Indicators:** Loss of reflexes (pedal, corneal palpebral), no response to toe pinch.
- **Signs of inadequate depth:** Purposeful movement, reflexes present, response to pain stimuli, twitching whiskers, and changes in heart rate/respiratory rate/blood pressure (monitored using specialized equipment such as a pulse oximeter).

## E. ANALGESIA

### 1) Assessing Pain in Animals

Pain assessment in animals can be challenging, especially in prey species that instinctively hide signs of pain and distress.

Clinical signs vary by species, but common indicators include:

- **Changes in Appearance:**
  - a) Hunched posture
  - b) Scruffy coat
  - c) Porphyrin staining (rats/mice)
- **Activity Changes:**
  - a) Decreased activity or inactivity
  - b) Hyperactivity or pacing
  - c) Abnormal postures (e.g., back arching, belly pressing, wound guarding, writhing)
- **Other Indicators:**
  - a) Decreased appetite
  - b) Isolation from cage mates
  - c) Exaggerated or diminished response to handling
  - d) Vocalization

Recent methods include using a **rodent facial expression (grimace) scale** for pain assessment. Careful observation of appearance and behavior post-surgery is essential to detect subtle changes that may indicate the need for additional pain management.

## 2) Analgesia Guidelines

- Analgesia must be administered to ALL surgical animals unless otherwise justified in the protocol.
- Pre-emptive analgesia (administered before surgery) is strongly recommended.
- If additional analgesia is needed post-surgery, contact LARC veterinary staff.
- Whenever possible, use multimodal analgesia for balanced pain control: Combine local anesthetics at the incision site with systemic agents such as opioids or NSAIDs.

## F) RECOMMENDED PER PROCEDURE

### 1) Rodent Laparotomy (e.g., major surgery)

- Induction and maintenance with appropriate anesthetic (isoflurane, ketamine/xylazine, or pentobarbital).
- Administer opioid analgesic (e.g., buprenorphine, Ethiqx XR) prior to surgery. *NSAIDs (e.g., Carprofen, Meloxicam) may be used as supplemental analgesia but are not recommended as the sole agent for major procedures.*
- Consider a local anesthetic along the incision site for multimodal analgesia.
- Provide analgesics for **at least 48 hours post-operatively**.  
Monitor rodents closely for signs of pain; administer additional analgesia until pain is no longer evident.

### 2) Rodent Subcutaneous Implant or Vascular Catheter Placement (e.g., minor surgery)

- Induction and maintenance with an appropriate anesthetic (isoflurane, ketamine/xylazine, or pentobarbital).
- Administer NSAID or opioid analgesic prior to surgery.
- Consider a local anesthetic along the incision site for multimodal analgesia.
- Provide analgesics for **at least 24 hours post-operatively**.
- Monitor rodents closely for signs of pain; administer additional analgesia until pain is no longer evident.

## G) TYPES OF ANESTHESIA/ANALGESIA

### 1) Neonatal Rodents (mice and rats)

- Neonatal rodents must receive adequate anesthesia and analgesia during surgical procedures.
- Balance safety and effectiveness when selecting anesthetics for neonates.
- Neonates have immature hepatic/renal systems, which can lead to prolonged anesthesia and a narrow safety margin with injectable drugs.
- Opioid analgesics may be used successfully in neonates but should be administered at the lower end of the published dose range to avoid complications.
- **Recommended anesthesia methods:**
  - a) Inhalant anesthetics (isoflurane, sevoflurane)
  - b) Hypothermia (for pups <7 days old)

### Hypothermia Anesthesia

<b>Age</b>	- Altricial rodents up to 7 days old.
<b>Induction</b>	<ul style="list-style-type: none"> <li>- 2-4 minutes.</li> <li>- Protect the pup by placing it into the finger of a glove or a paper-lined test tube. This will prevent skin damage from direct contact with ice/cold water.</li> <li>- Immerse pup in ice water or place on crushed ice (2-3°C or 35-37°F).</li> <li>- Observe pups closely during induction.</li> </ul>
<b>Maintenance</b>	<ul style="list-style-type: none"> <li>- Up to 15 minutes of anesthesia.</li> <li>- Remove pups from the ice bath when adequate anesthesia is achieved (immobile/lethargic).</li> <li>- The pup can be maintained by placing it on an ice pack, covered with a latex/paper towel.</li> </ul>
<b>Recovery</b>	<ul style="list-style-type: none"> <li>- Up to 1 hour.</li> <li>- Avoid rapid warming during the recovery period.</li> <li>- Recommend re-warming in an incubator set to 90-95°F (32-25°C) or in a paper-lined cage set over a circulating warm-water blanket.</li> <li>- Electric heating blankets and heat lamps are not recommended.</li> </ul>
<b>Additional Considerations</b>	<ul style="list-style-type: none"> <li>- Fiber optic lighting should be used during surgical procedures to maintain hypothermia (incandescent lamps can warm the surgical field).</li> <li>- Steps should be taken to avoid rejection by the dam post-surgery.</li> <li>- <b>Recommendation:</b> <ol style="list-style-type: none"> <li>a) Remove blood/disinfectants from the pup after surgery (wipe with wet gauze and dry).</li> <li>b) Make sure the neonate is completely recovered (warm, pink, breathing, moving).</li> <li>c) Place neonates in bedding/nesting material from the home cage to obtain the appropriate scent.</li> <li>d) Return neonates as a group to the home cage.</li> </ol> </li> </ul>

Mouse and Rat Formulary					
Analgesics	Dose (mg/kg)		Route	Frequency	Comments
	Mouse	Rat			
Acetaminophen (Oral dose)		100-300	PO	Every 4 hours	- <b>Not adequate as a sole analgesic.</b> Can use in combination with another class of analgesics for post-op pain.
Acetaminophen (Water bottle)	1-2 mg/ml drinking water	6 mg/ml drinking water	PO	Every 4 hours	- Change the water every other day. - Water must be placed in the cage 48 hours prior to a painful procedure to allow the rats to acclimate.
Buprenorphine	0.05-0.1	0.01-0.05	SC	Every 12 hours	- Excellent for moderate-severe pain (major surgical procedures).
Buprenorphine ER	1-1.2mg/kg	1-1.2mg/kg	SC	Every 72 hours	- Excellent for moderate-severe pain (major surgical procedures). - One dose lasts up to 72 hours.
Ethiqa XR	3.25	0.65	SC	Every 72 hours	- Excellent for moderate-severe pain (major surgical procedures). - One dose lasts up to 72 hours.
Carprofen	5	5	SC	Every 24 hours	- Good for mild to moderate pain (minor surgical procedures).
Carprofen/ Meloxicam Tabs (Bioserv®)			PO	Every 24 hours	- Administration based on manufacturer recommendations. - Mouse/rat formulations of Meloxicam are available. - Single-rodent formulations of Carprofen are available.
Meloxicam	1-2	1-2	PO, SC	Every 24 hours	- Good for mild to moderate pain (minor surgical proc.).
Meloxicam SR	2	4	SC	Mouse: Every 24 hours Rat: Every 72 hours	- Provides stable analgesia after a single administration. - Compounded product from Zoopharm. - Since mice metabolize meloxicam 20x higher than rats, sustained-release therapeutic levels may not be >24 hrs.
Tramadol	20-40	5-20	IP		- For chronic or severe pain. Literature does not define the recommended dosing interval in rodents. In other species administered up to TID. Start at BID dosing.

Anesthetics	Mouse	Rat	Route	Duration	Comments	
Recommended: Isoflurane	2-5%	2-5%	Inhalation	Min. time necessary/procedure	- <b>Gold standard anesthetic.</b> Must have appropriate equipment for safe use (precision vaporizer/scavenging).	
Ketamine/ xylazine	90-120 10	40-80 5-10	IP	30-45 minutes	- Ketamine combinations are the next-best anesthetics if isoflurane cannot be used.  - <b>Do not re-dose xylazine.</b>  - If an additional dose is needed, provide ~1/3 dose of ketamine.	
Ketamine/ medetomidine	50-75 1-10	60 0.4	IP			
Ketamine/ xylazine/ acepromazine	100 2.5 2.5	40 8 4	IM, IP			
Pentobarbital	30-90	30-60	IP	60-120 minutes	- Not readily available. - High cost assoc. with pharmaceutical-grade formulations.	
Tribromoethanol	250	Not recommended	IP		- Very short-term anesthesia, not recommended for survival procedures; inappropriate storage or mixing may result in toxicity. <b>Must scientifically justify use in protocol.</b>	
Reversal Agents	Mouse	Rat	Route	Duration	Comments	
Yohimbine	0.2	0.2	IP	N/A	Reverses xylazine	
Atipamezole	1	1	SC	N/A	Reverses xylazine and medetomidine	
Local anesthetics	Mouse	Rat	Route	Duration	Comments	
Bupivacaine/ Lidocaine mixture	1.5 mg/kg	1.5 mg/kg	SC	4-8 hours	Slow onset, long duration	Mix together in the same syringe for infiltration around the incision
	0.5 mg/kg	0.5 mg/kg		<1 hour	Rapid onset, short duration	

## H) REFERENCES

- 1) Fish RE et al. Anesthesia and Analgesia in Laboratory Animals, 2nd edition, 2008.
- 2) Carpenter J. Exotic Animal Formulary, 4th ed, 2012.