

# Analgesia Guidance for Rodent Procedures

**Important tips:**

1. Expected post-procedural pain level is based on the procedure being performed optimally by skilled personnel. Sub-optimal performance of any procedure is likely to produce more pain than is typical.
2. Consider the effects of using the specific analgesic (NSAID or opioid) on the scientific objectives of the study.
3. Include multiple (or all) options in your protocol to maintain flexibility. See additional information on drugs below chart.
4. Animals should be monitored as follows: moderate pain → at least once daily; severe pain → at least twice daily until analgesia is done and the animal is stable (see green post-op card instructions).
5. Analgesia lasting longer than required is permitted (e.g. sustained release formulas).
6. More frequent dosing may be required in the initial post-op period, with less frequent dosing needed as the animal heals.
7. Other analgesic regimens may be proposed. Contact a veterinarian to discuss available alternatives. All analgesic regimens must be reviewed and approved by the IACUC prior to use.
8. Multi-modal pain relief (e.g. a combination of local anesthetic, opioid, and NSAID) is generally superior to single-modality analgesia.

Rodent Procedure Examples	Expected Post-procedural Pain Level	Analgesic Options (see additional info that follows)
<ul style="list-style-type: none"> <li>• IP, SC, or IV injection</li> <li>• Percutaneous catheter insertion</li> <li>• Genotyping (tail snip, toe clip, ear notch)</li> <li>• SC tumor implant by needle</li> <li>• Retro-orbital blood collection or injection (typically requires general anesthesia)</li> </ul>	<p>No Pain or Minimal or Momentary Pain</p>	<ul style="list-style-type: none"> <li>• Analgesia is not required.</li> <li>• Any of the “mild pain” options may be used if desired.</li> </ul> <p style="color: red;">In general, if anesthesia is not required, then analgesia is not required.</p>

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Rodent Procedure Examples	Expected Post-procedural Pain Level	Analgesic Options (see additional info that follows)
<ul style="list-style-type: none"> <li>• Skin incision only (any site)</li> <li>• Subcutaneous implant (e.g., osmotic pump, pellet, transponder)</li> <li>• Catheter placement via cut down</li> <li>• Punch biopsy of skin</li> <li>• Vascular access port implantation</li> <li>• Ocular (eye) procedure—minor</li> </ul>	<p>Mild Pain (analgesia to last at least 8 hours)</p>	<ul style="list-style-type: none"> <li>• <u>Option 1</u>: Local anesthetic (incisional)</li> <li>• <u>Option 2</u>: 1 dose of buprenorphine</li> <li>• <u>Option 3</u>: NSAID (to last at least 8 hours)</li> </ul> <p style="text-align: right; color: red;">General anesthesia is required.</p>
<ul style="list-style-type: none"> <li>• Embryo transfer via lumbar incision</li> <li>• Castration/ Vasectomy</li> <li>• Intracranial surgery—minor</li> <li>• Thyroidectomy</li> <li>• Thymectomy</li> <li>• Mammary fat pad manipulation</li> <li>• Orthopedic procedures—minor</li> <li>• Ocular (eye) procedure—moderate</li> <li>• Tissue dissection/transection (e.g. incisional biopsy or tumor removal)</li> </ul>	<p>Moderate Pain (analgesia needs to last 12-24 hours)</p>	<ul style="list-style-type: none"> <li>• <u>Option 1</u>: Lidocaine or Bupivacaine local at the time of surgery followed by NSAID (12-24 coverage)</li> <li>• <u>Option 2</u>: Buprenorphine + injectable NSAID (12-24 hour coverage)</li> <li>• <u>Option 3</u>: Buprenorphine + oral NSAID (12-24 hour coverage)</li> <li>• <u>Option 4</u>: 1 dose of Buprenorphine-SR (lasts 72 hours)</li> </ul> <p style="text-align: right; color: red;">General anesthesia is required.</p>
<ul style="list-style-type: none"> <li>• Thoracotomy (use of local anesthetic on incision site is highly desirable— see following pages)</li> <li>• Laparotomy (for C-section, GI, kidney, spleen, liver, reproductive, or other abdominal procedures)</li> <li>• Craniotomy—with bone removal— major</li> <li>• Laminectomy/Vertebral surgery</li> <li>• Nerve surgery</li> <li>• Ocular (eye) procedure—major</li> <li>• Orthopedic procedure—major</li> </ul>	<p>Severe Pain (analgesia needs to last 24-48 hours)</p>	<ul style="list-style-type: none"> <li>• <u>Option 1</u>: Lidocaine or Bupivacaine local at the time of surgery followed buprenorphine +/- NSAID (thoracotomy)</li> <li>• <u>Option 2</u>: Buprenorphine + injectable NSAID (24-48 hour coverage)</li> <li>• <u>Option 3</u>: Buprenorphine-SR given 1 hour prior to surgery; +/- local anesthetic; +/- oral NSAID to reduce swelling and increase comfort</li> </ul> <p style="text-align: right; color: red;">General anesthesia is required.</p>

### Major vs. Minor Procedures

- **Minor** procedures typically do not result in permanent or chronic impairment. Healing is rapid with little obvious change in the area or organ
- **Major** procedures require more extensive tissue resection and organ involvement resulting in delayed healing or chronic inflammation.

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## Additional Information on Rodent Analgesics

### I. Systemic analgesics

#### A. Buprenorphine (Buprenex®)

Narcotic/Opioid (Schedule III)

Drug concentration in ampule: 0.3 mg/ml

Analgesic duration: 4-8 hours

Dosages:

Rats\*: 0.01 – 0.05 mg/kg given SC (preferred route) or IP every 6-8 hours

Mice: 0.05-0.1 mg/kg given SC (preferred route) or IP every 4-6 hours

\*may cause pica (eating of non-food substances) in rats; use lower dose range for Sprague- Dawley rats

#### B. Buprenorphine-Sustained Release (“Bup-SR”)

Narcotic/Opioid (Schedule III) from [ZooPharm](#)

Drug Concentration: 1 mg/ml (5 ml vial)

Analgesic duration: 72 hours

Bup-SR is preferred to standard Buprenorphine as it provides 72 hours of analgesic coverage with one single injection.

Dosages:

Rats: 1.0 - 1.2 mg/kg\* *[for a single 72-hour SC injection]*

Mice: 0.5 – 1.0 mg/kg\* *[for a single 72-hour SC injection]*

#### C. Carprofen (Rimadyl®) Non-steroidal anti-inflammatory (NSAID)

##### 1. Carprofen Oral (chewable tabs): from [Bio-serv](#)

Flavored chewable tablet containing 2 mg carprofen/5 gram tablet.

How to use: Placebo tab (no carprofen) can be used 3 days prior to surgery to acclimate the animal. Place on the cage floor for easy access. The tablet is nutritionally complete, stimulates appetite, and allows animals time to recover undisturbed. It is important to verify that animals are eating the tablet in order to ensure appropriate analgesic coverage.

Dosages:

Rats: One 5 gm tablet per rat per day

Mice: ¼ tablet per mouse per day (one 5 gm tablet for up to 4 mice)

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2. Carprofen Oral (Drinking water):

Drinking water is treated with injectable carprofen (50mg/ml) to provide therapeutic levels.

How to use: Determine size of water bottle used in cages (most commonly 400 ml bottles).

All water bottle doses are approximations based on normal daily water consumption for a given species. **In order to provide adequate analgesia, carprofen-containing water bottles must be placed on the cage at least 12 hours prior to painful procedures. Change carprofen-containing water bottles every 7 days.**

Dosages:

Rats: 0.05mg to 0.1mg carprofen per ml water [Add 0.1 to 0.2 ml carprofen (50mg/ml) per 100 ml water]

Mice 0.05mg carprofen per ml water [Add 0.1 ml carprofen (50 mg/ml) per 100 ml water]

3. Carprofen Injectable:

Drug concentration in bottle: 50 mg/ml \*Store at 4° C

How to use: Drug is viscous and needs to be diluted in sterile water 1:10 or more.

Administer injectable solution as below using a 25 or 27g needle. The carprofen chewable tablet may be used to extend analgesic coverage beyond 24 hours after the initial carprofen injection.

Dosages:

Rats: 5-10 mg/kg SC every 24 hours for up to 3 days

Mice: 5-10 mg/kg SC every 12 hours for up to 3 days

D. **Meloxicam (Metacam<sup>®</sup>)** Non-steroidal anti-inflammatory (NSAID)

1. Meloxicam Oral (chewable tab): available from [Bio-Serv](#)

Flavored, nutritionally complete chewable 5 gram tablet

How to use: Placebo tab (no meloxicam) can be used 3 days prior to surgery to acclimate the animal. Place on the cage floor for easy access.

Dosages:

Rats: One 5 gm tablet/rat/day (0.5 mg meloxicam/tablet)

Mice: One 5 gm tablet/mouse/day (0.125 mg meloxicam/tablet)

2. Meloxicam Injectable\*: (5 mg/ml)

How to use: Administer injectable solution as below using a 25 or 27g needle.

Dosages:

Rats: 1 mg/kg SC every 12-24 hours for up to 3 days

Mice: 5-10 mg/kg every 8-12 hours for up to 3 days

[Meloxicam-SR is not recommended for use in rodents]

3. Meloxicam Oral Solution (for oral dosing): (1.5 mg/ml)

How to use: Drug must be diluted with sterile diluent 1:10 prior to use. Specific training in oral dosing by gavage is required. Contact DCM to arrange training.

Dosages:

Rats: 0.5 mg/kg PO every 12 hours up to 3 days

Mice: 2.5 - 5 mg/kg PO every 12 hours up to 3 days

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## II. Local anesthetics that provide analgesia

General considerations for local analgesics:

- Provides local pain relief, and is most effective when injected BEFORE making the incision.
- Use in the skin around the **planned** incision site for surgeries. Intradermal injection is preferred.
- For thoracotomies, inject into the intercostal space (rib muscles) at the planned site of incision. Can be used to supplement systemic analgesia (opioids, NSAIDS)

### A. Bupivacaine (Marcaine®) 0.5%

Concentration: 5 mg/ml (0.5%); sold in a 50ml vial

Analgesic duration: 4 – 8 hours, slow onset

How to use: Dilute in sterile water to 2.5mg/ml (0.25%).

Dose: Do not exceed 8mg/kg SC

### B. Lidocaine (Xylocaine®) 2%

Concentration: 20 mg/ml (2%); sold in a 50 ml vial

Analgesic duration: 1 hour, fast onset

How to use: Some formulations of lidocaine include epinephrine to promote vasoconstriction (to keep anesthetic agent in area longer). Do not use if epinephrine will complicate research study. Dilute with sterile water to final concentration of 5 mg/ml (0.5%) before use.

Dose: Do not exceed 7 mg/kg

## III. Documentation of Analgesic Administration

Administration of post-operative analgesics must be documented. Federal regulators and inspectors consider a lack of documentation to mean analgesics were not provided and would classify that event as non-compliance. Please use the links below for more information about how to document analgesic administration.

Post-Surgical Monitoring Records (Green Cards) are required for all survival surgery procedures. They may also be required for prolonged anesthesia exposure or other painful procedures as described in your approved IACUC protocol.

1. <https://research.wustl.edu/green-card-instructions/>.
2. <https://research.wustl.edu/avery-green-sticker-templates/>

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## References

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