**DLAM**

**Anesthesia and Analgesia in Laboratory Animals at UNTHSC**

MOUSE FORMULARY

Note that all of these doses are approximations and must be titrated to the animal’s strain, age, sex and individual responses. Significant departures from these doses should be discussed with a veterinarian. Doses will also vary depending on what other drugs are being administered concurrently.

All doses are listed as milligrams per kilogram (mg/kg) unless otherwise noted. Dilution of injected drugs allows more precise dosing, but may shorten the shelf-life of the compound. (UNTHSC-DLAM standard: diluted drugs should be labeled, then discarded after 21 days).

**Inhalation Anesthetics**

Recommended:

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| --- | --- | --- | --- | --- |
| **Drug Name** | **Dose** | **Route** | **Frequency** | **Notes** |
| Isoflurane | 1-3% to effect (up to 5% for induction) | Inhalation | Whenever general anesthesia is required | Must use precision vaporizer – survival surgery requires concurrent preemptive analgesia |
| Sevoflurane | 1-3% to effect (up to 8% for induction) |
| Nitrous oxide (N2O) | Up to 60% with oxygen | Whenever deep sedation or general anesthesia is required | Not acceptable for surgery as sole agent – usually used with inhalant anesthetic to potentiate effect and lower required dose |
| Carbon dioxide | To effect (cannot determine percentage) | Once, at time of euthanasia | May be used for fast terminal procedure followed by euthanasia |

**Ketamine Combinations**

Recommended:

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| --- | --- | --- | --- | --- |
| **Drug Name** | **Dose** | **Route** | **Frequency** | **Notes** |
| Ketamine-Xylazine-Acepromazine | 70-100 (K) + 10- 20 (X) + 2-3 (A) (in same syringe)  | Injection | As needed | May not produce surgical-plane anesthesia for major procedures. If redosing, use ketamine alone. May be partially reversed with Atipamezole (better option) or Yohimbine |
| Ketamine-Medetomidine | 50-75 + 0.5 -1 IP (in same syringe) | Injection | May not produce surgical-plane anesthesia for major procedures. If redosing, use ketamine alone. May be partially reversed with Atipamezole |
| Ketamine-Xylazine | 80-100 + 5-10 IP (in same syringe) | Injection | May not produce surgical-plane anesthesia for major procedures. If redosing, use ketamine alone. May be partially reversed with Atipamezole or Yohimbine |
| Ketamine-Xylazine | 80-100 + 5-10 IP (in same syringe) | Injection |
| Ketamine-Midazolam | 80-100 + 4-5 IP (in same syringe) | Injection | May not produce surgical-plane anesthesia for major procedures, but may be useful for restraint.  |
| Ketamine alone | 100-200 IP | Injection | Deep sedation, but not surgical anesthesia. Not often used alone. |

**Reversal Agents**

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| --- | --- | --- | --- | --- |
| **Drug Name** | **Dose** | **Route** | **Frequency** | **Notes** |
| Atipamezole | 0.1 - 1.0 | SC or IP | Any time medetomidine or xylazine has been used | More specific for medetomidine than for xylazine (as a general rule, Atipamezole is dosed at the same volume as Medetomidine, though they are manufactured at different concentrations). |
| Yohimbine | 1.0 – 2.0 | Any time xylazine has been used | For reversal of xylazine effects  |

**Other Injectable Anesthetics**

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| --- | --- | --- | --- | --- |
| **Drug Name** | **Dose** | **Route** | **Frequency** | **Notes** |
| Sodium pentobarbital (Nembutal)  | 40 – 50 | IP | Recommended for terminal/acute procedures only, with booster doses as needed | Consider supplemental analgesia (opioid or NSAID) for invasive procedures |
| Tribromoethanol (Avertin) | 250-500  | May be used once for survival procedure (boosted as necessary during procedure) and once for terminal/acute procedure | Diluted Avertin Solution must be used within 30 days of initial preparation and be properly stored. Lower concentration (1.25%) less likely to cause peritonitis. See recipe below. |
| Propofol  | 12-26 | IV | As needed | Only useful IV, so therefore limited usefulness in mice. Respiratory depression upon induction is possible.  |

**Opioid Analgesia**

Recommended:

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| **Drug Name** | **Dose** | **Route** | **Frequency** | **Notes** |
| Buprenorphine | 0.05 - 0.1  | SC or IP | Used pre-operatively for preemptive analgesia and post-operatively every 4-12hrs  | When used as sole analgesic, typical regimen is: once at time of procedure, second dose will be administered 4-6 hours later. Additional doses every 8-12hrs as needed. Consider multi-modal analgesia with NSAID and local analgesic. |

**Non-Steroidal Anti-Inflammatory Analgesia (NSAID)**

Note that prolonged use my cause renal, gastrointestinal, or other problems

Recommended:

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| **Drug Name** | **Dose** | **Route** | **Frequency** | **Notes** |
| Carprofen | 5-10 | SC | Used pre-operatively for preemptive analgesia and post-operatively every 12-24 hour | Depending on the procedure, may be used as sole analgesic, or as multi-modal analgesia with buprenorphine. |

Recommended:

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| **Drug Name** | **Dose** | **Route** | **Frequency** | **Notes** |
| Meloxicam | ~ 5-10 | PO, IM or SC | Used pre-operatively for preemptive analgesia and post-operatively every 12-24 hour | Depending on the procedure, may be used as sole analgesic, or as multi-modal analgesia with buprenorphine. |
| Ketoprofen | 2 – 5  | SC |
| Ketorolac | 5 – 7.5  | Oral or SC |
| Flunixin meglumine | ~ 2 | SC |

**Local Anesthetic/Analgesics**

Lidocaine and Bupivacaine may be combined in one syringe for rapid onset and long duration analgesia.

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| **Drug Name** | **Dose** | **Route** | **Frequency** | **Notes** |
| Lidocaine hydrochloride | Dilute to 0.5%, do not exceed 7 mg/kg total dose | SC or Intra-Incisional | Use locally before making surgical incision, or before final skin closure | Faster onset than bupivacaine but short (<1 hour) duration of action |
| Bupivacaine | Dilute to 0.25%, do not exceed 8 mg/kg total dose | SC or Intra-Incisional | Use locally before making surgical incision, or before final skin closure | Slower onset than lidocaine but longer (~ 4-8 hour) duration of action |

**Avertin Recipe**

100% stock avertin

Mix: add Tribromoethanol to Tertiary Amyl Alcohol and dissolve by heating and stirring. Add distilled water and continue until the solution is well mixed. Store wrapped in foil (light sensitive solution, ok to use brown glass bottle), 4° C.

Solution may have to be warmed to dissolve. Mixture should be clear.

* Warning! Decomposition can result from improper storage.
* 2.5% Diluted Avertin Solution must be used within 30 days of initial preparation and be properly stored. Be sure to label the container with the date of preparation.

For use in mice, dilute the 100% to 2.5% (1:40) using diluent, water or isotonic saline.

**Diluent Recipe**

0.8% NaCl

1mM Tris (pH 7.4)

0.25mM EDTA

Check the pH. Adjust to pH 7.4.

To make 50 ml 2.5% avertin, add 1.25 ml 100% to 48.75 ml liquid (diluent, water or saline)

Filter .22 micron

Store at 4° C, away from light in foil wrap or brown bottle

Dosage for mice may vary with different preparations of Avertin. Dosage should be redetermined each time a 100% stock is made up. Test for best effect in a few mice before choosing dose. Allow 5-10 min to take effect.