

**UC Berkeley**  
**Office of Laboratory Animal Care**  
**Rat Anesthesia and Analgesia Formulary**

<b>Drug name</b>	<b>Dose &amp; Route</b>	<b>Frequency</b>	<b>Notes</b>
<b>Inhalation anesthetics</b>			
<b>Recommended:</b> Isoflurane or Sevoflurane	1-3% inhalant to effect (up to 5% for induction). Up to 8% for Sevoflurane	Whenever general anesthesia is required	Survival surgery usually requires concurrent preemptive analgesia and use of precision vaporizer
<b>Ketamine combinations</b>			
<b>Recommended:</b> Ketamine-Xylazine  Best used in conjunction with isoflurane	40-80 Ket + 5-10 Xylazine mg/kg IP (in same syringe)	As needed	May not produce surgical-plane anesthesia for major procedures in some strains. May be partially reversed with Atipamezole. If more anesthetic is required, add isoflurane to effect ( <b>recommended</b> ) or re-dose about one-fourth initial dose.
<b>Recommended:</b> Ketamine-Xylazine-Acepromazine  Best used in conjunction with isoflurane	40-80 Ket + 5-10 Xylazine + 1-2 Acepromazine mg/kg IP; (in same syringe)	As needed	May not produce surgical-plane anesthesia for major procedures on some strains. May be partially reversed with Atipamezole. If more anesthetic is required, add isoflurane to effect ( <b>recommended</b> ) or re-dose about one-fourth initial dose.
Ketamine-Dexmedetomidine  Best used in conjunction with isoflurane	60-75 Ket + 0.2-0.5 Dex mg/kg IP (in same syringe)	As needed	May not produce surgical-plane anesthesia for major procedures on some strains. May be partially reversed with Atipamezole. If more anesthetic is required, add isoflurane to effect ( <b>recommended</b> ) or re-dose about one-fourth initial dose.
<b>Reversal agents</b>			
Atipamezole	1-2.5 mg/kg subcutaneous or IP	Any time dexmedetomidine or xylazine has been used	~1 mg for every 10 mg of xylazine; use 5 mg for every 1 mg of dexmedetomidine

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<b>Other injectable anesthetics</b>			
Sodium pentobarbital	30-60 mg/kg IP	Recommended for terminal/acute procedures only, with booster doses as needed	Consider supplemental analgesia (opioid or NSAID) for invasive procedures.
<b>Hypothermia for Neonatal Anesthesia</b>			
Hypothermia	Ice-water slurry	Once. Only for mice up to 7 days of age	Rat pup must not be placed in direct contact with ice-water slurry
<b>Opioid analgesia</b>			
<b>Recommended:</b> Buprenorphine	0.01 - 0.05 mg/kg SC or IP	For pain management during and after surgeries. Re-dose in 4 – 8 hours if used without NSAID. When re-dosing is necessary after the second dose, administer every 8 – 12 hours.  If using NSAID, second dose of buprenorphine may not be necessary depending on the procedure.	Recommend administering 30-60 minutes before surgery if using isoflurane; after surgery if using a ketamine combination.  WARNING: May induce pica (abnormal consumption of bedding or other inappropriate material) in rats. Contact veterinary staff if this is noted.  Light sensitive - always store in a dark place and protect from light.
Sustained-Release Buprenorphine	1.2 mg/kg SC only	Used once at time of surgery	Not to be used IP.

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	DO NOT DILUTE	for very invasive surgeries (thoracotomy; orthopedics).  If needed for additional pain control, re-dose after 48-72h from initial administration.	WARNING: May induce pica (abnormal consumption of bedding or other inappropriate material) in rats. Contact veterinary staff if this is noted.
Extended-Release Buprenorphine	0.65 mg/kg SC only  DO NOT DILUTE	Used once at time of surgery for very invasive surgeries (thoracotomy; orthopedics)  If needed for additional pain control, re-dose after 48-72h from initial administration.	Not to be used IP.  WARNING: May induce pica (abnormal consumption of bedding or other inappropriate material) in rats. Contact veterinary staff if this is noted.
<b>Non-steroidal anti-inflammatory analgesia (NSAID)</b>			
<b>Recommended:</b> Carprofen	5 mg/kg SC or PO	Used pre-operatively for preemptive analgesia, with a second dose the next day and then every 24 hour if needed	Depending on the procedure, may be used as sole analgesic, or as multi-modal analgesia with buprenorphine. Oral formulations also available <a href="https://www.bio-serv.com/product/RRMD.html">https://www.bio-serv.com/product/RRMD.html</a>
<b>Recommended:</b> Meloxicam	1-2 mg/kg SC or PO	Used pre-operatively for preemptive analgesia, with a second dose	Depending on the procedure, may be used as sole analgesic, or as multi-modal analgesia with

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		the next day and then every 24 hour if needed	buprenorphine. Oral formulations also available
Other NSAIDs: Ketoprofen, Flunixin	2 – 5 mg/kg 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.
<b>Local anesthetic/analgesics</b>			
<b>Recommended:</b> Bupivacaine	Dilute to 0.25%, up to 0.3cc SC or intra-incisional	Use locally before making surgical incision	Slower onset than lidocaine but longer (~ 4-8 hour) duration of action
Lidocaine hydrochloride	Dilute to 0.5%, up to 0.3cc SC or intra-incisional	Use locally before making surgical incision	Faster onset than bupivacaine but short (<1 hour) duration of action