

IACUC Reference Document

Analgesia and Anesthesia for Laboratory Animals

Federal law requires the administration of analgesia to laboratory animals if subjected to painful procedures, unless there is scientific justification to withhold. Principle IV of the US Government Principles for the Utilization and Care of Vertebrate Animals Used in Testing, Research, and Training states: *“Proper use of animals, including the avoidance or minimization of discomfort, distress, and pain when consistent with sound scientific practices, is imperative. Unless the contrary is established, investigators should consider that procedures that cause pain and distress in human beings may cause pain and distress in other animals.”* This table provides drug dosages for commonly used anesthetics and analgesics.

Analgesics Recommended for each Species

Species	Drug	Dose and Route of Administration	Comments
Mouse	Buprenorphine*	0.05-0.1 mg/kg, subq, pre-operatively for preemptive analgesia and every 12 hours	Opioid partial agonist
	Buprenorphine SR*	0.5-1.0 mg/kg (per manufacturer) 1.2mg/kg (Clark, et al. JAALAS 2014) Subq pre-operatively for preemptive analgesia and every 48-72 hrs.	Sustained release formulation
	Flunixin	2.5 mg/kg, subq, pre-operatively for preemptive analgesia and every 12 hours	NSAID, may cause gastric ulceration if overdosed
	Carprofen	5-10 mg/kg subq pre-operatively for preemptive analgesia and post-operatively every 12-24 hour	NSAID, may cause gastric ulceration if overdosed
	Meloxicam	5-10 mg/kg subq or PO pre-operatively for preemptive analgesia and post-operatively every 12-24 hour	NSAID, may cause gastric ulceration if overdosed
	Ketoprofen	2-5 mg/kg subq pre-operatively for preemptive analgesia and post-operatively every 12-24 hour	NSAID, may cause gastric ulceration if overdosed
Rat	Buprenorphine*	0.01-0.05 mg/kg, subq or iv, pre-operatively for preemptive analgesia and every 8-12 hours	Opioid, partial agonist
	Buprenorphine SR*	1.0-1.2 mg/kg (per manufacturer) 0.3-1.2mg/kg (Chum, et al. JAALAS 2014) Subq pre-operatively for preemptive analgesia and every 48-72 hrs.	Sustained release formulation
	Flunixin	2.5 mg/kg, subq, pre-operatively for preemptive analgesia and every 12 hours	NSAID, may cause gastric ulceration if overdosed
	Carprofen	5-10 mg/kg subq pre-operatively for preemptive analgesia and post-operatively every 12-24 hour	NSAID, may cause gastric ulceration if overdosed
	Meloxicam	5-10 mg/kg subq or PO pre-operatively for preemptive analgesia and post-operatively every 12-24 hour	NSAID, may cause gastric ulceration if overdosed
	Ketoprofen	2-5 mg/kg subq pre-operatively for preemptive analgesia and post-operatively every 12-24 hour	NSAID, may cause gastric ulceration if overdosed
Guinea pig	Buprenorphine*	0.05 mg/kg, subq, pre-operatively for preemptive analgesia and every 8-12 hours	Opioid partial agonist
	Ketoprofen	1 mg/kg subq or IM pre-operatively for preemptive analgesia and post-operatively every 12-24 hour	NSAID, may cause gastric ulceration if overdosed
	Flunixin	2.5 mg/kg, subq or IM, pre-operatively for	NSAID, may cause gastric

		preemptive analgesia and every 12 hours	ulceration if overdosed
	Carprofen	1-4 mg/kg subq or PO pre-operatively for preemptive analgesia and post-operatively every 12-24 hour	NSAID, may cause gastric ulceration if overdosed
	Meloxicam	0.5 mg/kg subq or PO pre-operatively for preemptive analgesia and post-operatively every 12-24 hour	NSAID, may cause gastric ulceration if overdosed
Rabbit	Buprenorphine*	0.01-0.05 mg/kg, subq or iv, pre-operatively for preemptive analgesia and every 8-12 hours	Opioid Partial Agonist
	Flunixin	1.1 mg/kg, subq or im, pre-operatively for preemptive analgesia and every 12 hours	NSAID, may cause gastric ulceration if overdosed
	Ketoprofen	3 mg/kg, im pre-operatively for preemptive analgesia and post-operatively every 12-24 hour	NSAID, may cause gastric ulceration if overdosed
	Carprofen	1-2 mg/kg, im or subq pre-operatively for preemptive analgesia and post-operatively every 12-24 hour	NSAID, may cause gastric ulceration if overdosed
	Meloxicam	Loading dose of 1.0 mg/kg PO/SC pre-operatively, then follow up with 0.5 PO post-operatively every 12-24 hour	NSAID, may cause gastric ulceration if overdosed

Anesthesia Regimes Recommended for each Species

Species	Drug/Method	Dose and Route of Administration	Comments
Mouse	Isoflurane/Inhalant	5% for induction 1-3 for maintenance	Good for all procedures requiring anesthesia
	Ketamine* and Xylazine Parenteral Administration	90-120mg/kg ketamine IP 10mg/kg xylazine IP	Good for short, surgical procedures
	Ketamine*/Xylazine/Acepromazine Parenteral Injection	30mg/kg ketamine IP 6mg/kg xylazine IP 1mg/kg IP	Good for longer, major surgery
	Ketamine* and diazepam	80-100 + 4-5 IP (in same syringe)	May not produce surgical-plane anesthesia for major procedures, but may be useful for restraint, or as pre-anesthetic in conjunction with isoflurane.
	Ketamine-Dexmedetomidine	50-75 + 0.25-0.5 IP (in same syringe)	May not produce surgical-plane anesthesia for major procedures. If redosing, use ketamine alone. May be partially reversed with Atipamezole. If more anesthetic is required, add isoflurane to effect (recommended) or re-dose about one-third initial dose of ketamine alone.
Rat	Isoflurane/Inhalant	5% for induction 1-3 for maintenance	Good for all procedures requiring anesthesia
	Ketamine* and Xylazine Parenteral Administration	90mg/kg ketamine IM 10mg/kg xylazine IM	Good for short, surgical procedures

	Ketamine*/Xylazine/Acepromazine Parenteral Injection	40 - 80 Ketamine + 8 Xylazine + 4 Acepromazine; (in same syringe)	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 (recommended) or re-dose about one-third initial dose of ketamine alone
	Ketamine* and dexmedetomidine	60 - 75 ketamine + 0.2 – 0.5 dexmedetomidine IP (in same syringe)	May not produce surgical-plane anesthesia for major procedures. If redosing, use ketamine alone. May be partially reversed with Atipamezole. If more anesthetic is required, add isoflurane to effect (recommended) or re-dose about one-third initial dose of ketamine alone.
Guinea pig	Isoflurane/Inhalant	5% for Induction, 1-3 for maintenance	Good for all procedures requiring anesthesia
	Ketamine* and Xylazine Parenteral Administration	50mg/kg ketamine IP 5mg/kg IP	Good for short, procedures
	Ketamine* and Acepromazine	20-40 0.5 mg/kg, IM IP	Good for short, surgical procedures
	Ketamine* and medetomidine	40 0.25-0.5 mg/kg, IM	20-30 minutes duration
	Ketamine* and diazepam	20-40 2-3 mg/kg, IM IP	Good for short, surgical procedures
	Telazol	20-40 mg/kg, IM IP	Good for short, surgical procedures
Rabbit	Isoflurane/Inhalant	5% for Induction, 1-3 for maintenance	Good for all procedures requiring anesthesia
	Ketamine* and Xylazine Parenteral Administration	35mg/kg ketamine IM 5mg/kg xylazine IM	Good for short, procedures
	Ketamine*/Xylazine/Acepromazine Parenteral Injection	35mg/kg ketamine IM 5 mg/kg IM xylazine IM 0.75 mg/kg acepromazine IM	Good for short, surgical procedures
	Ketamine* and diazepam	10K + 0.5 D IV (in same syringe)	Follow with isoflurane to maintain anesthesia

References: Hawk and Leary, Formulary for Laboratory Animals, 2nd Ed. 1999. Iowa State University Press

Anesthesia and Analgesia in Laboratory Animals (1997). ACLAM Series **Anesthetic Regimes for laboratory Animals*** Controlled

Substances requires prior authorization from the Controlled Substance Manager (619) 594-2865

UCSF small animal formulary

University of Colorado formulary

<http://www.srvet.net/index.php/other/buprenorphine-sr/35-main/main/95-buprenorphinesrdosage>

Clark, TS, et al. Pharmacokinetic comparison of sustained-release and standard buprenorphine in mice. 2014. JAALAS 53(4):387-91.

Chum, HH, et al. Antinociceptive effects of sustained-release buprenorphine in a model of incisional pain in rats. 2014 JAALAS 53(2):193-7.