

**SUNY UPSTATE MEDICAL UNIVERSITY
DEPARTMENT OF LABORATORY ANIMAL RESOURCES**

GUIDELINES FOR ANESTHESIA AND ANALGESIA IN LABORATORY ANIMALS

MOUSE

Anesthesia in Mice	Dose & Route	Comments
Isoflurane (Forane®)	To effect. In general, 3-4% induction, 1-2% maintenance; inhalation	Precision vaporizer, adequate ventilation or scavenging essential
Halothane (Fluothane®)	To effect. In general, 3-4% induction, 1-2% maintenance; inhalation	Precision vaporizer, adequate ventilation or scavenging essential
Enflurane (Ethrane®)	To effect. In general, 3-4% induction, 1-2% maintenance; inhalation	Precision vaporizer, adequate ventilation or scavenging essential
Pentobarbital	35 mg/kg IV 40 – 70 mg/kg IP	Caution! Potentially significant cardiovascular and respiratory depression, variable response
Thiopental	50 mg/kg IP 25 mg/kg IV	
Tribromoethanol (Avertin)	125-250 mg/kg IP	Store at 4°C; dark conditions
Ketamine + Xylazine	100 mg/kg (K) + 10 mg/kg (X) IP	
Ketamine + Xylazine + Acepromazine	100 mg/kg (K) + 10 mg/kg (X) + 3 mg/kg (A) IP	
Ketamine + Medetomidine	75 mg/kg (K) + 1.0 mg/kg (M) IP	
Analgesia in Mice		
Morphine	1 – 10 mg/kg SC	Up to 3 hours of analgesia
Oxymorphone	0.05 mg/kg SC	Up to 3 hours of analgesia
Meperidine	10 – 20 mg/kg SC	Up to 3 hours of analgesia
Imipramine	2 – 3 mg/kg SC	Up to 12 hours of analgesia
Buprenorphine (Buprenex®)	0.05 – 2.0 mg/kg SC	3 – 5 hours of analgesia; do not use with tribromoethanol
Carprofen (Rimadyl®)	10 mg/kg SC	From 12 - 24 hours of analgesia
Ketoprofen	10 mg/kg SC	From 12 - 24 hours of analgesia
Sedation in Mice		
Medetomidine	30 – 100 µg/kg SC	Reverse with Atipamezole @ 1.0 µg/kg SC, IP, or IV
Ketamine	44 mg/kg SC	
Chlorpromazine	5 – 10 mg/kg SC	

RAT

Anesthesia in Rats	Dose & Route	Comments
Isoflurane (Forane®)	To effect. In general, 3-4% induction, 1-2% maintenance; inhalation	Precision vaporizer, adequate ventilation or scavenging essential
Halothane (Fluothane®)	To effect. In general, 3-4% induction, 1-2% maintenance; inhalation	Precision vaporizer, adequate ventilation or scavenging essential
Enflurane (Ethrane®)	To effect. In general, 3-4% induction, 1-2% maintenance; inhalation	Precision vaporizer, adequate ventilation or scavenging essential
Pentobarbital	30 – 40 mg/kg IV 40 – 60 mg/kg IP	Caution! Potentially significant cardiovascular and respiratory depression, variable response
Thiopental	20 – 40 mg/kg IV 40 mg/kg IP	
Tribromoethanol (Avertin)	125-250 mg/kg IP	Store at 4°C; dark conditions
Ketamine + Xylazine	60 – 90 mg/kg (K)+ 6 – 9 mg/kg (X) IP, IM	30 – 45 minute duration; may supplement with ketamine only @ 1/3 dose
Ketamine + Medetomidine	75 mg/kg (K) + 0.5 mg/kg (M) IP or SC	
Urethane	1000 – 1500 mg/kg IP	Caution! Prolonged anesthesia; terminal procedures only; carcinogenic and mutagenic
Inactin	80 – 100 mg/kg IP	
Tiletamine - Zolazepam (Telazol ®)	20 – 40 mg/kg IP	
Methohexital (1% solution)	40 mg/kg IP	
Equithesin	3 ml/kg IP	Fresh mixture required
Analgesia in Rats		
Morphine	10 mg/kg SC	Up to 3 hours of analgesia
Oxymorphone	0.15 mg/kg SC	Up to 3 hours of analgesia
Meperidine	20 mg/kg SC	Up to 3 hours of analgesia
Imipramine	10 mg/kg SC	Up to 12 hours of analgesia
Buprenorphine (Buprenex®)	0.01 – 0.05 mg/kg SC	6 - 8 hours of analgesia; do not use with tribromoethanol
Carprofen (Rimadyl®)	5 mg/kg SC	From 12 - 24 hours of analgesia
Ketoprofen	5 mg/kg SC	From 12 - 24 hours of analgesia
Sedation in Rats		
Medetomidine	30 – 100 µg/kg SC	Reverse with Atipamezole @ 1.0 µg/kg SC, IP, or IV
Ketamine	50 – 100 mg/kg IP	
Chlorpromazine	1 - 2 mg/kg IM	

GUINEA PIG

Anesthesia in Guinea Pigs	Dose & Route	Comments
Isoflurane (Forane®)	To effect. In general, 3-4% induction, 1-2% maintenance; inhalation	Precision vaporizer, adequate ventilation or scavenging essential
Enflurane (Ethrane®)	To effect. In general, 3-4% induction, 1-2% maintenance; inhalation	Precision vaporizer, adequate ventilation or scavenging essential
Pentobarbital	37 mg/kg IP	Caution! Potentially significant cardiovascular and respiratory depression, variable response
Ketamine + Xylazine	40 mg/kg (K) + 5 mg/kg (X) IP	
Ketamine + Medetomidine	40 mg/kg (K) IP, IM + 0.5 mg/kg (M) SC	
Ketamine + Diazepam	100 mg/kg (K) + 5 mg/kg (D) IM	
Fentanyl / Fluanisone (Hypnorm®) + Diazepam	1.0 ml/kg (F/F) + 2.5 mg/kg (D) IM, IP	
α-Chloralose (1%) + Urethane (40%) in a 7:1 mixture	8.0 ml/kg IP	
Analgesia in Guinea Pigs		
Morphine	2 - 5 mg/kg SC	Up to 4 hours of analgesia
Meperidine	10 - 20 mg/kg SC	Up to 3 hours of analgesia
Buprenorphine (Buprenex®)	0.5 mg/kg SC	Up to 12 hours of analgesia
Carprofen (Rimadyl®)	4 mg/kg SC, IM	From 12 - 24 hours of analgesia
Ketoprofen	1 mg/kg SC, IM	From 12 - 24 hours of analgesia
Sedation in Guinea Pigs		
Acepromazine	0.5 – 1.0 mg/kg IM 2.5 – 5.0 mg/kg IP	
Diazepam	2.5 – 5.0 mg/kg IP, IM	
Midazolam	1.0 – 5.0 mg/kg IM, IP	
Ketamine	22 - 44 mg/kg IM	
Chlorpromazine	0.2 mg/kg SC	

RABBIT

Anesthesia in Rabbits	Dose & Route	Comments
Isoflurane (Forane®)	To effect. In general, 3-4% induction, 1-2% maintenance; inhalation	Precision vaporizer, adequate ventilation or scavenging essential
Halothane (Fluothane®)	To effect. In general, 3-4% induction, 1-2% maintenance; inhalation	Precision vaporizer, adequate ventilation or scavenging essential
Enflurane (Ethrane®)	To effect. In general, 3-4% induction, 1-2% maintenance; inhalation	Precision vaporizer, adequate ventilation or scavenging essential
Pentobarbital	30 – 40 mg/kg IV	Caution! Potentially significant cardiovascular and respiratory depression, variable response
Thiopental	28 mg/kg IV, IP	
Ketamine + Xylazine	35 – 50 mg/kg (K) + 5 – 10 mg/kg (X) IM	Minor procedures; up to 45 minutes of anesthesia; can supplement with ketamine @ 1/3 dose
Ketamine + Medetomidine	25 mg/kg (K) + 0.5 mg/kg (M) IM	
α-Chloralose	80 – 100 mg/kg IV	
Urethane	1000 mg/kg IV, IP	Caution! Prolonged anesthesia; terminal procedures only; carcinogenic and mutagenic
Analgia in Rabbits		
Morphine	2 - 5 mg/kg SC	Up to 3 hours of analgesia
Meperidine	10 mg/kg SC	Up to 3 hours of analgesia
Buprenorphine (Buprenex®)	0.01 – 0.05 mg/kg SC	6 - 12 hours of analgesia
Butorphanol (Torbutrol® 0.5mg/ml)	0.1 – 0.5 mg/kg SC, IM or IV	Up to 4 hours of analgesia
Carprofen (Rimadyl®)	1.5 mg/kg SC	From 12 - 24 hours of analgesia
Ketoprofen	1.0 mg/kg SC	From 12 - 24 hours of analgesia
Sedation in Rabbits		
Butorphanol + Acepromazine	1 mg/kg (B) + 1 mg/kg (A) IM	
Acepromazine	0.75 – 1.0 mg/kg IM	
Diazepam	5 – 10 mg/kg IM	
Ketamine	30 mg/kg IM	
Xylazine	3 – 5 mg/kg IM, SC	
Chlorpromazine	25 - 100 mg/kg IM	

DOG

Anesthesia in Dogs	Dose & Route	Comments
Isoflurane (Forane®)	To effect. In general, 3-4% induction, 1-2% maintenance; inhalation	Precision vaporizer, adequate ventilation or scavenging essential
Halothane (Fluothane®)	To effect. In general, 3-4% induction, 1-2% maintenance; inhalation	Precision vaporizer, adequate ventilation or scavenging essential
Enflurane (Ethrane®)	To effect. In general, 3-4% induction, 1-2% maintenance; inhalation	Precision vaporizer, adequate ventilation or scavenging essential
Pentobarbital	20 – 30 mg/kg IV	Caution! Divide dose and administer ½ as bolus and ½ to effect
Thiopental	8 – 12 mg/kg IV	Short acting
Ketamine + Diazepam	10 mg/kg (K) + 0.5 mg/kg (D) IV	Minor procedures
Ketamine + Midazolam	10 mg/kg (K) + 0.5 mg/kg (M) IV	Minor procedures
α-Chloralose	80 – 110 mg/kg IV	Between 6 – 10 hours of anesthesia, premedicate with morphine @ 5 mg/kg, terminal procedures
Telazol® (Tiletamine + Zolazepam)	6 – 8 mg/kg IM	
Telazol® + Xylazine + Butorphanol	6 – 8 mg/kg (T) + 0.5 mg/kg (X) + 0.2 mg/kg (B) IM	
Analgesia in Dogs		
Morphine	0.25 – 5.0 mg/kg SC, IM	4 - 6 hours of analgesia
Meperidine	2 - 10 mg/kg SC, IM	Up to 3 hours of analgesia
Buprenorphine (Buprenex®)	0.01 – 0.02 mg/kg SC	8 - 12 hours of analgesia
Butorphanol (Torbutrol® 0.5mg/ml)	0.2 – 0.4 mg/kg IM, SC	2 - 5 hours of analgesia
Carprofen (Rimadyl®)	2.2 mg/kg PO 5 mg/kg SC	Up to 12 hours of analgesia
Ketoprofen	2.0 mg/kg SC, IM	From 12 - 24 hours of analgesia
Fentanyl patch	<5 kg body weight = ½ of 25 µg/hr patch 5 – 10 kg BW = 25 µg/hr patch 10 – 20 kg BW = 50 µg/hr patch 20 – 30 kg BW = 75 µg/hr patch > 30 kg BW = 100 µg/hr patch	Each dose provides up to 72 hours of analgesia; place 12 hours prior to anticipated pain; do not apply heat to patch (e.g., from heating pads)
Sedation in Dogs		
Butorphanol + Acepromazine	0.2 – 0.4 mg/kg (B) + 0.02 – 0.05 mg/kg (A) SC, IM, IV	
Acepromazine	0.05 – 0.1 mg/kg IM, SC	Maximum administer ≤3 mg total
Diazepam	1.0 mg/kg IV	Maximum administer ≤20 mg total
Xylazine	0.5 – 1.0 mg/kg IM	
Chlorpromazine	1 – 6 mg/kg IM, SC	

CAT

Anesthesia in Cats	Dose & Route	Comments
Isoflurane (Forane®)	To effect. In general, 3-4% induction, 1-2% maintenance; inhalation	Precision vaporizer, adequate ventilation or scavenging essential
Halothane (Fluothane®)	To effect. In general, 3-4% induction, 1-2% maintenance; inhalation	Precision vaporizer, adequate ventilation or scavenging essential
Enflurane (Ethrane®)	To effect. In general, 3-4% induction, 1-2% maintenance; inhalation	Precision vaporizer, adequate ventilation or scavenging essential
Pentobarbital	20 – 30 mg/kg IV	Caution! Potentially significant cardiovascular and respiratory depression, variable response
Ketamine + Diazepam	10 mg/kg (K) + 0.5 mg/kg (D) IV	Minor procedures
Ketamine + Medetomidine	7.0 mg/kg (K) + 0.08 mg/kg (M) IM	Minor procedures
Analgesia in Cats		
Morphine	0.1 mg/kg SC, IM	Up to 4 hours of analgesia; caution, mania and excitation with overdose
Meperidine	2 - 10 mg/kg SC, IM	Up to 3 hours of analgesia
Buprenorphine (Buprenex®)	0.005 – 0.01 mg/kg SC, IM	6 - 12 hours of analgesia
Oxymorphone	0.05 – 0.15 mg/kg IM, SC or IV	Between 3 – 5 hours of analgesia
Carprofen (Rimadyl®)	4.0 mg/kg SC, IV	From 12 - 24 hours of analgesia
Ketoprofen	1.0 mg/kg SC, IM or IV	From 12 - 24 hours of analgesia
Fentanyl patch	<2.5 kg body weight = ½ of 25 µg/hr patch > 2.5 kg BW = 25 µg/hr patch	Each up to 5 days analgesia; place 8 hours prior to anticipated pain; do not apply heat to patch (e.g., from heating pads)
Sedation in Cats		
Butorphanol + Acepromazine	0.1 – 0.4 mg/kg (B) SC, IM or IV + 0.02 – 0.05 mg/kg (A) SC, IM or IV	
Acepromazine	0.05 – 0.1 mg/kg IM, SC	
Diazepam	0.2 – 0.4 mg/kg IV, IM	
Ketamine	10 – 20 mg/kg IM	
Xylazine	0.4 – 0.9 mg/kg SC, IM	
Chlorpromazine	1.0 – 2.0 mg/kg IM	
Midazolam	0.2 – 0.4 mg/kg IV, IM	

PIG

Anesthesia in Pigs	Dose & Route	Comments
Isoflurane (Forane®)	To effect. In general, 3-4% induction, 1-2% maintenance; inhalation	Precision vaporizer, adequate ventilation or scavenging essential
Halothane (Fluothane®)	To effect. In general, 3-4% induction, 1-2% maintenance; inhalation	Precision vaporizer, adequate ventilation or scavenging essential
Enflurane (Ethrane®)	To effect. In general, 3-4% induction, 1-2% maintenance; inhalation	Precision vaporizer, adequate ventilation or scavenging essential
Pentobarbital	5 – 15 mg/kg IV	Caution! Divide dose and administer ½ as bolus and ½ to effect
Thiopental	5 - 19 mg/kg IV	Short acting
Ketamine + Xylazine	20 mg/kg (K) + 2 mg/kg (X) IM	Minor procedures
Ketamine + Acepromazine	33 mg/kg (K) + 1.1 mg/kg (A) IM	
Ketamine + Medetomidine	10 mg/kg (K) + 0.08 mg/kg (M) IM	Immobilization; light anesthesia
Ketamine + Telazol®	2.2 mg/kg (K) + 4.4 mg/kg (T) IM	
Ketamine + Telazol® + Xylazine	2.2 mg/kg (K) + 4.4 mg/kg (T) + 2.2mg/kg (X) IM	Minor procedures
Telazol® + Xylazine	2.0 - 8.8 mg/kg (T) + 2.2 mg/kg (X) IM	May produce cardiopulmonary depression
Analgesia in Pigs		
Aspirin	10 mg/kg PO	Up to 6 hours of analgesia; use enteric-coated tablet
Meperidine	4 – 10 mg/kg IM	Up to 4 hours of analgesia
Phenylbutazone	10 – 20 mg/kg PO	Up to 12 hours of analgesia; use to alleviate musculoskeletal pain
Buprenorphine (Buprenex®)	0.005 - 0.01 mg/kg IM	8 - 12 hours of analgesia
Butorphanol (Torbutrol® 0.5mg/ml)	0.1 – 0.3 mg/kg IM	2 - 5 hours of analgesia
Carprofen (Rimadyl®)	0.5 - 4.0 mg/kg SC	Up to 24 hours of analgesia
Ketoprofen	1.0 - 3.0 mg/kg SC	Up to 24 hours of analgesia
Sedation in Pigs		
Acepromazine	0.11 – 1.1 mg/kg IM, SC	
Diazepam	0.5 – 10 mg/kg IM	
Azaperone (Stresnil®)	2 – 8 mg/kg IM	
Chlorpromazine	0.5 – 4.0 mg/kg IM, SC	

SHEEP & GOAT

Anesthesia in Small Ruminants	Dose & Route	Comments
Isoflurane (Forane®)	To effect. In general, 3-4% induction, 1-2% maintenance; inhalation	Precision vaporizer, adequate ventilation or scavenging essential
Halothane (Fluothane®)	To effect. In general, 3-4% induction, 1-2% maintenance; inhalation	Precision vaporizer, adequate ventilation or scavenging essential
Enflurane (Ethrane®)	To effect. In general, 3-4% induction, 1-2% maintenance; inhalation	Precision vaporizer, adequate ventilation or scavenging essential
Pentobarbital	20-30 mg/kg IV	Administer to effect
Thiopental	20 - 25 mg/kg IV	Short acting
Ketamine + Xylazine	10 - 15 mg/kg (K) + 0.2 mg/kg (X) IM (Sheep) 10 - 15 mg/kg (K) + 0.1 mg/kg (X) IM (Goat)	Minor procedures
Ketamine + Diazepam	4.5 mg/kg (K) + 0.1 mg/kg (D) IV	Minor procedures
Ketamine + Medetomidine	0.5-1 mg/kg (K) + 20-25 µg/kg (M) IM	
Telazol®	2-4 mg/kg IV	
Telazol® + Xylazine	4 mg/kg (T) + 0.1 mg/kg (X) IM 1 mg/kg (T) + 0.05 mg/kg (X) IV	
Analgesia in Small Ruminants		
Aspirin	50-100 mg/kg PO	Up to 12 hours of analgesia
Flunixin	1-2 mg/kg IV, IM	Up to 24 hours of analgesia; only administer post-operatively to conscious animals
Meperidine	2 mg/kg IM, IV	Up to 4 hours of analgesia
Butorphanol + Diazepam	0.05-0.1 mg/kg (B) + 0.05-0.2 mg/kg (D) IV	Up to 4 hours of analgesia
Buprenorphine (Buprenex®)	0.005 - 0.01 mg/kg IM	Up to 4 hours of analgesia
Sedation in Small Ruminants		
Acepromazine	0.05-0.1 mg/kg IM, SC	
Diazepam	0.2-0.5 mg/kg IV, IM	
Ketamine	20 mg/kg IM	
Medetomidine	25 µg/kg IM	
Xylazine	0.2 mg/kg IV, IM	

MACAQUE

Anesthesia in Macaques	Dose & Route	Comments
Isoflurane (Forane®)	To effect. In general, 3-4% induction, 1-2% maintenance; inhalation	Precision vaporizer, adequate ventilation or scavenging essential
Halothane (Fluothane®)	To effect. In general, 3-4% induction, 1-2% maintenance; inhalation	Precision vaporizer, adequate ventilation or scavenging essential
Enflurane (Ethrane®)	To effect. In general, 3-4% induction, 1-2% maintenance; inhalation	Precision vaporizer, adequate ventilation or scavenging essential
Pentobarbital	20-30 mg/kg IV	Administer to effect
Thiopental	15-20 mg/kg IV	Short acting
Ketamine + Xylazine	10 mg/kg (K) + 0.25-2.0 mg/kg (X) IM	
Ketamine + Diazepam	15 mg/kg (K) + 1.0 mg/kg (D) IM	
Ketamine + Medetomidine	2-6 mg/kg (K) + 30-60 µg/kg (M) IM	
Telazol®	4-6 mg/kg IM	
Analgesia in Macaques		
Aspirin	20mg/kg PO	Up to 8 hours of analgesia
Acetaminophen	10 mg/kg PO	Up to 6 hours of analgesia
Meperidine	2-4 mg/kg IM	Up to 4 hours of analgesia
Oxymorphone	0.15 mg/kg SC, IM, IV	Up to 6 hours of analgesia
Morphine	1-2 mg/kg SC, IM	Up to 4 hours of analgesia
Buprenorphine (Buprenex®)	0.005-0.01 mg/kg IM	Up to 8 hours of analgesia
Flunixin	2-4 mg/kg SC	Up to 24 hours of analgesia; only administer postoperatively to conscious animals
Carprofen (Rimadyl®)	2-4 mg/kg PO, SC	Up to 24 hours of analgesia
Ketoprofen	5 mg/kg IM	Up to 8 hours of analgesia
Ketorolac	15-30 mg/kg IM	
Meloxicam	0.1-0.3 mg/kg PO	Up to 24 hours of analgesia
Naproxen	10 mg/kg PO	Up to 12 hours of analgesia
Sedation in Macaques		
Acepromazine	0.2 mg/kg IM	
Diazepam	1.0 mg/kg IM	
Ketamine	5-20 mg/kg IM	
Xylazine	0.25-0.5 mg/kg IM	