

## **Anesthetics, Analgesics and Sedatives Currently IACUC Approved by Species & Dose**

This is intended to be used as a reference of suggested and possible anesthetic doses of anesthetics and analgesics for a variety of species. Some guidelines for recognizing and categorizing pain are also included. However, there is no claim made that this information is complete, original or unique. Rather, the information provided has come from a number of sources including IACUC protocols, reference manuals and books, and research and technical articles from journals.

When using analgesic agents the concept of pre-emptive analgesia should be followed. That is, relieving the potential pain before the pain is felt. To do so will result in a quicker, less stressful recovery of the patient.

### **Dosages, Measures, and Methods**

BW	body weight	mg	milligrams
d	days	min	minutes
h	hours	ml	milliliters
IA	intraarterially	mm	millimeters
IC	intracoelomically	PO	by mouth (per os)
IM	intramuscularly	prn	as needed
in.	inches	q	every
IP	intraperitoneally	s	seconds
IPP	intrapleuroperitoneally	SC	subcutaneously
IT	intratracheally	sid	once daily
IU	international units	Tbs	tablespoons (approximately 15 ml)
IV	intravenously	tid	three times daily
kg	kilograms	tsp	teaspoons (approximately 5 ml)
l	liters	%	g/100 ml
lb	pounds		

### **Potential sources for information on anesthetic/analgesic doses:**

Users are encouraged to consult the following for other anesthetic or analgesic agents and techniques:

1. The veterinary and clinical animal care staff of the facility, for advice during protocol preparation and during the conduct of the study.
2. Scientific and technical journal research and review articles dealing with the research procedures and anesthetics/analgesics that will be used.
3. Books and monographs dealing with veterinary and laboratory animal anesthesia, surgery and research techniques/procedures. There are a number of current, good and comprehensive volumes available. Contact veterinary and clinical animal care staff for assistance in identifying them.
4. Other investigators in the field of research.

**Anesthetics, Analgesics and Sedatives Currently IACUC Approved by  
Species & Dose**

<b>SPECIES</b>	<b>Anesthetic and Analgesic Agents * (Utilized individually or in combination with other authorized agents)</b>
Amphibian	MS 222 (Tricaine), Telazol,
Bovine	Acepromazine Maleate, Banamine, Isoflurane, Ketamine, Lidocaine, Pentobarbital, Procaine, Rompun, Xylazine
Cat	Acepromazine Maleate, Isoflurane, Ketamine, Telazol, Xylazine
Chicken	Avertin, Pentothal
Dog	Acepromazine Maleate, Aspirin, Atropine, Benzocaine, Buprenorphine, Butorphanol, Carprofen, Halothane, Isoflurane, Ketamine, Lidocaine, Pentothal, Procaine, Propofol, Sodium Pentothol, Telazol, Thiopental, Torbugesic, Xylazine
Ferret	Buprenorphine, Ketamine, Isoflurane, Halothane
Frog	Benzocaine, MS-222, Tricaine
Gerbil	Isoflurane
Guinea Pig	Ether, Inactin, Ketamine, Morphine, Pentobarbital, Xylazine
Hamster	Buprenorphine, Butorphanol
Lizard	Isoflurane, Ketamine, MS-222, Nembutal
Mouse	Acepromazine Maleate, Acetaminophen, $\alpha$ -chloralose, Avertin, Buprenorphine, Butorphanol, Celecoxib, Chloral Hydrate, Chlorulose, Halothane, Ibuprofen, Isoflurane, Ketamine, Methoxyflurane, Sodium Pentobarbital, Telazol, Urethane, Valium, Xylazine
Pig	Acetylpromazine Maleate, Aspirin, Atropine, Buprenex, Buprenorphine, Butorphanol, Halothane, Isoflurane, Ketamine, Lidocaine, Meperidine, Methyl salicylate, Pentothal, Sevoflurane, Sodium Pentobarbital, Telazol, Tiletamine, Torbugesic, Xylazine, Zolazepam
Primate	Acepromazine Maleate, Acetaminophen, Atropine, Buprenorphine, Diazepam, Dopamine, Fentanyl, Halothane, Isoflurane, Ketamine, Lidocaine, Oxymorphone, Propofol, Sodium Pentobarbital, Telazol, Xylazine, Xyllocaine
Rabbit	Acepromazine Maleate, Acetylpromazine Maleate, Buprenex, Buprenorphine, Butorphanol, Isoflurane, Ketamine, Lidocaine, Pentobarbital, Phenobarbital, Rompun, Tetracaine, Torbugesic, Xylazine
Rat	Acepromazine Maleate, Acetaminophen, $\alpha$ -chloralose, Aspirin, Atropine, Bupivacaine, Buprenex, Buprenorphine, Butorphanol, Ether, Halothane, Ibuprofen, Inactin, Isoflurane, Ketamine, Ketaset, Metafane, Morphine, Nembutal, Pentobarbital, Rompun, Sodium Pentobarbital, Tetracaine, Thiobutabarbitol, Tylenol, Urethane, Xylazine
Sheep	Buprenorphine, Butorphanol, Propofol
Snake	Isoflurane
Various	Chlorotone, Isoflurane, Nembutal, Tricaine methanesulfonate
Wild Feline	Ketamine, Xylazine

### Anesthetics used in Amphibians

Anesthesia in Amphibians	Dose & Route	Comments
Tricaine methanesulfonate (MS 222)	Immerse in 0.1% solution 50-150 mg/kg BW SC, IM	
Telazol	5-25 mg/kg IM	Restraint

### Anesthetics and Analgesics used in Bovine

Anesthesia in Bovine	Dose & Route	Comments
Banamine (Flunixin)	1.1 – 2.2 mg/kg	
Isoflurane Halothane Sevoflurane	To effect. In general, 3-4% induction, 1-2% maintenance; inhalation.	Precision vaporizer, adequate ventilation or scavenging essential.
Ketamine	Local injection to effect.	
Lidocaine (Procaine)	Local injection to effect.	
Xylazine	20-40 mg IV	

Analgesia in Bovine	Dose & Route	Comments
Acepromazine	0.02-0.05 mg/kg, IV 0.05-0.2 mg/kg, IM	
Pentobarbital	390 mg (50 mg) per 10 lbs.	

### Anesthetics and Analgesics used in Cats

Anesthesia in Cats	Dose & Route	Comments
Isoflurane Halothane Sevoflurane	To effect. In general, 3-4% induction, 1-2% maintenance; inhalation.	Precision vaporizer, adequate ventilation or scavenging essential.
Xylazine	0.5 mg/lb BW IV 1 mg/lb BW IM, SC	

Analgesia in Cats	Dose & Route	Comments
Acepromazine Maleate	0.1 – 0.2 mg/kg BW IM, SC 0.5 – 1.0 mg/lb BW PO prn	
Buprenorphine	0.005-0.01 mg/kg BW SC, IM q12h  0.005-0.01 mg/kg BW IV, SC q8-12h	
Butorphanol	0.4 mg/kg BW SC q6h 0.22 mg/kg BW IM 0.4-1.5 mg/kg BW PO q4- 8h 0.4 mg/kg BW SC q3-4h	
Ketamine	10-30 mg/kg BW IM, IV	
Telazol (Tiletamine/zolazepam)	7.5 mg/kg BW IM and 7.5 mg/kg BW IM	

### Anesthetics and Analgesics used in Chicken

Anesthesia in Chicken	Dose & Route	Comments
Avertin (Tribromoethanol)	0.06-0.1 ml IP	
Pentothal (Thiopental)	90 mg/kg IP	

### Anesthetics and Analgesics used in Dogs

Anesthesia in Dogs	Dose & Route	Comments
Atropine	0.75-5 mg/kg IM	
Benzocaine	0.1 – 0.2 mg/kg	
Halothane Isoflurane Sevoflurane	To effect. In general, 3-4% induction, 1-2% maintenance; inhalation.	Precision vaporizer, adequate ventilation or scavenging essential.
Ketamine	10-100 mg/kg	
Lidocaine (Procaine)	Local injection to effect.	
Propofol	5-6 mg/kg IM	
Thiopental (Pentothal, Sodium Pentothal)	6-12 mg/lb BW IV; lower dose with preanesthetic tranquilization 10-18 mg/kg IV	
Telazol	6-12 mg/kg IM, SC 3-6 mg/kg IV	

Analgesia in Dogs	Dose & Route	Comments
Acepromazine Maleate	0.1-0.5 mg/kg BW IV, IM, SC 0.25-1.0 mg/lb BW PO prn	
Aspirin	10-20 mg/kg BW PO q12h	
Buprenorphine	0.01-0.02 mg/kg BW SC q12h	
Butorphanol (Torbugesic)	0.2-0.4 mg/kg BW SC, IM, IV q2-5h	Between 2 -5 hours of analgesia
Carprofen	4.4 mg/kg PO, SC	As long as needed, guideline of 3-4 days for soft tissue surgery and 8-10 following orthopedic procedures.
Xylazine	0.5 mg/lb BW IV 1 mg/lb BW IM, SC	

### Anesthetics and Analgesics in Ferrets

Anesthesia in Ferrets	Dose & Route	Comments
Isoflurane Halothane Sevoflurane	To effect. In general, 3-4% induction, 1-2% maintenance; inhalation.	Precision vaporizer, adequate ventilation or scavenging essential.

<b>Analgesia in Ferrets</b>	<b>Dose &amp; Route</b>	<b>Comments</b>
Buprenorphine	0.01-0.05 mg/kg BW IM, IV, SC q8-12h	
Ketamine	10-30 mg/kg BW IM	

#### **Anesthetics in Frogs**

<b>Anesthesia in Frogs</b>	<b>Dose &amp; Route</b>	<b>Comments</b>
Benzocaine	200-300 mg/l bath	
Tricaine (MS 222)	500-2000 mg/l. Immerse to effect.	

#### **Anesthetics in Gerbils**

<b>Anesthesia in Gerbils</b>	<b>Dose &amp; Route</b>	<b>Comments</b>
Isoflurane Halothane Sevoflurane	To effect. In general, 3-4% induction, 1-2% maintenance; inhalation.	Precision vaporizer, adequate ventilation or scavenging essential.

#### **Anesthetics and Analgesics in Guinea Pigs**

<b>Anesthesia in Guinea Pigs</b>	<b>Dose &amp; Route</b>	<b>Comments</b>
Ether	To effect	
Inactin	150 mg/kg IP	
Ketamine	25-30 mg/kg BW IM 22-64 mg/kg BW IP	
Guinea Pig Mix (same as Rabbit Mix)	Full anesthesia – 1cc/kg Induction – ½ cc/kg, 1cc/kg	Some investigators use this, we have not.
Pentobarbital	28 mg/kg BW IP 15-40 mg/kg IP	Caution! Potentially significant cardiovascular and respiratory depression, variable response

<b>Analgesia in Guinea Pigs</b>	<b>Dose &amp; Route</b>	<b>Comments</b>
Ketamine	44 mg/kg BW IM, atropine recommended	
Morphine	10 mg/kg BW SC, IM q2-4h 2-5 mg/kg BW SC, IM q2-4h	Up to 4 hours of analgesia
Xylazine	3-5 mg/kg BW IM 5-40 mg/kg IP	

#### **Analgesia in Hamsters**

<b>Analgesia in Hamsters</b>	<b>Dose &amp; Route</b>	<b>Comments</b>
Buprenorphine	0.05 – 0.5 mg/kg BW SC q8-12h	Between 8 – 12 hours of analgesia
Butorphanol	1 – 5 mg/kg	

### Anesthetics and Analgesics in Lizards

Anesthesia in Lizards	Dose & Route	Comments
Isoflurane Halothane Sevoflurane	To effect. In general, 3-4% induction, 1-2% maintenance; inhalation.	Precision vaporizer, adequate ventilation or scavenging essential.
Ketamine	50-150 mg/kg SC, IM	
Tricaine (MS 222)	1 mg/kg	

### Anesthetics and Analgesics in Mice

Anesthesia in Mice	Dose & Route	Comments
Avertin (Tribromoethanol)	125 mg/kg BW IP (0.25% solution) 250 mg/kg BW IP 0.2 ml/10 g BW IP	See Appendix I. for Stock solution, Working Solution and Practical Suggestions for Use.
Chloral hydrate	400 mg/kg BW IP	
Isoflurane Halothane Sevoflurane	To effect. In general, 3-4% induction 1-2% maintenance; inhalation.	Precision vaporizer, adequate ventilation or scavenging essential.
Ketamine	44 mg/kg BW IM for sedation 100-200 mg.kg BW IM 200 mg/kg BW IM 50 mg/kg BW IV	
Methoxyflurane	In general, 3% for induction, 0.5 – 1.0% for maintenance, inhalation. (administer to effect).	Precision vaporizer, adequate ventilation or scavenging essential.
Mouse Mix (same as Rabbit Mix)	Full anesthesia – 1cc/kg Induction – ½ cc/kg, 1cc/kg	Some investigators use this, we have not.
α-chloralose	50-60 mg/kg	
Sodium Pentobarbital	50 – 200 mg/kg IV	
Telazol	100 mg/kg	
Urethane	1.2 – 200 mg/kg IP	
Valium	5 – 10 mg/kg IP	

Analgesia in Mice	Dose & Route	Comments
Acepromazine Maleate	1-2 mg/kg BW IM 2-5 mg/kg BW IP	
Acetaminophen	300 mg/kg BW PO	
Buprenorphine	0.05 – 0.1 mg/kg SC	
Butorphanol	0.05-5.0 mg/kg BW SC q4h 5.4 mg/kg BW SC 1-5 mg/kg BW SC q4h	Up to 6 – 12 hours of analgesia
Celecoxib	200 mg/kg	
Ibuprofen	7.5 mg/kg BW PO	
Xylazine	4-8 mg/kg BW IM	

### Anesthetics and Analgesics in Pigs

<b>Anesthesia in Pigs</b>	<b>Dose &amp; Route</b>	<b>Comments</b>
Halothane Isoflurane Sevoflurane	To effect. In general, 3-4% induction, 1-2% maintenance; inhalation.	Precision vaporizer, adequate ventilation or scavenging essential.
Ketamine	15-25 mg/kg BW IV	
Lidocaine	Local injection to effect.	
Thiopental (Pentothal, Sodium Pentobarbital)	24-30 mg/kg BW IP 5-19 mg/kg BW IV	
Tiletamine (Telazol)	6.6-11 mg/kg BW IM	
<b>Analgesia in Pigs</b>	<b>Dose &amp; Route</b>	<b>Comments</b>
Acetylpromazine Maleate	10 mg/cc (Dose at 1 cc/kg)	
Aspirin	10-20 mg/kg BW PO q4h	Up to 6 hours of analgesia; use enteric-coated tablet
Atropine	0.05 – 0.5 mg/kg	
Buprenorphine (Buprenex)	0.0005-0.01 mg/kg BW IM, IV	Up to 12 hours of analgesia
Butorphanol (Torbugesic)	0.1-0.3 mg/kg BW IM	
Meperidine	2-10 mg/kg BW IM, IV	
Methyl Salicylate	150 mg – 1 g IV	
Xylazine	10 mg/kg BW IM	
Zolazepam	4 mg/kg	

### Anesthetics and Analgesics in Non-Human Primates

<b>Anesthesia in Primates</b>	<b>Dose &amp; Route</b>	<b>Comments</b>
Isoflurane Halothane Sevoflurane	1-2% IP	
Atropine	0.05 mg/kg IM	
Dopamine	1-10 mg/kg	
Ketamine	20-25 mg/kg	
Propofol	7.5-12.5 mg/kg BW IV	
Lidocaine	Local injection to effect.	
Thiopental	15-25 mg/kg BW IV, IP	
Telazol	2-6 mg/kg BW IM	

<b>Analgesia in Primates</b>	<b>Dose &amp; Route</b>	<b>Comments</b>
Acepromazine Maleate	0.2-1.0 mg/kg BW IM	
Acetaminophen	5-10 mg/kg BW PO	
Buprenorphine	0.005-0.01 mg/kg BW IM, IV	
Diazepam	1 mg/kg BW IM	
Fentanyl	0.05-0.10 mg/kg BW SC, IM	
Oxymorphone	0.15 mg/kg BW SC	
Ketamine	5-40 mg/kg BW IM	
Xylazine	1-2 mg/kg BW IM	

### Anesthetics and Analgesics in Rabbits

Anesthesia in Rabbits	Dose & Route	Comments
Isoflurane Halothane Sevoflurane	To effect. In general, 3-4% induction, 1-2% maintenance; inhalation.	Precision vaporizer, adequate ventilation or scavenging essential.
Lidocaine	Local injection to effect.	
Rabbit Mix (Xylazine HCl 160 mg (8 cc of 20 mg/cc), Ketamine HCl 500 mg (5 cc of 100 mg/cc), Acepromazine maleate 20 mg (10 mg/cc))	Full anesthesia – 1cc/kg Induction – ½ cc/kg, 1cc/kg	Mix in sterile vile.
Tetracaine	2-3 drops in eye.	
Xylazine	3-9 mg/kg, IM or IV	

Analgesia in Rabbits	Dose & Route	Comments
Acepromazine Maleate	1.5 mg/kg IM 1-5 mg/kg BW IM	
Buprenex	0.02 – 0.1 mg/kg SC	
Buprenorphine	0.01-0.05 mg/kg BW SC, IM, IV	Between 6-12 hours of analgesia
Butorphanol	0.1-0.5 mg/kg BW IM, IV	Up to 4 hours of analgesia
Ketamine	30 mg/kg BW IM	
Phenobarbital	120 mg/kg	
Pentobarbital	60 – 150 mg/kg	
Xylazine	3-5 mg/kg BW IM	

### Anesthetics and Analgesics in Rats

Anesthesia in Rats	Dose & Route	Comments
Isoflurane Halothane Sevoflurane	To effect. In general, 3-4% induction, 1-2% maintenance; inhalation.	Precision vaporizer, adequate ventilation or scavenging essential.
Ether	To effect.	
Inactin	80-100 mg/kg IP	
Ketaset	33 mg/kg IP	
Methoxyflurane	In general, 3% for induction. 0.5-1.0% for maintenance by inhalation. (administer to effect).	Precision vaporizer, adequate ventilation or scavenging essential.
Rat Mix (same as Rabbit Mix)	Full anesthesia – 1cc/kg Induction – ½ cc/kg, 1cc/kg	Some investigators use this, we have not.
Thiobutabarbitol	40-100 mg/kg	
Thiopental	20-40 mg/kg IV 40 mg/kg IP	5-10 minutes of anesthesia
Urethane	1000-1500 mg/kg IP	Caution! Prolonged anesthesia; terminal procedures only; carcinogenic and mutagenic.

<b>Analgesia in Rats</b>	<b>Dose &amp; Route</b>	<b>Comments</b>
Acepromazine Maleate	1-10 mg/kg BW IM IP	
Acetaminophen	100-300 mg/kg BW PO	
Alpha-chloralose	35-40 mg/kg IP	
Aspirin	100 mg/kg BW PO	
Atropine	0.02-0.05 mg/kg	
Bupivacaine	10-20 mg/kg IM	
Buprenorphine (Buprenex)	0.01-0.05 mg/kg SC	From 6-12 hours of analgesia
Butorphanol	0.05-2.0 mg/kg BW IV	From 6-12 hours of analgesia
Ibuprofen	10-30 mg/kg BW PO	
Morphine	2-5 mg/kg	Up to 3 hours of analgesia
Nembutal	40-150 mg/kg IP	
Pentobarbital	30-150 mg/kg IP	
Rompun	0.1-3.1 mg/kg IM	
Tetracaine	0.4 mg/kg	
Xylazine	1-8 mg/kg BW IM	

### Anesthetics and Analgesics in Sheep

<b>Anesthesia in Sheep</b>	<b>Dose &amp; Route</b>	<b>Comments</b>
Isoflurane Halothane Sevoflurane	To effect. In general, 3-4% induction, 1-2% maintenance; inhalation.	Precision vaporizer, adequate ventilation or scavenging essential.
Propofol	4.0-6.0 mg/kg IV for induction 20-25 mg/min/35-65 kg, IV infusion.	

<b>Analgesia in Sheep</b>	<b>Dose &amp; Route</b>	<b>Comments</b>
Buprenorphine	0.005-0.01 mg/kg BW IM	
Butorphanol	0.5 mg/kg BW SC	

## APPENDIX I.

<p><b>Components:</b></p> <ul style="list-style-type: none"><li>○ Avertin (2,2,2 tribromoethanol, Aldrich T4, 840.2 or eq.)</li><li>○ Tert_ amyl alcohol</li></ul> <p><b>Stock solution (1.6 g/ml):</b></p> <ul style="list-style-type: none"><li>○ Add 15.5 ml Tert_ amyl alcohol to 25 g. avertin in dark bottle (the bottle that the avertin is shipped in works great).</li><li>○ Stir on magnetic stirrer until the avertin is dissolved (about 12 hours).</li><li>○ Avertin stock is light sensitive and hydroscopic</li><li>○ Keep in dark bottle at room temperature:<ul style="list-style-type: none"><li>▪ If the solution is kept at 4 deg. F. the avertin will “freeze” out, necessitating redissolving the avertin.</li></ul></li><li>○ Keep away from light and tightly sealed. Do not leave the bottle open longer than necessary.</li></ul> <p><b>Working solution:</b></p> <ul style="list-style-type: none"><li>○ Mix 0.5 ml avertin stock solution and 39.5 ml normal saline in glass vessel (graduate cylinder works great).</li><li>○ Seal container with parafilm, wrap in foil to exclude light and stir on magnetic stirrer for about 12 hours or until dissolved.</li><li>○ Filter sterilize through 0.2 micron filter and store at 4 deg C.</li><li>○ It can be aliquoted into ~5 ml lots in foil wrapped, sterile serum vials or kept in a dark, capped bottle at 4 deg. C.</li></ul>	<p><b>Comments:</b></p> <p>It will take about 5 min. for the animal to become fully anesthetized (lack of toe pinch reflex). An additional 0.1-0.2 ml can be given to effect. The animal will remain anesthetized for approximately 15–20 minutes and recover within 30-60 minutes. Keep animal warm during recovery. Note: that the effective dosage is dependent upon the weight of the animal. Older, fatter or lactating animals will need more avertin to become fully anesthetized. It is difficult to over-anesthetize (kill) the animal even at higher dosages.</p> <p>* This information is provided from a number of different sources, therefore it is not accountable.</p>
--	--