

**A COMPENDIUM OF DRUGS USED FOR LABORATORY
ANIMAL ANESTHESIA, ANALGESIA, TRANQUILIZATION
AND RESTRAINT**

Including:

Blood Volumes, Blood Sampling Volumes, and Injection Volumes for Laboratory Animals

Signs of Pain in Animals

Guidelines on Adjuvants and Antibody Production

General Requirements for Survival Surgery

Detailed Considerations for Animal, Surgeon and Instrument Preparation Prior to Surgery

Rules of Thumb for Assessing the Need for Anesthesia or Anagesia Prior to Beginning a Procedure

Drug Compendium

BLOOD VOLUMES, BLOOD SAMPLING VOLUMES, AND INJECTION VOLUMES FOR LABORATORY ANIMALS

1. Circulating Blood Volumes of Healthy Adult Animals*

<u>Species</u>	<u>Volume (ml/kg)</u>
Cat	55 (47-66)
Dog	86 (79-90)
Ferret	75
Gerbil	67
Goat	70
Guinea Pig	75 (67-92)
Hamster	78
Monkey (rhesus)	54
Mouse	79 (78-80)
Pig	65
Rabbit	56 (44-70)
Rat	64 (50-70)
Sheep	60

*Can be 15% less in obese and old animals

2. Blood Sampling Volumes (one time sampling)

- a. Generally safe: **10% of circulating blood volume.**
Will initiate homeostatic cholinergic mechanism.
- b. Dangerous: **15-20% of circulating blood volume.**
Cardiac output and blood pressure is reduced
- c. Very Dangerous: **30-40% of circulating blood volume.**
Can induce hemorrhagic shock.
- d. Lethal: **>40% of circulating blood volume.**
Can cause 50% mortality in rats.

3. Blood Sampling Volumes (multiple sampling)

A maximum of **1.0%** of an animal's circulating blood volume can be removed daily. This is approximately 0.7 ml/kg/day

4. Maximum Injection Volumes (ml) Per Site

	<u>SC</u>	<u>IM</u>	<u>IP</u>	<u>IV</u>
Cat	50-100	1.0	50-100	2-5
Dog	100-200	2-5	200-500	10-15
Ferret	20-30	0.5-1.0	50-100	2-5
Guinea Pig	5-10	0.3	10-15	1.0
Hamster	3-4	0.1	3-4	0.3
Mouse	2-3	0.05	2-3	0.2
Monkey (rhesus)	15-20	1.0	50-75	5-10
Rabbit	30-50	0.5-1.0	50-100	1.0-5.0
Rat	5-10	0.3	5-10	0.5

SIGNS OF PAIN IN ANIMALS

The pain threshold appears to be the same for humans and other animals

Signs of Pain in Rodents

<u>Mild Pain</u>	<u>Moderate Pain</u>	<u>Severe Pain</u>
Reduced weight gain	Weight loss up to 20%	Weight loss >25%
Food and water consumption 40-75% of normal for 72 hours.	Food and water consumption <40% of normal for 72 hrs.	Food and Water consumption <40% for 7 days, or anorexic
Partial piloerection	Marked piloerection	Marked piloerection with other dehydration signs such as tenting of skin.
Subdued but responsive. Shows normal provoked behavior patterns.	Subdued behavior patterns even when provoked.	Unresponsive to extraneous actions and provocation.
Interacts with peers	Little peer interaction.	Persistently hunched
Hunched transiently, especially after dosing.	Hunched intermittently	Unprovoked vocalization
Transient vocalization	Intermittent vocalization when provoked.	Persistent and copious reddish nasoocular discharge
Transient reddish-brown nasoocular discharge.	Persistent reddish-brown nasoocular discharge	Labored breathing
Normal respiration	Abnormal breathing patterns	Persistent tremors
Transient tremors	Intermittent tremors	Persistent convulsions
No Convulsions	Intermittent convulsions	Prostration > 1 hr
No prostration	Transient prostration (<1 hr)	Self mutilation
No self-mutilation	No self mutilation	

Signs of Acute Pain in Rabbits

- | | |
|--|---|
| <ul style="list-style-type: none"> a. Drinking less water b. Sits hunched up in corner of cage c. Reduced awareness and response to environmental stimuli d. Not using affected body part e. Licking or scratching a particular area f. Body drawn in or continuously maximally extended g. Noise on expiration | <ul style="list-style-type: none"> h. Rapid, shallow breathing i. Unsteady gait j. Self-mutilation k. Eating less l. Weighs less m. Not grooming. Scraggly fur. n. Change in temperament |
|--|---|

Signs of Acute Pain in Dogs and Cats

- a. Eating less
- b. Drinking less
- c. Weighs less
- d. Vocalizing, especially when moving or when the painful area is touched.
- e. Licking, picking or scratching a particular area
- f. Not using affected body part
- g. Change in temperament
- h. Pacing, repeatedly lies down and gets up again
- i. Lack of mobility (with joint or abdominal pain)
- j. Failure to groom
- k. Abnormal resting postures
- l. Failure to show normal pattern of inquisitiveness
- m. Noise on expiration
- n. Rapid, shallow breathing

Signs of Chronic Pain in Dogs and Cats

- a. Excess licking, rubbing, biting or scratching the painful area.
- b. Becomes more withdrawn
- c. Loss of appetite
- d. Sunken eyes
- e. Dehydration
- f. Dysuria
- g. Weight loss

Signs of Acute Pain in Monkeys

- a. Eats less
- b. Drinks less
- c. Loss of appetite
- d. Change in bowel habits
- e. Grimacing
- f. Sits unresponsively in cage
- g. Change in temperament
- h. Vocalizes, especially when moving or when painful area is touched
- i. Licking, scratching or self-mutilating a particular area
- j. Lack of mobility (with joint or abdominal pain)
- k. Failure to groom
- l. Abnormal resting postures

**Proposed Method to Quantify Pain, Distress and Suffering
(Morton & Griffiths, Vet. Record. 116:431-436, 1985)**

Variable

Body Weight Changes

- 0 = Normal**
- 1 = <10% loss**
- 2 = 10-15% loss**
- 3 = >20% loss**

Physical Appearance

- 0 = Normal**
- 1 = Lack of Grooming**
- 2 = Rough coat, nasoocular discharge**
- 3 = Very rough coat, abnormal posture, enlarged pupils**

Measurable Clinical Signs

- 0 = Normal**
- 1 = Small changes of potential significance**
- 2 = Temp change of 1-2 C. Cardiac & respiratory rates increased up to 30%**
- 3 = Temp change >2 C. Cardiac & respiratory rates increased up to 50% or greatly decreased**

Unprovoked behavior

- 0 = Normal**
- 1 = Minor changes**
- 2 = Abnormal, reduced mobility, decreased alertness, inactive**
- 3 = Unsolicited vocalizations, self mutilation, either very restless or immobile**

Behavioral Responses to External Stimuli

- 0 = Normal**
- 1 = Minor depression/exaggeration of response**
- 2 = Moderately abnormal responses**
- 3 = Violent reactions or comatose**

If "3" is given more than once, change all "3" into "4". Sum the scores from all variables.

- 0-4 = Normal
- 5-9 = Mild pain/distress
- 10-14 = Moderate pain/distress
- 15-20 = Severe pain/distress

GUIDELINES ON ADJUVANTS AND ANTIBODY PRODUCTION

(Condensed from Jackson, L. and Fox, J. ILAR Jour. 37(3):141-152, 1995)

Note: NIH/OLAW requires *in vitro* production of monoclonal antibodies as the default action. Monoclonal antibody production by mouse hybridomas requires strong scientific justification, often entailing documentation that *in vitro* production is not feasible.

In Vivo Monoclonal Antibody Production

1. Hybridoma recipient mice must be histocompatible, or if not, must be immunodeficient or immunosuppressed by exogenous means such as radiation.
2. Female mice abdominal musculature is presumed to be more distensible, which allows larger ascites volumes to be tolerated without discomfort. BALB/c male mice are aggressive and often require individual housing.
3. The immunization schedule and the selection of, or need for, adjuvants should be determined based on the nature of the antigen. For example, intravenous inoculation can be used for particulate antigens without adjuvant and for booster immunizations of soluble antigens in saline. Subcutaneous and intraperitoneal routes of injection are commonly used for primary immunization of mice with antigen-adjuvant preparation.
4. Because of limited muscle mass, intramuscular injections in mice are discouraged. Intradermal injections are usually limited to a total volume of 0.05 ml. Volumes of 0.05 to 0.2 ml may be administered subcutaneously, and volumes <0.5 ml may be administered intraperitoneally. We limit the total volume to 0.1 ml if Freund's Complete Antigen (FCA) is used. Freund's incomplete adjuvant (FIA) should be used for subsequent boosts.
5. In mice that do not receive a priming agent prior to hybridoma cell inoculation, solid tumors may form, but little or no ascites is produced. Pristane is used most often to rime the peritoneal cavity. An alternative to the use of Pristane is FIA. Biologic effects of pristane include granulomatous inflammation in the peritoneum, immunosuppression, induction of growth factors, lymphatic obstruction, etc. The interval between Pristane priming and hybridoma cell inoculation varies from 5 days to 4 weeks.
6. The optimal cell number for inoculations may be dependent on its biologic behavior. Pilot studies may be needed. Guidelines for the number of cells in the hybridoma inoculum range from 10,000 to 10,000,000.
7. Ascites pressure is to be relieved by abdominal paracentesis when visible abdominal distention becomes evident and before the development of marked distention with clinical signs of pain or distress. Ascitic fluid volume should not exceed 20% of the baseline body weight prior to performing paracentesis. Anesthesia is recommended when performing paracentesis. An 18-20 gauge

needle is often used. To help prevent shock, 2-3 ml of warm saline or lactated Ringers solution may be administered subcutaneously to the mouse at the time of paracentesis. Intervals of 1-3 days between taps are recommended in the literature. Some MCPHU investigators use only one tap. MCPHU policy is for a maximum of 3 taps and euthanasia should precede the final abdominal paracentesis.

8. Animals must be observed daily for signs of pain or distress, particularly for difficult breathing, pale eyes, ears, and mucous membranes. Animals should be monitored for at least 30 minutes following an abdominal tap.

Polyclonal Antibody Production

1. Rabbits are commonly used, although other animals are used as well. Rabbits are usually over 2 kg in weight before immunization commences.
2. Antigens should be free of extraneous microbial contamination. The presence of byproducts, such as polyacrylamide gel, should be avoided. Extremes of pH, contamination with chemical or other toxic agents should be avoided.
3. If FCA is used, the mycobacteria should first be resuspended by vortexing or shaking. One part or less of FCA to one part antigen (v/v) is recommended. Glass syringes are preferred for mixing. The emulsion is properly prepared when it is thick and difficult to inject back and forth. A droplet placed into a saline solution should not disperse. For antigen-adjuvant preparations using adjuvants other than Freund's follow manufacturer's instructions.

Freund's Adjuvant and Alternatives

1. The use of FCA requires sound scientific justification, as per USDA policy.
2. FCA should be used only once, for initial immunization. Use FIA for boosters.
1. Formulations of FCA not exceeding 0.1 mg dry mycobacterial cell mass/ml are recommended to avoid increased inflammation and necrosis. The use of FCA is specifically discouraged for use in primates because of subsequent positive tuberculin test results.

Injection Site Selection and Preparation (Freund's and other adjuvants)

1. Care should be taken to avoid areas where animal may be lifted (e.g. the dorsal cervical area of rabbits). Avoid sites that may be prone to self-mutilation, and avoid sites that may interfere with ambulation, such as footpads. "Footpad" injections in rabbits are prohibited as the lack of anatomically defined footpads plus the weight bearing function of the rabbit's feet preclude this site for immunization.
2. Clip hair from intradermal and subcutaneous sites and aseptically prepare the same for injection. The use of sterile needles and syringes is mandatory.

Routes, Volumes, and Sites of Administration with FCA and FIA

1. Inject small volumes into multiple injection sites. Injection sites must be sufficiently separated to prohibit coalescing of the inflammatory lesions. This helps prevent draining abscesses and provides more foci for antigen presentation.
2. Booster sites should be distanced from previous injection sites.
3. Maximum volume for rabbit intradermal injection is 0.1 ml/site, using a 25-27 gauge needle. Intradermal injection is not generally recommended in rodents; however, some institutions use 0.01-0.05 ml/site.
4. Maximum subcutaneous injection in rabbits is 0.25 ml/site. Subcutaneous injection volumes in rodents are maximally 0.10 ml/site.
5. The intramuscular route of injection is not usually permitted with FCA.
6. Intraperitoneal Freund's is only recommended in rodents. Volumes should be <0.1 ml.
7. Intravenous use of FCA or FIA is not permitted.
8. Investigators are to observe animals for ulcers, infection, etc., no less often than 3 times weekly for a period of 4 weeks following immunization.

Blood Collection After Immunizations

1. Survival bleeding is most commonly performed via tail vein or retro-orbital sinus from rodents under anesthesia, and via the marginal ear vein or central ear artery in rabbits with appropriate sedation or tranquilization.
2. Blood collection from rabbit ears by transecting the vein is prohibited. The use of xylene for vasodilation is discouraged.
3. Intracardiac blood collection is limited to terminal procedures and is performed under general anesthesia in both rodents and rabbits. Survival intracardiac blood collection is not permitted.

GENERAL REQUIREMENTS FOR SURVIVAL SURGERY

(Additional details can be found on the following pages)

1. Federal law requires that *all* survival surgeries on any vertebrate animal (including rodents) be performed aseptically.
 - a. Sterile surgical instruments and supplies must be used for each individual animal. Satisfactory sterilization may be obtained via autoclaving, sterilization (e.g. 2% glutaraldehyde solution) and gas sterilization. Chemicals such as 70% ethanol and quaternary ammonium compounds are *not* sterilants. The use of a hot glass bead sterilizer may be satisfactory if the handle of the instrument is kept sterile or sterilized in the hot bead sterilizer prior to use.
 - b. The surgical field should be broadly clipped (avoid shaving if possible), and washed with an antiseptic cleanser (e.g. providone iodine surgical scrub). 70% alcohol may be used as a final skin preparation. *70% alcohol by itself is inadequate for skin disinfection.*
 - c. The surgical field should be draped with a sterile drape.
 - d. The surgeon should properly wash his/her hands (and arms if possible) with an antiseptic cleanser, and don sterile gloves and gown. A surgical mask must be used. Head and shoe covers are recommended.
 - e. The surgeon must reglove if any nonsterile object is touched during surgery. *Most surgeons never drop their hands below their waist.*
 - f. The surgeon and surgical assistants must be skilled in the techniques required of them for the specific procedure being performed.
2. All survival surgery on any non-rodent mammal *must* be performed in an aseptic surgical suite, as defined in the *Guide for the Care and Use of Laboratory Animals*, and approved by the Institutional Animal Care and Use Committee. Survival surgery on rodents may be performed in an aseptic surgical suite, or in a clean area of a laboratory or other room that is used for surgery only, when a surgical procedure is being performed.
3. All animals must be observed until they recover from anesthesia to the point of being able to maintain sternal recumbency. Animals must be kept separate from other animals (i.e. in separate cages) until fully recovered.
4. Drugs for pain relief or other purposes must be used in the manner stated in the investigator's IACUC approved protocol.

5. **The university's Anesthesia Record and Postprocedure Treatment form *must* be used when survival surgery is performed on any non-rodent species.**

These forms are available at all surgery suites. For the protection of the investigator, it is suggested that these forms be used for any surgical procedure, including non-survival surgery.

DETAILED CONSIDERATIONS FOR ANIMAL, SURGEON and INSTRUMENT PREPARATION PRIOR TO SURGERY

- A. Bathe the entire body the day before, if grossly dirty.
- B. Removal of hair from operative site.
 - 1. Should be done outside of the operating room or surgical area. In ULAR surgical suites there is a prep area separate from the room where the surgery is performed.
 - 2. The amount of time between the pre-op clip and the operation has a direct effect on the wound infection rate.
 - a. Avoid scrapes, nicks, scratches, and cuts because cutaneous bacteria will proliferate in these areas and increase the chances of infection. Clip, do not shave whenever possible.
 - b. The extent of the area to be clipped is determined by the site of the incision and the nature of the operation. For orthopedic surgery of the extremities, the clip should extend from one joint above to one joint below the area of incision.
 - 3. Skin prep in the operating room has the disadvantages that the anesthesia time is prolonged and loose hair remaining in the surrounding drapes may get into the wound.
- C. Skin disinfection of the operative area.
 - 1. Use a commercially available sterile skin preparation set.
 - a. Wash your hands before preparing the animal.
 - b. Use sterile gloves (if necessary) for maximal protection.
 - c. Place absorbent pads around patient to protect operating room table and sheets or heating pad from getting wet.
 - 2. Antiseptic agents used to prep skin.
 - a. Most commonly used skin antiseptic is povidone/iodine, a complex of polyvinylpyrrolidone and iodine.
 - i. It possesses the potent germicidal effect of iodine without many of its irritating properties.
 - ii. The activity is prolonged because it is released gradually from the binding polymer.
 - iii. It is effective in the presence of purulent exudates but has a shorter duration in the presence of blood or serum.
 - iv. It can be safely used on mucous membranes but do not allow it to pool on skin or in body cavities.

- v. It has been shown to become contaminated by Pseudomonas spp. Thus, the practice of keeping spray bottles of diluted Betadine or scrub-soaked gauze sponges can actually contribute to post-op infections.
 - b. 70% alcohol
 - i. Works by defatting the skin and by mechanical removal of microorganisms.
 - ii. It is flammable and should be used in small quantities and not allowed to pool.
 - c. Chlorhexadine
 - i. Comes in a 4% aqueous concentration skin cleanser (Hibiclens) or as a tincture of 0.5% chlorhexidine gluconate in 70% isopropyl alcohol (Hibitane).
 - ii. Hibiclens residues accumulate on the skin with repeated use and produce a prolonged effect, up to 6 hours.
 - iii. Hibitane maintains a reduction in microbial flora for at least 4 hours. Its activity is decreased in the presence of soap or organic matter.
 - iv. Chlorhexidine can cause corneal damage if splashed in the eye.
- 3. The skin scrub begins with chlorhexidine or povidone/iodine at the line of the proposed incision and proceeds to the periphery of the area.
 - a. Use a circular motion in ever-widening circles.
 - b. The soiled cleaning sponges are discarded when the prep area is covered. A soiled sponge is never brought back over a scrubbed surface.
 - c. Repeat with separate sponges for a minimum of 5 minutes.
- 4. Wipe scrub off with 70% alcohol or pat dry with sterile towel. Remove the towel by lifting it toward self without dragging the edge over cleansed area.
- 5. Paint the prep site with povidone-iodine solution.
 - a. Apply prep starting at the incision site and move in a circular motion to the periphery. Do not bring the sponge back over the already prepped area.
- 5. Remove absorbent pad without reaching over prepped area.

SURGICAL SCRUB FOR THE SURGEON

- A. An area equipped with surgical sinks should be close to, but apart from the operating room.

- B. Objectives of the surgical scrub:
 - 1. To remove dirt, skin, oil, and microbes from hands and lower arms.
 - 2. To reduce the microbial count to as near zero as possible. (Bacteria multiply rapidly on gloved hands which provide great conditions for growth).
 - 3. To leave an antimicrobial residue on the skin to prevent the growth of microbes for several hours.

- C. The anatomic counted brush stroke method takes about 5 minutes.
 - 1. 30 strokes to the nails and 20 strokes to each area of the skin.
 - 2. When scrubbing, the fingers, hands, and arms should be visualized as having four sides; each side must be scrubbed effectively.

- D. Procedure
 - 1. Open sterile scrub brush before wetting hands.
 - 2. Wet hands and arms and wash thoroughly to 2 inches above the elbows. This loosens surface debris and transient organisms. Scrubbing with a brush removes the resident flora.
 - 3. Clean nails with nail cleaner provided in the scrub brush packet under running water.
 - 4. Rinse thoroughly with running water.
 - 5. Begin scrub – hold hands up – nails, fingers, and hand. In the one-brush method each side is alternately scrubbed as the procedure advances proximally to the elbow.
 - 6. Each side of the arm is scrubbed to 2” above the elbow.
 - 7. Keep hands above elbows to allow water and detritus to flow away from the first scrubbed and cleanest area. Hold hands and arms away from body.
 - 8. Rinse or pat hands dry without rinsing. A study described in the *Am J of Surgery* compared rinsing hands washed with chlorhexidine to patting hands dry without rinsing. The results were lower bacterial counts post-surgically on the hands which were not rinsed.
 - 9. Hold hands and arms up in front of body with elbows slightly flexed while entering the operating room.
 - 10. Drying hands – grasp sterile towel and lift up and away from sterile field. Bend forward slightly at waist with hands and elbows above waist and away from body.
 - a. Allow towel to unfold downward to its full length.
 - b. Top half of towel is held securely with one hand and the opposite fingers and hands are blotted dry, making sure they are thoroughly dry before moving up the arm. To avoid contamination a rotating motion is used while moving up the arm to the elbow and an area is not retraced.

- c. The lower end of the towel is grasped with the dried hand, and same procedure is repeated to dry the other hand and forearm.
11. Using aseptic technique, don surgical gloves.

DRAPING OF THE ANIMAL

A variety of different surgical drapes are available. All must be sterile when used. For small rodents, commercially available plastic drapes with a small center hole provide a satisfactory alternative to traditional surgical drapes (e.g. consider using 3M Brand Steri-Drape 1024 which has a 2.25 x 1.13 inch oval aperture).

STERILIZATION OF INSTRUMENTS

All instruments used in survival surgery on any species must be sterile at the time of their use. Common ways of assuring sterilization include autoclaving, ethylene oxide gas sterilization, and soaking in a sterilant solution for the appropriate length of time. It is recognized that for multiple surgical procedures on small rodents it is often difficult to have sufficient sterile instruments between animals and “flash” sterilize them in a commercial glass bead sterilizer. Another option is to have more than one set of instruments available and soak one or more sets in a commercial sterilant solution while the others are being used. A indicator of sterility must be placed within the surgical pack and these strips should be maintained with the surgical records.

RULES OF THUMB FOR ASSESSING THE NEED FOR ANESTHESIA OR ANALGESIA PRIOR TO BEGINNING A PROCEDURE

1. **If a procedure would probably cause pain or distress in a human, it will be painful or distressful to a laboratory animal.** Although there are some exceptions, this is the guiding principle used at Drexel University and by the federal government.
2. The corollary to the above is that if a human would require anesthesia, analgesia or tranquilization, so would a laboratory animal.
3. Pain in most laboratory animals is difficult to judge because they do not exhibit many of the outward signs we associate with pain in humans. Often, the lack of an overt pain response is an adaptive mechanism used to promote survival in the animals' natural habitat. Use rule 1 above, and see the enclosed guidelines for assessing pain in laboratory animals.
4. Procedures that only require a burr hole to be made through the skull *may not* require postoperative analgesia. Procedures that require the periosteum to be scraped or muscles to be moved *most likely will* require post operative analgesia.
5. **Do no assume that because an anesthetic is used, there is adequate postoperative relief of pain.** Most anesthetics provide minimal and very transient postoperative pain relief.
6. Never use a tranquilizer in lieu of an anesthetic or analgesic. The majority of tranquilizers have little or no analgesic activity, and by definition, they are not anesthetics.
7. Never use a neuromuscular blocking agent in lieu of an anesthetic or analgesic. They do not provide anesthesia or analgesia.

DRUG COMPENDIUM

ANALGESIA (1-4 HOURS OF DURATION)

(Note: This listing is only for drugs having their frequency of administration listed)

Amphibian:	clonidine, fentanyl; see Frog
Bird:	butorphanol
Cat:	butorphanol, medetominine, meperidine, methadone, morphine, nalbuphine, nalorphine, osymorphone, pentazocine, Phenobarbital
Cattle:	acetylsalicylic acid, buprenorphine, butorphanol, meperidine, morphine
Dog:	acetaminophen, acetylsalicylic acid, butorphanol, fentanyl, ibuprofen, medetomidine, meperidine, methadone, morphine, nalbuphine, nalorphine, oxymorphone, pentazocine, Phenobarbital
Ferret:	butorphanol, meperidine, morphine, nalbuphine, oxymorphone, pentazocine
Frog:	butorphanol, flunixin
Gerbil:	butorphanol, meperidine, morphine, nalbuphine, oxymorphone, pentazocine
Guinea Pig:	acetylsalicylic acid, butorphanol, codeine, fentanyl, ibuprofen, meperidine, morphine, nalbuphine, oxymorphone, pentazocine
Hamster:	acetylsalicylic acid, butorphanol, fentanyl, meperidine, morphine, nalbuphine, oxymorphone, pentazocine
Mouse:	acetaminophen, acetylsalicylic acid, butorphanol, codeine, ibuprofen, meperidine, methadone, morphine, nalbuphine, oxymorphone, pentazocine
Primate:	acetylsalicylic acid, butorphanol, methadone, morphine, nalbuphine, oxymorphone, pentazocine.
Rabbit:	acetylsalicylic acid, butorphanol, fentanyl, ibuprofen, meperidine, methadone, morphine, nalbuphine, oxymorphone, pentazocine.
Rat:	acetaminophen, acetylsalicylic acid, butorphanol, codeine, fentanyl/medetomidine, ibuprofen, ketamine/xylazine, meperidine, methadone, morphine, nalbuphine, nalorphine, oxymorphone, pentazocine, phenobarbital

Reptile: meperidine

Sheep/Goat: acetylsalicylic acid, buprenorphine, butorphanol, clonidine, codeine, meperidine, methadone (goat), morphine, nalbuphine, pentazocine

Swine: acetylsalicylic acid, butorphanol, fentanyl, meperidine, morphine, oxymorphone, pentazocine, sufentanyl

ANALGESIA (4-8 HOURS DURATION)

(Note: This listing is only for drugs having their frequency of administration listed)

Amphibian:	codeine, morphine
Cat:	buprenorphine, butorphanol, methadone, pentzocine, sufentanyl
Cattle:	
Dog:	acetaminophen, buprenorphine, codeine, methadone, morphine, sufentanyl
Ferret:	buprenorphine, morphine, oxymorphone
Gerbil:	buprenorphine
Guinea Pig:	acetylsalicylic acid, buprenorphine
Hamster:	acetylsalicylic acid, buprenorphine
Mouse:	buprenorphine, codeine
Primate:	acetaminophen, buprenorphine, hydromorphone, flunixin
Rabbit:	acetylsalicylic acid, buprenorphine
Rat:	buprenorphine
Sheep/Goat:	
Swine:	acetylsalicylic acid

ANALGESIA (8 OR MORE HOURS DURATION)

(Note: This listing is only for drugs having their frequency of administration listed)

Bird:	flunixin
Cat:	acetylsalicylic acid, carprofen, fentanyl patch, flunixin, ibuprofen, ketoprofen, morphine, phenylbutazone, tolfenamic acid
Cattle:	acetylsalicylic acid, flunixin, ketoprofen, meoxicam, phenylbutazone, tolfenamic acid
Dog:	acetylsalicylic acid, bupivacaine (epidural), carprofen, fenoprofen, fentanyl patch, flunixin, ibuprofen, ketoprofen, ketorolac, meloxicam, naproxen, oxymorphone (epidural), phenylbutazone, tolfenamic acid
Ferret:	buprenorphine, flunixin
Frog:	butorphanol
Gerbil:	flunixin
Guinea Pig:	diclofenac, flunixin, piroxicam
Hamster:	flunixin
Mouse:	flunixin
Primate:	carprofen, flunixin, ketoprofen, naproxen
Rabbit:	carprofen, fentanyl patch, flunixin, ketoprofen, lofentanil, meloxicam, piroxicam
Rat:	carprofen, diclofenac, flunixin, ketoprofen (in jelly), lofentanil, meloxicam, piroxicam
Reptile:	carprofen, flunixin, ketoprofen
Sheep/Goat:	acetylsalicylic acid, buprenorphine, carprofen, fentanyl patch, flunixin, phenylbutazone
Swine:	buprenorphine, carprofen, fentanyl patch, flunixin, ketoprofen, ketorolac, phenylbutazone

ANESTHESIA – GENERAL PARENTERAL

(Note: This listing is only for drugs having their frequency of administration listed)

(Single dose duration less than 1 hour)

Amphibian:	tricaine methane sulfonate
Bird:	alphaxalone/alphadalone, propofol
Cat:	alphaxalone/alphadalone, ketamine, methohexital, pentobarbital, propofol, thiamylal, thiopental, tiletamine/zolazepam
Cattle:	ketamine, methohexital, pentobarbital, thiamylal, thiopental, tiletamine
Dog:	etomidate, fentanyl/fluanisone, ketamine, methohexital, pentobarbital, propofol, thiamylal, thiopental, thiletamine/zolazepam
Ferret:	alphaxalone/alphadalone, ketamine, tiletamine/zolazepam
Fish:	eugenol
Gerbil:	alphaxalone/alphadalone, fentanyl/fluanisone, ketamine, pentobarbital, tiletamine zolazepam, tribromoethanol
Guinea Pig:	alphaxalone/alphadalone, ketamine, fentanyl/fluanisone, methohexital, pentobarbital, thiopental, tiletamine/zolazepam
Hamster:	alphaxalone/alphadalone (up to 2.5 hours), ketamine, medetomidine, methohexital, pentobarbital, thiopental, tiletamine/zolazepam
Mouse:	alphaxalone/alphadalone, fentanyl/fluanisone, hexobarbital, ketamine, methohexital, metomidate, pentobarbital, propofol, thiamylal, thiopental, tiletamine/zolazepam, tribromoethanol
Primate:	alphaxalone/alphadalone, ketamine, ketamine/xylazine, methohexital, pentobarbital, propofol, thiopental, tiletamine/zolazepam
Rabbit:	alphaxalone/alphadalone, fentanyl/fluanisone, hexobarbital, ketamine, medetomidine, methohexital, pentobarbital, propofol, thiamylal, thiopental, tiletamine/zolazepam
Rat:	alphaxalone/alphadalone, fentanyl/fluanixone, hexobarbital ketamine, methohexital, pentobarbital, propofol, thiamylal, thiopental, tiletamin/zolazepam, tribromoethanol

Reptiles: ketamine

Sheep/Goat: alphaxalone/alphadalone, etomidate, ketamine combinations, methohexital, pentobarbital, propofol, thiamylal, thiopental, tiletamine/zolazepam

Swine: alphaxalone/alphadalone, ketamine, methohexital, metomidate, pentobarbital, thiamylal, thiopental, tiletamine/zolazepam

ANESTHESIA – GENERAL PARENTERAL

(Note: This listing is only for drugs having their frequency of administration listed)
(Single dose duration greater 1-3 hours)

Rat: inactin

ANESTHESIA – GENERAL PARENTERAL

(Note: This listing is only for drugs having their frequency of administration listed)
(Single dose duration greater than 3 hours)

Cat: urethane

Dog: urethane

Ferret: urethane

Guinea Pig: urethane

Hamster: urethane

Rabbit: urethane

Rat: ketamine/xylazine infusion, pentobarbital (some females), urethane

ANESTHESIA – LOCAL ANESTHETICS OF 1-3 HOUR DURATION

(Note: This listing is only for drugs having their frequency of administration listed)

Amphibian: benzocaine

Cat: bupivacaine, lidocaine, mepivacaine

Cattle: mepivacaine

Dog: bupivacaine, lidocaine, mepivacaine

Ferret:

Fish: benzocaine

Gerbil:

Guinea Pig:

Hamster:

Mouse:

Primate:

Rabbit:

Rat: bupivacaine

Sheep/Goat:

Swine:

NEUROMUSCULAR BLOCKING/IMMOBILIZING AGENTS

****These agents should only be given when adequate anesthesia is provided****

Bird:	atacurium
Cat:	atacurium, gallamine, pancuronium, pipecuronium, rocronium, succinylcholine, tubocurarine, vecuronium
Cattle:	alcuronium, gallamine, panuronium, succinylcholine, tubocurarine
Dog:	alcuronium, atacurium, gallamine, pancuronium, pipecuronium, pyridostigmine, succinylcholine, vecuronium
Ferret:	succinylcholine
Fish:	gallamine
Frog:	succinylcholine
Gerbil:	
Guinea Pig:	
Goat:	etorphine, pancuroniu, succinylcholine
Hamster:	
Mouse:	
Primate:	atacurium, mivacurium, pancuronium, vecuronium
Rabbit:	atacurium, gallamine, pancuronium, pipecuronium, succinylcholine, tubocurarine, vecuronium
Rat:	atacurium, pancuronium, succinylcholine, vecuronium
Sheep:	atacurium, etorphine, gallamine, pancuronium, succinylcholine, tubocurarine, vecuronium
Swine:	atacurium, doxacurium, etorphine, gallamine, mivacurium, pancuronium, pipecuronium, rocuronium, succinylcholine, vecuronium

TRANQUILIZERS/SEDATIVES/HYPNOTICS

Bird:	acetylpromazine, diazepam, midazolam
Cat:	acetylpromazine, alphaxalon/alphadalone, α -chloralose ¹ , chlorpromazine, diazepam, etomidate, etorphine/methotrimeprazine, fentanyl/droperidol, midazolam, phenobarbital, promazine, xylazine
Cattle:	acetylpromazine, chloral hydrate, α -chloralose, chlorpromazine, diazepam, midazolam, promazine, xylazine
Dog:	acetylpromazine, chloral hydrate, α -chloralose, chlorpromazine, diazepam, ethylosobutrazine, etomidate, etorphine/methotrimeprazine, fentanyl/droperidol/midazolam, medetomidine, pentobarbital, phenobarbital, promazine, romifidine, xylazine
Ferret:	acetylpromazine, diazepam
Fish:	etomidate
Gerbil:	alphaxalone/alphadalone, diazepam, fentanyl/fluanisone
Guinea Pig:	acetylpromazine, alphaxalone/alphadalone, chloral hydrate, α -chloralose, chlorpromazine, diazepam, droperidol, etomidate, fentanyl/droperidol, promazine
Hamster:	acetylpromazine, alphaxalone/alphadalone, α -chloralose, diazepam, fentanyl/droperidol, fentanyl/fluanisone, medetomidine, promazine, tiletamine, triflupromazine
Mouse:	actylprmazine, alphaxalone/alphadalone, chloral hydrate, α -chloralose, chlorpromazine, diazepam, etomidate, fentanyl/droperidol, fentanyl/fluanisone, promazine, xylazine
Opossum:	azaperone
Primate:	acetylpromazine, alphaxalone/alphadalone, diazepam, droperidol, etomidate, fentanyl/droperidol, fentanyl/fluanisone, promazine, xylazine
Rabbit:	acetylpromazine, alphaxalone/alphadalone, chloral hydrate, α -chloralose, chlorpromazine, diazepam, etomidate, etorphine/methotrimeprazine,

¹ See drug listing for possible use as an anesthetic

fentanyl/droperidol, fentanyl/fluanisone, medetomidine, midazolam, phenobarbital, promazine, xylazine

Rat: acetylpromazine, alphaxalone/alphadalone, chloral hydrate, α -chloralose, chlorpromazine, diazepam, droperidol, etomidate, etorphine/methotrimeprazine, fentanyl/droperidol, midazolam, promazine, xylazine

Sheep/Goat: acetylpromazine, chlorpromazine, diazepam, etomidate, etorphine/acetylpromazine, etorphine/methotrimeprazine, promazine, romifidine, xylazine

Swine: acetylpromazine, alphaxalone/alphadalone, azaperone, α -chloralose, chlorpromazine, climazolam, diazepam, droperidol, ethylisobutrazine, etomidate, fentanyl/droperidol, fluzepam, ketamine/xylazine, midazolam, promazine, triflupromazine, xylazine

USE OF THIS DRUG COMPENDIUM

By Jerald Silverman, DVM

Updated by Richard B. Huneke, DVM

1. This compendium provides dosages of drugs and drug combinations for use in research protocols approved by the Institutional Animal Care and Use Committee (IACUC) of Drexel University and by persons approved by that committee.

No drugs, including antibiotics, replacement fluids, etc. can be used without IACUC approval. IN unique circumstances, approval by the university's veterinarians can be obtained without IACUC approval.

2. Very often, *numerous dosages for the same drug are provided* for the same species. These often reflect different research needs (e.g., controlling minimal versus severe pain) or the experience of different authors. A Laboratory Animal Medicine veterinarian will be pleased to help you.
3. Drug combinations frequently provide better overall anesthesia than one drug alone. If you would like to use a drug combination but need further consultation, please call a Laboratory Animal Medicine veterinarian. It is important to check the listings for all drugs in a drug combination.
4. The user is expected to be knowledgeable about the physiologic effects of these drugs. Help may be obtained in laboratory animal and human medicine texts kept in the university library, as well as from the Laboratory Animal Medicine veterinarians.
5. **It is the responsibility of the principal investigator to make informed decisions, and not to blindly follow this Compendium. For example, certain analgesics may provide satisfactory visceral analgesia but unsatisfactory skeletal analgesia. When possible, these differences are noted. Many veterinary and human tests are available for investigator use, as noted above.**

**A COMPENDIUM OF DRUGS USED FOR LABORATORY ANIMAL
ANESTHESIA, ANALGESIA, TRANQUILIZATION AND RESTRAINT**
(Highlighted dosages are those commonly used)

ACEPROMAZINE – see acetylpromazine

ACETAMINOPHEN (Tylenol, Datril)

Class Aminophenol derivative analgesic, antipyretic

Source Over the counter

Cat	DO NOT USE
<u>Dog</u>	15 mg/kg PO²⁰
Gerbil	100-150 mg/kg PO ²³⁴
Goat	300 mg/kg PO ¹⁴⁷
Guinea Pig	87 mg/kg PO ²³⁴
Mouse 1	110-135 mg/kg PO IP ¹²
Mouse 2	300 mg/kg IP ^{2, 37}
Primate	10 mg/kg PO ¹
Rabbit 1	1.0-2.0 mg/ml in drinking water ²³³
Rabbit 2	200-500 mg/kg PO ²³³
Rabbit 3	1.0 ml with codeine elixir (2.4 mg/ml) in 10-20 ml drinking water. Add dextrose to enhance palatability. ²³³
Rat	110-305 mg/kg PO, IP ¹² . See comments

Dosage Frequency

Dog	8 hours ²⁰
Gerbil	4 hours ²³⁴
Mouse 1	4 hours ¹¹
Primate	8 hours ¹
Rat	4 hours ^{11, 110}

Antagonist

Acetylcysteine (q.v.) for toxicity

Comments

All Empirically, may cause hepatotoxicity in combination with pentobarbital.

All **Poorly water soluble**

Rat Not effective at any oral dose or flavor²¹⁷

Rabbits Low grade analgesia²³³

ACETYLCYSTEINE (Mucomyst, Mucosol)

Class Acetaminophen toxicity antidote

Source Bristol, Dey, generic

Cat 140 mg/kg PO, IV then 70 mg/kg every 4 hours for 7 more doses⁷²
Dog 140 mg/kg PO, IV then 70 mg/kg every 4 hours for 7 more doses⁷²

Dosage frequency
See under “dose”

Comments

All Bad taste. May have to intubate⁷²

ACETYLPROMAZINE (Acepromazine, Promace)

Class Phenothiazine tranquilizer (α -1 antagonist)

Source Generic, Fort Dodge Laboratories, Tech America

Bird 0.5-1.0 mg/kg IM¹⁴⁷
Calf 1 0.04-0.09 mg/kg IV²¹. 25 mg maximum in adult cattle for preoperative tranquilization⁵⁹
Calf 2 0.1 mg/kg IM²⁰
Cat 1 0.1-0.3 mg/kg IM, SC, IV⁶. 0.5 mg/kg IM³⁷
Cat 2 0.03-0.05 mg/kg IV, IM²⁰
Dog 1 0.1 mg/kg IM, SC, IV 15 minutes to 4 hours before anesthesia with maximum of 3 mg. Maximum 0.02-0.05 mg in aged animals¹. See comments.
Dog 2 See Butorphanol
Ferret 1 0.2-0.5 mg/kg SC, IM¹¹⁶
Ferret 2 0.1-0.25 mg/kg IM, SC²³²
Gerbil **Do Not Use**^{148,175}
Goat 0.04-0.06 mg/kg IM, IV²⁰
Guinea Pig 0.75-2.0 mg/kg IM, SC¹⁴⁷
Hamster 0.5-2.0 mg/kg IM¹⁴⁷, SC¹⁷⁵
Mouse 1 2-5 mg/kg IP²⁰
Mouse 2 0.5-2.5 mg/kg SC, IM¹⁷⁵
Primate 1 0.2 mg/kg IM^{20,37}, SC¹⁴⁷
Primate 2 0.55 mg/kg (IM?)¹¹¹
Rabbit 1 1 mg/kg IM²⁰, SC¹⁴⁷
Rabbit 2 5 mg/kg IM²¹

Rabbit 3	0.1-0.2 mg/kg IV ²¹
Rat 1	1 mg/kg IM ²⁰⁻³⁷
Rat 2	0.5-2.5 mg/kg IM, SC ¹⁷⁵
Sheep	0.04-0.06 mg/kg IM, IV ²⁰
Swine 1	1.1-2.2 mg/kg IM ²⁰ , IV, SC ²⁴⁰
Swine 2	0.02-0.07 mg/kg IV ²¹ . IV not a recommended route ²²²
Swine 3	0.1-0.2 mg/kg IM, SC, IV ¹⁴⁸ . IV not a recommended route ²²²

Dosage frequency

Cat 1	4 hours ²²⁰
Dog 1	Up to 48 hours ⁵⁵ , 1-2 hours ⁷⁰ , 4 hours ²²⁰
Primate	2 hours ⁷²
Rabbit 2	20-30 minutes ¹¹⁰

Antagonist

Phenylephrine (q.v.)

Comments

All	Antiarrhythmic, hypotensive, hypothermic
All	Antagonizes central dopamine receptors.
Dog 1	See also oxymorphone, butorphanol and proprenorphine. Causes vasodilation
Calf 1	Can increase risk of regurgitation during anesthesia. ¹³⁵
Ferret 1	Hypotensive, hypothermic ²³²
Primate 1	Can increase risk of regurgitation during anesthesia. ¹³⁵

ACETYLSALICYLIC ACID (Aspirin)

Class NSAID salicylate analgesic for mild to moderate musculoskeletal pain

Source Widely available generic and brand name (oral)

Cat	10 mg/kg PO ²⁰ . See duration of effect and comments.
Cattle	20-100 mg/kg PO ⁷²
Dog	10 mg/kg PO ²⁰ . 10-20 mg/kg PO ⁷² . See duration of effect.
Ferret 1	200 mg/kg PO ¹¹⁶
Ferret 2	10-20 mg/kg SC ²³²
Gerbil	240 mg/kg PO ²²³
Goat 1	50-100 mg/kg PO ²⁰
Goat 2	10-20 mg/kg PO ¹⁴⁸
Guinea Pig 1	20 mg/kg SC ²
Guinea Pig 2	86 mg/kg PO
Guinea Pig 3	270 mg/kg IP ¹⁴⁸
Hamster	240 mg/kg IP ¹⁴⁸ , PO ²²³
Mouse 1	400 mg/kg SC ¹¹⁷
Mouse 2	20 mg/kg SC ²
Mouse 3	120-300 mg/kg PO ²⁰
Primate 1	10-20 mg/kg PO ^{1, 37}

Primate 2	325 mg/adult Old World animal ¹¹⁸
Primate 3	125 mg/5 kg rectal suppository ²¹⁹
Rabbit 1	100 mg/kg PO ^{11, 110} . See comments
Rabbit 2	500 mg/kg PO ²⁰
Rabbit 3	10 mg/kg PO ¹²⁰
Rabbit 4	1-20 mg/kg SC ²¹⁸
Rat 1	20 mg/kg SC ³
Rat 2	110-120 mg/kg PO¹²
Rat 3	450 mg/kg PO ⁸¹
Sheep 1	50-100 mg/kg PO ²⁰
Sheep 2	10-20 mg/kg PO ¹⁴⁸
Swine	10-20 mg/kg PO ³

Dosage frequency

Cat	12 hours ¹²⁰ , <u>48 hours (detoxification time)¹³³</u>
Cattle	12 hours ⁷²
Dog	12 hours ¹⁴⁸
Ferret	Once daily ²³²
Gerbil	Once daily ²²³
Goat 1	12 hours ²⁰
Guinea Pig 1	4 hours ¹¹
Guinea Pig 2	6 hours ^{1, 37}
Guinea Pig 3	Once daily ²³³
Hamster	4 hours ¹⁵⁷ Once daily ²³³
Mouse 1	4 hours ¹¹
Mouse 2	4 hours ¹¹⁰
Primate 1	4 hours ¹¹
Mouse 2	4 hours ¹¹⁰
Primate 1	4 hours ¹⁰
Primate 2	4 hours ¹⁰
Rabbit 1	6-8 hours ²⁰ . Dosing every 12 hours probably safer.
Rat 2	4 hours ²⁰
Sheep 1	12 hours ²⁰
Swine	4-6 hours ²²¹

Comments

All	Can impair blood clotting
All	For mild to moderate pain. Not for visceral or sharp, intense pain. ¹⁰
All	Not readily water soluble
Cat	Not recommended for cats¹³³
Hamster	Readily consume children's aspirin with a little coaxing ¹⁵⁷
Rabbit 3	Bleeding tendency in 33% of rabbits given 50 mg/kg PO for three days ²³³

ALCURONIUM

Class Nondepolarizing neuromuscular blocking agent
Source Roche (Not available in U.S.)

Cattle 0.08 mg/kg. Route not specified⁵⁹
Dog 0.1 mg/kg. Route not indicated³⁷

Dosage frequency

Antagonist

Edrophonium (q.v.)
Neostigmine (q.v.)
Pyridostigmine (q.v.)

ALFENTANYL (Alfenta)

Class Opioid analgesic. **Controlled substance.**
Source Janssen

Rabbit 0.03-0.07 mg/kg IV¹⁷
Rat 0.044 mg/kg IV³⁴
Mouse 0.05-1.5 mg/kg IP²¹⁷

Dosage frequency

Mouse 15 minutes²¹⁷
Rabbit 45 minutes¹⁷

Antagonist

Naloxone (q.v.)

Comments

All Can give by continuous infusion³⁷

ALPHAXALONE (9 MG/ML)/ALPHADALONE (3 MG/ML) (Saffan, Althesin)

See Comments

Class Steroid sedative, analgesic, anesthetic

Source Available in Canada and Europe

Bird 8.0 mg/kg IV in incremental doses to 25 mg/kg maximum¹⁴⁸
Cat 1 9 mg/kg IV. Anesthesia. Can also give by continuous infusion of 0.3-0.2 mg/kg/minute³⁷
Cat 2 9 mg/kg IM. Light sedation³⁷
Cat 3 12-18 mg/kg IM¹²¹ then 3.0 mg/kg IV as needed¹⁴⁸
Dog **Do Not Use**¹⁴⁸
Ferret 1 6.0-8.0 mg/kg IM (preanesthetic)¹¹⁶
Ferret 2 12-15 mg/kg IM (anesthesia)¹¹⁶ Light sedation²²⁰
Ferret 3 10-12 mg/kg IV (anesthesia)²²⁰
Gerbil 1 20 mg/kg SC¹¹⁹

Gerbil 2	450 mg/kg PO ¹¹⁹
Gerbil 3	80-120 mg/kg IP. Sedation/anesthesia. See comments ³⁷
Guinea Pig 1	20 mg/kg IV bolus anesthesia
Guinea Pig 2	40 mg/kg IM ³⁷ or IP ¹³² immobilization
Guinea Pig 3	45 mg/kg IM, 20 minutes after 5.0 mg/kg diazepam IP ¹³²
Hamster 1	20 mg/kg SC ¹¹⁹
Hamster 2	150 mg/kg IP. Sedation/anesthesia. ³⁷ See comments.
Hamster 3	150 mg/kg IP. Immobilization and anesthesia ¹⁷⁷
Hamster 4	240 mg/kg PO ¹¹⁹
Mouse 1	120 mg/kg IP ⁸² See comments
Mouse 2	5.0 mg/kg IV then as needed to maximum of 20 mg/kg ¹⁴⁸
Mouse 3	10-15 mg/kg IV ³⁷ . Surgical anesthesia. Follow with 4-6 mg/kg every 15 minutes as needed ⁸²
Primate 1	<i>Rhesus</i> . 0.2 mg/kg/minute after induction with ketamine (q.v.) ¹⁸³
Primate 2	10-12 mg/kg IV ³⁷ anesthesia
Primate 3	12-18 mg/kg IM. Sedation ³⁷ then 6.0-9.0 mg/kg IV as needed
Primate 4	<i>Marmoset</i> . 0.1-0.15 ml/100 grams IM ¹²²
Primate 5	<i>Callithrix</i> . 15-19 mg/kg IM ²¹⁹
Primate 6	<i>Baboon</i> . 0.2 mg/kg/minute after induction with ketamine (q.v.) ¹¹¹
Rabbit 1	9-12 mg/kg IM. Sedation. ³⁷ Not recommended for anesthesia ³⁷
Rabbit 2	10-20 mg/kg IV. Sedation only. Not recommended for anesthesia ^{102, 157}
Rabbit 3	12 mg/kg IV. Light anesthesia ¹¹¹
Rat 1	9-12 mg/kg IP for preanesthesia ³⁷
Rat 2	10-12 mg/kg IV for surgical anesthesia ³⁷
Rat 3	6.0-9.0 mg/kg IV for surgical anesthesia ³⁷
Sheep	2.2 mg/kg IV for adults. 6.0 mg/kg IV for lambs. Can be administered by continuous infusion ³⁷
Swine 1	1.0-2.0 mg/kg IV. Anesthesia. Can use continuous infusion ³⁷
Swine 2	6.0 mg/kg IM ³⁷ . Sedation

Dosage Frequency

Cat 2	10 minutes ³⁷
Cat 3	15-30 minutes ¹²¹
Ferret 2	15-30 minutes ²²⁰
Ferret 3	10-15 minutes ²²⁰
Gerbil 1	75 minutes ¹³²
Guinea Pig 1	49-90 minutes ¹³²
Guinea Pig 2	10-12 minutes ¹³²
Guinea Pig 3	60 minutes ¹³²
Hamster 1	120-150 minutes ⁸³
Hamster 4	20-60 minutes ¹⁷⁷
Mouse 2	5 minutes ¹⁷⁷
Primate 2	15 minutes ³⁷
Primate 4	2 hours ¹²²
Primate 5	1 hour ²¹⁹

Rabbit 1	5-10 minutes ¹⁷⁷
Rabbit 2	8-10 minutes ¹¹¹
Rat 2	5 minutes ¹⁷⁷
Sheep	10 minutes ¹²⁴
Swine 2	<30 minutes ⁶¹

Comments

All	Dosage based on 12 mg/ml total steroid content
Gerbil 1-3	High mortality possible ³⁷
Mouse	LD ₅₀ is 180-200 mg/kg IP ⁸² . Poor analgesia ⁸² Can cause death ³⁷
Rabbit 1-3	Poor safety margin ¹⁰²
Rat 1	Variable effects. Low analgesia. Consider use of atropine ³⁷
Rat 2	Can give by continuous infusion ³⁷

4-AMINOPYRIDINE

Class Droperidol antagonist
Source

Dog	0.5 mg/kg IV ⁷²
Primate	0.73 mg/kg IV (ED50) ²¹⁶

ATIPAMEZOLE (Antisedan)

Class α_2 -adrenoceptor antagonist
Source Pfizer, Farnos Group Ltd.

Bird	Five times the medetomidine dose ¹⁴⁷
Calf 1	Five times medetomidine dosage (w/w), divided IV and SC. Can also be used if ketamine is used with medetomidine ⁴⁷
Calf 2	1 mg/10mg xylazine. Route not noted ⁴⁷
Dog 1	0.04 mg/kg IV ⁴⁵
Dog 2	0.4-0.6 mg/kg IM ⁷⁰
Dog 3	5000 μ g/m ² IM ⁹³
Ferret	400 mg/kg. Route? ²³²
Fish	0.2 mg/kg IM ¹⁴⁷
Gerbil	0.1-1.0 mg/kg IP, IV, IM, SC ²³⁴
Goat 1	20-60 mg/kg IV
Goat 2	0.2 mg/kg IV ²²¹
Goat 3	0.06 mg/kg IM, SC ²²¹
Guinea Pig	1.0 mg/kg SC ¹⁴⁷
Hamster	0.1-1.0 mg/kg IP, IV, IM, SC ²³⁴
Mouse	1.0-2.5 mg/kg IP ²³⁴
Primate 1	Three times medetomidine dosage (w/w), divided IV and SC. Can also use if ketamine is used with medetomidine ⁴⁷
Primate 2	<i>Squirrel monkey</i> . 200 μ g. Route? ²¹⁹
Rabbit 1	1.0 mg/kg IM ¹⁴⁷
Rabbit 2	1.0 μ g/kg SC, IP, IV ²³³

Rat	1.0 mg/kg IP ⁹⁰ , SC
Sheep 1	20-60 mg/kg IV
Sheep 2	0.2 mg/kg IV ²²¹
Sheep 3	0.06 mg/kg IM, SC ²²¹
Swine 1	0.2 mg/kg IV ¹⁸²
Swine 2	1.0 mg/kg IM, SC, IV ²⁴⁰

Comments

Dog 1	Administer slowly intravenously ⁴⁵
Swine 1	Can cause tachycardia ¹⁸²

ATRACURIUM (Tracrium)

<i>Class</i>	Nondepolarizing neuromuscular blocking agent
<i>Source</i>	Burroughs Wellcome

Bird	<i>Chicken</i> 0.46 mg/kg IV ²¹⁶
Cat 1	0.125-0.250 mg/kg IV ^{56, 216} See comments
Cat 2	Infusion 3.7 µg/kg/min ²¹⁶
Dog 1	0.22 mg/kg IV ⁷² See comments
Dog 2	0.125 mg/kg IV (ED95) ²¹⁶
Primate 1	0.25-0.3 mg/kg ²¹⁶
Primate 2	Infusion (ED50) 1.5 µg/kg/min ²¹⁶
Rabbit 1	0.1 mg/kg. Route? ²³³
Rabbit 2	Infusion 0.004-0.01 mg/kg/hr ²¹⁶
Sheep	4.0-7.0 µg/kg/min for one hour ^{56, 135}
Swine 1	2.0 mg/kg IV ²¹⁶
Swine 2	Infusion 0.12 mg/kg/min ²¹⁶

Dosage Frequency

Cat 1	23 minutes ^{56, 216}
Dog 1	20 minutes ^{50, 216}
Primate	20 minutes ²¹⁶
Sheep	20-30 minutes ¹³⁵

Antagonist

Edrophonium (q.v.)
Neostigmine (q.v.)
PHysostigmine ⁷²
Pyridostigmine ⁵⁰ (q.v.)

Comments

Cat	Give 1/10 to 1/6 of dose, followed by remainder in 5 minutes ⁷²
Dog	Give 1/10 to 1/6 of dose, followed by remainder in 5 minutes ⁷²

AZAPERONE (Stresnil). No longer available.

Class Butyrophenone tranquilizer

Source

Opossum 1	1.0-2.0 mg/kg IM ⁴⁰
Opossum 2	2.0-4.0 mg/kg IM prior to local anesthesia ⁴⁰
Opossum 3	2.0 mg/kg IM prior to general anesthesia ⁴⁰
Swine 1	2.2 mg/kg IM ³ , 5 mg/kg IM ³⁷ . Higher dose for heavier sedation.
Swine 2	5.0 mg/kg IM with metomidate 10 mg/kg IM. See comments ^{20, 37}
Swine 3	4.0 mg/kg IM with diazepam 0.5 mg/kg IM. Sedation ¹¹¹
Swine 4	4.0 mg/kg IM then ketamine 30 mg/kg IM with maximum of 10 ml of ketamine (100 mg/ml) ¹⁸⁶
Swine 5	2.0 mg/kg IM with etomidate 4.0-8.0 mg/kg IV ²²¹

Dosage Frequency

Opossum 1	1-2 hours young, 3-4 hours adults. Peak effect in 15 minutes for young, 30 minutes for adults ⁴⁰
Swine 1	15-30 minutes ²²¹

Comments

Swine 1	See use with meperidine
Swine 2	Suitable for minor surgical procedures ^{20, 37}

BENZOCAINE (Cetacaine)

Class Topical anesthetic [ethyl p-aminobenzoate]

Source Cetylite Industries, Beulitch, Fisons

Amphibian 1	<i>Adult</i> 200-300 mg/liter ¹⁴⁸
Amphibian 2	<i>Larvae</i> 50 mg/liter, dissolved in ethanol ¹⁴⁸
Fish 1	<i>Channel catfish</i> 25- 25-70 mg/liter ¹²³
Fish 2	<i>Goldfish</i> 25-70 mg/liter ¹²³
Fish 3	<i>Striped bass</i> 50 mg/liter ²³⁵
Rabbit	Not recommended ²²³

Comments

All	Can cause methemoglobinemia in rats, mice, ferrets, rhesus monkeys, cynomolgus monkeys, owl monkeys, rabbits, miniature swine ⁶⁹
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BUPIVACAINE (Marcaine, Sensorcaine)

Class Local anesthetic

Source AstraZeneca, Eastman Kodak

Cat 1	1.0 ml/4.5 kg of 0.75% ⁹
Cat 2	0.15 ml of 0.5% intrapleural ¹⁶¹
Dog 1	1.0 ml/4.5 kg of 0.75% ⁹
Dog 2	0.3 ml of 0.5% intrapleural ¹⁶¹
Dog 3	0.5% at 1.0 ml/10cm distance from lumbosacral space (epidural) ¹⁹²

Dog 4	0.5% with 0.1 mg/ml preservative free morphine, at 0.1 mg/kg BW. Epidural ¹⁹²
Rat 1	0.125% solution as local infiltration ⁵¹
Rat 2	3.0 mg/kg for infiltration ²¹⁰

Dosage Frequency

Dog 1	1-3 hours ⁹ , 4-6 hours ¹³³
Cat 1	1-3 hours ⁹ , 4-6 hours ¹³³

Comments

All	Used by many post-thoracotomy
Cat 1	3-4 times more potent than lidocaine
Dog 1	3-4 times more potent than lidocaine

BUPRENORPHINE (Buprenex)

Class Analgesic, opiate antagonist/agonist. **Controlled substance.**

Source Reckitt & Colman, Norwich Eaton

Bird 1	0.05 mg/kg SC, IM ¹⁴⁸
Bird 2	<i>African gray parrot</i> Not effective at 0.1 mg/kg IM ²³⁰
Calf	0.005 mg/kg IV ¹⁶⁴
Cat	0.005-0.01 mg/kg IV, SC ²⁰ , IM ³⁷
Dog 1	0.01-0.03 mg/kg IM ⁹ , SC, IV ²⁰
Dog 2	0.009 mg/kg IM with acetylpromazine 0.07 mg/kg IM. Moderate to deep sedation. Preanesthesia ³⁷
Dog 3	0.0075-0.01 mg/kg IV with acetylpromazine 0.03 mg/kg IV ⁷⁰
Ferret 1	0.01-0.03 mg/kg SC, IM, IV ⁷⁶
Ferret 2	0.05-0.1 mg/kg SC, IM, IV ¹³⁰
Gerbil 1	0.1-0.2 mg/kg SC ¹¹⁹
Gerbil 2	0.05-0.1 mg/kg SC, IM ¹⁷⁵
<u>Goat</u>	0.005 mg/kg IM¹⁹ IV⁴¹
<u>Guinea Pig 1</u>	0.05 mg/kg SC^{20, 110, 139}
Guinea Pig 2	0.5 mg/kg SC ⁷⁶
Guinea Pig 3	0.1 mg/kg IV ³⁷
<u>Hamster 1</u>	0.05 mg/kg SC^{52, 119}
Hamster 2	0.5 mg/kg SC ¹⁴⁸
Mouse 1	0.2 mg/kg SC, IV, IP ³⁷
<u>Mouse 2</u>	0.05-0.1 mg/kg SC^{11, 110}
Mouse 3	2 mg/kg SC, IV, IV ³⁷
<u>Primate 1</u>	0.01-0.03 mg/kg IM, SC¹¹
Primate 2	0.01 mg/kg IV ²⁰
Rabbit 1	0.1 mg/kg SC ³ , IM, IV ¹⁰
<u>Rabbit 2</u>	0.02-0.05 mg/kg IV, SC²⁰, IM²³³
Rabbit 3	0.0075-0.3 mg/kg SC, IM, IV ¹⁰ See comments
Rabbit 4	0.4 mg/kg IM, followed by 0.2 mg/kg IM every 5 hours. ¹⁰

	See comments
Rabbit 5	0.5 mg/kg per rectum ²³³ . See comments
Rat 1	0.1-0.5 mg/kg SC ² , IV ²⁰
<u>Rat 2</u>	<u>0.02-0.08 mg/kg SC^{20, 110}, IV²⁰</u>
Rat 3	0.01-0.04 mg/ml Jello. Feed 1.0 gram/100 gram body weight. Results in 0.1-0.4 mg/kg buprenorphine dose ²²⁸
<u>Sheep</u>	<u>0.005 mg/kg IM¹⁹, IV⁴¹</u>
Swine 1	0.005-0.01 mg/kg IM ³ . Can combine with carprofen (q.v.) ¹⁵⁸
<u>Swine 2</u>	<u>0.1 mg/kg IM²⁰</u>

Dosage Frequency

Calf	3 hours ¹⁶⁴
Cat	12 hours ²⁰ , 6-8 hours ²²⁰
Dog 1	8-12 hours ²⁰
Dog 1	6-8 hours ²¹⁹
Dog 3	2-3 hours ⁷⁰
Ferret 1	8-12 hours ¹⁷⁵
Gerbil 1	8 hours ¹¹⁹ , 8-12 hours ¹⁷⁵
Goat	210 minutes to thermal stimulus, no minutes to mechanical stimulus ²²¹
Guinea Pig 1	6-10 hours ^{1-3, 5}
Guinea Pig 1	8 hours ¹²⁵ , 12 hours ¹³⁹
Guinea Pig 2	8-12 hours ⁷⁶
Hamster 1	8-12 hours ⁵² , 8 hours ¹¹⁹
Mouse 1	8-12 hours ¹¹⁰
Mouse 2	12 hours ¹⁷⁷
<u>Mouse 1, 2</u>	<u>4-6 hours¹⁷⁰</u>
Primate 1	6-10 hours ^{1-3, 5}
Primate 1	6-8 hours ²¹⁹
Rabbit 1	6-10 hours ^{1-3, 5}
Rabbit 2	8-12 hours ¹⁷⁷
Rabbit 3	5-13 hours ¹⁰
Rabbit 4	8-12 hours ¹¹⁰
Rabbit 5	10 hours ²³³
Rat 1	6-10 hours ^{1-3, 5}
<u>Rat 2</u>	<u>8-12 hours^{175, 177}</u>
Sheep	210 minutes to thermal stimulus, no minutes to mechanical stimulus ²²¹
Swine 2	8-12 hours ¹³⁴

Antagonist

None (possible naloxone, q.v.)

Comments

All For moderate intensity pain²¹⁸
 All Can potentiate urinary bladder pain

All	Do not use with diazepam ⁷²
Dog 2	Con combine in same syringe. Moderate sedation ⁷⁰
Dog 2, 3	Depressed ventricular function due to acetylpromazine ¹¹²
Dog 3	May not be effective for acute pain ¹⁰
Goat	Can use with flunixin (q.v.) ¹²⁶
Rabbit 1	May not be effective for acute pain ¹⁰
Rabbit 5	Controversial efficacy ²³³
Rat 1	Give intraoperatively or just after surgery ¹⁰ . Do not use at >1.0 mg/kg due to hematuria and gastrointestinal bleeding ²¹⁷

BUTORPHANOL (Stadol, see comments) (Torbutrol, Torbugesic)

Class Analgesic (synthetic opiate receptor agonist/antagonist), for visceral pain
Source Fort Dodge, Mead Johnson, Bristol

Bird 1	0.5-2.0 mg/kg IM, lower dose preferred ¹⁴⁷
Bird 2	<i>African gray parrot</i> 1.0 mg/kg IM ²³⁰
Cat 1	0.05-0.2 mg/kg IM, SC, IV ⁹ . See comments
Cat 2	0.1-0.8 mg/kg IV, IV ²⁰ . See comments
Cattle	20-30 mg/kg IV ⁷² . See comments
Dog 1	0.2-0.3 mg/kg SC 15 minutes before anesthesia recovery ⁴ . See comments
Dog 2	0.2-0.4 mg/kg preoperative ⁴ . See comments
Dog 3	0.1-0.2 mg/kg IV ²¹
<u>Dog 4</u>	0.2 mg/kg IV, IM with acetylpromazine 0.01 mg/kg IV, IM⁷⁰. Preoperative use⁷²
Dog 5	0.2-0.4 mg/kg Sc, IM, IV ⁷²
Ferret 1	0.2 mg/kg (SC?) ¹³⁰
Ferret 2	0.4 mg/kg IM ¹³⁶
Ferret 3	0.05-0.5 mg/kg IM, SC ²³²
Frog	<i>Leopard</i> 25 mg/kg IP ¹⁸⁴
Gerbil	1.0-5.0 mg/kg SC ¹⁷⁵
Goat 1	0.01-0.02 mg/kg IV ¹⁹ . See comments
Goat 2	0.1 mg/kg IV ⁴¹ . See comments
Goat 3	0.03-0.07 mg/kg IM ¹⁹
<u>Guinea Pig 1</u>	20 mg/kg SC⁷⁶
Guinea Pig 2	0.043 mg/kg SC ¹³⁹
Hamster	1.0-5.0 mg/kg SC ¹⁷⁵
Mouse 1	5.4 mg/kg SC ²⁰ 1-5 mg/kg SC ^{11, 110}
Mouse 2	5.6 mg/kg PO ¹⁰
Mouse 3	0.05-5.4 mg/kg SC ¹⁰
Primate 1	0.025 mg/kg IM ¹
Primate 2	2-5 mg/kg IM ³²
Primate 3	<i>Callithrix</i> : 0.02 mg/kg SC ²¹⁹
<u>Rabbit 1</u>	0.1-1.5 mg/kg IV¹¹, SC²²²
Rabbit 2	1.0-7.5 mg/kg IM, SC ¹¹ . And see ketamine

Rabbit 3	1.0 mg/kg SC, IM with acepromazine in 1:1 ratio. Sedation and vasodilation ¹⁰
Rat 1	23.3 mg/kg SC ²⁰
Rat 2	2 mg/kg SC ¹¹ , 1-5 mg/kg SC ⁷⁶
Rat 3	0.04-23.3 mg/kg SC ¹⁰
Rat 4	2.1 mg/kg PO ¹⁰
Sheep 1	0.5 mg/kg SC ¹⁴⁸
Sheep 2	0.01-0.02 mg/kg IV ¹⁹ . See comments
Sheep 3	0.1 mg/kg IV ⁴¹ . See comments
Sheep 4	0.03-0.07 mg/kg IM ¹⁹
Sheep 5	0.5 mg/kg IV then tiletamine/zolazepam 12.0 mg/kg IV ¹⁰¹
Swine	0.1-0.3 mg/kg IM ³

Dosage Frequency

Bird 1	90 minutes or more ²⁰⁴
Cat 1	6 hours ⁵²
Dog 1	1.5-5 hours ⁹
Dog 2	2-5 hours ⁴ 45-90 minutes ⁹
Dog 4	15-60 minutes ⁷⁰ Up to 4 hours ²²⁰
Dog 5	4-5 hours ⁷²
Ferret 2	4-6 hours ¹³⁶
Ferret 3	4 hours ²³²
Frog	12 hours ¹⁸⁴
Gerbil	2-4 hours ¹⁷⁵
Goat 1	2-4 hours ^{19, 41}
Goat 3	4-6 hours ¹⁹
Goat 4	25-50 minutes ¹⁰¹
Guinea Pig 1	2-4 hours ⁷⁶
Guinea Pig 2	8 hours ¹³⁹
Hamster	2-4 hours ¹⁷⁵
Mouse	2-4 hours ^{12, 110}
Primate 1	3-6 hours ¹
Primate 2	12-48 hours ⁷⁶
Primate 3	6 hours ²¹⁹
Rabbit 1	4 hours ^{11, 175}
Rabbit 2	4 hours ¹¹
Rabbit 3	2-3 hours ¹⁴⁸
Rat 1	2-4 hours ¹⁰
Rat 2	4 hours ¹¹⁰
Sheep 2	2-4 hours ^{19, 41}
Sheep 4	4-6 hours ¹⁹
Sheep 5	25-50 minutes ¹⁰¹
Swine	4 hours ³

Antagonist

Naloxone (q.v.)

Comments

All	30x more potent than morphine in rats
All	Not a controlled rug
All	Increases arterial pressure
All	Causes sedation
All	Do not use with pentobarbital ⁷²
All	Stadol: 1 mg or tartrate salt = 0.68 mg of base ⁷²
Cat 1	Best for moderate visceral pain. Can cause irritability or excitement. Somatic analgesia with higher dosage in cats ²⁰ .
Cattle	IV dosage may cause excitement ²²¹
Dog 1	Use lower dose (0.05 mg/kg) if acetylpromazine used as preanesthetic.
Dog 1, 2	Best for moderate visceral pain, but oxymorphone is preferred ²⁰
Dog 4	Can combine in same syringe ⁷⁰
Goat 1, 2	May cause excitement ¹³⁵ , especially IV ²²¹
Sheep 2, 3	May cause excitement in sheep ¹³⁵ , especially IV ²²¹

CARBON DIOXIDE

<i>Class</i>	Anesthetic, euthanasia agent
<i>Source</i>	Medical gas companies

Most animals 40-60% in air or oxygen

Antagonist

Oxygen. Not true antagonist.

Comments

All	Use only for procedures of one to two minutes. Generally not satisfactory for anesthesia and can cause pulmonary hemorrhage
All	Most humane as euthanasia agent when chamber is slowly filled with 100% carbon dioxide.

CARFENTANIL (Wildnil)

<i>Class</i>	Opioid analgesic. Controlled substance
<i>Source</i>	Wildlife Laboratories, Inc. (Ft. Collins, CO)

Rat	0.32 µg/kg IV ⁵⁴
Mouse	0.003 mg/kg IM with etomidate 15 mg/kg IM ¹³²

Antagonist

Naloxone

CARPROFEN (Rimadyl)

<i>Class</i>	Arylpropionic acid derived non-steroidal anti-inflammatory and analgesic.
<i>Source</i>	Pfizer. <i>Only available in table form in U.S.</i>

Bird	1-4 mg/kg IM ²⁷⁷
Cat 1	2-4 mg/kg SC, IV single dose ²²⁷
Cat 2	2-4 mg/kg PO for 4 days, then every 2 days
Cattle	Cow 1.4 mg/kg SC, IV ²²⁷ Single dose ²²¹
<u>Dog 1</u>	4.0 mg/kg ^{145, 255} PO, IV, IM, SC ¹⁶⁵
<u>Dog 2</u>	2.0 mg/kg PO ²⁵⁵
Ferret	1.0 mg/kg PO ²⁶⁹
Goat	0.7 mg/kg IV ¹⁵⁰
Mouse	5.0 mg/kg SC ²⁵¹ PO ²⁷⁷
Primate 1	3-4 mg/kg SC for 3 days ²⁷⁷
Primate 2	2-4 mg/kg PO, SC ²⁶⁹
Rabbit 1	1.5 mg/kg (route?) ²⁵⁵ PO ²⁷⁷
Rabbit 2	2.2 mg/kg PO ²³³
Rabbit 3	4.0 mg/kg SC ²⁷⁷
Rat 1	5.0 mg/kg SC(?) ¹⁷⁷ , PO ²⁷⁷
Rat 2	5.0-10.0 mg/kg PO ²³⁴
Rat 3	neonate 5.0 mg/kg in 0.1 ml [water?] PO ²⁴⁸
Reptile	2-4 mg/kg SC, IV, IM, PO ²⁷⁷ Once, then 1.0-2.0 mg/kg ²⁷⁷
Sheep 1	0.7 mg/kg IV ¹⁵⁰
Sheep 2	1.5-2.0 mg/kg SC, IV ²⁷⁷
Sheep 3	pregnant 1.4 mg/kg with buprenorphine 0.006 mg/kg IV, after surgical induction with thiopental (q.v.) ²⁵⁶
Swine	2.0-4.0 mg/kg IV, SC ¹⁴⁹

Dosage Frequency

Bird	Single dose ²⁷⁷
Cat 1	Use one dose only ^{165, 277}
<u>Dog 1</u>	24 hours ¹⁴⁵ , 12 hours ¹⁹¹
<u>Dog 2</u>	12 hours
Ferret	12-24 hours ²⁶⁹
Mouse	24 hours ²⁷⁷
Primate 1	24 hours ²⁷⁷
Primate 2	12-24 hours ²⁶⁹
Rabbit 1	12 hours ^{225, 277}
Rabbit 2	12 hours ²³³
Rabbit 3	12 hours ²⁷⁷
Rat 1	8-12 hours ¹⁷⁷
Rat 2	24 hours ²⁷⁷
Reptile	25-72 hours ²⁷⁷
Swine	24 hours ¹⁴⁹

Comments

All Cyclooxygenase inhibitor¹⁴⁵. Use with caution in animals with impaired renal, cardiovascular or hepatic function. Do not use with bleeding diseases.

All	Rimadyl only available as caplets
Cat	One report of perforated duodenal ulcer ¹⁹¹
Dog	Potent COX 2 inhibitor ²³¹

CHLORAL HYDRATE (Noctec)

<i>Class</i>	Hypnotic (Controlled Substance)
<i>Source</i>	Roxane (oral), Sigma Chemical

Amphibian	1.0-2.0 ml of 10% solution into dorsal lymph sac ¹⁴⁸
Calf	50-70 mg/kg IV ²¹
Cat	300 mg/kg IP ¹⁴⁸
Dog	125-300 mg/kg IV ²¹ . See comments
Fish	800-900 mg/liter ¹⁴⁷
Goat 1	50-300 mg/kg IV ¹⁴⁸
Goat 2	50-70 mg/kg IV for sedation ²²¹
Guinea Pig	300-400 mg/kg IP ²⁸ . See comments
Hamster	270-360 mg/kg IP ²⁸ . See comments
Mouse 1	114 mg/kg IP ²⁸ . See comments
Mouse 2	370-400 mg/kg IP ²⁸ . See comments
Mouse 3	<i>C57BL/6J</i> 480 mg/kg IP ⁸²
Mouse 4	60-90 mg/kg IP ²¹⁷
Rabbit 1	200 mg/kg IV ²⁸ . See comments
Rabbit 2	250 mg/kg IV with ketamine 20 mg/kg IV, IM ⁸ Anesthesia
<u>Rat 1</u>	350-450 mg/kg IP² of 5% solution. See comments
Rat 2	400 mg/kg PO ²⁸ . See comments
Rat 3	34 mg/kg IP with 149 mg/kg pentobarbital IP. Maintain anesthesia at 7.8 mg/kg IP chloral hydrate and 34 mg/kg pentobarbital IP given no sooner than 30 minutes after first dose. ⁹⁷
Rat 4	<i>Equithesin</i> combine 2.1 grams of MgSO ₄ .1H ₂ O, 44.3 ml propylene glycol, 4.25 grams chloral hydrate, 0.98 grams sodium pentobarbital, 9.9 ml 95% ethanol and sterile water to volume. Heat to 30-35°C. while stirring. Filter small amounts through a 0.22µ filter and store in a sterile glass vial with a rubber stopper. For anesthesia induction, dose at 3.0-3.6 ml/kg IP, which contains 30-36 mg/kg of pentobarbital and 125-150 mg/kg of chloral hydrate. For anesthesia maintenance, use 0.3 ml IP as needed. ²¹⁴
Sheep 1	50-300 mg/kg IV ¹⁴⁸
Sheep 2	50-70 mg/kg IV for sedation ²²¹
Swine 1	730 mg/kg IV ²¹ . See comments
Swine 2	100-300 mg/kg IV ¹⁴⁸

Dosage Frequency

Calf	30-40 minutes ⁵⁹
Dog	70-85 minutes ²¹ 60-136 minutes, dose dependent ¹⁰³
Rabbit 2	3 hours ⁸⁰ , 20 minutes ¹³²

Rat 1 2 hours²¹, 65 minutes (300 g/kg IP)⁶⁷, 111 minutes (400 mg/kg IP)⁶⁷, 137 minutes, (450 mg/kg IP)⁶⁷

Comments

All Poor analgesia often reported, although reference 67 claims good analgesia

All Premedicate with thiobarbituræ, opioid or α -2 agonist for improved analgesia and easier recovery

Calf 33% solution. 125-150 ml maximum²¹

Dog Good anesthesia reported¹⁰³ Consider using atropine²¹

Rabbit 2 No apparent side effects⁸⁰

Rat 1 40 mg/kg if needed to maintain anesthesia²¹ Can cause gastric ulcers. **Not recommended for survival surgery**²¹. 40 mg/ml minimizes abdominal organ irritancy compared to 80 mg/ml^{215, 270}

CHLORALOSE (α -chloralose)

Class Hypnotic

Source Sigma Chemical, Aldrich Chemical

Calf 35-62 mg/kg IV²¹

Cat 75 mg/kg IV²¹ See comments

Dog 1 80-110 mg/kg IV, 1% solution²¹ See comments

Dog 2 60 mg/kg IV²¹ Light anesthesia only. See comments

Dog 3 50 mg/kg IV with thiopental 15 mg/kg IV for induction²¹. See comments

Dog 4 80 mg/kg IV with thiopental 5 mg/kg IV for induction²¹. See comments

Dog 5 80 mg/kg IV. Preanesthetize with morphine 5 mg/kg SC²¹ See comments

Dog 6 Continuous infusion of 29.25 mg/kg/hr IV¹⁸⁷

Guinea Pig 1 0.8 ml/100 g of 1% solution with urethane 40 percent in a 7:1 mixture. All IP¹³²

Guinea Pig 2 70 mg/kg IV¹⁴⁷

Hamster 80-199 mg/kg IP² Sedation only. See comments

Mouse 114 mg/kg IP²⁸ of 5% solution

Primate 60 mg/kg IV¹⁴⁷

Rabbit 1 80-100 mg/kg IV (2% in propylene glycol)²¹

Rabbit 2 10 grams/liter saline. Dose at 80 mg/kg with 500 mg/kg urethane (in liter of saline). Slow IV²¹⁸

Rat 1 30-50 mg/kg IP² See comments

Rat 2 **100 mg/kg IP (2% in propylene glycol)²¹ Light anesthesia. See comments**

Sheep, Goat 42-60 mg/kg IV¹⁴⁸

Swine 1 55-86 mg/kg IV³. Alone or with preanesthetic²¹

Swine 2	100 mg/kg IV ¹¹¹
Swine 3	50 mg/kg IV preceded by halothane induction ²¹
Swine 4	See Droperidol and Propofol

Dosage Frequency

Calf	1 hour ²¹
Cat	5-19 hours ^{21,37}
Dot 1-6	5-10 hours ^{21, 37}
Guinea Pig 1	>2 hours ¹³²
Rabbit 1	30 minutes ¹³²
Rabbit 2	5-10 hours ^{21, 37}
Rat 2	8-10 hours ¹⁷⁷

Comments

All	Solution must be properly prepared
All	Poor analgesia
All	Premedicate with thiobarbiturate, α -2 agonist or opioid
All	May result in adynamic ileus, peritonitis when given IP
All	Does not show classical signs of anesthesia
Dog 5	See urethane
Guinea Pig 1	May cause severe peritonitis IP
Hamster	May cause severe peritonitis IP
Mouse	May cause sever peritonitis IP
Rat 1, 2	May cause severe peritonitis IP
Swine 1	See droperidol
Swine 2	Depresses carotid chemoreceptor stimulation ²¹

CLIMAZOLAM

<i>Class</i>	Benzodiazepine tranquilizer
<i>Source</i>	Not available in US

Swine	2.0 mg/kg IV ²²¹
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CHLORPROMAZINE (Thorazine)

<i>Class</i>	Phenothiazine tranquilizer
<i>Source</i>	GlaxoSmithKline, generic

Amphibian	See <i>Frog</i>
Cat 1	1.1-2.2 mg/kg IM, IV ⁵⁵
Cat 2	3.3 mg/kg PO ⁷²
Cat 3	0.5-4.4 mg/kg IV ⁷²
Cattle 1	0.22-1.0 mg/kg IV ⁷²
Cattle 2	1.0-4.4 mg/kg IM ⁷²
Dog 1	1.1-2.2 mg/kg IM, IV ⁵⁵
Dog 2	3.3 mg/kg PO ⁷²
Dog 3	0.8-2.2 mg/kg PO ⁷²

Frog	30 mg/kg in dorsal lymph sac ²⁶⁵
Gerbil	0.5 mg/kg IM ¹¹⁹
Goat 1	0.55-4.4 mg/kg IV ⁷²
Goat 2	2.2-6.6 mg/kg IM ⁷²
Guinea Pig 1	0.2 mg/kg SC ²²⁶
Hamster	0.5 mg/kg IM ¹¹⁹
Mouse 1	3-35 mg/kg IM
Mouse 2	6 mg/kg IP ²⁸
Mouse 3	0.5 mg/kg IM ¹¹⁷
Mouse 4	5.0-10 mg/kg SC ¹⁴⁸
Primate 1	3.0-6.0 mg/kg IM ¹⁴⁸ , PO ¹⁴⁷
Primate 2	1.0-6.0 mg/kg PO, IM ²⁶⁹
Rabbit 1	25-100 mg/kg IM See comments
Rabbit 2	7-10 mg/kg IV ²⁸ See comments
Rabbit 3	1.0-10.0 mg/kg IM, IV ²⁶⁹ Preanesthetic. See comments
Rat 1	1-20 mg/kg IM
Rat 2	4-8 mg/kg IP ²⁸
Sheep 1	0.55-4.4 mg/kg IV ⁷²
Sheep 2	2.2-6.6 mg/kg IM ⁷²
Swine 1	0.55-3.3 mg/kg IV ⁶¹
Swine 2	2.0-4.0 mg/kg IM ⁶¹ SC ²²¹

Dosage Frequency

Cat 2	6-24 hours ⁷²
Cat 3	6-24 hours ⁷²
Dog 1	6-24 hours ⁷²
Dog 2	6-24 hours ⁷²
Dog 3	6-24 hours ⁷²
Frog	5+ hours ²⁶⁵

Comments

Rabbit 1, 2	Can produce myostis ¹⁴⁸ Limit IV volume to 1.5 ml in New Zealand White rabbits and to 1.0 ml in Dutch Belted rabbits. ²¹⁸
Rabbit 3	Lower end of dose range is preferred ²⁶⁹

CLONIDINE (Catapres)

Class Analgesic, sedative (α -adrenoceptor agonist)

Source Boehringer Ingelheim

Amphibian	2.0 gram/kg SC (dorsal lymph sac) ²⁷⁸
Cattle	0.015 mg/kg IV Sedation ²¹⁸
Sheep 1	6 μ g/kg IV ⁴¹
Sheep 2	0.015 mg/kg IV Sedation ²¹⁸

Dosage Frequency

Amphibian 3-4 hours²⁷⁸
Sheep 90-120 minutes⁴¹

Antagonist

Tolazine (q.v.)
Yohimbine (q.v.)

CODEINE

Class Opioid analgesic. **Controlled substance**
Source Generic

Amphibian 110-220 mg/kg SC (dorsal lymph sac)²⁷⁸
Dog 1 2 mg/kg SC¹²
Dog 2 0.25-0.5 mg/kg PO with acetaminophen (q.v.)³⁷
Goat 1 60-90 mg/kg PO¹⁴⁷
Goat 2 20 mg/kg SC¹⁴⁷
Guinea Pig 1 10 mg/kg PO¹²⁵
Guinea Pig 2 24-40 mg/kg SC²¹⁷
Mouse 1 20 mg/kg SC^{2, 37}
Mouse 2 90 mg/kg PO^{10, 37}
Rabbit 1 10 mg/kg PO¹²⁰
Rabbit 2 280-560 mg/kg PO²¹⁸
Rabbit 3 37-50 mg/kg SC²¹⁸
Rat 1 60 mg/kg SC^{2, 37}
Rat 2 25-60 mg/kg SC¹⁴⁸
Rat 3 60-90 mg/kg SC¹⁴⁸

Dosage Frequency

Amphibian >4 hours²⁷⁸
Rat 1-3 4 hours¹⁰
Mouse 1, 2 4 hours¹⁰
Dog 2 6 hours³⁷
Goat 1, 2 4 hours¹⁴⁷
Guinea Pig 1 4 hours²¹⁷

Antagonist

Nalaxone

CYCLOPROPANE (Trimethylene)

Class Anesthetic
Source Medical gas companies

All species 20-30% for induction, 10-25% for maintenance

Dosage frequency

As long as gas is provided

Antagonist

Oxygen. Not a true antagonist

Comments

All Flammable and explosive. Respiratory and cardiac arrhythmias³⁷. Rarely used

DESFLURANE (Suprane)

Class Anesthetic

Source

Cat Induce at 18% maintain at 14%, oxygen flow 200 ml/kg/minute¹⁹⁷
Mouse "easy induction"¹⁷²
Swine 2.0% with nitrous oxide:oxygen (70:30%) after propofol Induction (q.v.)¹⁹⁹

Dose frequency

All As long as gas is provided

Antagonist

Oxygen. Not a true antagonist

Comments

Swine Does not elicit a hyperdynamic circulatory response in the pig¹⁹⁹

DETOMIDINE (Dormosedan)

Class Analgesic, hypnotic sedative (α -adrenoceptor agonist)

Source Pfizer

Bird *Poultry* 0.3 mg/kg IM¹⁴⁷
Cat 10-30 μ g/kg IV²¹
Cattle 1 30-60 μ g/kg IV, IM⁷² Sedation/analgesia
Cattle 2 *Calv.* 2.5-10.0 mg/kg IV¹³⁵ Sedation
Dog 20-4- μ g/kg IV²¹
Rabbit **Do Not Use**¹⁰⁵ Possible myocardial necrosis
Sheep 1 10-20 mg/kg IV¹³⁵ Sedation
Sheep 2 0.03 mg/kg IV²²¹ Sedation
Swine 1 40 μ g/kg IV¹⁸²
Swine 2 0.125 mg/kg IM with midazolam 0.3 mg/kg IM and atropine 0.06 mg/kg IM²⁶⁹

Dosage frequency

Cattle 2	30 minutes
Sheep 1	30-60 minutes ¹³⁵

Antagonist

Atipamezole (q.v.)
Idazoxan (q.v.)
Tolazoline (q.v.)
Yohimbine (q.v.)

Comments

All	Bradycardia possible
Swine 1	No analgesic effect ¹⁸²

DIAZEPAM (Valium)

Class Benzodiazepine tranquilizer, preanesthetic agent. **Controlled substance.**

Source Roche

Bird 1	5-1.5 mg/kg IM, IV ¹³⁶ preanesthetic
Bird 2	2.0-5.0 I ¹⁴⁸
Calf 1	0.2-0.5 mg/kg, route not specified ²⁰
Calf 2	0.04-0.5 mg/kg IV ⁵⁹
Cat 1	0.25-1.0 mg/kg IM, SC, IV ⁶ See comments
Cat 2	1-2 mg/kg PO ⁷²
Dog 1	0.2 mg/kg IM 20 minutes before anesthesia ⁴ See comments
Dog 2	0.5 mg/kg IM, SC, IV ³ See comments
Dog 3	0.25 mg/kg PO ⁷²
Ferret 1	1-2 mg/kg IM ^{116, 147} SC ²⁸¹ See comments
Ferret 2	1.0 mg/animal IV ²⁶⁹ for seizure control
Ferret 3	1.0-1.5 mg/hr continue drip ²⁶⁹ for seizure control
Ferret 4	<1.0 mg/kg IM ²⁶⁹ Appetite stimulant
Gerbil	3.0-5.0 mg/kg IM ¹⁷⁵ SC, IP ¹⁸¹
Goat 1	2.0 mg/kg IM ³⁷ See comments
Goat 2	15 mg/kg PO in food ¹⁴⁸
Goat 3	1.0 mg/kg IV ³⁷
Goat 4	0.2-0.5 mg/kg IV ²²¹ prior to ketamine ⁵⁹
Guinea Pig 1	5.0 mg/kg IP ³⁷
Guinea Pig 2	2.5 mg/kg IP, IM ¹⁴⁸
Guinea Pig 3	1.05-5.0 mg/kg IM, SC ¹⁷⁵ IP ²¹⁷
Hamster 1	5 mg/kg IP ²⁸ , IM ¹⁴⁷ , SC
Hamster 2	5 mg/kg IP with methohexital 30 mg/kg IP. Use separate syringes ⁵³
Mouse	5.0 mg/kg IP ²⁸
Primate 1	5.0 mg/kg IM, twice a day ¹⁹ See comments
Primate 2	.05-1.0 mg/kg IV (slowly) ¹⁹ or IM ³⁷

Rabbit 1	1.0 mg/kg IM, IP ²⁸ See comments
Rabbit 2	4.0 mg/kg IM, IP ³⁷ See comments
Rabbit 3	5-10 mg/kg IM ⁸⁰ See comments
Rabbit 4	20 mg/kg IV ³⁷
Rabbit 5	1.0 mg/kg IV ¹¹⁰
Rat 1	2.0 mg/kg IV ³⁷
<u>Rat 2</u>	<u>2.5 mg/kg IP²⁸</u>
Rat 3	4.0 mg/kg IM, IP ³⁷ See comments
Rat 4	2.0 mg/kg 5-15 mg/kg SC ¹³² Sedation ²¹⁷
Sheep 1	2.0 mg IM ³⁷ See comments
Sheep 2	15 mg/kg PO in food ¹⁴⁸
Sheep 3	1.0 mg/kg IV ³⁷
Sheep 4	0.2-0.5 mg/kg IV ²²¹ prior to ketamine ⁵⁹
Swine 1	2 mg/kg IM ³⁷ See comments
Swine 2	0.5-1.5 mg/kg IV ¹⁴⁸
Swine 3	0.5-10.0 mg/kg IM ²²¹
Swine 4	1.0 mg/kg/hr IV infusion ²⁴⁰
Swine 5	0.2-0.3 mg/kg per rectum ²⁵⁴ Sedation
Swine 6	0.1-0.2 mg/kg PO ²⁵⁴ Sedation

Dosage frequency

Cat 2	12 hours ⁷²
Dog 3	12 hours ⁷²
Goat 3	30-60 minutes (without Ketamine) ¹³⁵
Hamster 2	20 minutes ⁵³
Rabbit 5	2-6 hours ¹¹⁰
Sheep 3	30-60 minutes (without Ketamine) ¹³⁵
Swine 2	2 hours ²²¹
Swine 3	2-4 hours ²²¹

Antagonist

Flumazenil (q.v.)²²

Comments

All	Minimal cardiac depression. Hypotension in high doses.
All	Can be painful IM ²⁰ or SC. Give by deep IM if you must give IM
Dog 2	See “oxymorphone” and ketamine”
Guinea Pig 3	May see apprehension and pruritis in sows
Rabbit 1-4	And see listing under “ketamine.” Can stimulate appetite up to 30 minutes

DICLOFENAC (Cataflam, Voltaren)

<i>Class</i>	Phenylacetic acid NSAID analgesic
<i>Source</i>	Novaris, Roxane

Mouse 1	14-100 mg/kg PO ²¹⁷
Mouse 2	8.0 mg/kg PO ²²⁶
Guinea Pig	2.1 mg/kg PO ²²⁶
Rat	10 mg/kg PO ²²⁶

Dosage frequency

Guinea Pig 3	24 hours ²⁷⁷
Mouse 2	24 hours ²⁷⁷
Rat	24 hours ²⁷⁷

Comments

All Possible gastrointestinal ulceration and bleeding²²⁶

DIPRENORPHINE (Revivon)

Class Etorphine antagonist

Source C-Vet

Cattle	Twice the etorphine dose ⁶²
Dog	0.5 ml/kg IV ³⁷
Goat	Twice the etorphine dose ⁶²
Sheep	Twice the etorphine dose ⁶²

DOXACURIUM (Nuromax)

Class Nondepolarizing skeletal muscle relaxant

Source Glaxo Wellcome

Swine	0.01 mg/kg IV ²¹⁶
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DROPERIDOL (Inapsine)

Class Butyrophenone tranquilizer

Source Janssen

Guinea Pig	2.5 mg/kg IM ¹¹¹
Primate	<i>Ape</i> 2.0-3.0 mg/kg PO ¹⁴⁷
Rat	0.5-2.0 mg/kg ¹³² SC ²¹⁷ Sedation ²¹⁷
Swine 1	0.1-0.4 mg/kg ⁷⁵ IM ²⁶⁹
Swine 2	2.0 mg/kg IM, followed by 50µg IV of flunitrazepam in 30 minutes. Then 10 minutes later, chloralose 60 mg/kg IV and maintenance dose of 20 mg/kg/hr IV. ⁷⁷

Antagonist

4-aminopyridine (q.v.)

EDROPHONIUM (Tensilon, Enlon, Reversol)

Class Antagonist of nondepolarizing neuromuscular blocking agents

Source Anaquest, ICN Pharmaceuticals, Baxter, Organon

Cat 1 0.1-0.2 mg/kg IV
Cat 2 0.25-0.5 mg/kg IV²¹⁶
Dog 0.1-0.2 mg/kg IV

Comments

Dog Precede by atropine 0.04 mg/kg IV
Cat 1 Precede by atropine 0.04 mg/kg IV

ENFLURANE (Ethrane)

Class Halogenated Ether Anesthetic

Source Anaquest

All Species 3-5% induction, 1-3% maintenance³⁷ Rarely need more than 3.5% in dogs and cats.⁶⁰
Dog See comments
Goat See comments
Sheep 1-2% in oxygen, preceded by ketamine 22 mg/kg IM.⁹⁶
Swine **Do Not Use.** See comments

Dosage frequency

As long as gas is supplied

Antagonist

Oxygen (not a true agonist)

Comments

All Waste gas must be scavenged.
All Respiratory and cardiovascular depression³⁷
Dog Respiratory depression and acidosis. No cardiovascular effect¹¹¹
Goat Respiratory depression requires artificial ventilation. Good anesthesia¹⁰⁸
Swine Moderate fall in blood pressure and respiratory rate¹¹¹ Can cause seizures²²¹

ETHER

Class Inhalant Anesthetic

Source Sigma Chemical

All species Induction 10-20%, Maintenance 4-5%.³⁷ To effect, usually by placing animal in closed container for induction, then using face mask. See comments.
Guinea Pig **DO NOT USE**
Rabbit See comments

Dosage frequency

As long as gas is supplied

Antagonist

Oxygen (not a true antagonist)

Comments

All Explosive.
All Respiratory tract irritant.
All Can cause cardiac arrest at high concentrations.
All Stimulates catecholamine release³⁷
Rabbit Can cause laryngospasm. Hold breath and may have cardiac depression⁸⁰

ETHYLISOBUTRAZINE (Diquel)

Class Phenothiazine tranquilizer

Source Coopers

Dog 1 4.4-11 mg/kg IM, PO⁷²
Dog 2 2.2-4.4 mg/kg IV⁷²
Swine 1 1.25 mg/kg IV²²²
Swine 2 2.2-4.4 mg/kg IM²²²

Dosage frequency

Dog 1 6-72 hours. Dose dependent⁷²

ETOMIDATE (Amidate, Hypnomidate)

Class Non-barbiturate hypnotic

Source Abbott. Not available in U.S.

Cat 1.1-4.4 mg/kg IV²¹ See Comments.
Dog 1 1.1-4.4 mg/kg IV²¹
Dog 2 See "Medetomidine"
Fish 1 *Channel catfish:* 2-10 mg/liter (anesthesia)¹²³
Fish 2 *Tropical.* 2-10 mg/liter (anesthesia)¹²³
Guinea Pig 0.14 mg/kg IV²⁸
Mouse 1 24-30 mg/kg IP^{28, 85, 132}. Anesthesia⁸²
Mouse 2 11.2 mg/kg IV¹³²
Primate 0.5-2.0 mg/kg IV²⁸² Anesthesia induction.
Rabbit 1.1-4.4 mg/kg IV²¹
Rat 0.57-1.11 mg/kg IV²⁸
Sheep 2.0 mg/kg IV²²¹ Anesthesia.
Swine 1 1.1-4.4 mg/kg IV²¹
Swine 2 4.0-8.0 mg/kg IV²²¹. See azaperone
Swine 3 0.6 mg/kg IV with ketamine infusion of 10 mg/kg/hr IV. Anesthesia²⁴⁰

Dosage frequency

Dog 1, 2	5-10 minutes
Mouse 1	15 minutes ⁸²
Mouse 2	20 minutes ¹³²
Primate	20 minutes ²⁸²
Sheep	12 minutes ²²¹

Comments

Cat	For induction only. May cause vomiting. Use preanesthetics. ¹²¹ Minimal cardiopulmonary depression. ¹³³ Can cause decreased adrenocortical function. ¹⁹³
Primate	Minimal cardiac depression. ²⁸²
Sheep	Can have hypersalivation and hemoglobinemia. ²²¹

ETORPHINE WITH ACETYLPROMAZINE (Immobilon LA)

<i>Class</i>	Narcotic immobilization agent/analgesic/sedative. Controlled substance.
<i>Source</i>	Not available in US

Cattle	0.1 mg/kg IM, without acetylpromazine ¹⁴⁷
Goat	0.5 ml/50 kg IM ³⁷
Reptile	0.5-1.5 mg/kg IM without acetylpromazine ²⁷⁸
Sheep	0.5 ml/50 kg IM ³⁷
Swine	0.5 mg/50 kg IM. ³⁷ See comments.

Dosage frequency

Swine	20 minutes ²²¹
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Antagonist

Diprenorphine (q.v.)⁶²

Comments

Goat	For animals >30 kg ³⁷
Sheep	For animals >30 kg ³⁷
Swine	Immobilization and anesthesia. May be high mortality. ³⁷

ETORPHINE WITH METHOTRIMEPRAZINE (Immobilon SA)

<i>Class</i>	Narcotic immobilization agent/analgesic/sedative. Controlled substance.
<i>Source</i>	Lemmon (with diprenorphine), C-vet (with methotrimeprazine). Not in US.

Cat	0.5 mg/4 kg IM ³⁷
Dog	0.5 mg/4 kg IM. ³⁷ See comments.
Goat	0.5 ml/4 kg for under 30 kg ³⁷
Rabbit	0.25-0.5 mg/kg IM. ³⁷ See comments.
Rat 1	0.5 ml/kg IM. ³⁷ Anesthesia.

Rat 2	0.5 ml/kg IM with midazolam (5 mg/ml) IM. 1:1 ratio. ³⁷ Anesthesia.
Sheep	0.5 ml/4 kg for under 30 kg ³⁷
Swine	24.5 mg/kg with diprenorphine (Revivon) 0.3 mg/kg ³

Antagonist

Dog	Diprenorphine (q.v.) ⁶²
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Comments

Cat	Adequate for immobilization and minor surgery ³⁷
Dog	Adequate analgesia for minor to moderate surgery. Bradycardia (use atropine). ³⁷
Rabbit	Adequate for immobilization and minor surgery. ³⁷ Not recommended due to respiratory depression. ¹¹¹

EUGENOL (Clove Oil)

<i>Class</i>	Fish anesthetic
<i>Source</i>	Health food stores

Fish	40-100 mg/liter ²⁷⁹
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Comments

Fish	Use 95% ethanol to create a stock solution of 100 mg/ml. Add to induction chamber water. ²⁷⁹
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FENOPROFEN (Nalfon)

<i>Class</i>	Nonsteroidal anti-inflammatory analgesic
<i>Source</i>	Dista, Lederle Standard, Mylan

Dog	0.5-1.0 mg/kg ¹⁴⁸
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Dosage frequency

Dog	Every 24 hours ¹⁴⁸
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FENTANYL (Sublimaze) Often combined with Droperidol as INNOVAR-VET. **Do Not Use Human Formulation of Innovar.** Innovar-vet is no longer available.

<i>Class</i>	Opioid containing neuroleptanalgesic, tranquilizer, mild anesthetic (α -adrenergic blocker). Controlled substance.
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<i>Source</i>	AstraZeneca, Elkins-Sinn, Abbott, Baxter, Janssen (transdermal patch)
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Amphibian	(<i>And see Frog</i>). 1.0-2.0 mg/kg SC in dorsal lymph sac. ²⁷⁸
Cat 1	0.1 mg/kg IM. ²⁰ See comments.
Cat 2	20 mg/kg IV (<u>without droperidol</u>) with diazepam 0.5 mg/kg IV. Anesthesia induction.
Cat 3	25 μ g/hour transdermal patch. ²⁴⁶

Cat 4	5.0-10.0 µg/kg epidural ²⁷⁷
Dog 1	0.02-0.04 mg/kg IM (<u>without droperidol</u>) ⁴ SC, IV ²²⁰
Dog 2	1 ml/10-20 kg IV as drip or given slowly, preanesthesia ⁴
Dog 3	1 ml/7-10 kg IM ⁶ with droperidol. Analgesia and tranquilization ⁷²
Dog 4	1 ml/15-30 kg with droperidol, slowly, IV ⁶ Anesthesia ⁷²
Dog 5	1 ml/18 kg IM with droperidol. Anesthesia ⁷²
Dog 6	20 mg/kg IV (<u>without droperidol</u>) with diazepam 0.5 mg/kg IV. Anesthesia induction.
Dog 7	<u>Without droperidol.</u> Oxymorphone 0.05 mg/kg, glycopyrrolate 0.02 mg/kg (premedication). Induce at 10-20 µg/kg IV with 0.1 mg/kg midazolam IV. Maintain with fentanyl 0.7-1.0 µg/kg/min IV and midazolam 0.35 µg/kg. Can use with isoflurane (0.5%) and atacurium (q.v.). ¹⁵¹
Dog 8	50 µg/hr transdermal patch for 1-3 days. ²²⁰
Dog 9	5.0-10.0 µg/kg epidural ²⁷⁷
Dog 10	0.001-0.005 mg/kg IV ²⁷⁷ or drip at 0.003-0.010 mg/kg/hour ²⁷⁷
Ferret 1	0.5 mg/kg IM ¹⁴⁸
Ferret 2	Not Recommended ¹⁷⁵
Frog	(<i>Rana pipiens</i>) 1.4 nmol/gram, dorsal lymph sac (<u>without droperidol</u>) ¹⁴⁸
Gerbil	0.3-0.5 ml/kg IM, SC ¹⁷⁵
Goat	2.0 ml/kg IM ¹⁴⁷
Guinea Pig 1	0.66-0.88 ml/kg IP ² , IM. ¹³² See comments.
Guinea Pig 2	1 ml/kg IP with diazepam 2.5 mg/kg IP ²
Guinea Pig 3	0.16 ml/kg IM. ²⁰ See comments.
Guinea Pig 4	0.32 mg/kg IM with diazepam 5.0 mg/kg IP given prior to Innovar-vet ²¹⁷
Hamster 1	Not satisfactory ²⁸
Hamster 2	1 ml/kg IP with diazepam 5 mg/kg IP ²
Hamster 3	0.9 ml/kg IM. Analgesia with unpredictable degree of sedation ¹⁷⁷
Hamster 4	0.9 ml/kg IM. Analgesia with unpredictable degree of sedation
Mouse 1	0.01-5.0 ml/kg IM. ²⁰ See comments. Immobilization and analgesia ¹⁷⁷
Mouse 2	2.0-5.0 ml/kg of 1:10 dilution, IM, SC ¹⁷⁵
Primate 1	0.002 mg/kg IM, IV (analgesia, <u>without droperidol</u>) ¹
Primate 2	(Ape) 0.02 mg/kg IM (<u>without droperidol</u>) ¹⁴⁷
Primate 3	(Ape) 0.00008 IV (<u>without droperidol</u>) ¹⁴⁷
Primate 4	0.05-0.1 mg/g IV, IM ²⁰
Primate 5	0.1-0.2 mg/kg IM. ²⁰ See comments.
Primate 6	<i>Baboon, mangabey, pigtail macaque</i> 0.3-2.2 mg/kg IM ²⁰
Primate 7	<i>Macaque.</i> Transdermal patch. 25 µg/kg/hr continuous IV infusion ²⁶⁹

Primate 8	10-25 µg/kg/hr continuous IV infusion ²⁶⁹
Primate 9	0.005-0.01 mg/kg IV ²³²
Rabbit 1	0.18-0.23 ml/kg continuous IV infusion up to 6 hours ²
Rabbit 2	0.25 mg/kg IM. ⁶ See comments. Immobilization and analgesia. ¹⁷⁷
Rabbit 3	15 µg/kg continuous IV infusion, <u>without droperidol</u> ¹⁴
Rabbit 4	0.7 mg/kg IV (analgesia, <u>without droperidol</u>) ⁵
Rabbit 5	5-20 µg/kg IV bolus <u>without droperidol</u> ¹³
Rabbit 6	0.3 ml/kg IM with diazepam 5.0 mg/kg IM. Anesthesia ¹¹¹
Rabbit 7	Intranasal. Do not use. ⁸⁶
Rabbit 8	½ of a 25 µg/hr patch per medium size rabbit for 3 days. Do not cut patch. ²³³
Rabbit 9	25 µg/hour cutaneous patch. See comments. ²⁶⁰
Rat 1	0.2-0.6 ml/kg IP. ² Immobilization and light anesthesia.
Rat 2	<u>0.30 mg/kg IP mixed with medetomidine 0.20-0.30 mg/kg IP. No droperidol. Surgical anesthesia.</u> ⁹⁰
Rat 3	0.3 ml/kg IM. ² See comments.
Rat 4	0.2-0.4 ml/kg (IP?) with diazepam 2.5 mg/kg (IP?). Excellent surgical anesthesia. ¹¹¹
Rat 5	<i>Neonate</i> Dilute 0.5 ml in 9.5 ml saline. Inject 0.2 ml SC. ²⁴ 3.0-5.0 mg/kg SC or PO ²⁰⁵
Rat 6	5-20 mg/kg IV bolus followed by 15 mg/kg continuous IV infusion. <u>No droperidol.</u>
Rat 7	<i>Neonate</i> 3.0-5.0 µg/kg SC ²⁴⁸
<u>Sheep 1</u>	<u>0.01 mg/kg IV without droperidol.</u> ⁴¹
Sheep 2	See “ketamine”
Sheep 3	Approximately 75 kg animal. Use three 50 µg/hr transdermal patches for 24 hours prior to surgery. ²⁰³
Sheep 4	0.005 mg/kg IV ²²¹
<u>Swine 1</u>	<u>0.01 mg/kg IM (analgesia, without droperidol)³ IV²⁴⁰</u>
Swine 2	0.05 ml/kg IV if weighs <90 kg. 0.025 ml/kg IV if weighs >90 kg ²⁰
Swine 3	0.1 ml/kg IM ¹⁴⁸
Swine 4	0.005 mg/kg IV ²²¹
Swine 5	1.0 ml/13.5 kg IM ²²¹
<u>Swine 6</u>	<u>Swine 30-100 µg/kg/hr IV drip (analgesia, without droperidol)^{3, 240}</u>
<u>Swine 7</u>	<u>Use 25 µg-75 µg/hr transdermal patches for 25-35 kg pig. See comments.</u>
Swine 8	<i>Minipig</i> 100 µg/hr transdermal patch on approximately 20 kg pig. ²⁶²
Swine 9	50 µg transdermal patch on 25 kg pig. ²⁷⁶
<i>Dosage frequency</i>	
Amphibian	4 hours
Cat 4	2-5 hours ²⁷⁷

Dog 1	30 minutes ²²⁰
Dog 3	2 hours ⁶
Dog 9	2-5 hours ²⁷⁷
Dog 10	20-30 minutes ²⁷⁷
Guinea Pig 1	60 minutes ¹⁷⁷
Guinea Pig 4	60-90 minutes ²¹⁷
Mouse 1	20-30 minutes ¹⁷⁷
Primate 1	Brief ¹
Primate 5	30-60 minutes light anesthesia ⁶
Primate 9	30 minutes ²³²
Rabbit 2	30-75 minutes ¹³²
Rabbit 5	30-60 minutes ¹³
Rat 1	20-30 minutes ¹⁷⁷
Rat 2	120 minutes ⁹⁰
Rat 5	35 minutes ²⁴
Rat 7	4 hours ²⁴⁸
Sheep 1	60-80 minutes ⁴¹
Sheep 1	25-40 minutes ²²¹
Sheep 4	30 minutes ²²¹
Swine 1	2 hours ³
Swine 5	20 minutes ²²¹
Swine 8	Approx. 3 days ²⁶²

Antagonist

Naloxone (q.v.) for fentanyl

4-aminopyridine (q.v.) for droperidol⁷²

Comments

All	Animal may be sensitive to loud or abrupt sounds.
All	Atropine recommended 10 minutes before use to prevent bradycardia.
Rodents/Rabbits	Intramuscular injection in rodents and rabbits may cause muscle necrosis. Consider other routes.
Cat 1	Do not use in cat without tranquilizer to prevent excitement reaction.
Cat 2	Hyperventilation ¹³³
Cat 3	Apply 6 hours before surgery ²⁴⁶
Guinea Pig 2	Hyperventilation ¹³³
Mouse 1	Lower dosage for restraint only
Primate 5	Premedicate with atropine 0.04 mg/kg IM, SC ⁶
Rabbit 2	For minor surgical procedures only. ⁶
Rabbit 3	Respiratory depression ²³³
Rabbit 9	Reached blood concentrations presumed adequate for analgesia only if hair did not regrow. No effect on heart rate, respiratory rate or rectal temperature. ²⁶⁰

Rat 2	Significant respiratory depression. Reverse using antagonist shown above. ⁹⁰
Rat 4	Reduces mean arterial blood pressure ¹¹¹
Swine 7	Either begin patch 12 hours prior to surgery or use another analgesic for first 12 hours after patch is applied. ^{211, 244} The 25µg patch leads to blood serum levels below those needed for human analgesia. ²⁷⁶

FENTANYL 0.3 mg/ml (Combined with Fluanisone 10 mg/ml as Hypnorm)

Class Opioid containing sedative, anesthetic

Source Janssen (Not available in US)

Cat	0.5 ml/kg IM ¹⁴⁸
Dog 1	0.1-0.2 ml/kg IM ³⁷
Dog 2	0.1 ml/kg IM. Then pentobarbital, 5.0 mg/kg IV, diluted in IV drip of 1 gram/liter saline, administered at 5 ml/kg/hour. Also, use pancuronium 0.05 mg/kg IV ¹¹¹
Ferret 1	0.3 ml/kg IM (preanesthesia) ¹¹⁶
Ferret 2	0.2 ml/kg IM (analgesia) ¹¹⁶
Gerbil 1	0.5-1.0 ml/kg IM. Immobilization ³⁷ or IP ¹¹⁹
Gerbil 2	0.3 ml/kg IM with diazepam 5 mg/kg IP ³⁷ Anesthesia.
Gerbil 3	0.6 ml/kg IM with xylozine 5.0 mg/kg IP. Sedation. ¹³²
Guinea Pig 1	0.5-1.5 ml/kg IM. ¹³² Sedation and analgesia.
<u>Guinea Pig 2</u>	<u>0.2-1.5 ml/kg IM with diazepam 2.5-5.0 mg/kg IP, IM¹³²</u>
Hamster 1	1 ml/kg IP ³⁷ of 1:10 dilution. See comments. Sedation.
Hamster 2	0.5 ml/kg IP. Immobilization and analgesia. ¹⁷⁷
Mouse 1	0.1-0.3 ml/kg IP. Sedation and light anesthesia. ³⁷ Combine with diazepam (q.v.) and midazolam (q.v.) for surgical anesthesia. ³⁷
Mouse 2	7-10 ml/kg IP ¹¹⁷
Primate	0.3 ml/kg IM ³⁷ , SC. ²¹⁹ Sedation and analgesia ³⁷
Rabbit 1	0.05 ml/kg IM with diazepam 5 mg/kg IM. See comments. ³⁸ Anesthesia.
Rabbit 2	0.2-0.5 ml/kg IM ³⁷ or SC. ¹³² Sedation. ³⁷ See comments. Short-term anesthesia. ²³³
Rabbit 3	5-20 mg/kg IV bolus. ¹³²
Rabbit 4	15 mg/kg continuous IV drip.
Rabbit 5	0.3 ml IM and approx. 20 minutes later 0.5-2.0 mg/kg midazolam IV ²¹⁸
Rat 1	0.2-0.5 ml/kg IM ³⁷ or IP. ¹³² Immobilization and analgesia ¹⁷⁷
Rat 2	0.3-0.6 ml/kg IP with diazepam (q.v.) or midazolam (q.v.) ³⁷
Swine	See Midazolam and Diazepam

Dosage frequency

Dog 2 6-8 hours¹¹¹

Gerbil 1	20-30 minutes ¹⁷⁷
Gerbil 2	20 minutes ¹³²
Guinea Pig 1	20-30 minutes ¹³² 60 minutes ¹⁷⁷
Hamster 1	20-30 minutes ¹⁷⁷
Mouse 1	30-40 minutes (surgical anesthesia) ³⁷
Rabbit 1	33 minutes ³⁸
Rabbit 2	4 hours ¹³² 20-30 minutes analgesia ¹⁷⁷
Rabbit 3	30-60 minutes ¹³²
Rat 1	20-40 minutes ³⁷

Antagonist

All	Naloxone (q.v.)
All	Buprenorphine (q.v.)
Dog 2	Atipamezole (1.0 mg/kg) mixed with nalbuphine (2.0 mg/kg) or butorphanol (0.4 mg/kg). Give IP ⁹⁰

Comments

Guinea Pig 1	Restraint, sedation and analgesia for minor procedures ³⁷
Hamster 1	Sufficient analgesia for superficial procedures ³⁷
Mouse 1	Dilute commercial preparation 1:10 ³⁷
Rabbit 1	Unpredictable anesthesia and lowered blood pressure ³⁸
Rabbit 2	May be respiratory depression at higher dose ³⁷ Causes vasodilation ¹¹¹
Rat 1	Good surgical anesthesia and muscle relaxation ³⁷

FLUAZEPAM

Class Benzodiazepine tranquilizer

Source

Swine	2.0 mg/kg IV, PO ²²⁹
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FLUMANZENIL (Mazicon, Romazicon)

Class Benzodiazepine reversing agent²²²

Source Roche

Bird	<i>Pigeon:</i> 0.1 mg/kg IM ¹³⁶
Cat 1	0.1-0.2 mg/kg IV, IM ¹³³
Cat 2	0.02 mg/kg IV ¹⁷³
Dog 1	2-5 mg/kg IV ⁷⁰
Dog 2	0.02 mg/kg IV ¹⁷³
Dog 3	0.1-0.2 mg/kg IV, IM ¹³³
Primate	0.025 mg/kg IV ²⁶⁹
Rabbit	0.01-0.1 mg/kg IM, IV ²⁸¹

FLUNIXIN MEGLUMINE (Benamine)

Class Nicotine acid derivative, analgesic/anti-inflammatory. For mild to moderate musculoskeletal pain

Source Schering

Bird 1.0-10 mg/kg IM¹⁴⁸

Calf *heifer*: 2.2 mg/kg PO, IM, IV¹⁹⁶

Cat 1 1.0 mg/kg SC¹¹⁰

Cat 2 1.0 mg/kg IV¹⁴⁸

Cat 3 0.3 mg/kg IM¹⁴⁸

Cat 4 1.0 mg/kg slow IV drip²⁷⁷

Cattle See Calf

Dog 1 1.1 mg/kg IV, IM²⁰, SC⁷¹

Dog 2 1.0 mg/kg PO¹¹⁰

Dog 3 1.0 mg/kg slow IV drip²⁷⁷

Ferret 0.5-2.0 mg/kg SC, IV⁷⁶, deep IM¹⁷⁵, PO.²³² See comments.

Gerbil 2.5 mg/kg IM¹⁷⁵

Goat 1 1.1 mg/kg IM¹⁹, SC⁷⁶, IM¹⁷⁵

Goat 2 2.2 mg/kg IV²²¹

Guinea Pig 2.5-5.0 mg/kg SC⁷⁶, IM¹⁷⁵

Hamster 1 1.1-2.5 mg/kg SC¹⁵⁷

Hamster 2 2.5 mg/kg IM¹⁷⁵

Mouse 2.5 mg/kg SC, IM¹¹

Primate 1 0.3-1.0 mg/kg SC, IV⁷⁶

Primate 2 2.5-10 mg/kg IM (estimated)

Primate 3 (*Prosimian*) 0.5 mg/kg IM¹⁴⁸

Primate 4 0.5-4.0 mg/kg SC, IV²⁷⁷

Rabbit 1 1.1 mg/kg IM¹¹ or SC¹⁰ or IV¹⁷³

Rabbit 2 0.3-2.0 mg/kg PO, IM, IV²⁶⁹

Rat 1 2.5 mg/kg SC⁷⁶

Rat 2 1.1 mg/kg SC, IM⁷⁶

Reptile 0.1-0.5 mg/kg IM, IV²⁷⁷

Sheep 1 1.1 mg/kg IM¹⁹, SC.¹¹⁰ See comments.

Sheep 2 2.2 mg/kg IV^{221, 277}

Swine 1.1 mg/kg IM¹⁹, SC¹¹⁰, IV²⁷⁷

Dosage frequency

Bird 24 hours²⁷⁷

Calf Up to 5 days²⁷⁷

Cat 1 Once a day, 5 days minimum¹¹⁰, with effect for 12 hours¹³³

Cat 2 24 hours¹⁴⁸

Dog 1 Once a day⁷¹, with effect for 12 hours¹³³

Dog 2 Once a day¹¹⁰, with effect for 12 hours¹³³

Ferret 12-24 hours.⁷⁶ Once a day.²³²

Gerbil 12-24 hours¹⁷⁵

Goat 1 12-24 hours.¹⁹ Goat 24 hours¹²⁶

Goat 2 150 minutes²²¹

Guinea Pig	12-24 hours ^{76, 175}
Hamster 1	12 hours ¹⁵⁷
Hamster 2	12-24 hours ¹⁷⁵
Mouse	12 hours? ¹¹ 12-24 hours ¹⁷⁵
Primate 1	6 hours. ¹⁶⁶ 12-24 hours ²⁶⁸
Primate 2	Once a day ¹¹⁰
Primate 3	24 hours ¹⁴⁸
Primate 4	24 hours ²⁷⁷
Rabbit 1	12 hours ¹⁰ , 12-24 hours ¹⁷⁵ , 8 hours ¹⁷⁷
Rabbit 2	12-24 hours ²⁶⁹
Rat 1	12 hours? ¹¹ 12-24 hours ¹⁷⁵
Rat 2	12-24 hours ⁷⁶
Reptile	12-24 hours for 1-2 days. ²⁷⁷ 2-3 days ²⁷⁸
Sheep 1	12-24 hours ¹⁹
Sheep 2	150 minutes ²²¹ , 24 hours ²⁷⁷
Swine	12 hours ¹⁹ , 24 hours ²⁷⁷

Comments

All	Non-narcotic, non-steroidal cyclooxygenase inhibitor
All	Preferable administered IM. Based on information from primates, this is likely to be a SC irritant
All rodents	Minimal analgesia ²¹⁷
Dog 1, 2	Do not repeat daily dose. Do not use before or after methoxyfluane anesthesia. ¹³³
Dog 1, 2	Reports of GI ulceration and renal damage ¹⁹¹
Ferret	Do not use for more than 3 days ²²³
Goat	Good musculoskeletal analgesia. 2-4 doses maximum ¹⁹
Hamster 1	Variable results ¹⁵⁷
Primate 1	Can use in combination with buprenorphine or morphine. Irritant when given SC ¹⁶⁶
Rabbit	Minimal analgesic efficacy. ¹⁰ Irritating when given SC. Do not use for more than 3 days. ²³³
Sheep	Good musculoskeletal analgesia. 2-4 doses maximum ¹⁹

GALLAMINE (Flaxedil)

<i>Class</i>	Nondepolarizing neuromuscular blocking agent
<i>Source</i>	Davis & Geck

Calf	0.4 mg/kg IV ⁵⁶
Cat	0.4-1.6 mg/kg IV ^{6, 37}
Dog	0.4-1.0 mg/kg IV ^{6, 37}
Fish	1.0-3.0 mg/kg IM ¹⁴⁷
Rabbit	1.0 mg/kg. Route not indicated ³⁷
Sheep 1	6 µg/kg/min IV ⁵⁶
Sheep 2	<i>Lamb</i> 0.4 mg/kg IV ⁵⁶
Swine 1	4.0 mg/kg IV ¹¹⁰

Swine 2 2.0 mg/kg. Route not indicated³⁷

Dosage frequency

Calf 10-240 minutes⁵⁶
Cat 15-30 minutes^{6, 56}
Dog 15-30 minutes^{6, 56}
Sheep 2 10-240 minutes⁵⁶
Swine 1 20-40 minutes¹¹⁰
Swine 2 10-20 minutes⁵⁶

Antagonist

Edrophonium (q.v.). Do not use after large or multiple doses.⁵⁶
Neostigmine (q.v.)
Pyridostigmine (q.v.)

Comments

All Precede antagonism with atropine, 0.04 mg/kg IV given slowly.⁵⁶
All Crosses placenta²¹⁶

HALOTHANE (Fluothane)

Class Fluorinated hydrocarbon anesthetic. See comments.

Source Wyeth-Aerst, Fort Dodge

Amphibian (*Terrestrial*) 4.0-5.0R in anesthetic chamber¹⁴⁸
Bird Induce with 1.0-2.5%, maintain with 0.5-1.5%¹³⁶
Dog 1 4% for mask or chamber induction. Do not exceed 2.5% once intubated. Maintenance 0.9-1.5%.⁶
Dog 2 4% with 60% nitrous oxide in oxygen with face mask. Then 1.3 % halothane only (intubated), end-tidal volume⁴²
Ferret 3-3.5% for induction, 0.5-2.5% for maintenance¹¹⁶
Fish 0.5-2.0 ml/liter¹⁴⁷ bubbled through water.
Gerbil 1-4%¹¹⁹
Goat See comments.
Guinea Pig 1-3%², 1-5%.¹³² See comments.
Hamster 1 1-4%²
Hamster 2 2-4% induction, 0.5-2% maintenance⁸³
Mouse 1-4%²
Rabbit 1 4% induction, 0.5-1.5% maintenance.⁵ See comments.
Rabbit 2 4% induction with nitrous oxide:oxygen (2:1)³⁸
Rat 1-4%.² See comments.
Sheep Induce with 10-15 mg/kg thiopental IV and 0.5 mg atropine IV. Then halothane 0.5-2% with nitrous oxide 50% and oxygen 48-49.5%⁹⁸
Swine **Not recommended** due to increased risk of malignant hyperthermia

Dosage frequency

As long as gas is supplied.

Antagonist

Oxygen (not true antagonist)

Comments

All	Waste gas must be scavenged.
All	May cause respiratory and cardiovascular depression. ³⁷
All	Use higher concentrations for induction, lower for maintenance.
Dog 1	Use nonrebreathing system if <7 kg ⁶
Goat	Respiratory depression requires artificial ventilation. Good anesthesia. ¹⁰⁸
Guinea Pig	May cause hepatocellular necrosis, even at low concentration. ²¹⁷
Rabbit 2	Decrease in blood pressure
Rat, Rabbit	Odor may be unpleasant to rats and rabbits and lead to struggling during induction. Consider mixing with 50% nitrous oxide when using anesthetic machine. ²⁸

HEXOBARBITAL

Class Anesthetic. **Controlled substance.** Not available in US since 1982.

Source

Amphibian	120 mg/kg, dorsal lymph sac ¹⁴⁸
Mouse 1	100 mg/kg IP ²⁸
Mouse 2	47 mg/kg IV ⁸⁵
Rabbit	40 mg/kg IV ²⁸
Rat	100 mg/kg IP ²⁸

HYDROMORPHONE (Dilaudid)

Class Opiate analgesic, preanesthetic. **Controlled substance.**

Source Knoll

Dog 1	0.2 mg/kg IM, anesthesia premedication ¹⁷¹
Dog 2	0.1 mg/kg IV, anesthesia induction ¹⁷¹
Primate	0.01-0.02 mg/kg IM ¹

Dosage frequency

Primate 4-6 hours¹

Comments

Primate Causes vomiting. Sedation comparable to oxymorphone.¹⁷¹

HYPOTHERMIA

Class Analgesic, anesthetic

Source Ice chips

Frog 6°C. for 10 minutes (one leg)²³⁷
Mouse *Neonatal (1-7 days)*. Wrap in latex sleeve and place on ice.
Rat *Neonatal (1-7 days)*. Wrap in latex sleeve and place on ice.

Dosage frequency

All 30 minutes¹⁸¹

Antagonist

All Warm gently. Do not use heat pads or lamps to warm due to tissue damage. A 33°C incubator for 20-30 minutes is preferred.²¹⁷

Frog Naltrexone 0.1 mg/kg IP. Naloxone 10.0 mg/kg IP²³⁷

Comments

For neonatal rodents, use only 1-7 days postpartum

IBUPROFEN (Advil, Nuprin, Motrin, generic)

Class Propionic acid derivative, nonsteroidal analgesic

Source Lederle, generic

Cat 5.0 mg/kg PO.¹⁴⁸ **See comments. Suggest Not to Use.**
Dog 1 10 mg/kg²⁰ PO. See duration of effect. **See comments.**
Dog 2 5.0 mg/kg PO.¹⁴⁸ **See comments.**
Guinea Pig 10 mg/kg IV¹¹, IM¹¹⁰
Mouse 1 30 mg/kg PO¹²
Mouse 2 7.5 mg/kg PO²⁰
Primate 20 mg/kg/day PO²⁶⁹
Rabbit 1 10-20 mg/kg IV¹¹
Rabbit 2 7.5 mg/kg PO²⁶⁹
Rat 1 7.5 mg/kg PO¹²
Rat 2 10-30 mg/kg PO²⁰

Dosage frequency

Cat 24 hours¹⁴⁸
Dog 1, 2 24-48 hours (slow detoxification) at both dose levels
Guinea Pig 4 hours?¹¹
Mouse 1 4 hours?¹¹ 24 hours²⁷⁷
Mouse 2 4 hours²⁶⁸
Rabbit 1 4 hours¹⁰

Rabbit 2 6-8 hours²⁶⁹
Rat 1 4 hours?¹¹
Rat 2 24 hours²⁷⁷

Comments

Cat Because of potential toxicity in the cat, it is suggested that this drug **not be used**.
Dog 1, 2 Reports of gastric perforation.³⁴ Gastric perforation seen at 3 mg/kg PO q48h for 6 weeks.³⁵
Rabbit 1, 2 No controlled studies performed for toxicity¹⁰ or efficacy²³³

IDAZOXAN

Class α_2 -antagonist
Source Not available in US

Calf 0.05-0.1 mg/kg IV⁴⁵
Sheep 0.1 mg/kg IV⁴⁵

INACTIN (ethyl(1-methyl-propyl)malonyl-thio-urea salt)

Class Anesthetic
Source

Hamster 200 mg/kg IP²¹⁷
Mouse 80 mg/kg IP²¹⁷
Rabbit 1 See Ketamine
Rabbit 2 47.5 mg/kg IV²¹⁸
Rat 80-100 mg/kg IP.¹⁴⁸ Surgical anesthesia¹⁷⁷

Dosage frequency

Rat 60-240 minutes¹⁷⁷

ISOFLURANE (Forane, Aerrane, generic)

Class Fluorinated ether anesthetic. See comments.
Source Anaquest

Amphibian 1 (*And see Frog*) *Terrestrial*: 4-5% in anesthetic chamber¹⁴⁸
Amphibian 2 3 ml/L topical bath²⁷⁹
Amphibian 3 3 ml isoflurane, 1.5 ml water and 3.5 ml KY Jelly. Shake well until uniform and apply to dorsum of skin. Remove gel with moist gauze pad once anesthesia has occurred.²⁷⁹
Bird 1 5% induction, 0.25-2.0% maintenance¹³⁶
Bird 2 1.5-2.5%. Drug of choice¹⁴⁸
Dog 1 1.6% (maintenance) in 50% nitrous oxide and oxygen.⁷²
Dog 2 1.6% (maintenance) in 50% nitrous oxide and oxygen, with midazolam 0.2 g/kg IV.⁷²

Ferret	4% in 100% oxygen (2 liters/min) via Bain circuit. Intubate, then 2% in 100% oxygen ¹¹⁵
Fish	0.4-0.75 ml/L induction then 0.25-0.4 ml/L maintenance. Spray under water through a 25 gauge needle. ²⁷⁹
Frog	<i>African clawed frog</i> . 0.008-0.6 ml per gram of moisture-proof disposable underpad. ²⁶⁶
Gerbil	1-4% ¹¹⁹
Goat	See comments.
Guinea Pig	1-3% ² , 1-5% ¹³²
Hamster	1-4% ²
Mouse 1	1-4% ² , See comments
Mouse 2	3% with oxygen flow of 2 liter/min. After induction, 1-2%, oxygen flow of 0.75 liter/min. ⁸⁷ See comments.
Rabbit	4% induction, 0.5-1.5% maintenance ⁵
Rat	1-4% ² , 1-5% ²¹⁷
Sheep	3% induction, 1.5% maintenance. Precedex by ketamine, 15 mg/kg IM. ⁹⁷
Swine	4% induction and 1:1 mixture of nitrous oxide and oxygen (total flow, 5 liters/min). Maintain at 2%. ²⁵

Dosage frequency

All	As long as gas is supplied
Frog	10-27 minutes. Dose dependent. ²⁶⁶

Comment

All	Waste gas must be scavenged.
All	Use higher dosages for induction, lower for maintenance.
All	Respiratory depression and some cardiovascular depression. ¹¹¹
All	Typical induction concentration 3-4% for rodents and rabbits, typical maintenance concentration 1.5-3.0% for rodents and rabbits ¹⁷⁷
Goat	Requires artificial ventilation. Good anesthesia. ¹⁰⁸
Mouse 1, 2	Can cause transient postoperative immunosuppression. May be teratogenic in mice ²¹⁷
Swine	When mixed with nitrous oxide (2:1 isoflurane:nitrous) has the least myocardial depressant effects of any inhaled anesthetics. ²⁴⁰

KETAMINE (Ketalar, Ketaset, Vetalar, generic) **Controlled substance**

Class Arylcyclohexylamine dissociative anesthetic. See comments.

Source Parke-Davis, Fort Dodge

Amphibian 1	50-150 mg/kg SC ¹⁴⁸ , IM ¹⁴⁷
Amphibian 2	10-15 mg/kg SC in dorsal lymph sac. Anesthesia ¹³⁶

Bird 1	10-30 mg/kg IM with xylazine, 1-4 mg/kg IM. Anesthesia ¹³⁶
Bird 2	10-50 mg/kg IM ¹⁴⁸
Bird 3	70-100 mg/kg IM if <100 grams of body weight. ¹⁴⁸
Bird 4	50-80 mg/kg IM if 200-500 grams body weight. ¹⁴⁸
Bird 5	30-60 mg/kg IM if >500 grams body weight. ¹⁴⁸
Calf 1	0.5 mg/kg IV with medetomidine, 20 mg/kg IV ¹³⁵
Calf 2	4.4-10 mg/kg IM with xylazine 0.1 mg/kg IM ²⁰
Cat 1	11 mg/kg IM for restraint. ²⁹
Cat 2	22-32 mg/kg IM for minor surgery. ²⁹ Maximum dosage of 50 mg/kg for any single procedure. ²⁹
Cat 3	4.4-6.6 mg/kg IV with diazepam 0.44 mg/kg IV ²⁰ or with diazepam 0.25 mg/kg IV. ⁷⁴ Give as a single bolus. ²²⁰ See comments
Cat 4	0.5-2.0 mg/kg IV ¹²¹
Cat 5	10-22 mg/kg IM, SC with xylazine 1.1 mg/kg IM ²⁰
Cat 6	2.2-6.6 mg/kg IV with xylazine 0.66 mg/kg IV ²⁰
Cat 7	30 mg/kg IM with aceylpromazine 0.1 mg/kg IM³⁷
Cat 8	<i>Male kitten</i> 11 mg/kg IM (for castration) ⁷⁹ <i>Female kitten</i> 11 mg/kg IM with 0.22 mg/kg IM midazolam and 11 mg/kg ketamine IM, all in same syringe. For ovariohysterectomy. See comments. ⁷⁹
Cat 9	7.0 mg/kg IM with medetomidine 80 µg/kg IM. Surgical anesthesia ¹⁵²
Cat 10	10 mg/kg IM with midazolam 0.5 mg/kg IV ²²⁰
Cattle 1	10 mg/kg IV ²²¹
Cattle 2	0.5 mg/kg IV with medetomidine 0.02 mg/kg IV ²²¹
Dog 1	1 ml/5-10 kg with diazepam 50:50 volume ratio. ⁴ See comments.
Dog 2	4.4-6.6 mg/kg IV with xylazine 0.33 mg/kg IV. ²⁰ See comments
Dog 3	11 mg/kg IV with xylazine 1.1 mg/kg IV. ²⁰ See comments.
Dog 4	5.5 mg/kg IV with midazolam 0.28 mg/kg IV (equivalent to 1 ml/9 kg of a 1:1 v/v mixture). ⁷⁰ See comments.
Dog 5	Diazepam 0.5 mg/kg IV then ketamine 10 mg/kg IV. Induction of general anesthesia. ⁷² Use separate syringes. See comments.
Dog 6	2.5-7.5 mg/kg IM with medetomidine 40 µg/kg IM. Light anesthesia. ¹⁵²
Ferret 1	55 mg/kg IM with 0.55 mg/kg acetylpromazine IM ⁴⁰
Ferret 2	10-30 mg/kg IM with 0.05-0.3 mg/kg acetylpromazine IM ¹⁷⁵
Ferret 3	5.0 mg/kg IV. Sedation.
Ferret 4	10-20 mg/kg IM (tranquilization) ¹¹⁶ SC ²³²
Ferret 5	20-60 mg/kg IM (anesthesia) ¹¹⁶

Ferret 6	20-30 mg/kg IM with xylazine 1-4 mg/kg SC ¹¹⁶ , IM ¹⁷⁵
Ferret 7	25-35 mg/kg IM with diazepam 2-3 mg/kg IM. ¹¹⁶ Administer with 0.05 mg/kg atropine. ¹³⁰ Use separate syringes.
Ferret 8	8.0 mg/kg IM with medetomidine 100 µg/kg IM. Surgical anesthesia. ¹⁵² Use separate syringes. ²³² Can add butorphanol at 0.1 mg/kg IM ²³²
Ferret 9	See Tiletamine
Fish	14-18 mg/kg IM. ²⁷⁸ Anesthesia.
Gerbil 1	Not Recommended. ¹⁷⁵
Gerbil 2	100-200 mg/kg IP. ^{2, 37} Anesthesia. ¹³²
Gerbil 3	75 mg/kg IP with acetylpromazine 3 mg/kg IM. ^{2, 37} See comments. Sedation. ¹³²
Gerbil 4	50 mg/kg IP ^{2, 37} , SC ²⁸¹ with xylazine 2 mg/kg IM ^{2, 37} , IM. ²⁸¹ See comments. Sedation. ¹³²
Gerbil 5	75 mg/kg IP with medetomidine 0.5 mg/kg IP. Surgical anesthesia ¹⁵²
Gerbil 6	44 mg/kg IM. ²⁸ See comments. Sedation. ¹³²
Gerbil 7	50 mg/kg IM with diazepam 5 mg/kg IP. ³⁷ See comments. Sedation. ¹³² Use separate syringes.
Gerbil 8	100 mg/kg SC, IP with diazepam 5.0 mg/kg SC, IP. ²⁸¹ Anesthesia.
Gerbil 9	40 mg/kg IP, SC with medetomidine 0.5 mg/kg IP, SC. ²⁸¹ Anesthesia.
Goat 1	20 mg/kg IM ³⁷
Goat 2	7.5 mg/kg IV with 0.375 mg/kg Diazepam IV. Sedation. ¹³² Use separate syringes.
Goat 3	11 mg/kg IM with xylazine (0.022 mg/kg IM) and atropine (0.02 mg/kg IM) preanesthesia. ¹³¹
Guinea Pig 1	50-200 mg/kg IP. ² See comments.
Guinea Pig 2	100 mg/kg IM. ³⁷ See comments.
Guinea Pig 3	22-44 mg/kg IM.²⁸ 40 mg/kg is typical.²¹⁷ see comments about IM injection.
Guinea Pig 4	100 mg/kg IP with diazepam 5 mg/kg IM, IP. ^{2, 37} Use separate syringes. See comments.
Guinea Pig 5	20-50 mg/kg IM with diazepam 3.0-5.0 mg/kg IM ¹⁷⁵
Guinea Pig 6	40-60 mg/kg IP or IM ²⁸ with xylazine 4-5 mg/kg IM, SC ² or IP. ²⁰ Sedation to light anesthesia. See comments.
Guinea Pig 7	35 mg/kg IM with xylazine 0.2 mg/kg IM. Improved hemodynamic stability. ⁵³ See comments.
Guinea Pig 8	87 mg/kg IM with xylazine 13 mg/kg IM. Surgical anesthesia.
Guinea Pig 9	20-44 mg/kg IM with droperidol 2.5 mg/kg (IM?) ¹¹⁰
Guinea Pig 10	125-150 mg/kg IM with droperidol 1 mg/kg IM ¹³²
Guinea Pig 11	125 mg/kg IP with acetylpromazine 5 mg/kg IM, SC. ^{2, 37} Anesthesia ¹³²

Guinea Pig 12	44 mg/kg IM with acetylpromazine 3 mg/kg IM. ²⁰ See comments. Sedation. ¹³²
Guinea Pig 13	20-30 mg/kg IM with acetylpromazine 0.5-1.0 mg/kg IM. ¹⁷⁵
Guinea Pig 14	40 mg/kg IM or IP with medetomidine 0.5 mg/kg SC ¹³² , IP ¹⁵² Immobilization
Hamster 1	200 mg/kg IP (anesthesia) ²
Hamster 2	40 mg/kg IP (sedation) ²
Hamster 3	100 mg/kg IM. ²⁸ Sedation ¹³²
Hamster 4	60 mg/kg IM ¹⁴⁸
Hamster 5	100-200 mg/kg IP with xylazine 7-10 mg/kg IP or IM. ^{2, 20} Anesthesia. See comments
Hamster 6	150 mg/kg IP with acetylpromazine 5 mg/kg IM ² , see comments
Hamster 7	80-100 mg/kg IP with xylazine 7-10 mg/kg IP ¹³²
Hamster 8	50-150 mg/kg IM with acetylpromazine 2.5-5.0 mg/kg IM ¹⁷⁵
Hamster 9	40-150 mg/kg IM with diazepam 5.0 mg/kg IM. See comments ¹⁷⁵
Hamster 10	100 mg/kg SC followed by pentobarbital 50 mg/kg IP, IM ¹⁷⁷ 10 minutes later. ⁸³ Anesthesia.
Hamster 11	100 mg/kg IP with medetomidine 250 µg/kg IP ¹⁵²
Mouse 1	80-100 mg/kg IM. ¹³² See comments.
Mouse 2	100-150 mg/kg IP (inadequate for surgery) ²
<u>Mouse 3</u>	150 mg/kg IP with xylazine 10 mg/kg IP²
Mouse 4	100 mg/kg IP with acetylpromazine 2.5 mg/kg IP, IM. ² See comments. Anesthesia or immobilization ¹⁷⁷
Mouse 5	150 mg/kg IP with diazepam 5 mg/kg IP. ² Use separate syringes.
Mouse 6	44 mg/kg IM ²⁸
Mouse 7	100-200 mg/kg IM ¹¹⁷
Mouse 8	50 mg/kg IV ²⁸
Mouse 9	50 mg/kg IM xylazine 50 mg/kg IM
Mouse 10	100 mg/kg IM with xylazine 10 mg/kg IM ²⁸
Mouse 11	200 mg/kg IP with xylazine 10 mg/kg IP. ³⁷ See comments.
Mouse 12	30 mg/kg with xylazine 6.0 mg/kg and acetylpromazine 1 mg/kg. all IP in same syringe. ⁹⁴
Mouse 13	100 mg/kg IM with acetylpromazine 2.5 mg/kg IM and xylazine 2.5 mg/kg IM. ¹³² See comments. Depth varies from sedation to anesthesia. ¹³²
Mouse 14	100 mg/kg IM with azaperone 75 mg/kg IM ¹⁴⁸
Mouse 15	75 mg/kg IP with medetomidine 1.0 mg/kg IP ¹⁵²
Mouse 16	Same as Rat 16 (ketamine, midazolam and butorphanol, q.v.)

<u>Primate 1</u>	5-10 mg/kg IM. ¹ Maximum dose for any single procedure is 40 mg/kg IM. ²⁹ See comments.
Primate 2	<i>Pigtail macaque, Baboon</i> 5.0-7.5 mg/kg IM ²⁹
Primate 3	<i>Squirrel monkey</i> 13 mg/kg IM restraint ²⁰
Primate 4	<i>Squirrel monkey</i> 25 mg/kg IM anesthesia ²⁰
Primate 5	10 mg/kg IM with diazepam 0.5 mg/kg. ¹ See comments.
Primate 6	<i>Baboon</i> 10 mg/kg IM with diazepam 7.5 mg/kg IM ²⁰
Primate 7	<i>Callithrix</i> 15 mg/kg IM with diazepam 1.0 mg/kg IM ²¹⁹
Primate 8	11 mg/kg IM with acetylpromazine 0.55 mg/kg IM, SC. ¹ See comments.
Primate 9	10 mg/kg IM with oxymorphone 0.15 mg/kg. ¹ See comments.
Primate 10	10 mg/kg IM with xylazine 0.5 mg/kg IM. Surgical anesthesia. ³⁷ Minor surgery only. ²¹⁹
Primate 11	5.0 mg/kg IM followed by pentobarbital 20-30 mg/kg IV. ⁵³
Primate 12	5.0-20 mg/kg PO. ⁷⁶
Primate 13	15 mg/kg IM with midazolam 0.05-0.15 mg/kg IV. Follow by ketamine 12 mg/kg hr IV drip ²¹⁹
Primate 14	5.0 mg/kg IM with medetomidine 0.1 mg/kg IM ²¹⁹
Primate 15	<i>Callithrix</i> 15-20 mg/kg IM ²¹⁹
Primate 16	<i>Callithrix</i> 15-22 mg/kg IM with xylazine 1.0-1.5 mg/kg IM ²¹⁹
Primate 17	<i>Chimpanzee</i> 15 mg/kg IM with xylazine 1.0 mg/kg IM. Minor surgery ²¹⁹
Rabbit 1	25 mg/kg Intranasal. ⁸⁶ Dilute with saline to 0.4 ml/kg. Light anesthesia.
Rabbit 2	25 mg/kg Intranasal with midazolam 1.0 mg/kg Intranasal. ⁸⁶ Dilute with saline to 0.4 ml/kg.
Rabbit 3	20 mg/kg IM. ²²⁴ See comments.
Rabbit 4	20-60 mg/kg IM with acetylpromazine 5 mg/kg IM. ²⁸
Rabbit 5	10 mg/kg IV (sedation) ²²⁴
Rabbit 6	44 mg/kg IM with acetylpromazine 5 mg/kg IM ²⁸
Rabbit 7	75 mg/kg IM 30 minutes after acetylpromazine 5 mg/kg IM ¹³²
Rabbit 8	10 mg/kg Intranasal with xylazine 3 mg/kg Intranasal. ⁸⁶ Dilute with saline to 0.4 ml/kg. Mild narcosis only. ²¹¹
<u>Rabbit 9</u>	35-50 mg/kg IM with xylazine 5-10 mg/kg IM.⁵ Light anesthesia.²⁰ See comments.
<u>Rabbit 10</u>	3 mg/kg IM with xylazine 5.0 mg/kg IM and acetylpromazine 0.75 mg/kg SC.³⁹
Rabbit 11	20 mg/kg ketamine IM with 1.0-3.0 mg/kg xylazine IM ²²⁴
Rabbit 12	25-35 mg/kg IM with diazepam 5-10 mg/kg IM. ⁵ Sedation, relaxation. See comments.
Rabbit 13	60-80 mg/kg IM 30 minutes after diazepam, 510 mg/kg IM ¹³²

Rabbit 14	Diazepam 0.2-0.5 mg/kg IV followed by ketamine, 10-15 mg/kg IV to effect ⁷⁶
Rabbit 15	10 mg/kg IV with xylazine, 3 mg/kg IV. ³⁷ Anesthesia.
Rabbit 16	50 mg/kg IM with guaifenesin 200 mg/kg IV. ⁵ See comments.
Rabbit 17	50 mg/kg IM with paraldehyde 0.5 mg/kg IM. Anesthesia. See comments.
Rabbit 18	35 mg/kg IM with xylazine 5 mg/kg IM and butorphanol 0.1 mg/kg IM. Precede all with atropine 0.04 mg/kg IM. ²⁶ See comments. Surgical anesthesia. ¹⁷⁷
Rabbit 19	20 mg/kg IM followed by chloral hydrate 250 mg/kg IV ten minutes later. ³⁹
Rabbit 20	35 mg/kg IM followed by chloral hydrate 250 mg/kg IV ten minutes later. ³⁹
Rabbit 21	2.5 mg/kg IM with medetomidine 0.5 mg/kg SC ¹³² IM ²³³
Rabbit 22	25 mg/kg IP with 0.5 mg/kg medetomidine IP. Surgical anesthesia ¹⁵²
Rabbit 23	15 mg/kg SC, IM with medetomidine 0.25 mg/kg IM, SC. For intubation. ^{212, 257}
Rabbit 24	5-10 mg/kg IM with midazolam 0.3-1.0 mg/kg IM. Light anesthesia. ²³³
Rabbit 25	<i>Fetal surgery</i> Anesthetize dam with 20 mg/kg ketamine with 1.0 mg/kg acetylpromazine. Give ½ dose IM and remainder IV, 20 minutes later. Then use halothane at 1-1.5% with 1 liter/min oxygen flow. ²¹⁸
Rabbit 26	10 mg/kg IM with midazolam 0.5 mg/kg IM and buprenorphine 0.03 mg/kg IM. ²⁸¹ Premedication for gas anesthesia.
Rat 1	60-100 mg/kg IP.¹ Sedation.²
Rat 2	40-80 mg/kg IP with xylazine 5-10 mg/kg IP. ² Sedation and relaxation. ²⁰
Rat 3	40-80 mg/kg IP with acetylpromazine 2.5 mg/kg IP, IM. ² See comments.
Rat 4	50-100 mg/kg IM with acetylpromazine 2.5-5.0 IM. Light anesthesia. ¹⁷⁵
Rat 5	40-80 mg/kg IP with diazepam 5-10 mg/kg IP ² or 2.5 mg/kg IM. ¹³² Use separate syringes. See comments.
Rat 6	10 mg/kg IP with xylazine 3 mg/kg IP. Anesthesia. ³⁷
Rat 7	44 mg/kg IM ²⁸ 25 mg/kg IM. ³⁷ See comments.
Rat 8	87 mg/kg IM ²⁸ or IP ¹³² with xylazine 1 mg/kg IM ²⁸ or IP. ¹³² See comments.
Rat 9	48 mg/kg IM with xylazine 3-5 mg/kg IM, IP.²¹⁷ See comments about IM.
Rat 10	60-75 mg/kg IP with medetomidine 0.25-0.5 mg/kg SC ¹³² , IP ¹⁴⁹ , IM (more effective) ²¹³ . See comments about IM injections. Surgical anesthesia.

Rat 11	60 mg/kg IM with detomidine 10 mg/kg IM for male ¹⁴⁸
Rat 12	40 mg/kg IM with detomidine 5.0 mg/kg IM for female ¹⁴⁸
Rat 13	87 mg/kg IM with azaperone 50 mg/kg IM. Give 25% to 150% of this dose for 1-6 hours duration. ¹⁴⁸
Rat 14	37 mg/kg IM with xylazine 7.0 mg/kg IM. Then maintain with ketamine 1.0-1.25 mg/kg/minute with xylazine 0.032-0.040 mg/kg/min using a syringe pump at 40-50 µl/minute, IV. ¹⁷⁹
Rat 15	75.0 mg/kg IP with midazolam 5.0 mg/kg IP ²³⁹
Rat 16	40 mg/kg IP with midazolam 2.0 mg/kg IP and (optional) butorphanol 0.1 mg/kg IP. ²⁵⁰ Surgical anesthesia.
Rat 17	40 mg/kg IM with 8.0 mg/kg IM xylazine and 4.0 mg/kg IM acetylpromazine. ²⁶⁴ Can also use IP (preferred). See comments.
Rat 18	45 mg/kg IP with medetomidine 0.3 mg/kg IP one hour following buprenorphine 0.05 mg/kg SC. ²⁷² See comments.
Reptile 1	20-60 mg/kg IM ^{72, 278} Sedation.
Reptile 2	55-88 mg/kg IM ²⁷⁸ Surgery
Reptile 3	<i>Lizards</i> 10-50 mg/kg IM ²⁷⁸
Reptile 4	<i>Chelonians</i> 40-80 mg/kg IM ²⁷⁸
Reptile 5	<i>Snakes</i> 30-100 mg/kg IM ²⁷⁸
Reptile 6	<i>Chelonians</i> 1.0-2.0 mg/kg IV ²⁸⁰
Reptile 7	<i>Turtle</i> 5.0-10 mg/kg IM with 0.1-0.2 mg/kg detomidine IM ²⁶¹
Reptile 8	10 mg/kg IM with acetylpromazine 0.05 mg/kg IM and butorphanol 0.1 mg/kg IM ²⁸¹ Sedation.
Sheep 1	10 mg/kg IM with xylazine 0.1 mg/kg IM. ²⁰ Anesthesia ²⁰
Sheep 2	7.5 mg/kg IV with xylazine 0.1 mg/kg IV ⁹⁹
Sheep 3	4.0 mg/kg IV with xylazine 1 mg/kg IM. Give xylazine 10 minutes before ketamine. Light surgical anesthesia ³⁷
Sheep 4	10 mg/kg IM with xylazine 0.2 mg/kg IM. ⁴⁰
Sheep 5	10 mg/kg IV ²²¹
Sheep 6	10 mg/kg IM with diazepam 0.2-05 mg/kg IM. ²⁰ Anesthesia. Use separate syringes.
Sheep 7	7.5 mg/kg IV with diazepam 0.375 mg/kg IV. ⁹⁹ Use separate syringes.
Sheep 8	4.0 mg/kg IV with diazepam 2 mg/kg IM or diazepam 1 mg/kg IV. Anesthesia. ³⁷ Use separate syringes.
Sheep 9	22-44 mg/kg IM, IV with acetylpromazine 0.55 mg/kg IV. ²⁰ Anesthesia.
Sheep 10	4.4 mg/kg IV with diazepam 2 mg/kg IM or 1.0 mg/kg IV. Give diazepam 10 minutes before ketamine. ³⁷ Use separate syringes.
Sheep 11	20 mg/kg IM. Sedation ³⁷

Sheep 12	1.5 mg/ml ketamine, 0.1 mg/ml xylazine, 50 mg/ml guaifenesin. Use with 5% dextrose in saline IV drip. Induce with 0.5 ml/kg of the solution, and maintain anesthesia with flow rate of 2.2 ml/kg/hour ⁹¹
Sheep 13	10 mg/kg IM followed by fentanyl, 3 mg/kg IV. Maintain anesthesia with fentanyl 1.0 mg/kg/hr IV with 50% nitrous oxide.
Sheep 14	0.5 mg/kg IV with medetomidine 0.02 mg/kg IV ²²¹
Swine 1	11-33 mg/kg IM. ³ 10 mg/kg IM ³⁷
<u>Swine 2</u>	<u>22 mg/kg IM with acetylpromazine 1.1 mg/kg IM³</u>
<u>Swine 3</u>	<u>15 mg/kg IM with diazepam 2 mg/kg IM^{3,37} Sedation¹¹¹</u>
	Use separate syringes
Swine 4	20 mg/kg IM with xylazine 2 mg/kg IM ³ Sedation. ¹¹¹ Can add acetylpromazine (1.1 mg/kg IM) and atropine (0.05 mg/kg IM) ¹³¹
<u>Swine 5</u>	<u>10 mg/kg IM, IV with xylazine 1 mg/kg IM, IV.²⁰</u> <u>Anesthesia</u>
Swine 6	11 mg/kg IM with fentanyl-droperidol 1.0 ml/14 kg IM ^{3,68}
Swine 7	15-20 mg/kg IV ¹⁴⁸
Swine 8	15 mg/kg IM with azaperone 2 mg/kg IM. ³ Note: Azaperone is no longer commercially available
Swine 9	2 mg/kg IM with xylazine 2 mg/kg IM and oxymorphone 0.075 mg/kg IV (or oxymorphone 0.15 mg/kg IM). ³ Anesthesia.
Swine 10	1.0 mg/kg of 500 mg/ketamine and 500 mg xylazine added to 500 ml of 5% guaifenesin (prepared in 5% dextrose). See comments. ⁶¹
Swine 11	11 mg/kg IM with xylazine 2 mg/kg IM and butorphanol 0.22 mg/kg IM for pigs from 5-20 kg body weight. ⁷⁵
Swine 12	20 mg/kg IM with xylazine 2.0 mg/kg IM, then 50 mg of a 2.5% thiopental solution, dissolved in 500 ml of isotonic saline. Administer IV at 30 drops/minute. ¹¹¹
Swine 13	10 mg/kg IM with medetomidine 80µg/kg IM. Light anesthesia. ¹⁵²
<u>Swine 14</u>	<u>10 mg/kg IV with 0.2 mg/kg medetomidine IV²²¹</u>
Swine 15	See Tiletamine
Swine 16	See Midazolam

Dosage frequency

Cat 1	30-45 minutes ²²⁰
Cat 2	30-40 minutes ²⁰
Cat 5	15 minutes ¹¹¹
Cat 9	45 minutes ²²⁰
Ferret 4	30-60 minutes ²²⁰
Ferret 6	36 minutes ¹⁸⁵
Gerbil 2	15 minutes

Gerbil 3	75 minutes ¹³²
Gerbil 4	41 minutes ¹³²
Gerbil 6	30 minutes ¹³²
Gerbil 7	50 minutes ¹³²
Guinea Pig 1	1 hour, surgical level ⁵³
Guinea Pig 3	35 minutes ¹³² (at 40 mg/kg)
Guinea Pig 6	30 minutes ¹⁷⁷
Guinea Pig 8	60 minutes
Guinea Pig 11	1 hour ⁵³
Guinea Pig 12	1.5 hours ²⁰
Hamster 6	45-120 minutes ¹⁷⁷
Mouse 12	6 minutes ⁹⁴
Mouse 9	30-40 minutes ³⁷ 60-100 minutes ²¹⁷
Mouse 13	20-30 minutes ¹⁷⁷
Primate 1	20-55 minutes ²⁹ 15-30 minutes ²¹⁹
Primate 9	30-45 minutes ¹¹⁸
Primate 10	30-40 minutes ³⁷
Primate 11	1 hour ⁵³
Primate 12	20-30 minutes ²⁰
Primate 15	15-30 minutes
Primate 16	30 minutes ²¹⁹
Primate 17	25 minutes ²¹⁹
Rabbit 1	37 minutes ⁸⁶
Rabbit 2	53 minutes ⁸⁶ (with midazolam)
Rabbit 3	30-60 minutes ¹¹¹
Rabbit 6	20-30 minutes ¹⁷⁷
Rabbit 8	35 minutes ⁸⁶
Rabbit 9	40 minutes ³⁹
Rabbit 10	60-120 minutes ³⁹ 20-40 minutes ⁶ 45-60 minutes ²⁰
Rabbit 15	30 minutes ^{20, 37}
Rabbit 17	2-4 hours ²⁰
Rabbit 18	60 minutes ²⁶
Rabbit 19	20 minutes ³⁹
Rabbit 20	20 minutes ³⁹
Rabbit 21	90-180 minutes
Rat 1	20-30 minutes ¹⁷⁷
Rat 6	30 minutes ²⁰
Rat 9	60 minutes ⁸⁹
Rat 14	Up to 12 hours ¹⁷⁹
Rat 15	30-45 minutes ²³⁹
Reptile 1	30-45 minutes ¹³⁶
Reptile 7	Approx 45 minutes ²⁶¹
Sheep 1	30-40 minutes ²⁰
Sheep 7	25 minutes ¹¹¹
Sheep 8	30-40 minutes ²⁰
Sheep 9	1-1.5 hours ²⁰

Swine 1	30 minutes ²²¹
Swine 2	20 minutes ¹³⁴ 15-25 minutes ⁹⁹
Swine 3	90 minutes ¹¹¹ 20 minutes ¹³⁴
Swine 4	15-25 minutes ⁹⁹ 40 minutes ¹¹¹ 20 minutes ¹³⁴
Swine 8	20 minutes ²²¹
Swine 9	20-30 minutes. ²⁰ Extrapolation
Swine 12	30-45 minutes at 20 mg/kg ³⁷
Swine 14	30 minutes ²²¹
<i>Antagonist</i>	
Cat 1	4-aminopyridine (partial antagonist)
Cat 7	4-aminopyridine (partial antagonist)
Gerbil 7	Mild antagonism by yohimbine (q.v.), 0.2 mg/kg IV ³⁶
Rat 15	Can reverse midazolam with atipamezol (q.v.) ²⁶¹
Reptile 7	Atipamezol for medetomidine
Swine 3	Yohimbine (q.v.) ⁴⁵ (without acetylpromazine)
<i>Comments</i>	
All	Not satisfactory alone for abdominal surgery. ⁶ Somatic analgesia.
All	Pedal reflex may remain.
All	Usually poor muscle relaxation.
All rodents/rabbits	Can cause injection site myonecrosis, sciatic axonal degeneration and self mutilation. ²³³ Consider IP if possible.
Cat 3	Empirical reports on Internet of hyperanesthesia, nystagmus
Cat 8	Follow by inhalant anesthetic if necessary. ⁷⁹
Dog 1, 5	Empirical reports on Internet of hyperaesthesia, nystagmus
Ferret 5	incomplete analgesia ²³²
Gerbil 6	Glutamate receptor antagonist. Do not use in stroke models. ¹³³
Guinea Pig 1	Can use atropine, 0.04 mg/kg IM, SC to control salivation. Poor analgesia. ¹¹¹
Guinea Pig 2, 3, 5-14	Not recommended in guinea pig for IM infection in survival studies ²⁸
Hamster 10	Glutamate receptor antagonist. Do not use in stroke models. ¹³³
Hamster 10	May have transient cardiac arrhythmias. ¹³⁰
Mouse 9	May not provide adequate analgesia for surgery. ³⁷
Primate 1-12	Hypersalivation common. Give with atropine ²¹⁹
Primate 9	Drug of choice for severe pain. ¹¹⁸
Primate 10	Can decrease mean arterial pressure and heart rate ²¹⁹
Rabbit 1	Clinically, found only sedation ¹⁷⁰
Rabbit 3	Poor analgesia ¹¹¹
Rabbit 9	Unpredictable levels of anesthesia ³⁸

Rabbit 9,18	Moderate reduction in heart rate. Large decrease in respiratory rate. Moderate reduction in mean arterial pressure. ²⁶
Rabbit 11	May cause severe bradycardia and respiratory depression ²²⁴
Rabbit 24	Variable results ²²⁴
Rat 1	Possible ventricular arrhythmias ¹³⁶
Rat 5	Do not use in pregnant animals ²¹⁷
Rat 7	Poor muscle relaxation and analgesia ³⁷
Rat 15	For short procedures, such as radiographs. Pedal reflex not lost. ²³⁹
Rat 18	May lead to increased mortality after repeated weekly anesthesia ²¹⁷
Sheep 2	Hypotensive ⁹⁹ Cardiac depressant ²²¹
Swine 10	Use atropine 0.04 mg/kg IV, IM before induction ⁶¹
Swine 11	Butorphanol enhances analgesia ⁷⁵

KETOPROFEN (Ketofen, Orudis)

Class Propionic acid derived non-steroidal anti-inflammatory

Source Fort Dodge, Wyeth-Ayerst, Mylan

Bird	2.0-4.0 mg/kg IM ¹¹¹
Cat 1	2.0 mg/kg IV ¹⁴² SC ²⁷⁷
Cat 2	1.0 mg/kg oral. Mild pain control ¹⁴²
Cattle	Cow 3.0 mg/kg IM, IV ²⁷⁷
Dog 1	2.0 mg/kg IM ¹⁴² , SC ¹⁴³
Dog 2	1.0 mg/kg oral. Mild pain control ¹⁴²
Dog 3	2.0 mg/kg IM with oxymorphone 0.05 mg/kg IM ¹⁹⁰
Ferret	1.0 mg/kg PO, IM ²⁶⁹
Mouse	5.0 mg/kg SC ²⁰⁹
Primate 1	<i>Cynomolgus</i> 2.0 mg/kg SC ¹⁹⁸
Primate 2	1.0-5.0 mg/kg IM ²⁰⁸
Primate 3	5.0-10.0 mg/kg PO ²⁰⁸
Rabbit 1	1.0 mg/kg IM ^{148, 269}
Rabbit 2	3.0 mg/kg IM ^{202, 226} SC ²⁷⁷
Rat 1	2.0 mg/kg PO in berry flavored jelly. ¹⁶² See comments.
<u>Rat 2</u>	5.0 mg/kg SC^{209, 269}
Rat 3	2.0 mg/kg SC
Reptile	2.0 mg/kg SC, IM ²⁷⁷
Swine 1	3.0 mg/kg IM ²³⁸
Swine 2	1.0-3.0 mg/kg PO ²⁴⁰

Dosage frequency

Cat 1	12 hours ¹⁴² Once daily for 3 days ²⁷⁷
Cat 2	Once a day for 5 days ^{142, 277}
Cattle	24 hours for up to 3 days ²⁷⁷
Dog 1	12 hours ¹⁴² Once daily for 3 days ²⁷⁷

Dog 2	Once a day for 5 days ^{142, 277}
Ferret	24 hours ²⁶⁹
Primate 2	Twice a day ²⁰⁸
Primate 3	2-4 times a day ²⁰⁸
Rabbit 1	12-24 hours ²⁶⁹
Rabbit 2	24 hours ²⁷⁷
Rat 1	24 hours ¹⁶²
<u>Rat 2</u>	<u>24 hours²⁷⁷</u>
Reptile	24-48 hours ²⁷⁷
Swine 1	Single dose ²³⁸
Swine 2	8-12 hours ²⁴⁰

Comments

All	cyclooxygenase inhibitor. Use with caution in animals with impaired renal, cardiovascular, hepatic or bleeding disorder.
Dog 1	If necessary, can supplement with oxymorphone 0.05-0.1 mg/kg IM, IV or buprenorphine 0.01 mg/kg IM.
Dog 2	4-5% vomiting incidence
Dog 3	Better than oxymorphone or butorphanol for general postoperative pain ¹⁹⁰
Rat 1	Not effective PO ²⁰⁹
Rat 3	One report of ulcerative, hemorrhagic gastroenteritis involving entire gut after two days of treatment. ²³⁶

KETOROLAC (Toradol)

<i>Class</i>	Pyrrolo-pyrrole nonsteroidal anti-inflammatory
<i>Source</i>	Roche, Mylan, Fort Dodge

Dog 1	0.5 mg/kg IM ²⁰⁷
Dog 2	30 mg IM if less than 17 kg. 60 mg IM if greater than 17 kg ²²⁰
Mouse	0.7-10 mg/kg PO ²¹⁷
Primate 1	<i>Baboon</i> 1.0 mg/kg (IM?) at time of procedure, then 0.75 mg/kg every 6 hours ²⁰⁸
Primate 2	<i>Macaque</i> 15-30 mg/animal IM ^{219, 269}
Swine	1.0 mg/kg IV ²²⁹ IM ²⁴⁰

Dosage frequency

Dog 1	Twice a day ²⁰⁷
Dog 2	Every 6 hours ²²⁰
Swine	Four times a day ²²⁹

Comments

All	Can inhibit platelet function.
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Dog 1 Repeated use may cause gastrointestinal ulceration and bleeding.

LEVALLORPHAN (Lorfan)

Class Opioid antagonist
Source Roche

Cat 0.02-0.2 mg/kg IM, SC, IV⁶
Dog 0.02-0.2 mg/kg IM, SC, IV⁶
Rat 6.0 mg/kg SC⁸¹

Dosage frequency

Cat 90-180 minutes⁶
Dog 90-180 minutes⁶

Comments

Cat 2-3 minute IV onset⁶
Dog 2-3 minute IV onset⁶

LIDOCAINE (Xylocaine)

Class Local anesthetic
Source AstraZeneca, generic

Cat 1.0 ml of 2%⁹
Dog 1 1.0 ml of 2%⁹
Dog 2 3.0-5.0 mg/kg epidural²⁷⁷
Mouse 0.05 ml of 2%⁸²
Rabbit 1 1% local SC infiltration²³³
Rabbit 2 10% topical on glottis²³³
Rabbit 3 0.4 mg/kg epidural of 1.5% lidocaine²⁶⁹
Swine 1 1 ml of 2% solution/4.5 kg. Inject at 1.0 ml/2-3 seconds.
Lumbosacral epidural.¹²⁸
Swine 2 2.0-4.0 mg/kg IV, 50 mg/kg mix IV drip¹³⁴

Dosage frequency

Cat 1-3 hours⁹
Dog 1 1-3 hours⁹
Dog 2 2-4 hours²⁷⁷

Antagonist

Comments

LIDOCAINE (2.5%) With PRILOCAINE (2.5%) (EMLA cream)

Class Local anesthetic for intact skin
Source AstraZeneca

All species Topical on skin 15 minutes before needed.¹⁴³ Use with an occlusive dressing.

LOFENTANIL (Not available in US)

Class Opioid analgesic

Source

Rabbit 0.5 µg/kg SC¹⁸

Rat 0.7 µg/kg IV⁵⁴

Dosage frequency

Rabbit 12 hours¹⁸ up to 24 hours¹³²

LORAZEPAM (Ativan)

Class Benzodiazepine tranquilizer

Source Wyeth-Ayerst

Swine 0.1 mg/kg IV²²¹

Comments

All Must be diluted before using.

MEDETOMIDINE (Domitor)

Class Analgesic, sedative (α-2 adrenoceptor agonist)

Source Pfizer, Farnos, Ltd. (Finland)

Cat 1 30-40 µg/kg IM, SC. See comments⁹

Cat 2 50-150 µg/kg IM, SC¹⁵²

Cat 3 50 µg/kg IV²¹

Cat 4 20µg/kg IM

Cat 5 10-40 µg/kg IM

Cat 6 10-15 µg/kg epidural²⁷⁷

Cattle 0.01 mg/kg IV²²¹ sedation

Dog 1 30-40 µg/kg IM, SC^{9, 21} 40 µg/kg IV²¹

Dog 2 1000 µg/m² IM. Follow in 20 minutes with butorphanol (0.1 mg/kg) IV and midazolam (1.0 mg/kg IV).⁹³

Dog 3 15 µg/kg IM followed by etomidate 0.5 mg/kg IV, and then immediate infusion of etomidate at 50 µg/kg/min¹¹⁴

Dog 4 10 µg medetomidine IM then propofol 2.8 mg/kg IV, then maintain anesthesia with halothane.

Dog 5 750 µg/m² body surface IV¹⁸⁸

Dog 6 10-20 µg/kg IV with morphine 0.07-0.1 mg/kg IV²²⁶

Dog 7 30-40 µg/kg IM with morphine 0.2-0.3 mg/kg IM²²⁶

Dog 8 10-20 µg/kg IV with oxymorphone 0.01-0.02 mg/kg IV²²⁶

Dog 9 30-40 µg/kg IM with oxymorphone 0.05-0.1 mg/kg IM²²⁶

Dog 10 0.01-0.8 mg/kg IM²²⁰

Dog 11	10-15 µg/kg epidural ²⁷⁷
Ferret	Also see Ketamine
Ferret 1	0.1 mg/kg See comments ⁴⁶ IM, ^{226, 232} SC ¹⁸¹
Ferret 2	80 µg/kg IM with butorphanol 0.1 mg/kg IM ²³²
Gerbil	100-200 µg/kg SC ¹⁵² IP ²⁸¹
Goat	25 µg/kg IM ²²⁶
Guinea Pig 1	30-40 µg/kg IM, SC. See comments ⁹
Guinea Pig 2	300 µg/kg IM, SC ¹⁵²
Hamster 1	30-40 µg/kg IM, SC. See comments ⁹
Hamster 2	100 µg/kg SC ¹⁷⁷ IP SC ²⁸¹
Hamster 3	0.2-0.4 mg/kg IP with 1-2 mg/kg ketamine IP. Mix together in same syringe. See comments. ⁴⁶
Mouse 1	100 µg/kg SC ⁴⁶
Mouse 2	30-100 µg/kg SC. Light to moderate anesthesia ¹⁵²
Primate	Also see Ketamine
Primate 1	<i>Marmoset</i> 500 µg/kg IM ¹⁵²
Primate 2	<i>Saimiri</i> 100 µg/kg IM, SC ²¹⁷ Facilitates mask induction with isoflurane.
Primate 3	<i>Rhesus</i> Not recommended without other drugs ²¹⁹
Primate 4	<i>Rhesus</i> 100µg/kg IM five minutes after acetylpromazine - 0.25 mg/kg IM and butorphanol 0.3 mg/kg IM SC ²⁴⁵
Primate 5	30-60 µg/kg IM with ketamine 5.0-6.0 mg/kg IM
Rabbit	Also see Ketamine and Propofol
Rabbit 1	30-40 µg/kg IM, Sc. See comments ⁹
<u>Rabbit 2</u>	100-500 µg/kg SC. See comments⁹
Rabbit 3	0.25 mg/kg IM with atropine (0.5 mg/kg IM) and 5 minutes later, propofol (4 mg/kg IV) ²³
Rabbit 4	0.25 mg/kg IM with atropine (0.5 mg/kg IM) and midazolam (0.5 mg/kg IM) and 5 minutes later, propofol (2 mg/kg IV) ²³
Rabbit 5	0.3 mg/kg SC with ketamine 20 mg/kg SC and with diazepam, 0.75-1.5 mg/kg SC. Surgical anesthesia. ⁴⁶
Rabbit 6	0.35 mg/kg IM and after sedation, ketamine 5.0 mg/kg IV ²⁰⁰
Rabbit 7	2.0 mg/kg diluted in sterile saline to 0.4 ml/kg intranasal ²²³ sedation without analgesia.
Rabbit 8	0.3 mg/kg IP, IV with 10 ml saline, and with ketamine 10 mg/kg IP ²⁰¹
Rabbit 9	6.0 mg/kg IV of 1.25% solution ²¹⁸
Rat 1	30-40 µg/kg IM, SC. See comments ⁹
Rat 2	30-100 µg/kg IM, SC. Reliable immobilization at higher doses ¹⁵²
Rat 3	See Fentanyl
Reptile	See Ketamine
Sheep 1	10 mg/kg IV ¹³⁵
Sheep 2	25 µg/kg IM ¹⁵²

Sheep 3	0.005 mg/kg IV ²²¹
Sheep 3	0.01 mg/kg IV ²²¹
Swine 1	20 mg/kg IP ¹²⁸
Swine 2	80 mg/kg IM. Variable effects ¹⁵²
Swine 3	40 µg/kg IV

Dosage frequency

Cat 6	1-8 hours ²⁷⁷
Dog 1	1-3 hours ⁷⁰
Dog 2	80 minutes ⁹³
Dog 11	1-8 hours ²⁷⁷
Hamster 1	15-25 minutes ²⁰¹
Rabbit 3	25 minutes ²³
Rabbit 4	37 minutes ²³
Rabbit 5	One hour ⁴⁶
Rat 4	100-120 minutes ²⁷³
Sheep 3	40-60 minutes ²²¹

Antagonist

Atipmeazole (q.v.)
Tolazoline (q.v.)
Yohimbine (q.v.)

Comments

Cats	May vomit
Cat 1	Good sedation, poor analgesia. ⁹ May cause bradycardia, hypertension, hypotension. ²⁴²
Cat 4	Decreased cardiac output, stroke volume and heart rate ²⁴²
Cat 5	Variable effects ⁹
Dog 1	Good for <u>post-thoractomy pain</u> ¹²⁹ Immobilization at higher doses ¹⁵²
Dog 2	Significant bradycardia and hypothermia. Good analgesia and skeletal muscle relaxation ⁹³
Dog 5	Variable effects ⁹
Ferret 1	Light sedation ²⁶⁹
Gerbil	Light to moderate sedation ¹⁵²
Guinea Pig 1	Good analgesia on writhing test ⁴⁶
Hamster 2	Sedation and analgesia
Primate 1	Light to moderate sedation ¹⁵²
Rabbit 1, 3	Can cause bradycardia ²³ Poor analgesic
Rabbit 4, 6	Mild sedation without good analgesia ⁹
Rat 1	Sedation and loss of righting reflex ⁴⁶
Rat 4	Can cause respiratory depression. Use with oxygen. Reverse with butorphanol (0.2 mg/kg SC) and atipamezole (0.5 mg/kg SC). ²⁷³

MELOXICAM (Mobic)*Class* Enolic NSAID, analgesic*Source* Boehringer Ingelheim. Available in tablets only (water insoluble).

Cat 1	0.2 mg/kg SC
Cat 2	0.3 mg/kg PO on day 1 then 0.1 mg/kg once daily for 3 days then 0.1 mg/kg daily ²⁷⁷
Cattle	Cow 0.5 mg/kg SC, IV ²⁷⁷
Dog 1	0.2 mg/kg SC ²⁷⁷
Dog 2	0.2 mg/kg PO on day 1 then 0.1 mg/kg PO/day ²⁷⁷
Rabbit	0.2 mg/kg SC ²⁷⁷
Rat	1.0 mg/kg SC, PO ²⁷⁷
Reptile	0.1-0.2 mg/kg PO ²⁷⁷

Dosage frequency

Cat 1	Single dose ²⁷⁷
Cat 2	See above
Cattle	Every 3 days ²⁷⁷ (Slow detoxification. May not give pain relief this long).
Dog 1	Single dose only ²⁷⁷
Dog 2	See above
Rabbit	Every 24 hours for 3 days ²⁷⁷
Rat	24 hours ²⁷⁷

Comments

All	Serious gastrointestinal toxicity, including gastric perforation, is possible.
Reptile	Chronic or orthopedic pain ²⁷⁸

MEPERIDINE (Demerol, Pethidine)*Class* Narcotic analgesic (opiate agonist). **Controlled substance.***Source* Sanofi Winthrop

Amphibian	100-200 mg/kg SC (dorsal lymph sac) ²⁷⁸
Cat 1	2-6 mg/kg IM, SC, IV ⁴
Cat 2	5-10 mg/kg IV. ²⁰ See comments.
Cat 3	10-20 mg/kg SC ¹¹⁰
Cat 4	5.0-10.0 mg/kg epidural ²⁷⁷
Cattle	3.0 mg/kg IM ⁵⁹ , SC ⁷²
Dog 1	2-6 mg/kg IM, SC, IV ⁴
Dog 2	10 mg/kg IM ¹¹⁰ , SC ²⁷⁷
Dog 3	1.0-3.0 mg/kg IV. Can adacetylpromazine, 0.2 mg/kg IM, SC or 0.1 mg/kg IV ⁶
Dog 4	5.0-10.0 mg/kg epidural ²⁷⁷
Ferret	5-10 mg/kg SC, IM, IV ⁷⁶
Gerbil	20 mg/kg IM ¹¹⁹ , SC ¹⁷⁵ , IP ²³³

Goat 1	Up to 200 mg/kg IM total dose, every 4 hours. ³⁷
Goat 2	2.0-10 mg/kg IM ¹⁴⁸
Guinea Pig 1	20 mg/kg SC, IM ²
Guinea Pig 2	1-2 mg/kg IM, SC ²⁰ , or IP ²⁸
Guinea Pig 3	10-20 mg/kg SC ¹¹⁰
Hamster	20 mg/kg IM ¹¹⁹ , SC, IP ²³³
Mouse 1	2.0 mg/kg IM ¹¹⁷ , SC ¹⁴⁸
Mouse 2	40 mg/kg IP
Mouse 3	20 mg/kg SC, IM ^{2, 37}
Mouse 4	20-60 mg/kg IM, SC ²⁰
Primate 1	2-4 mg/kg IM ¹⁹ or IV. ³² See comments.
Rabbit 1	5-10 mg/kg SC ⁵ or IM ¹⁰ or IV. ²⁸ See comments.
Rabbit 2	10-20 mg/kg SC ¹¹⁰
Rabbit 3	Add 0.2 mg/ml (of 10 mg/ml syrup) to drinking water. ²³³
Rat 1	20 mg/kg SC, IM ^{2, 37}
Rat 2	25-50 mg/kg IM, SC ²⁰
Rat 3	50 mg/kg IP ²⁸
Rat 4	2-16 mg/kg IP ⁸¹
Rat 5	150 mg/kg PO ²⁸
Rat 6	2.5 mg/kg IV ²⁸
Reptile	<i>Tortoise</i> 20 mg/kg IM ²⁷⁷
Sheep	5.0 mg/kg IV ⁴¹
Sheep 1	Up to 200 mg/kg IM total dose, every 4 hours ³⁷
Sheep 2	2.0-10 mg/kg IM ¹⁴⁸
Swine 1	2-10 mg/kg IM ^{3, 52}
Swine 2	2.2 mg/kg IM with azaperone 2.2 mg/kg IM followed in 20 minutes by ketamine 22 mg/kg IM and morphine 2.2 mg/kg IM. ³

Dosage frequency

Cat 1	2 hours ³⁷
Cat 3	3 hours ¹¹⁰
Dog 1	45 minutes ^{3, 4} , <1 hour ⁸ , 4 hours ⁵² , 30-60 minutes ²²⁰
Dog 2	3 hours ¹
Dog 3	<1 hour ⁸
Ferret	2-4 hours ^{76, 232}
Gerbil	2-3 hours ¹⁷⁵
Guinea Pig 1	2-3 hours ^{10, 30}
Hamster	2 hours ¹⁴⁷
Mouse 1	2-3 hours ^{10, 30}
Primate	1 hour ¹⁹ , 3-4 hours ³⁷ , ½ - 1 hour ¹¹⁸
Rabbit 1	2-3 hours ^{10, 30, 132}
Rat 1	2-3 hours ^{10, 30}
Reptile	12-24 hours ²⁷⁷
Sheep	45 minutes ⁴¹ 5-30 minutes ²²¹
Sheep, Goat 1	4 hours ³⁷

Swine 1 4 hours^{3, 72}
Swine 2 45 minutes^{3, 4}

Antagonist

Levallorphan (q.v.)
Nalorphine (q.v.)
Naloxone (q.v.)

Comments

All **Do not use with head surgery or increased intracranial pressure.**⁷²
All **May be irritating SC.** Give slowly IV⁷²
Cat 1 Use with anticholinergic as preanesthetic.⁹ Less sedative effect than morphine.
Dog 1 Use with anticholinergic as preanesthetic.⁹ Less sedative effect than morphine.
Primate Reports of sudden death even at low dose¹¹⁸
Rabbit 1, 2 May cause convulsions when given IV (one report only)²¹⁸

MEPIVACAINE 2% solution (Carbocaine, Scandicain)

Class Local anesthetic
Source Sanofi-Winthrop

Cat 1 2 ml (epidural or caudal anesthesia)⁴³
Cat 2 2-20 ml intraurethral⁴³
Cattle 3-10 ml (epidural or caudal anesthesia)⁴³
Dog 2-5 ml (epidural or caudal anesthesia)⁴³

Dosage frequency

All 1-4 hours⁴³

Antagonist

Comments

Cat 1, 2 1% solution is also effective⁴³
Dog 1 1% solution is also effective⁴³

METHADONE (Dolophine)

Class Synthetic opioid analgesic. **Controlled substance.**
Source Lilly

Cat 1 **Not recommended.**⁵⁵
Cat 2 0.7-1.0 mg/kg epidural²⁷⁷
Dog 1 1.0 mg/kg IV¹⁷⁸, SC.⁵⁴ Can combine with propionylpromazine (q.v.) as preanesthetic¹⁷⁸

Dog 2	0.7-1.0 mg/kg epidural ²⁷⁷
Dog 3	0.1-0.25 mg/kg IM, IV, SC ²⁷⁷
Goat	0.2 mg/kg IM ¹⁰⁶
Guinea Pig	3.0-6.0 mg/kg SC ¹⁴⁸
Hamster	3.0-6.0 mg/kg SC ¹⁴⁸
Mouse	1.6-2.0 mg/kg SC ¹²
Primate	0.0-1.0 mg/kg IM, PO ¹
Rabbit 1	0.7 mg/kg IV ⁵
Rabbit 2	0.1-0.5 mg/kg IV ²¹⁸
Rat 1	1.0 mg/kg IP ¹⁰
Rat 2	3.75 mg/kg SC ¹⁰

Dosage frequency

Cat 2	4-9 hours ²⁷⁷
Dog 1	6-10 hours ¹⁷⁸
Dog 2	6-10 hours ¹⁷⁸
Dog 3	4-6 hours ²⁷⁷
Goat	3 hours ¹⁰⁶
Primate	2-6 hours ¹

METHOHEXITAL (Brevane, Brevital)

Class Anesthetic. See comments. **Controlled substance.**

Source Lilly

Bird	4.0-8.0 mg/kg IV ¹⁴⁷
Calf	3-4.5 mg/kg IV ²¹
Cat	10-12 mg/kg IV ⁶
Dog	10-12 mg/kg IV ⁶ , 4-8 mg/kg of 1% solution ³⁷
Goat	4.0 mg/kg IV ³⁷
Guinea Pig	31 mg/kg IP ³⁷ See comments
Hamster	60-90 mg/kg IP ⁷⁸
Mouse 1	8-16 mg/kg IV ¹³² Surgical anesthesia
Mouse 2	6.0 mg/kg IV ¹⁴⁸
Primate	10 mg/kg IV ³⁷
Rabbit 1	6-8 mg/kg IV ²¹ use 1:10 dilution.
Rabbit 2	10-15 mg/kg IV ³⁷ use 1:10 dilution
Rat 1	10-15 mg/kg of 1% solution IV ³⁷
Rat 2	7.0-10 mg/kg IV ¹⁴⁸
Rat 3	40 mg/kg IP ¹³²
Rat 4	40 mg/kg IP (induction) with pentobarbital, 20 mg/kg maintenance IP ¹³²
Sheep	4.0 mg/kg IV ³⁷
Swine	5.0 mg/kg IV ³⁷

Dosage frequency

Cat	5-10 minutes ⁶
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Dog	5-10 minutes ^{6, 37}
Mouse 1	2 minutes ¹³² , 5 minutes ¹⁷⁷
Primate	5-10 minutes ³⁷
Rabbit	5-10 minutes ³⁷
Rat 1	5-10 minutes ³⁷
Rat 3	15-20 minutes ¹³²
Rat 4	2 hours ¹³²
Sheep, Goat	5-10 minutes ³⁷

Comments

All	Use only as induction agent ⁶
Sheep, Goat	For immobilization

METHOXYFLURANE (Metofane, Panthrane)

<i>Class</i>	Halogenated ethyl methyl ether anesthetic
<i>Source</i>	Schering-Plough. No longer commercially available in US

Bird	Induce at 3-4%, maintain at 1-2% ¹³⁶
Cat	3% induction, 0.5% maintenance ¹⁴⁷
Dog	1-3% induction, 0.3-1% maintenance ⁶
Ferret	1-3% induction ¹¹⁶
Gerbil	1-3% ¹¹⁹
Guinea Pig	0.5-3% ² see comments
Hamster 1	1-4% ²
Hamster 2	1-3% ¹¹⁹
Mouse	0.5-3% ²
Primate	1-3% induction, 0.3-1% maintenance ⁶
Rabbit	1-3% induction, 0.3-1% maintenance ⁵
Rat 1	0.5-3% ²
Rat 2	<i>Neonatal</i> Safe with methoxyflurane soaked cotton in bell jar ¹⁸¹

Dosage frequency

All	As long as gas is supplied
Rat 2	30 minutes ¹⁸¹

Antagonist

Oxygen (not true antagonist)

Comments

All	Waste gas must be scavenged
All	Can cause respiratory and cardiovascular depression
All	Consider mixing with 50% nitrous oxide for maintenance when using anesthesia machine
Rodents, Rabbits	Typical induction concentration is 3-3.5%, maintenance 0.4-1% ¹⁷⁷

Dog	Often use flow rate of 15 ml/min/kg of 1:1 nitrous oxide and oxygen ⁶⁰
Guinea Pig	Can cause excess salivation. Premedicate with atropine.
Primate	Use non-rebreathing system if <7 kg ⁶

METOMIDATE (Hypnodil)

<i>Class</i>	Imidazonoe derivative anesthetic
<i>Source</i>	Not available in US

Fish 1	<i>Channel catfish</i> 4-10 mg/liter ¹²³
Fist 2	<i>Rainbow trout</i> 4-10 mg/liter ¹²³
Gerbil	50 mg/kg IP, SC ¹⁴⁷
Goat	60 mg/kg IP ¹⁴⁷
Hamster	50 mg/kg IP ¹⁴⁷
Mouse	50 mg/kg IP ⁸²
Swine 1	2 mg/kg IM ³⁷ Immobilization
Swine 2	3.3 mg/kg IV, after azaperone (q.v.) ³⁷ anesthesia.
Swine 3	4.0 mg/kg IV ²²¹
<i>Dosage frequency</i>	
Mouse	15 minutes ⁸²

MIDAZOLAM (Versed)

<i>Class</i>	Benzodiazepine tranquilizer, Sedative. Controlled substance.
<i>Source</i>	Roche

Bird 1	1.0 mg/kg IM ¹⁴⁷
Bird 2	<i>Pigeon</i> 15.0 mg/kg IM. Preanesthetic ¹³⁶
Cat 1	0.066-0.22 mg/kg IM, IV ⁷²
Cat 2	0.2-0.4 mg/kg IM, IV ²²⁰
Cattle	0.4-1.3 mg/kg IV ²²¹ sedation
Dog 1	0.1-0.3 mg/kg IM, IV ⁷²
Dog 2	0.066-0.22 mg/kg IV, IV ⁷²
Dog 3	See Xylazine
Ferret 1	1.0 mg/kg IM, SC ¹⁷⁵
Ferret 2	0.5-3.0 mg/kg IM, SC ²⁸¹
Gerbil 1	10 mg/kg IP ¹⁴⁷
Gerbil 2	1.0-2.0 mg/kg IM, SC ¹⁷⁵
Hamster 1	5.0 mg/kg IP ¹⁴⁷
Hamster 2	1.0-2.0 mg/kg IM, SC ¹⁷⁵
Mouse 1	5.0 mg/kg IP ¹⁷⁷
Mouse 2	1.0-2.0 mg/kg SC ²³⁴
Primate 1	0.05-1.5 mg/kg IM, SC ²⁸² Sedation
Primate 2	<i>Lemur</i> 0.1-0.5 mg/kg IM ²⁶⁹
Rabbit 1	0.25 mg/kg IM ²³ see comments
Rabbit 2	2 mg/kg IV ³⁷ see comments IM ¹⁷⁵ IP ²⁶⁹
Rabbit 3	4 mg/kg IM, IP ³⁷ see comments

Rabbit 4	2.0 mg/kg Intranasal ⁸⁶ Dilute with saline to 0.4 ml/kg
Rat 1	2 mg/kg IV ³⁷
Rat 2	4 mg/kg IM, IP ³⁷
Rat 3	See Ketamine
Reptile 1	<i>Red-eared slider turtle</i> 1.5 mg/kg IM for muscle relaxation ²⁸⁰
Reptile 2	<i>Snapping and Red-eared turtles</i> 1.5 mg/kg IM with ketamine 20-40 mg/kg IM. Sedation and anesthesia ²⁸⁰
Reptile 3	0.5 mg/kg with oxymorphone (0.1 mg/kg) IM and glycopyrrolate (0.01 mg/kg) 0.4-1.3 mg/kg IV ²²¹
Sheep	0.4-1.3 mg/kg IV ²²¹
Swine 1	100-500µg/kg IM ³ IV ²²¹
Swine 2	100 µg/kg IM ¹²⁸
Swine 3	Thiopental (30 mg/kg IV) followed by midazolam (0.90 mg/kg IV), then continuous infusion of 0.90 mg/kg/hr and fentanyl (0.25 mg/kg IV), then continuous infusion of 0.025 mg/kg/hr ¹³⁷
Swine 4	<i>Piglet</i> Ketamine 20 mg/kg IM then midazolam 1.0 mg/kg IM ⁸⁸
Swine 5	<i>Adult</i> Ketamine 33 mg/kg IM, then midazolam 0.5 mg/kg IM ²²¹
Swine 6	<i>Piglet</i> 0.2 mg/kg intranasal for sedation ²⁷¹
Swine 7	<i>Piglet</i> 0.4 mg/kg IV for sedation ²⁷¹

Dosage frequency

Cat 2	Less than 2 hours ²²⁰
Cattle	15-30 minutes ²²¹
Primate 1	30 minutes ²⁸²
Rabbit 4	25 minutes ⁸⁶
Sheep	15-30 minutes ²²¹
Swine 1	20 minutes ²²¹
Swine 3	2 hours ¹³⁷
Swine 5	45 minutes ²²¹

Antagonist

Flumazenil (q.v.)²²

Comments

All	Use carefully with barbiturates or CNS depressants due to respiratory depression ⁷²
Dog 2	Good for aged or debilitated animals ⁷⁰
Rabbit 1-3	See medetomidine
Rabbit 4	Dilates ear vessels ⁸⁶
Reptile 1	Not good in snapping turtles or painted turtles ²⁸⁰
Swine	May reduce blood pressure ²⁵⁸

MIVACURIUM (Mivacrom)*Class* Nondepolarizing skeletal muscle relaxant*Source* Glaxo Wellcome

Primate	0.04 mg/kg IV ²¹⁶
Swine	0.02 mg/kg IV ²¹⁶

Dosage frequency

Primate	14-20 minutes
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Antagonist

4-aminopyridine (q.v.)

MORPHINE (Duramorph, Astramorph PF)*Class* Opioid analgesic (good for musculoskeletal pain), sedative. **Controlled substance.***Source* AstraZeneca, generic

Amphibian 1	See Frog
Amphibian 2	30-160 mg/kg IM, SC (dorsal lymph sac), topical ²⁷⁸
Calf	0.4-1.1 mg/kg IV ²¹
Cat 1	0.1 mg/kg IM ⁴ , SC ¹² , IV ²⁷⁷
Cat 2	0.05-0.1 mg/kg SC, IM ⁷² See comments
Cat 3	0.05-0.01 mg/kg IV ²⁰
Cat 4	0.2-0.5 mg/kg IM with 0.02-0.05 mg/kg acetylpromazine IM or IV ²²⁶
Cat 5	0.1 mg/kg epidural
Cat 6	0.1 mg/kg with medetomidine 1.0-5.0 µg/kg epidural ²⁷⁷
Cat 7	0.1 mg/kg with bupivacaine 1.0 mg/kg epidural ²⁷⁷
Cat 8	0.05 mg/kg IM, SC with acetylpromazine 0.1 mg/kg IM, SC ²⁷⁷
Dog 1	0.25 mg/kg IM, SC (analgesia)
Dog 2	5.0 mg/kg SC ²¹
Dog 3	0.4-1.1 mg/kg IV ²¹ , IM, SC ²⁷⁷
Dog 4	1.0-5.0 mg/kg IV ¹²⁷
Dog 5	0.25-0.5 mg/kg IM ⁴ , SC ⁷² (sedation) ⁴
Dog 6	0.1 mg/kg diluted in 0.13 ml/kg of saline, epidural. ⁹
Dog 7	0.05-1.0 mg/ lb IM with acetylpromazine 0.025-0.1 mg/ lb (maximum 3.0 mg) IM, for induction ²²⁶
Dog 8	0.1 mg/kg with medetomidine 1.0-5.0 µg/kg epidural ²⁷⁷
Dog 9	0.1 mg/kg with bupivacaine 1.0 mg/kg epidural ²⁷⁷
Ferret	0.5-5.0 mg/kg SC, IM ⁷⁶
Fish	10 mg/liter ²⁷⁸
Frog 1	<i>Rana pipiens</i> 100 nmol/g SC into dorsal lymph sac ¹⁵³
Frog 2	<i>Rana pipiens</i> 10 mg/kg IP ²³⁷

Frog 3	114 mg/kg into dorsal lymph sac ²⁶⁵
Gerbil 1	10 mg/kg IM ¹¹⁹
Gerbil 2	2.0-5.0 mg/kg IM, SC ¹⁷⁵
Goat 1	Up to 10 mg (total dose) IM, every 4 hours. ¹⁹ See comments
Goat 2	0.2 mg/kg IM ¹⁹⁵
Guinea Pig 1	10 mg/kg IM, SC ²⁰
Guinea Pig 2	2-5 mg/kg SC, IM ^{11,75} , IP ¹²⁵
Hamster 1	10 mg/kg IM ¹¹⁹
Hamster 2	2.0-5.0 mg/kg IM, SC ¹⁷⁵
Mouse 1	10 mg/kg IM ¹¹⁹
Mouse 2	10-20 mg/kg SC ²⁰
Mouse 3	2-5 mg/kg IP ²⁰ , SC ¹¹⁰ , IM ¹⁷⁵
Primate 1	1-2 mg/kg IM, SC, PO ²⁰ or IV ³²
Primate 2	0.1-0.2 mg/kg IM, SC, IV ²⁷⁷
Rabbit 1	2-5 mg/kg IM, SC, IV ²⁷⁷
Rabbit 2	0.1-5.0 mg/kg IV ²¹⁸
Rabbit 3	1.0-20.0 mg/kg SC ²¹⁸
<u>Rat 1</u>	<u>10 mg/kg IM, SC^{20, 37}</u>
Rat 2	2-5 mg/kg SC ¹¹ , IM ¹⁷⁵
Rat 3	5-24 mg/kg IP ²¹⁷
Rat 4	<i>Neonatal</i> 0.1-0.3 mg/kg IP, SC ²⁰⁵ . Increase to 5.3 mg/kg by 27 days of age ²⁰⁶
Rat 5	1.0-4.0 mg/kg IV ²¹⁷
Reptile 1	<i>Crocodile</i> 0.3-4.0 mg/kg intracelomic ²⁷⁸
Reptile 2	<i>Anole</i> 5.0 mg/kg intracelomic ²⁷⁸
Sheep 1	Up to 10 mg (total dose IM every 4 hours. ¹⁹ See comments
Sheep 2	0.2-0.5 mg/kg IM ²⁷⁷
Swine 1	0.2 mg/kg IV ²¹ , IM ²⁶⁹
Swine 2	0.2 mg/kg up to 20 mg total dose IM ⁵²

Dosage frequency

Cat 1	4 hours ¹² , 6-8 hours ²⁷⁷
Cat 5	16-24 hours ²⁷⁷
Cat 6	10-16 hours ²⁷⁷
Cat 7	16-24 hours ²⁷⁷
Dog 1	5-6 hours ³
Dog 5	2-4 hours ³⁷
Dog 6	Up to 24 hours ⁹
Dog 8	10-16 hours ²⁷⁷
Dog 9	16-24 hours ²⁷⁷
Ferret	6 hours ⁷⁶ , 2-6 hours ²⁶⁹
Frog 1	8 hours ¹⁵³
Frog 3	5+ hours ²⁶⁵
Gerbil 1	2-4 hours ¹⁷⁵
Goat 1	4 hours ¹⁹

Guinea Pig 1	2-3 hours ^{5, 10} , 4 hours ¹¹
Guinea Pig 2	2-3 hours ¹²⁵
Hamster 1	2-4 hours ¹⁷⁵
Mouse 1	2-3 hours ^{5, 10} , 1 hour ¹¹
Mouse 3	2-4 hours ¹¹⁰
Primate 1	4 hours ¹
Primate 2	4-6 hours ²⁷⁷
Rabbit 1	2-3 hours ^{5, 10, 132}
Rat 1	2-3 hours ^{5, 10} , 1 hour ¹¹
Rat 2	4 hours ¹⁷⁷ , 2-4 hours ²¹⁷
Rat 4	3-4 hours or more ²⁰⁵
Sheep 1	4 hours ¹⁹
Sheep 2	2 hours ²⁷⁷
Swine 1, 2	4 hours ⁵²

Antagonist

All	Levallorphan (q.v.)
All	Nalorphine (q.v.)
All	Naloxone (q.v.)
Frog 2	Naloxone 0.01 mg/kg IP ²³⁷
Frog 2	Naltrexone 0.01 mg/kg IP ²³⁷

Comments

All	May cause respiratory depression if opioids are used for anesthesia.
Calf	Can cause excitement in ruminants ¹⁹
Cat 1, 3	In cat, should not be used without a tranquilizer to prevent excitement reaction. ⁶
Dog 1-6	Associated with vomiting and defecation. ⁴ Do not give rapidly IV to dog (leads to excitement) ⁶
Dog 6	Using commercial morphine sulfate with preservative.
Goat	Can cause excitement in ruminants ¹⁹
Guinea Pig 1	Some sedation and respiratory depression. Dose dependent.
Mouse 1	Some sedation and respiratory depression. Dose dependent.
Primate 1, 2	Causes vomiting ²⁸²
Rabbit	Some sedation and respiratory depression. Dose dependent.
Rat 1	Some sedation and respiratory depression. Dose dependent.
Sheep	Can cause excitement in ruminants ¹⁹
Rabbit 1	Can cause hypertension and hyperglycemia ²¹⁸
MS-222	See Tricaine Methane Sulfonate

NALBUPHINE (Nubaine)

Class Analgesic, opiate antagonist. (Especially for visceral pain).

Source AstraZeneca, Endo

Cat 1	0.75-3.0 mg/kg IV, IM, SC. ²⁰ See comments
Cat 2	<i>Kitten</i> 0.2 mg/kg SC ⁷⁹
Cat 3	0.3-0.5 mg/kg IM, SC, IV ²⁷⁷
Dog 1	0.8-2 mg/kg IM ^{4, 6}
Dog 2	2 mg/kg SC (as a preanesthetic 15-30 minutes before anesthesia) ⁴ IM, IV ¹⁴⁸
Dog 3	1 mg/kg Sc 15 minutes before surgical recovery ⁴
Dog 4	0.2 mg/kg IV as oxymorphone antagonist ⁴
Dog 5	0.3-0.5 mg/kg IM, SC ²⁷⁷
Ferret	0.75-1.5 mg/kg IM, IV ⁷⁶ , SC ¹⁷⁵
Gerbil	4-8 mg/kg ¹⁷⁵
Guinea Pig	1-2 mg/kg IM ⁷⁶ , SC ¹⁷⁵
Hamster	4-8 mg/kg ¹⁷⁵
Mouse 1	4-8 mg/kg IM ¹¹ , SC ¹¹⁰
Mouse 2	40 mg/kg IV bolus followed by 100 mg/kg continuous IV infusion ¹³²
Mouse 3	2.0-4.0 mg/kg IM ²⁷⁷
Primate 1	<i>Macaca, adult</i> 2.5-5 mg/kg IM ¹
Primate 2	0.5 mg/kg IM, IV ⁷⁶
Rabbit 1	1-2 mg/kg SC ¹¹
Rabbit 2	1.0-10.0 mg/kg IV ²¹⁸
Rat 1	1 mg/kg SC ¹¹
Rat 2	4-8 mg/kg IM ⁷⁶ , SC ¹⁷⁵
Rat 3	1.0-2.0 mg/kg IV ¹⁴⁷ , SC ¹⁷⁵
Rat 4	1.0-2.0 mg/kg IV bolus followed by 100 µg/kg/min continuous IV infusion ¹³²
Sheep	1.0 mg/kg SC ¹⁴⁸
Swine	0.15-0.20 mg/kg IM ¹²⁸

Dosage frequency

Cat 1	2.5 hours ⁵²
Cat 3	3 hours ²⁷⁷
Dog 1	3 hours ⁴
Dog 3	3-8 hours ⁴ , 1-2 hours ⁹
Dog 5	3-4 hours ²⁷⁷
Ferret	2-3 hours ⁷⁶ , 2-6 hours ²³²
Gerbil	3 hours ¹⁷⁵
Guinea Pig	3 hours ⁷⁶
Hamster	3 hours ¹⁷⁵
Mouse 1	4 hours ¹¹
Mouse 3	4 hours ²⁷⁷
Primate 1	3-6 hours ¹

Primate 2	6 hours ⁷⁶
Rabbit 1	4-5 hours ¹¹
Rat 1	4 hours ¹¹
Rat 2	3 hours ⁷⁶
Sheep	2-3 hours ¹⁴⁸

Antagonist

Naloxone (q.v.)

Comments

All	Not a controlled substance
Cat 1	<u>Visceral</u> , not somatic analgesia ²⁰
Rabbit 1	Acute or chronic visceral pain ²³³

NALMEFENE (Nalmefene)

Class Opioid antagonist

Source Key, Ohmeda

Dog	0.03 mg/kg IV, IM ⁷⁰
Goat	0.5 mg/kg IM ¹⁴⁷

Dosage frequency

Comments

Dog	Long lasting ⁷⁰
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NALORPHINE (Nalline)

Class Opioid antagonist, analgesic

Source MSD Agvet, Rhone Merieux

Cat	0.2-2.0 mg/kg IM, IV ⁶
Cattle	0.3-0.8 mg/kg IM ¹⁴⁷
Dog	0.2-2.0 mg/kg IM, IV ⁶
Gerbil	2.0-5.0 mg/kg IV ²⁶⁹
Hamster	2.0-5.0 mg/kg IV ²⁶⁹
Mouse	2.0-5.0 mg/kg IV ²⁶⁹
Rat	5 mg/kg IM, SC (ED ₅₀) for analgesia ⁸¹
Rabbit	1.0-5.0 mg/kg IV ²⁶⁹

Dosage frequency

Cat	90-180 minutes ⁶
Dog	90-180 minutes ⁶

Comments

Cat	2-3 minutes onset of action, IV ⁶
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Dog 2-3 minutes onset of action, IV⁶

NALOXONE (Narcan)

Class Opioid antagonist

Source AstraZeneca, DuPont

Cat 1 0.04 mg/kg IM, IV⁶, SC.⁵⁴
Cat 2 0.05-0.1 mg/kg IV⁷²
Cat 3 0.04-1.0 mg/kg IM, SC, IV²⁷⁷
Dog 1 0.04 mg/kg IM, IV⁶, SC⁷²
Dog 2 0.04-1.0 mg/kg IM, SC, IV²⁷⁷
Ferret 0.04-1.0 mg/kg IM, SC, IV²⁶⁹
Gerbil 0.01-0.1 mg/kg IP, IV³⁷, SC²³⁴
Guinea Pig 0.01-0.1 mg/kg IV, IP³⁷
Hamster 0.01-0.1 mg/kg IP, IV³⁷, SC²³⁴
Mouse 0.1 mg/kg IV, IP³⁷, SC²³⁴
Primate 1 0.04 mg/kg IM, IV^{1, 37}
Primate 2 *Callithrix* 0.1-0.2 mg/animal²¹⁹
Rabbit 1 0.005 mg/kg IV¹⁵
Rabbit 2 0.1 mg/kg IV, IM³⁷
Rat 1 0.1 mg/kg IV³⁷, IP, SC²³⁴
Rat 2 *Neonatal* 20µl SC¹⁷⁴
Sheep, Goat 0.2 mg/kg IV^{41, 147}
Swine 1 0.01-0.05 mg/kg IV, IV³⁷
Swine 2 0.5-2.0 mg/kg IV²²¹

Dosage frequency

Cat 1 15-20 minutes⁶, 45-90 minutes⁷²
Dog 15-20 minutes⁶, 45-90 minutes⁷²
Primate 1 Brief¹

Comments

Cat 1 Onset of action 0.5-2.0 minutes IV, 5 minutes IM⁶
Dog Onset of action 0.5-2.0 minutes IV, 5 minutes IM⁶

NAPROXEN (Naprosyn)

Class Propionic acid derivative anti-inflammatory, NSAID analgesic

Source Syntex

Dog 5.0 mg/kg PO loading then 1.2-2.9 PO maintenance¹⁴⁸
Guinea Pig 14.9 mg/kg PO¹¹⁰
Mouse 37-350 mg/kg PO²¹⁷
Primate 10 mg/kg PO¹⁴⁸
Rabbit Add 2.4 mg/ml to drinking water for 21 days (septic arthritis)²³³
Rat 14.5 mg/kg PO¹⁴⁸

Dosage frequency

Dog Every 24 hours¹⁴⁸
Primate Every 12 hours¹⁴⁸

Comments

Dog Bleeding dyscrasias reported

NEOSTIGMINE (Prostigmine)

Class Antagonist of nondepolarizing neuromuscular blocking agents

Source ICN, Baxter

Cat 1 0.06-0.2 mg/kg IV.⁵⁶ See comments
Cat 2 0.04-0.07 mg/kg IV²¹⁶
Cattle 0.01-0.02 mg/kg IV⁵⁶
Dog 0.06-0.2 mg/kg IV.⁵⁷ 0.02-0.2 mg/kg IV²¹⁶ See comments
Rat 0.005-0.015 mg/kg IV (ED₅₀)²¹⁶
Sheep 0.01-0.02 mg/kg IV⁵⁶

Dosage frequency

Comments

Cat Precede by atropine 0.04 mg/kg IV given slowly⁵⁷
Dog Precede by atropine 0.04 mg/kg IV given slowly⁵⁷

NITROUS OXIDE

Class Anesthetic gas adjuvant

Source Medical gas companies

All species No anesthesia when used alone.¹⁶⁷ Use with other anesthetic agents.³⁷ Usually 50:50 or 60:40 with wxygen³⁷

Antagonist

Oxygen (not true antagonist)

Comments

All Can deplete vitamin B₁₂ if used for prolonged periods³⁷
All Administer 100% oxygen after prolonged use³⁷
Rabbit Can cause gastric dilation²³³

OXYMORPHONE HYDROCHLORIDE (Numophan)

Class Analgesic (opiate agonist). **Controlled substance.**

Source Endo

Cat 1 0.05 mg/kg SC. Sedation.¹³³
Cat 2 0.1-0.2 mg/kg IM, SC, IV⁶ Preanesthetic analgesic⁷²

Cat 3	0.02 mg/kg IV, IM ⁷² Restraint, sedation ⁷²
Cat 4	0.05-0.15 mg/kg IM, IV with acetylpromazine ⁷²
Cat 5	0.05-0.1 mg/kg IM, IV. Post-operative analgesia ⁷²
Cat 6	0.05-0.1 mg/kg epidural ²⁷⁷
Dog 1	0.01-0.1 mg/kg IM ⁴
Dog 2	0.2-0.4 mg/kg IV, IM ²⁰ , SC ²⁷⁷
Dog 3	0.05-0.3 mg/kg IV with diazepam 0.2 mg/kg IM (preanesthetic) ⁴
Dog 4	0.05-0.3 mg/kg IV ⁴ , IM ¹³³ , SC ¹³³ preceded by acetylpromazine 0.05-0.1 mg/kg IM, SC, IV (preanesthetic) ⁴
Dog 5	0.2 mg/kg IM preceded by acetylpromazine, 0.2 mg/kg IM, SC ⁶
Dog 6	0.1 mg/kg mixed in 0.13 ml/kg sterile saline, epidural ⁹
Ferret 1	0.2-0.5 mg/kg SC, IM, IV ⁷⁶
<u>Ferret 2</u>	0.05-0.2 mg/kg SC, IM¹⁷⁵, IV²³²
Gerbil 1	0.15 mg/kg IM ⁷²
Gerbil 2	0.2-0.5 mg/kg IM, SC ¹⁷⁵
<u>Guinea Pig 1</u>	0.2-0.5 mg/kg SC, IM⁷⁶
Guinea Pig 2	0.04 mg/kg Im ¹²⁵
Hamster 1	0.15 mg/kg IM ⁷²
Hamster 2	0.2-0.5 mg/kg IM, SC ¹⁷⁵
Mouse 1	0.2-0.5 mg/kg SC, IM ⁷⁶
Mouse 2	0.05 mg/kg SC (ED ₅₀) ²¹⁷
<u>Primate 1</u>	Macaca 0.15 mg/kg IM^{1, 32} IV, SC¹¹⁸
Primate 2	<i>Simiri</i> 0.075 mg/kg IM ^{1, 32}
Primate 3	<i>New world</i> 0.025 mg/kg IM. ¹⁹ See comments
Primate 4	<i>Baboon</i> 0.075 mg/kg IM ²¹⁹
Rabbit 1	0.2 mg/kg IM ¹⁰ IV ²⁸¹
Rabbit 2	0.05-0.2 mg/kg IM, SC ¹⁷⁵
Rat	0.22-0.33 mg/kg SC ¹⁰ IM ⁷⁶ IV ²⁸¹
Swine 1	0.15 mg/kg IM ³
Swine 2	0.0 mg/kg IM ²⁷⁷

Dosage frequency

Cat 1	2-4 hours ²⁷⁷
Cat 6	7-10 hours ²⁷⁷
Dog 1	1-3 hours ⁴
Dog 2	2-4 hours ²⁷⁷
Dog 6	10 hours ¹²⁷
Ferret 1	8-12 hours ⁷⁶
Ferret 2	6-12 hours ⁷⁶
Gerbil 1	6-12 hours ¹⁷⁵
Guinea Pig	6-12 hours ⁷⁶
Hamster 1	6-12 hours ¹⁷⁵
Mouse 1	6-12 hours ⁷⁶ 2-4 hours ¹³²

Primate 1, 2	3-6 hours ^{1, 219}
Rabbit	3-4 hours ¹⁰ , 8-12 hours ¹⁷⁵
Rat	3-4 hours ^{10, 175} , 6-12 hours ⁷⁶
Swine	4 hours ³

Antagonist

Nalbuphine (q.v.)
Naloxone (q.v.)

Comments

Cat 1	More potent and more sedation than morphine ⁶
Cat 4	About as potent as morphine ¹⁰
Dog 3	Hypoventilation common ¹³³
Dog 5	More potent and more sedation than morphine ⁶
Primate 3	Very sensitive to oxymorphone. Can easily overdose. Use only after full recovery from anesthesia. ¹⁹
Rabbit 1	About as potent as morphine ¹⁰
Swine	See uses with ketamine.

PANCURONIUM

Class Nondepolarizing neuromuscular blocking agent
Source AstraZeneca, Elkins-Sinn, Organon

Calf	0.043 mg/kg IV ^{56, 216}
Cat	0.05-0.10 mg/kg IV ⁶
Dog 1	0.05-0.10 mg/kg IV ⁶
Dog 2	0.03 mg/kg IV with methoxyflurane ⁷²
Dog 3	0.06 mg/kg IV with halothane ⁷²
Goat	0.025 mg/kg IM ⁴⁰
Primate 1	0.07 mg/kg IV (ED ₉₀) ²¹⁶
Primate 2	0.3 µg/kg/min IV infusion ²¹⁶
Rabbit 1	0.1 mg/kg. Route not indicated ³⁷
Rabbit 2	0.2 mg/kg/hr infusion ²¹⁶
Rat 1	2.0 mg/kg/hour IV ⁹⁷
Rat 2	1.0 mg/kg/hour IV ⁹⁷
Rat 3	0.1-0.19 mg/kg IV ²¹⁶
Sheep 1	5 µg/kg IV ⁵⁶
Sheep 2	0.15 µg/kg/min ⁵⁶
Swine 1	0.1 mg/kg IV ⁷²
Swine 2	0.003-0.03 mg/kg hr IV infusion ²⁴⁰

Dosage frequency

Calf	43 minutes ⁵⁶ , 26 minutes ²¹⁶
Cat	30-60 minutes ⁶ , 14 minutes ²¹⁶
Dog 1	30-60 minutes ⁶

Goat	45 minutes ⁴⁰
Primate 1	15 minutes ²¹⁶
Rat 3	4 minutes ²¹⁶
Sheep 1	21 minutes ⁵⁶
Swine 1	15 minutes ²¹⁶

Antagonist

Edrophonium (q.v.) ⁵⁷
Neostigmine (q.v.) ⁵⁷
Physiostigmine ⁷²
Pyridoshigmine (q.v.) ⁵⁰

Comments

All	Endotracheal intubation and artificial respiration necessary. ⁴⁰
All	Causes tachycardia ²¹⁶

PENTAZOCINE (Talwin, Talwin-V)

<i>Class</i>	Analgesic (partial opiate antagonist). Controlled substance
<i>Source</i>	Sanofi Winthrop, Upjohn

Cat 1	1.5-3.0 mg/kg IM, SC, IV ^{6, 72} See comments.
Cat 2	0.75-1.5 mg/kg IM, SC ⁹ See comments
Cat 3	0.2-0.5 mg/kg IM ¹²¹
Cat 4	8 mg/kg IP ¹²
Dog 1	2 mg/kg IM, SC ⁴ , IV ¹⁴⁸
Dog 2	0.5-1.0 mg/kg IM ⁷²
Dog 3	2-6 mg/kg IM ⁶
Ferret	5-10 mg/kg IM ^{76, 232}
Gerbil	10 mg/kg IM, SC ¹⁷⁵
Goat	10 mg/kg SC ¹⁴⁷
Guinea Pig 1	10 mg/kg SC, IM, IV ²
Guinea Pig 2	1-3 mg/kg IM ²⁰
Hamster	10 mg/kg IM, SC ¹⁷⁵
Mouse 1	10 mg/kg SC ^{2, 20, 37}
Mouse 2	2-3 mg/kg IM ²⁰
Primate	2-5 mg/kg IM ²⁰ , IV ²⁷⁷
Rabbit 1	10-20 mg/kg SC, IM ⁵
Rabbit 2	5 mg/kg IV ¹¹
Rat 1	10 mg/kg SC ^{2, 20, 37} , IM, IV ²
Rat 2	2-3 mg/kg IM ²⁰
Sheep	2.0 mg/kg IM, IV ²⁷⁷
Swine	1.5-3.0 mg/kg IM ^{3, 37, 240} , IV ²⁷⁷

Dosage frequency

Cat 1, 4	4 hours ⁵² , 2-3 hours ²⁷⁷
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Cat 3	6 hours ¹²¹
Dog 1	4 hours ¹² , 2-4 hours ²⁷⁷
Ferret	4 hours ⁷⁶
Gerbil	2-4 hours ¹⁷⁵
Goat	3-4
Guinea Pig 1	2-4 hours ¹⁷⁵
Hamster	2-4 hours ¹⁷⁵
Mouse 1	3-4 hours ¹⁷⁵
Primate	3-4 hours ^{1, 37, 277} < 1 hour ³²
Rabbit 1 & 2	1 hour ¹¹ , 2-4 hours ¹⁷⁵
Sheep	2 hours ²⁷⁷
Swine	4 hours ^{3, 37} IV ²⁷⁷

Antagonist

Naloxone (q.v.)

Comments

All	Rotate injection sites due to possible sclerosis
Cat 1	Weak analgesia ⁹
Cat 1	Minimal cardiovascular effects. Mild respiratory depressant.
Cat 2	Excitatory effects at this level. ⁹ Visceral, not somatic analgesia. ²⁰ Can cause dysphoria ⁷²
Dog 1, 3	For fractures, trauma, spinal disorders ⁷²
Dog 1, 3	Minimal cardiovascular effects. Mild respiratory depressant.

PENTOBARBITAL (Nembutal)

Class Barbiturate anesthetic, euthanasia agent. Controlled substance.

Source Abbott, Fort Dodge, generic

Amphibian	60 mg/kg in dorsal lymph sac ¹⁴⁸
Calf	15-30 mg/kg IV. Anesthesia ⁷²
Cat 1	20-28 mg/kg IV ⁶
Cat 2	2-4 mg/kg IV. Sedative ⁷²
Cat 3	2-4 mg/kg PO. Sedative ⁷²
Cattle	2.0 mg/kg IV. Sedation. (30-60 min) ¹³⁶
Dog 1	20-28 mg/kg IV ⁶
Dog 2	2.-4 mg/kg IV, PO. Sedative ⁷²
Euthanasia	<i>Most species, as adults</i> 150 mg/kg IV (preferred), IP
Ferret 1	30-36 mg/kg IP ¹¹⁶ , IV ¹⁴⁸
Ferret 2	Not recommended
Gerbil	60-100 mg/kg IP. ^{2, 37} See comments. Maximum 60 mg ¹⁴⁸
Goat 1	30 mg/kg IV. ³⁷ Anesthesia.
Goat 2	1.0-2.0 mg/kg IV for sedation ²²¹
Guinea Pig 1	35-40 mg/kg IP. ² See comments.

Guinea Pig 2	15-30 mg/kg IP ¹⁷⁵
Guinea Pig 3	30 mg/kg IV
Guinea Pig 4	50 mg/kg PO ²⁸
Guinea Pig 5	30 mg/kg IP with meperidine 2 mg/kg IM ²⁸
Guinea Pig 6	20 mg/kg IP with diazepam 8 mg/kg IM ²⁸
Guinea Pig 7	25 mg/kg IP with mehoxyflurane ³⁷
Hamster 1	36-90 mg/kg IP. ^{2, 37} See comments
Hamster 2	70-90 mg/kg IP. ¹³² See comments
Mouse 1	70-90 mg/kg IP. ² dilute in saline. See comments.
Mouse 2	30-40 mg/kg IP (sedation) ¹³²
Mouse 3	40-70 mg/kg IP, IV. ²⁸ See comments.
Mouse 4	40-60 mg/kg IP with chlorpromazine 22-50 mg/kg IM ²⁸
Mouse 5	<i>Neonatal</i> 5.0 mg/kg IP, 1-4 days of age ⁸²
Mouse 6	50-90 mg/kg IP. Dilute in saline to volume of 0.1 ml/10 g body weight
Primate 1	25-35 mg/kg IV ³⁷ , IP ¹⁴⁷ See comments
Primate 2	15-25 mg/kg IV ¹⁴⁸
Rabbit 1	20-45 mg/kg IV. ⁵ Dilute in saline. See comments.
Rabbit 2	40 mg/kg IP. ²⁰ See comments.
Rabbit 3	20-45 mg/kg IV with acetylpromazine 1.0-10.0 mg/kg IM. ⁵ See comments.
Rabbit 4	20-45 mg/kg IV with xylazine 5 mg/kg IM ⁵ or SC. ²⁰ See comments.
Rabbit 5	20-45 mg/kg IV with meperidine 25 mg/kg SC, IM. ⁵ See comments.
Rabbit 6	20 mg/kg IV with guifenasi 200 mg/kg IV. Anesthesia ¹³²
Rabbit 7	Ketamine 10 mg/kg IM. 10 minutes later, pentobarbital 30 mg/kg IV ²¹⁸
Rat 1	60-65 mg/kg IP. ² See comments
Rat 2	<i>Male</i> 50 mg/kg IP, 60-70 mg/kg IP ¹⁶⁹
Rat 3	<i>Female</i> 25 mg/kg IP. ¹¹¹ ; 60 mg/kg IP ¹⁶⁹
Rat 4	30-40 mg/kg IP. Adults⁸¹ Dilute in saline
Rat 5	50 mg/kg PO. ²⁸ Adults ⁸¹ Dilute in Saline.
Rat 6	10-30 mg/kg IP. Under 50 grams body weight ⁸¹
Rat 7	15 mg/kg/hour IV, anesthesia maintenance ⁸⁸
Rat 8	30-40 mg/kg IV ⁵³
Rat 9	60 mg/kg IP with ketamine 60 mg/kg IM¹⁵⁴
Rat 10	50 mg/kg IP then 500 µg/kg/min IV ²¹⁷
Sheep 1	30 mg/kg IV. ³⁷ Anesthesia.
Sheep 2	1.0-2.0 mg/kg IV for sedation ²²¹
Swine 1	24 mg/kg IV. ³ 30 mg/kg IV. ⁷² See duration of action and comments.
Swine 2	25 mg/kg IP ⁶¹
Swine 3	5-15 mg/kg hr IV drip. ¹³⁴ 5-40 mg/kg/hr Iv drip ²⁴⁰

Dosage frequency

Cat 1	15-30 minutes
Cat 3	6 hours ⁷²
Dog 1	30 minutes ¹³²
Dog 2	6 hours ⁷²
Gerbil	50-60 minutes ¹³² , 20-30 minutes ¹⁷⁷
Goat 1	30-60 minutes ³⁷
Guinea Pig 1	60-90 minutes ¹⁷⁷
Guinea Pig 2, 3	60 minutes ¹³²
Hamster 2	60-75 minutes ¹³² , 20-30 minutes ¹⁷⁷
Mouse 3	20-40 minutes ¹⁷⁷
Rabbit 1	30-45 minutes ⁸⁰ , 60-180 minutes
Rabbit 5	1 hour ¹¹¹
Rabbit 6	30 minutes ¹³²
Rat 2	1-1.5 hours (50 mg/kg) ¹⁶⁹
Rat 3	6-8 hours (25 mg/kg) ¹⁶⁹
Rat 4	60 minutes ⁵³ , 80 minutes (IP) ⁶⁷
Sheep 1	30-60 minutes ³⁷
Swine 1	20-30 minutes
Swine 2	1-2 hours ⁶

Comments

Gerbil	High mortality in hamsters and gerbils. ^{2, 37}
Goat 1	Respiratory depression common ³⁷
Guinea Pig 2	High risk of mortality ³⁷
Hamster 1, 2	High mortality in hamsters and gerbils ^{2, 37}
Hamster 2	Poor analgesic. ⁵³
Primate	Respiratory depression common ³⁷
Rabbit 1	Use 2% solution. ⁸⁰ Unreliable anesthesia. ²³³
Rabbit 1-5	High of mortality when higher dose levels of pentobarbital used. Use diluted to 2.0 mg/ml. lower dose levels may not be satisfactory when pentobarbital used alone. ³⁸
	Respiratory depression.
Rabbit	Dilute to 30 mg/ml for IV use. Dilute to 6 mg/ml for IP use. ²⁰
Rat	LD ₅₀ close to anesthetic dosage in rats. ^{2, 37} See Rodent comments and see Chloral Hydrate.
Rodent	Dilute to 30 mg/ml for IV use. Dilute to 6 mg/ml for IP use. ²⁰
Sheep	Respiratory depression common ³⁷
Swine 1	may cause cardiovascular depression

PHENOBARBITAL (Luminal)

<i>Class</i>	Sedative, anticonvulsant. Controlled substance.
<i>Source</i>	Elkins-Sinn, generic

Cat 1	2-9 mg/kg IV ⁶
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Cat 2	8-16 mg/kg PO ⁶
Cat 3	1-2 mg/kg PO. Sedation ⁷²
Dog	2-9 mg/kg PO, IV ^{6, 72}
Gerbil	10-20 mg/kg Route? To control seizures ¹⁷⁶
Rabbit	100 mg/kg IP. Anesthesia ⁸⁰
Rat	15 mg/kg IP. Sedative ⁸¹

Dosage frequency

Dog	Up to 24 hours. ⁶ 12 hours ⁷²
Cat 1, 2	up to 23 hours ⁶
Cat 3	8-12 hours ⁷²
Rabbit	Up to 24 hours ⁸⁰

Comments

Rabbit	May be more effective when used with pentobarbital ⁸⁰
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PHENYLBUTAZONE (Buazolidin, Phen-Buta-Veta)

Class Analgesic, anti-inflammatory (pyrazolone derivative)

Source Geigy, Anthony, Maurry, Bio-Ceutic, Coopers

Cat 1	15 mg/kg IV ¹⁴⁸
Cat 2	10-14 mg/kg PO ¹⁴⁸
Cattle	4 mg/kg IV, PO ⁷²
<u>Dog 1</u>	<u>15 mg/kg PO.²⁰ maximum 800 mg/kday⁷²</u>
Dog 2	15 mg/kg IV ¹⁴⁸
Ferret	100 mg/kg PO ¹¹⁶
Gerbil	100 mg/kg IP ¹¹⁹
Goat 1	6 mg/kg IV, IM, PO. ²⁰ See comments
Goat 2	2.0 mg/kg IV ²⁰³
Guinea Pig	40 mg/kg PO ¹¹⁰
Hamster	100 mg/kg IP ¹¹⁹
Mouse 1	150 mg/kg IP ¹¹⁷
Mouse 2	30 mg/kg PO ¹¹⁰
Rabbit	15 mg/kg PO ²³³
Rat 1	30-100 mg/kg PO ²⁰ , SC ⁸¹
Rat 2	20 mg/kg PO ¹¹⁰
Rat 3	7.5-15 mg/kg SC ²⁰
Sheep 1	6 mg/kg IV, IM, PO. ²⁰ See comments.
Sheep 2	2.0 mg/kg IV ²⁰³
<u>Swine 1</u>	<u>10-20 mg/kg PO³</u>
Swine 2	4-8 mg/kg PO ¹⁹

Dosage frequency

Cat 1	8 hours ¹⁴⁸
Cat 2	12 hours ¹⁴⁸
Cattle	24 hours ⁷²

Dog 1	8 hours ²⁰
Dog 1	up to 7 days then reduce dose to lowest effect dose ²⁷⁷
Dog 2	8 hour ¹⁴⁷
Swine 1	12 hours ³

Comments

All	Analgesic effect related to anti-inflammatory properties
All	Not suitable for major surgical procedures
Cattle	Can be irritating IM or SC ⁷²
Dog 1, 2	Can cause blood dyscrasias or decreased renal blood flow ⁷²
Ferret	May interfere with platelet function. ¹¹⁶
Goat 1	Can be irritating IM ⁷²
Rabbit	Efficacy and safety not established ²³³
Sheep 1	Can be irritating IM ⁷²

PHENYLEPHRINE (Isophrin, neo-synephrine, Prefrin)

Class α -1 agonist
Source Winthrop

Cat 1	0.01 mg/kg IV ⁷¹
Cat 2	0.1 mg/kg IM, SC ⁷¹
Dog 1	0.1 mg/kg IM, SC ⁷¹
Dog 2	0.01 mg/kg IV ⁷¹

Dosage frequency

Dog 1	15 minutes ⁷¹
Dog 2	15 minutes ⁷¹

Comments

All	Can use for reversal of acetylpromazine ⁷⁰
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PIPECURONIUM (Arduan)

Class Nondrepolarizing skeletal muscle relaxant
Source Organon

Cat	0.004 mg/kg IV (ED ₈₅) ²¹⁶
Dog	0.0056 mg/kg IV ²¹⁶
Rabbit	0.004 mg/kg IV (ED ₈₅) ²¹⁶
Swine	0.15 mg/kg IV (ED ₉₅) ²¹⁶

Dosage frequency

Dog	26 minutes ²¹⁶
Cat	28-32 minutes ²¹⁶
Rabbit	28-32 minutes ²¹⁶

Comments

All Does not influence cardiovascular function²¹⁶

PIROXICAM (Feldene)

Class Oxicam non-steroidal anti-inflammatory drug
Source Pfizer

Guinea Pig 6.0 mg/kg PO²⁷⁷
Mouse 3.4-20.0 mg/kg PO²⁶⁹
Rabbit 0.2 mg/kg PO²⁶⁹
Rat 3.0 mg/kg PO²⁷⁷

Dosage frequency

Guinea Pig 24 hours²⁷⁷
Mouse 24 hours²⁷⁷
Rabbit 8 hours²⁶⁹
Rat 24 hours²⁷⁷

PROMAZINE (Tranquazine, Sparine)

Class Phenothiazine tranquilizer
Source Wyeth-Ayerth, generic

Calf 0.4-1.1 mg/kg IV, IM²⁰
Cat 1 0.5-1.0 IM, SC, IV⁶
Cat 2 2.2-4.4 mg/kg IV, IM^{20, 55}
Dog 1 0.5-1.0 IM, SC, IV⁶
Dog 2 2.2-4.4 mg/kg IV, IM^{20, 55}
Goat 0.44-1.1 mg/kg IV, IM²⁰
Guinea Pig 0.5-1.0 mg/kg IM²⁰
Hamster 0.5-1.0 mg/kg IM²⁰
Mouse 5.0 mg/kg IP²⁰
Primate *Ape* 1.0 mg/kg IM¹⁴⁷
Rabbit 1-2 mg/kg IM²⁰
Rat 0.5-1.0 mg/kg IM^{20, 81}
Sheep 0.44-1.1 mg/kg IV, IM²⁰
Swine 1 1.1-3.3 mg/kg IV²¹
Swine 2 0.44-1.0 mg/kg IM⁶¹, IV⁷², SC²²¹

Dosage frequency

Dog 1 Up to 48 hours⁵⁵

Comments

All Urine may be brown or pink⁷²

PROPIONYLPROMAZINE (Combelen)

Class Phenothiazine tranquilizer
Source Bayer (Leverkusen, Germany)

Dog 1 0.11 mg/kg IV¹⁷⁸
Dog 2 See Methadone

PROPOFOL (Diprivan, Rapinovet)

Class Isopropylphenol sedative, hypnotic, anesthetic. See comments.

Source AstraZeneca, Stuart, ICI Pharmaceuticals

Bird 14.0 mg/kg IV¹³⁶
Cat 5.0 mg/kg IV²¹
Dog 1 5.2 mg/kg IV.²¹ See comments.
Dog 2 **10 mg/kg IV, over one minute, then 0.4 mg/kg/min for maintenance¹¹³**
Dog 3 5.5-7.0 mg/kg IV over 3-5 minutes. Maintain at 0.4 µg/kg/min (about 0.5 ml/hour) for a 25 kg dog, when 20 ml vial is diluted in 100 ml of 5% dextrose in water.¹⁵⁵
Dog 4 See Medetomidine
Mouse 1 12-24 mg/kg IV²
Mouse 2 26 mg/kg IV. Surgical anesthesia¹⁷⁷
Primate 1 Sedate with ketamine 5.0 mg/kg IM, then propofol 5.0 mg/kg IV bolus, then 25 mg/kg/hr IV. Light anesthesia¹⁸³
Primate 2 250 mg with 250 mg ketamine in 250 ml of standard IV fluid. Infuse at 10 mg/kg/hour¹⁶⁵
Primate 3 7.5-12.5 mg/kg IV²²⁵
Primate 4 *Macaque* 2.0-5.0 mg/kg IV²¹⁹
Primate 5 *Papio* 0.4-0.6 mg/kg min for sedation²¹⁹
Rabbit 1 2.4 mg/kg IV.²¹ See comments. Light anesthesia¹⁷⁷
Rabbit 2 10 mg/kg IV³⁷
Rabbit 3 7.5-15 mg/kg IV¹³²
Rabbit 4 1.5 mg/kg IV bolus, then 0.2-0.6 mg/kg/min infusion⁴⁸
Rabbit 5 Induce with ketamine:xylazine (q.v.). continue with IV propofol 0.6 mg/kg/minute and fentanyl (0.48 µg/kg/min) and vecuronium 0.003 mg/kg/min.¹⁸⁰
Rabbit 6 0.25 mg/kg medetomidine IM followed in 5 minutes by propofol 4.0 mg/kg IV²¹⁸
Rabbit 7 0.25 mg/kg medetomidine IM + midazolam 0.5 mg/kg IM then propofol 2.0 mg/kg IV²¹⁸
Rat 1 7.5-10 mg/kg IV induction
Rat 2 44-55 mg/kg/hr infusion² IV
Reptile 1 *Iguana* 10 mg/kg intraosseous²⁸⁰
Reptile 2 *Lizard* 3.0-5.0 mg/kg IV²⁸⁰
Reptile 3 *Chelonians* 3.0-5.0 mg/kg IV²⁸⁰
Sheep 1 2.0 mg/kg IV. Maintained with 300 µg/kg/min IV.¹⁰⁰
Sheep 2 4.0-6.0 mg/kg IV¹³⁵
Swine 1 0.83-1.66 mg/kg IV then 12-20 mg/kg/hr IV drip¹³⁴

Swine 2	Sedate with midazolam 0.5 mg/kg IM. ¹⁴⁶ Propofol 2.5 mg/kg IV until no reflexes. Intubate and respirate with O ₂ /NO (50:50) at 150 ml/kg/min. Then alpha chloralose 100 mg/kg IV. ¹⁴⁶
Swine 3	Sedate with ketamine:xylazine (q.v.). Propofol 4-8 mg/kg/hour (mix two 20 ml vials of 10 mg/kg propofol in 500 ml bag of dextrose (5% in water).

Dosage frequency

Bird	2-7 minutes ¹³⁶
Cat	10 minutes ³⁷
Dog 1	15 minutes ²²⁰
Mouse 1	6-7 minutes ¹³² , 5-10 minutes ¹⁷⁷
Primate 4	20 minutes ²⁸²
Rabbit 2	5-10 minutes ¹⁷⁷
Rabbit 5	4-16 minutes ¹³²
Rat 1	6-11 minutes ²¹⁷
Sheep 1	5-10 minutes ¹³⁵

Comments

All	Must be given IV. Poor analgesic.
Bird	Respiratory depression ¹³⁶
Dog 1-4	May cause bradycardia. ²³ Not recommended for Greyhounds ¹¹³
Rabbit 1	See also, metdetomidine and midazolam. For immobilization only.
Rabbit 1-4	Apnea at surgical levels if used as sole anesthetic. Use with analgesics, intubate and ventilate. Consider this drug to be a hypnotic ¹⁵⁸
Reptile 1	Can lead to prolonged anesthesia ²⁸⁰

PROPOXYPHENE (Darvon, Dolene)

Class Analgesic. Controlled substance.

Source Lilly, generic

Rat	25 mg/kg IP ⁸¹
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Comments

All	Mild analgesia
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PYRIDOSTIGMINE (Mestinon)

Class Nondepolarizing neuromuscular blocking agent antagonist

Source ICN Pharmaceuticals

Dog	0.2-0.3 mg/kg IV ⁵⁰
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Dosage frequency

Dog 15 minutes⁵⁰

Comments

Dog Give slowly over 5 minutes. Dilute dose in 10 ml of saline⁵⁰

Precede with atropine 0.04 mg/kg IV, given slowly⁵⁷

ROCURONIUM (Zemuron)

Class Nondepolarizing skeletal muscle relaxant

Source Organon

Cat 0.16-0.3 mg/kg IV²¹⁶

Swine 0.7 mg/kg IV (ED₅₀)²¹⁶

Dosage frequency

Cat 7 minutes²¹⁶

Swine 10 minutes²¹⁶

Antagonist

Edrophonium (q.v.)

Neostigmine (q.v.)

ROMIFIDINE (Sedivet)

Class Alpha-3 agonist

Source Boehringer Ingelheim (Canada). Not available in US

Cat 0.04 mg/kg IM with butorphanol 0.4 mg/kg IM²⁷⁷

Dog 0.04 mg/kg IM with butorphanol 0.4 mg/kg IM²⁷⁷

Sheep 1 50 mg/kg IV¹³⁵

Sheep 2 0.05 mg/kg IV²²¹

Comments

Sheep 1 It is possible that the author meant micrograms/kg, not milligrams/kg.

SEVOFLURANE (Ultane)

Class Anesthetic

Source Abbott

Calf 4-5% mask induction. Maintain at 2.5%

Dog 3.0% in oxygen flow of 3 liters/min¹⁹⁴

Goat 4-5% mask induction. Maintain at 2.5%

Mouse Do not use. "Difficult induction"¹⁷²

Rat Do not use. See comments.

Sheep	4-5% mask induction. Maintain at 2.5%
Swine	<i>Neonatal</i> 4-5% mask induction. Maintain at 2.5%

Antagonist

Oxygen. Not a true antagonist.

Comments

Dog	Cardiovascular effects similar to isoflurane (q.v.) ¹⁹⁴
Rat	Causes renal toxicity in rats, especially when used with close circuit oxygen.

SUCCINYLCHOLINE (Anectine, Quelicin, Sucostrin)

Class Depolarizing neuromuscular blocking agent

Source Burroughs Wellcome, Abbott, Squibb

Calf	0.02 mg/kg IV ⁵⁶
Cat 1	0.2-0.4 mg/kg IV ⁶
Cat 2	0.06-0.11 mg/kg IV ⁷²
Dog 1	0.2-0.4 mg/kg IV ⁶
Dog 2	0.07 mg/kg IV ⁷²
Ferret	0.15 mg/kg IV ²¹⁶
Frog	2.5 mg/kg in ventral lymph sac ²¹⁶
Goat 1	0.02 mg/kg IV ⁵⁶
Goat 2	0.04 mg/kg IV ²¹⁶
Mouse	0.05-0.1 mg/kg IV ²¹⁶
Primate	2.0 mg/kg IV ²⁶⁹
Rabbit 1	0.5 mg/kg IV ⁵⁶
Rabbit 2	0.1 mg/kg IV ²¹⁶
Rat 1	0.75 mg/kg IV ⁹⁷
Rat 2	50 mg/kg IV. ²¹⁶
Sheep 1	0.02 mg/kg IV ⁵⁶
Sheep 2	0.04 mg/kg IV ²¹⁶
Swine	0.2 mg/kg IV ⁵⁶

Dosage frequency

Calf	6-8 minutes ⁵⁶
Cat	2-5 minutes ⁶ , 5-11 minutes ²¹⁶
Dog 1	15-20 minutes ⁶
Dog 2	8-9 minutes ²¹⁶
Goat 1	6-8 minutes ^{56, 216}
Rabbit 1	5-10 minutes ⁵⁶
Sheep 1	6-8 minutes ^{56, 216}
Swine	2-3 minutes ^{56, 216}

Comments

All May be incompatible with pentobarbital and thiopental⁷²

Cat 1, 2	Subsequent doses are ½ original dose ⁶
Dog 1, 2	Subsequent doses are ½ original dose ⁶
Rat 2	Dosage seems high when compared to other species

SUFENTANYL (Sufenta)

Class Opioid analgesic. Controlled substance.

Source Janssen

Cat 1	2.0 µg/kg IV to a maximum of 5 µg/kg ⁷¹
Cat 2	0.7-2.0 µg/kg ²⁷⁷
Dog 1	2.0 µg/kg IV to a maximum of 5 µg/kg ⁷¹
Dog 2	2.0 µg/kg IV ²⁷⁷
Mouse	0.0023 mg/kg SC (ED ₅₀) ²¹⁷
Rat 1	See Medetomidine
Rat 2	0.71 µg/kg IV ⁵⁴
Rat 3	<i>Pup 10 days old</i> 1.7 µg/kg (ED ₅₀). Route?
Rat 4	<i>Pup 27 days old</i> 7.6 µg/kg (ED ₅₀). Route?
Swine 1	5.0-10 µg/kg IM ³
Swine 2	10-15 µg/kg/hr IV drip. ³ 15-30 µg/kg/hr IV drip ²⁴⁰
Swine 3	0.007 mg/kg IV ²⁴⁰

Dosage frequency

Cat 2	4-6 hours ²⁷⁷
Dog 2	4-6 hours ²⁷⁷
Swine 1	2 hours ³

Antagonist

Naloxone (q.v.)

Comments

Cat	Premedicate with acetylpromazine ⁷¹
Dog	Premedicate with acetylpromazine ⁷¹

SUXAMETHONIUM – see Succinylcholine

THIAMYLAL (Surital, Biothal, Bio-Tal)

Class Thiobarbiturate anesthetic. Controlled substance.

Source Not available from US pharmaceutical companies. Listed in Sigma catalog

Calf	9-13 mg/kg IV ²¹
Cat 1	16-20 mg/kg IV ⁶
Cat 2	9-13 mg/kg IV ²¹
Cat 3	8.8 mg/kg IV with opioid premedication ⁷²
Dog 1	16-20 mg/kg IV ⁶
Dog 2	9-13 mg/kg IV ²¹

Dog 3	8.8 mg/kg IV with opioid premedication ⁷²
Mouse	25-50 mg/kg IV ²⁰
Primate	25 mg/kg IV ¹⁴⁸
Rabbit	15-25 mg/kg of 1% solution, IV ⁵
Rat	20-50 mg/kg IV ²⁰
Sheep	13.2 mg/kg IV ⁷²
Swine 1	6.6-8.8 mg/kg IV ³
Swine 2	9-13 mg/kg IV ²¹
Swine 3	17.6 mg/kg IV ⁷² (from package insert)

Dosage frequency

Dog 1	15 minutes ⁶
Sheep	4-12 minutes ⁷²
Swine 2	15 minutes ⁶ , 5-10 minutes ³⁷

Comments

All Some species (e.g. cats) may have transient apnea during induction

THIOPENTAL (Pentothal)

Class Thiobarbiturate anesthetic. Controlled substance.

Source Abbott

Calf 1	9-13 mg/kg IV ²¹
Calf 2	25 mg/kg IV ²²¹
Cat 1	16-25 mg/kg IV ⁶
Cat 2	9-13 mg/kg IV ²¹
Dog 1	16-25 mg/kg IV ⁶
Dog 2	5-10 mg/kg IV ¹¹¹
Dog 3	9-13 mg/kg IV ²¹
Gerbil	40 mg/kg IP ¹¹⁹
Goat 1	10-15 mg/kg IV ³⁷
Goat 2	25 mg/kg IV ²²¹
Guinea Pig 1	20 mg/kg IV ²⁰ IP ¹⁷⁵
Guinea Pig 2	55 mg/kg IP ²⁸
Hamster 1	20 mg/kg IV ²⁰
Hamster 2	20-40 mg/kg IP ¹¹⁹
Mouse 1	30-40 mg/kg IV ² surgical anesthesia
Mouse 2	50 mg/kg IP ²⁸
Primate 1	15-20 mg/kg IV ³⁷
Primate 2	Ketamine 5.0 mg/kg IM then thiopental at 8.0 mg/kg/hour IV ¹⁸³
Primate 3	<i>Baboon</i> 15-17 mg/kg/hr IV drip. ²¹⁹ Anesthesia induction.
Rabbit 1	50 mg/kg IV ²⁸
Rabbit 2	28 mg/kg IV, IP ¹⁴⁸
Rabbit 3	15-25 mg/kg of 1% solution, IV ⁵

Rat 1	30 mg/kg IV of 1.25% solution ³⁷
Rat 2	40 mg/kg IP ²⁸
Sheep 1	10-15 mg/kg IV ³⁷
Sheep 2	4.0 mg/kg IV in 2.5% solution. Drip at 50-75 mg/min ¹²⁴
Sheep 3	25 mg/kg IV ²²¹
Swine 1	6.6-8.8 mg/kg IV
<u>Swine 2</u>	<u>3.0-30 mg/kg/hr IV infusion²⁴⁰</u> 50-75 µg/kg/min IV infusion ³
Swine 3	See Midazolam
Swine 4	24-30 mg/kg IV ¹⁴⁸

Dosage frequency

Cat 1	15 minutes ⁶
Dog 1	15 minutes ⁶
Dog 1	5-10 minutes ³⁷
Dog 2, 3	15 minutes ²²⁰
Goat	5-10 minutes ³⁷
Mouse 1	10 minutes ¹³²
Primate 1	5-10 minutes ³⁷
Rabbit 1, 3	5 minutes ¹⁷⁷
Rat 1	5-10 minutes ³⁷
Sheep 1	5-10 minutes ³⁷

Comments

All	Some species (e.g. cats) may have transient apnea during induction
All	Administer first 1/3 rapidly to avoid excitement phase of anesthesia
Rabbit	Dilute 1:10 with saline

TILETAMINE (Combined with zolazepam as Telazol)

Class Arylcyclohexylamine dissociative anesthetic with benzodiazepine tranquilizer. Controlled substance.

Source Fort Dodge, Robins

Calf 1	4.0 mg/kg IV ¹³⁵ anesthesia
Calf 2	4.0 mg/kg IV with xylazine 0.1 mg/kg IM ¹³⁵
Cat 1	1.0 mg/kg IV ¹³³
Cat 2	5.0 mg/kg SC, IM ¹³³
Cat 3	2.0-15.0 mg/kg IV, IM ⁵⁸
Dog 1	1.0 mg/kg IV ¹³³
Dog 2	2.0-13.0 mg/kg IV, IM ¹⁵⁸
<u>Dog 3</u>	<u>5.0 mg/kg IM, SC¹³³</u>
Ferret 1	12-22 mg/kg IM, SC ¹³⁰ Minor surgery. ¹³⁶
Ferret 2	Not recommended at 22 mg/kg IM ¹⁸⁵

Ferret 3	3.0 mg/kg IM with ketamine 2.4 mg/kg IM and xylazine 0.6 mg/kg IM ¹⁸⁵
Ferret 4	1.5 mg/kg IM with xylazine 1.5 mg/kg IM. ²³² Can add butorphanol 0.2 mg/kg IM ²³²
Gerbil 1	60 mg/kg IM ¹¹⁹
Gerbil 2	10-30 mg/kg IM with xylazine 5.0 mg/kg IM ¹⁷⁵
Goat	7.5 mg/kg IM, maintain on isoflurane. ⁴⁰
Guinea Pig 1	10-80 mg/kg IM or IP ¹³² Sedation. See comments.
Guinea Pig 2	40-60 mg/kg IM. Immobilization. ¹⁷⁷
Guinea Pig 3	10-30 mg/kg IM with xylazine 5.0 mg/kg IM. See comments.
Guinea Pig 4	60 mg/kg IP (total amount of the combined drugs) with xylazine 5.0 mg/kg IP and butorphanol 0.1 mg/kg IM (diluted 1:10 in saline). Surgical anesthesia. ²⁷⁴
Hamster 1	40 mg/kg IM ¹¹⁹ Sedation
Hamster 2	20-80 mg/kg IP for restraint only ²
Hamster 3	20 mg/kg IP with 10 mg/kg xylazine IP. Restraint only. ²⁷
Hamster 4	30 mg/kg IP with xylazine 10 mg/kg xylazine IP. Surgical anesthesia. ²⁷
Mouse 1	Do not use. See comments
Mouse 2	45 mg/kg IM combined with xylazine 7.5 mg/kg IM. ¹⁰⁴ See comments.
Primate 1	4-10 mg/kg oral ⁷⁶
Primate 2	<i>Rhesus, squirrel</i> 5.0 mg/kg (0.05) ml/kg IM for short procedures. ¹¹⁸ Double dose for longer procedures.
Primate 3	<i>Lemurs</i>
Primate 4	<i>Marmosets/tamarins</i> 20 mg/kg IM ⁷⁶ 5.0 mg/kg IM ²¹⁹
Primate 5	<i>Cynomolgus</i> 2.0 mg/kg IM sedation ¹⁵⁶
Primate 6	<i>Cynomolgus</i> 3.0-4.0 mg/g IM light anesthesia ¹⁵⁶
Primate 7	<i>Rhesus</i> 1.5-3.0 mg/kg IM ²¹⁸ light anesthesia ¹⁷⁰
Primate 8	<i>Baboon</i> 4.0-6.0 mg/kg IM ²¹⁹
Rabbit 1	32 mg/kg IM. ⁶³
Rabbit 2	50-80 mg/kg IM ¹⁷⁵
Rabbit 3	10 mg/kg Intranasal. ⁸⁶ Dilute with saline to 0.4 ml/kg.
Rabbit 4	15 mg/kg IM with xylazine 5.0 mg/kg IM ¹⁴⁸
Rat 1	20-40 mg/kg IP, IM ² Light anesthesia ¹⁷⁷
Rat 2	20-40 mg/kg IP Light anesthesia ¹⁷⁷
Rat 3	20-40 mg/kg IP with butorphanol 1.25-5.0 mg/kg IP ¹³²
Sheep 1	12-24 mg/kg IV ⁹² 4.0 mg/kg IV ²²¹
Sheep 2	2.2 mg/kg IM ¹⁴⁸
Sheep 3	See Butorphanol
Swine 1	4-6 mg/kg IM with xylazine 2.2 mg/kg IM, except for cardiac compromised animals. ^{3, 40} Preanesthetic. Can add glycopyrrolate (0.01 mg/kg IM) or atropine (0.05 mg/kg IM) ¹³¹

Swine 2	2.2 mg/kg IM with xylazine, 2.2 mg/kg IM and sterile water 2.5 ml ¹⁴⁰
Swine 3	2.2-5.0 mg/kg IM, with ketamine 2.2-2.5 mg/kg IM and xylazine 2.2-2.5 mg/kg IM. ^{140, 283}
Swine 4	2.0-8.8 mg/kg IM ²²¹
Swine 5	2.0 mg/kg IV ²²²

Dosage frequency

Cat 3	30-60 minutes ⁷²
Dog 2	30 minutes ⁷²
Dog 3	20-30 minutes ²²⁰
Ferret 3	33 minutes ¹⁸⁵
Guinea Pig 4	64-96 minutes ²⁷⁴
Hamster 2	20-30 minutes ¹⁷⁷
Hamster 3, 4	30 minutes ^{177, 27}
Mouse 2	36 minutes ¹⁰⁴
Primate 4	15 minutes ²¹⁹
Primate 5	30-40 minutes (light anesthesia) ¹⁵⁶ , 45-60 minutes (deep anesthesia) ¹⁵⁶
Primate 7, 8	45-60 minutes ²¹⁹
Rabbit 2	44 minutes ⁸⁶
Rat 1	15-25 minutes ¹⁷⁷
Rat 2	130-200 minutes ²¹⁷
Sheep 1	40 minutes ⁹²
Swine 1	20-30 minutes ²²¹
Swine 4	20 minutes ²²¹

Antagonist

Partial by yohimbine (q.v.)

Comments

All	May cause necrosis in rodents when used IM.
Cat 3	Higher dosages for anesthesia, lower for diagnostic purposes ⁷²
Cats	May be “rough” recovery ¹³³
Dog 2	Higher dosages for anesthesia, lower for diagnostic purposes ⁷²
Dogs	May be “rough” recovery ¹³³
Ferret 1	May see paddling and sneezing during recovery ²³²
Ferret 3	Short duration of analgesia and rough recovery ¹⁸⁵
Mouse 1	Unsatisfactory. Too lethal for mice. ⁶⁵
Primate 3	combine with diazepam or midazolam (0.1-0.5 mg/kg IM) to prevent seizures ⁷⁶
Rabbit 3	No clinical abnormalities. Kidney function not studied. ⁸⁶ Dilates blood vessels of ear. ⁸⁶

<i>Class</i>	Anesthetic
<i>Source</i>	Aldrich, Pfaltz & Bauer, other chemical suppliers
Gerbil 1	250-300 mg/kg IP of 1.25% solution ³⁷
Gerbil 2	225-250 mg/kg SC of 2.25% solution IP. ¹³² Anesthesia. Sedation ¹³²
Mouse 1	125 mg/kg IP of 0.25% solution ^{2, 37}
Mouse 2	250 mg/kg IP ^{28, 66} Surgical anesthesia
Mouse 3	0.015-0.017 ml/gram IP of following: Make stock solution by mixing 10 ml of tertiary amyl alcohol with 10 grams tribromoethanol. Take 1.25 ml of stock solution and add to 48.75 ml of water or saline (i.e. a 2.5% solution). Filter sterilize and place in sterile bottle. Store in foil, in refrigerator ⁹⁵ up to 6 weeks.
Mouse 4	450 mg/kg IP as a 2.5% solution ²⁷⁷
Rat	300 mg/kg IP ^{2, 37}
<i>Dosage frequency</i>	
Gerbil 1	10-35 minutes ¹³²
Gerbil 2	20-63 minutes ¹³²
Mouse 1	15-20 minutes ²
Mouse 2	15-45 minutes
Rat	15-20 minutes ²
<i>Comments</i>	
All	Must be carefully prepared as in reference 66
All	Good muscle relaxation
Rat	High mortality possible ³⁷ Fibrous adhesions and peritonitis at 200-400 mg/kg. Hepatic capsular fibrosis and adhesions. ²⁴¹
Mouse 1, 2	High mortality possible ³⁷ May cause peritonitis and fibrinous serositis of abdominal organs ²²⁷
Mouse 2	Varies from deep to light anesthesia ⁹⁵

URETHANE (ethyl carbamate, 50% w/v).

<i>Class</i>	Anesthetic
<i>Source</i>	Sigma Chemical, Aldrich Chemical
Amphibian 1	1.0-2.0% solution ¹⁴⁸
Amphibian 2	Frog? 0.04-0.12 ml/gram of 5.0% solution into dorsal lymph sac ¹⁴⁸
Cat	1250 mg/kg IV ³⁷
Dog	1000 mg/kg IV ³⁷
Ferret	1500 mg/kg IP ¹¹⁶
Fish	5.0-40 mg/liter ¹⁴⁸
Guinea Pig	1500 mg/kg IV, IP ^{2, 37}

Hamster 1	1500 mg/kg IP ²
Hamster 2	380 mg/kg IP with α -chloralose 38 mg/kg IP and pentobarbital 2.6 mg/kg IP ²
Rabbit 1	1000 mg/kg IV, IP ³⁷ Surgical anesthesia ¹⁷⁷
Rabbit 2	1000-1300 mg/kg IV with acetylpromazine 2.0 mg/kg IM ¹³² Sedation
Rabbit 3	1500 mg/kg IV ⁸⁰
Rat 1	1000-1200 mg/kg IP ² Surgical anesthesia ¹⁷⁷
Rat 2	500-800 mg/kg IP then α -chloralose, 60 mg/kg IP 15 minutes later ¹³²

Dosage frequency

Guinea Pig	360-480 minutes ¹⁷⁷
Hamster 1	360-480 minutes ¹⁷⁷
Ferret	4-6 hours ²²⁰
Rabbit 1	360-480 minutes ¹⁷⁷
Rabbit 2	13-23 hours
Rat 1	>24 hours ^{67, 103} 360-480 minutes ¹⁷⁷
Rat 2	21 hours ¹³²

Comments

All	Carcinogen. Only for nonsurvival surgery.
Rat 1	Good anesthesia reported ¹⁰³

VECURONIUM (Norcuron)

<i>Class</i>	Nondepolarizing neuromuscular blocking agent
<i>Source</i>	Organon

Cat	25-35 μ g/kg IV ^{56, 216}
Dog 1	0.1 mg/kg. Route not indicated ³⁷ IV ⁵⁰
Dog 2	0.014 (ED ₉₀) ²¹⁶
Primate 1	0.04-0.06 mg/kg IV ²¹⁹
Primate 2	0.4 μ g/kg/min IV ²¹⁹
Rabbit	See Propofol
Rat 1	1.5 mg/kg IV ⁹⁷
Rat 2	0.45 mg/kg IV ²¹⁶
Sheep	4.6 μ g/kg IV ^{56, 216}
Swine 1	0.5 mg/kg for intubation. Route not indicated ³⁷
Swine 2	0.2 mg/kg IV, maintain at 0.3 mg/kg/hour IV ¹⁹⁹
Swine 3	1.0 mg/kg IV ²⁴⁰

Dosage frequency

Cat	5-9 minutes ^{56, 216}
Dog 1	42 minutes ⁵⁶
Rat 1	10 minutes ⁹⁷
Sheep	14 minutes ^{56, 216}

Swine 1 10 minutes²¹⁶ 4 minutes²¹⁶

Antagonist

Pyridostigmine (q.v.)⁵⁰

Edrophonium (q.v.)

Neostigmine (q.v.)

Comments

Swine 3 No effect on heart rate²⁴⁰

XYLAZINE (AnaDed, Rompun), and see KETAMINE

Class Analgesic, sedative (α -adrenoceptor agonist)

Source Lloyd, Haver/Diamond, Mobay, TechAmerica

Bird 6.5 mg/kg IM with ketamine (dose not given)¹⁴⁷

Calf 1 0.09-0.35 mg/kg IM. Sedation, analgesia²⁰

Calf 2 0.02-0.1 mg/kg IV²¹

Calf 3 0.02 mg/kg IV followed by butorphanol, 0.07 mg/kg IV.⁴⁴

Cat 1 1-2 mg/kg IM⁴ or IV⁶ or SC.²⁰

Cat 2 0.5-1 mg/kg IV⁴

Cat 3 0.4-0.9 mg/kg IM²²⁰

Cat 4 0.25 mg/kg epidural²⁷⁷

Cat 5 0.3 mg/kg IM with butorphanol 0.4 mg/kg IM²⁷⁷

Cattle 50 μ g/kg in 5 ml sterile water in caudal epidural space⁴⁹

Dog 1 1-2 mg/kg IM^{4, 37} or IV⁶ or SC²⁰

Dog 2 0.25 mg/kg IM with glycopyrolate (0.01 mg/kg IM).
Preanesthetic.³³

Dog 3 0.5-1 mg/kg IV⁴

Dog 4 3.6 mg/kg IM with midazolam 3.6 mg/kg IM. Sedation.¹⁴¹

Dog 5 0.4-0. mg/kg IM²²⁰

Dog 6 0.1-0.5 mg/kg IV slowly²²⁰

Dog 7 0.25 mg/kg epidural²⁷⁷

Dog 8 0.3 mg/kg IM with butorphanol 0.4 mg/kg IM²⁷⁷

Ferret 1 1.0 mg/kg SC, IM¹¹⁶ Sedative¹⁷⁵

Ferret 2 1.0 mg/kg with 20-25 mg/kg ketamine and 0.05 mg/kg
atropine¹³⁰ (IM or SC)

Ferret 3 2.0 mg/kg IM and butorphanol 0.2 mg/kg IM²³²

Frog 10 mg/kg IP¹⁸⁴

Gerbil 1 5.0-10.0 mg/kg IM, SC. Sedative¹⁷⁵ IP²³⁴

Gerbil 2 5.0 mg/kg IP¹⁴⁷

Gerbil 3 2.0 mg/kg IP¹⁷⁷

Goat 0.05-0.1 mg/kg IV, IM.³⁷ Sedation²²¹

Guinea Pig 1 1.8 mg/kg. Route?¹¹⁰

Guinea Pig 2 3.0-5.0 mg/kg IM¹⁴⁸

Guinea Pig 3 5.0-40 mg/kg. Route? Mild sedation.¹³² IP²¹⁷

Hamster 1	4.0 mg/kg IM ¹⁴⁸ IP ²⁸²
Hamster 2	8.0-10.0 mg/kg IM, SC. Sedative ¹⁷⁵ IP ²³⁴
Mouse 1	10 mg/kg IP ³⁷ IM, SC. Sedative ¹⁷⁵ Sedation only, little analgesia ³⁷
Mouse 2	4.0-8.0 mg/kg IM ⁴⁸
Primate	0.6-2.0 mg/kg. Route? Sedation ¹¹⁰ , IM ²⁸²
Rabbit 1	3-5 mg/kg SC ⁵ or IM ¹⁰ Sedative only ³⁷
Rabbit 2	0.5-2.0 mg/kg IV ¹⁰ Sedative only ³⁷
Rabbit 3	5 mg/kg Sc followed by pentobarbital 12-29 mg/kg IV ten minutes later ³⁹
Rabbit 4	5 mg/kg Sc followed by 13-48 mg/kg ethyl (1-methylpropyl) malonyl-thio urea salt IV. Anesthesia ³⁹
Rabbit 5	5 mg/kg SC followed ten minutes later by 35 mg/kg ketamine IM and acetylpromazine 0.75 mg/kg IM ³⁹
Rat 1	5-12 mg/kg SC ¹⁰ IM ¹⁷⁵ Sedative
Rat 2	1-3 mg/kg IM ³⁷
Rat 3	10 mg/kg IP ¹⁷⁷
Sheep 1	0.05-0.1 mg/kg IV, IM. ³⁷ Sedation ²²¹
Sheep 2	0.1 mg/kg IM then 2.0 mg/kg hour IV infusion ²⁷⁵
Swine 1	1.2 mg/kg IM ²¹ IV ¹⁸²
Swine 2	10 mg/kg IM ¹⁴⁸
Swine 3	0.2 mg/kg IM ²²¹

Dosage frequency

Cat 1	30 minutes ⁹
Cat 4	1-4 hours ²⁷⁷
Dog 2	Up to 12 hours sedation ¹¹¹
Dog 3	30 minutes ⁹
Dog 6	30-60 minutes ²²⁰
Dog 7	1-4 hours ²⁷⁷
Frog	12-24 hours ¹⁸⁴
Goat	30-60 minutes ¹⁹ 30-35 minutes ³⁷
Primate	30 minutes ²⁸²
Rabbit 1	3-4 hours ¹⁰ , 20-60 minutes ⁷⁰
Rabbit 2	2-3 hours ¹⁰
Rabbit 3, 4	40 minutes ³⁹
Rabbit 5	60-120 minutes ³⁹
Rat 1	2 hours ¹⁰
Sheep	30-60 minutes ¹⁹ 30-35 minutes ³⁷
Swine 3	5 minutes ²²¹

Antagonist

Atipamezole (q.v.)
 Idazoxan (q.v.)
 Tolazoline (q.v.)
 Yohimbine (q.v.)

Comments

Calf	Will cause hyperglycemia. ¹³⁵ Can have oxytocin-like effect on uterus. Use demoidine in pregnant animals. ¹³⁵ May cause respiratory depression.
Cat 1	Sensitizes myocardium. Induces hyperglycemia.
Cat 1, 2	Use with caution. If used for preanesthesia, decrease dose of anesthetic induction agent by 75%. ⁴ Causes vomiting in 50% of dogs and 90% of cats. ⁶ Do not use alone for anesthesia or analgesia (insufficient analgesia). ²⁰
Dog 1	Heart rate and aortic blood flow reduced.
Dog 1-3	Avoid use in large dogs prone to gastric dilation
Dog 1-4	Use with caution. If used for preanesthesia, decrease dose of anesthetic induction agent by 75%. ⁴ Causes vomiting in 50% of dogs and 90% of cats. ⁶ Do not use alone for anesthesia or analgesia (insufficient analgesia). ²⁰
Dog 1, 3	Sensitizes myocardium. Induces hyperglycemia
Ferret 1	May cause transient cardiac arrhythmias ¹³⁰
Goat	Very sensitive. Respiratory depression and heart block can occur. Only use for acute pain. Do not repeat after initial dose. Use for sedation only. ³⁷ Many cardiovascular effects.
Mouse 2	May lead to lowered blood pressure ¹¹⁰
Rabbit 1, 2	Opioids better for somatic pain. ¹⁰ Can have severe bradycardia and respiratory depression. ²³⁴
Rabbit 2	Heart rate and aortic blood flow reduced.
Rabbit 2	Sensitizes myocardium. Induces hyperglycemia
Rabbit 5	Severe hypothermia ³⁹
Rat 1	Opioids better for somatic pain ¹⁰
Rat 1	Sedation but poor analgesia ³⁷
Sheep	Very sensitive. Respiratory depression, fatal pulmonary edema and heart block can occur. Only use for acute pain. Do not repeat after initial dose. Use for sedation only. ³⁷ Many cardiovascular effects.
Sheep	Will cause hyperglycemia. ¹³⁵ Can have oxytocin-like effect on uterus. Use detomidine in pregnant animals. ¹³⁵
Swine 1	May cause vomiting, salivation, bradycardia ⁶¹

YOHIMBINE (Yobine, Antagonil)

Class α_2 adrenergic antagonist. Xylazine antagonist

Source Wildlife Pharmaceuticals, Lloyd

Calf	0.125 mg/kg IV with 4-aminopyridine 0.3 mg/kg IV ⁴⁵
Cat 1	0.25 mg/kg IV with 0.6 mg/kg 4-aminopyridine IV ⁴⁵
Cat 2	0.1 mg/kg IV ^{45, 111}
Cat 3	0.5 mg/kg IV ⁷²

Dog 1	0.125 mg/kg IV with 4-aminopyridine 0.3 mg/kg IV ⁴⁵
Dog 2	0.11 mg/kg IV slowly ⁷²
Ferret 1	0.1 mg/kg SC, IM ¹³⁰
Ferret 2	0.5 mg/kg IM to reverse xylazine ²³²
Goat	0.125 mg/kg IV ^{45, 135}
Mouse	0.2 mg/kg IP ²³⁴
Rabbit 1	0.2 mg/kg IV ³⁶ IM ⁴⁰
Rabbit 2	0.2-1.0 mg/kg IM, IV ²³³
Rat 1	2.1 mg/kg IV for ketamine/xylazine combination ⁴⁵
Rat 2	0.2 mg/kg PI ²³⁴
Sheep	0.125 mg/kg IV ^{45, 135}
Swine 1	0.125 mg/kg IV ⁷⁵
Swine 2	1.0 mg/kg IV ²²¹

Comments

All	Administer slowly intravenously
Goat	May be ineffective in sheep ¹³⁵
Rabbit 1	Mild reversal. Decreases arousal time.
Sheep	May be ineffective in sheep ¹³⁵

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