

Utarbeidet av AA	Standard operasjonsprosedyre Analgesic protocols for rodents	Versjon: 4,0 Utarbeidet: 27.05.2014 Revidert: 30.10.2014 Revidert: 09.11.2020 Revidert: 03.09.2024
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General anesthesia produces loss of consciousness, but in unconscious animals, painful stimuli will still be transmitted and processed by the central nervous system. Central hypersensitivity can develop in the spinal cord and brain, causing perception of postoperative pain to be increased. Some of the drugs used for general anesthesia (such as Xylazine and Medetomidine) have some analgesic properties, but there is often a need for additional analgesia when performing surgery. The choice of drug and the duration of treatment must be adjusted to the procedure and the expected level of nociception.

Information about the recommended drugs

Opioids: Exert their effects on the opiate receptors in the central nervous system. Are effective for acute, deep, or visceral pain. Potential side effects: respiratory depression, nausea, pica (rats), constipation. At CoMed, Buprenorphine (Temgesic/Vetergesic) is the standard opioid drug for rodents. The drug is usually injected SC but can also be given orally to rats (PO). The oral treatment has a longer duration of effect.

NSAIDs: Act primarily to reduce the synthesis of prostaglandins. Are effective for pain associated with inflammation. Potential side effects: gastric or intestinal ulceration, changes in renal function, changes in platelet function. Meloxicam (Metacam) is the standard NSAID available at CoMed. The drug is injected SC, but Meloxicam is also available in a solution for oral treatment.

Local anesthetics: Have their effect on the nerves at the site of injection. Can reduce the need for frequent redosing of opioids and NSAIDs. Systemic toxicity (seizures) can result from over dosage or accidental IV injection. Lidocain (Xylocain) and bupivacain (Marcain) are the most used drugs at CoMed. Choose the longer acting bupivacain if the duration of pain is expected to exceed one hour or if the length of surgery is longer than 1 hour. When used in combination (lidocain plus bupivacain in the same syringe) the benefits of both drugs can be achieved, namely rapid onset with long duration of local anesthesia. The drugs are usually injected SC.

When diluting drugs, make sure to transfer solutions aseptically, label the vial with drug name, concentration and date of dilution and store it in the refrigerator. Discard solution in 7 days.

Dosages and calculations

Systemic analgesics

Doses:

Drug	Mouse (mg/kg)	Rat (mg/kg)	Duration	Type of drug
Buprenorphine (Temgesic/Vetergesic)	0.05-0.1 SC	0.01-0.05 SC 0,4 mg/kg PO	4-8 h 24 h	Opioid
Meloxicam (Metacam)	2-5 SC/PO	1-2 SC/PO	12-24 h	NSAID

Dilutions:

Temgesic/Vetergesic:

For SC treatment, dilute the 0,3 mg/ml drug 1:10 to a solution of 0,03 mg/ml. The recommended volumes below are equal to a dose of 0,1 mg/kg for mice and 0,05 mg/kg for rats.

For PO treatment, Temgesic sublingual tablets are dissolved in tap water and given by gavage. The tablets are available in 0,2 mg and 0,4 mg. A 0,2 mg tablet equals a dose for 500 g rat. Tablets are only available on request.

Metacam: For SC treatment: Dilute the 5 mg/ml drug 1:10 to a solution of 0,5 mg/ml. The recommended volumes below are equal to a dose of 2 mg/kg for mice and 1 mg/kg for rats. Metacam for PO treatment is only available on request.

Recommended volumes for SC inj:

Weight of Rat	Diluted Temgesic/Vetergesic 0,03 mg/ml	Diluted Metacam 0,5 mg/ml
250 g	0,43 ml	0,5 ml
300	0,50 ml	0,6 ml
350 g	0,60 ml	0,7 ml

Weight of Mouse	Diluted Temgesic/Vetergesic 0,03 mg/ml	Diluted Metacam 0,5 mg/ml
25 g	0,08 ml	0,10 ml
35 g	0,12 ml	0,15 ml

Local anesthetics

Doses:

Drug	Onset	Duration	Rec. dose	Toxic dose
Lidocain (Xylocain)	1-3 min	20-40 min	2-4 mg/kg	10 mg/kg
Bupivacain (Marcain)	20 min	6-8 hours	1-2 mg/kg	6 mg/kg

Dilutions:

Lidocain: Dilute the 20 mg/ml lidocain 1:10 to get final concentration of 2 mg/ml. The recommended volumes below are equal to 2 mg/kg.

Bupivacain: Dilute the 2,5 mg/ml bupivacain 1:5 to get final concentration of 0.5 mg/ml. The recommended volumes below are equal to 1 mg/kg. For rats, dilution might not be necessary or practical, depending on the length of your incision.

Recommended volumes:

Weight of Rat	Diluted lidocain 2 mg/ml: *	Undiluted bupivacain 2,5 mg/ml: *
250 g	0,25 ml	0,10 ml
300 g	0,30 ml	0,12 ml
350 g	0,35 ml	0,14 ml

Weight of Mouse	Diluted lidocain 2 mg/ml: *	Diluted bupivacain 0,5 mg/ml: *
25 g	0,025 ml	0,05 ml
35 g	0,035 ml	0,07 ml

*More NaCl can be added to the syringe to get a more practical volume for injection

Recommended analgesic protocols for mice and rats**Mild pain**

Preemptive (once)	Lidocain/bupivacaine as local infiltration AND meloxicam
Post-surgical (if necessary)	Meloxicam once

Mild to moderate pain – option 1

Preemptive (once)	Lidocain/bupivacaine as local infiltration AND buprenorphine
Post-surgical	Buprenorphine for 1-2 days

Mild to moderate pain – option 2

Preemptive (once)	Lidocain/bupivacaine as local infiltration AND buprenorphine AND meloxicam
Post-surgical	Buprenorphine or meloxicam, or both, for 1-2 days

Moderate to severe pain

Preemptive (once)	Lidocain/bupivacaine as local infiltration AND buprenorphine AND meloxicam
Post-surgical	Buprenorphine for 2 days AND meloxicam (highest dose) for 2-3 days
	AND consider morphine for severe pain (not standard at CoMed), for as long as needed

Examples of mild, moderate and severe post-surgical pain in mice and rats*

Mild:

- Subcutaneous pump or pellet implantation
- Tail clipping

Moderate:

- Vascular catheterization
- Embryo transfer
- Ovariectomy
- Orchidectomy
- Craniotomy

Severe:

- Orthopedic Procedures
- Thoracotomy
- Organ transplantation
- Major laparotomy procedures

*IMPORTANT CONSIDERATION: This is a guideline for classifying pain categories to common surgical procedures in mice and rats. The classification must be considered against other factors, such as length of procedure, extent of tissue dissection, degree of blood loss, materials implanted, unexpected surgical events, health status, age, strain, and surgeon's experience and skill.

When considering the analgesic protocol, possible side effects and effects on your scientific data must also be taken into consideration.