1. ***Purpose:*** To provide instructions for the administration of different formulations of analgesics to hamsters for pain control. To meet or exceed the standards as set out in the CCAC Guide to the Care and Use of Experimental Animals.

2. ***Responsibility:*** Animal care staff, veterinarians, and trained individuals listed on an approved Animal Utilization Protocols (AUPs). All animal users administering drugs to hamsters must have successfully completed Hamster A/B training courses.

3. ***Introduction*:** Hamsters should be provided with analgesia for painful procedures as directed by the Animal Care Committee (ACC), both to prevent suffering and to decrease scientific variability associated with distress. The most used analgesics in laboratory rodent medicine are non-steroidal anti-inflammatories (NSAIDS), opioids, and local anesthetics.

   Planned use of analgesics for experimental purposes (e.g., for surgery) must be outlined in the Animal Utilization Protocol (AUP) procedure section. Analgesics may also be recommended by a veterinarian as part of a treatment plan.

4. ***Procedures*:**

GUIDING PRINCIPLES OF PAIN CONTROL

- For mild pain, a single analgesic agent may be used, i.e., either an opioid or an NSAID.
    - E.g., subcutaneous implant, intramuscular injection, cancer cell injection, tracheal injections, skin biopsy
- For moderate-severe pain, a multi-modal analgesic protocol that includes both an NSAID and an opioid should be implemented.
    - E.g., castration, ovariectomy, laparotomy, jugular catheter placement, craniotomy +/- implant, spared nerve injury, thoracotomy
    - Where surgery is involved, a local anesthetic should be included in the protocol
    - These three classes of analgesics (NSAIDS, opioids, local) can be safely combined
- Anesthesia refers to the loss of consciousness and sensation but does not necessarily entail the loss of sensitivity to pain - analgesia should always be provided with anesthesia.
- Preventative analgesia that is provided before pain circuits are activated vs. after observing clinical signs of pain, is strongly preferred for both humane and scientific reasons:
    - Providing analgesia before a painful procedure and re-dosing at appropriate intervals reduces the intensity of the painful stimulus, which decreases the amount of anesthetic agent required to maintain a surgical plane of anesthesia (in turn decreasing the risk of an anesthetic overdose), and smooths recovery
    - Analgesia should be provided immediately after animals are anesthetized for surgery, i.e., before shaving, surgical prep etc., to maximize the time between administration and the first incision. Analgesia can also be provided prior to anesthesia if the animal is positively habituated to handling.
- After a procedure, animals should be monitored using validated species-specific indicators of pain so that follow-up analgesia can be provided if necessary.
- Animals who are painful are at risk of becoming dehydrated. Animals placed under general anesthesia for a painful procedure should receive a rehydration injection of warmed sterile, isotonic fluids (e.g., 0.9% sodium chloride) while anesthetized
    - 10-20 mL/kg is an appropriate starting point; consult with a veterinarian if multiple anesthesia events will occur within a week.
- Consideration should be given to attempting a non-invasive administration method, especially in animals that are handled routinely and habituated to syringe feeding.
- Research into ideal dosing and administration of analgesics for rodents is ongoing and recommendations may change.
- Analgesic doses, standard protocols for different predicted levels of pain, and dilution instructions can be found in Appendices 1-3, respectively. Changes must be justified to the ACC.

For more detailed information on the different classes of analgesics used in rodents (NSAIDS, opioids, and local anesthetics), dilutions, and voluntary oral administration please see ACS.814 – Administration of pain control to rats and mice.

References

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Foley, P. L., Kendall, L. V., & Turner, P. V. (2019). Clinical Management of Pain in Rodents. Comparative Medicine, 69(6), 468–489. https://doi.org/10.30802/AALAS-CM-19-000048

UBC Animal Care Committee: Rodent Procedures Classifications and Analgesia Requirements https://animalcare.ubc.ca/sites/default/files/documents/Guideline-Surgical%20Class%20and%20Analgesia%20Guidelines%20%282016%29.pdf

Vin Formulary for Exotic Animals

Appendix 1 – Doses and dilutions for common analgesics in hamsters
SOP.ACC.815.Administration of pain control to hamsters 2024

Table A1.1. Details of administration

Formulation	Drug class	Dose (mg/kg)	Frequency	Sto3k concentration (mg/mL)	Dilution (if necessary, mg/mL)	Route(s)	Refrigeration required (stock)?
Carprofen	NSAID	5	Every 24 hrs	50	5	SQ, oral in water[+]	Yes
Meloxicam – injectable	NSAID	1-2	Every 24 hrs	5	0.5	SQ	No
Meloxicam – oral	NSAID	1-2	Every 24 hrs	1.5	N/A	Voluntary oral	No
Buprenorphine	Opioid (controlled)	0.1	Every 6-8 hrs	0.3	0.03	Injectable	No
Lidocaine	Local anesthetic	Maximum 4 mg/kg[**]	Once at surgical site	20 (2%)	5 (0.5%)	Local infiltration (SQ)	No
Bupivacaine	Local anesthetic	Maximum 2 mg/kg[**]	Once at surgical site	5 (0.5%)	2.5 (0.25%)	Local infiltration (SQ)	No

[*]Risk of side effects increases with higher doses – consider using multimodal analgesia to allow effective use of lower doses.

[**] **Do not exceed.** Dose can be divided if multiple incisions are planned, and a lower volume can be used for a small incision.

Table A1.2. Example dose volumes of carprofen and meloxicam for hamsters using different dilutions and routes

Weight (g)	Carprofen diluted (5 mg/mL) Injectable use	Meloxicam diluted (0.5 mg/mL) Injectable use	Meloxicam undiluted (1.5 mg/mL) Oral use	Buprenorphine diluted (0.03 mg/mL) Injectable use	Lidocaine (0.5%) Injectable use	Bupivacaine (0.25%) Injectable use
90	0.09 mL	0.18 – 0.36 mL	0.06 – 0.12 mL	0.30 mL	MAX 0.07 mL	MAX 0.07 mL
100	0.10 mL	0.20 – 0.40 mL	0.07 – 0.13 mL	0.33 mL	MAX 0.08 mL	MAX 0.08 mL
110	0.11 mL	0.22 – 0.44 mL	0.07 – 0.15 mL	0.37 mL	MAX 0.09 mL	MAX 0.09 mL
120	0.12 mL	0.24 – 0.48 mL	0.08 – 0.16 mL	0.40 mL	MAX 0.10 mL	MAX 0.10 mL
130	0.13 mL	0.26 – 0.52 mL	0.09 – 0.17 mL	0.43 mL	MAX 0.10 mL	MAX 0.10 mL
140	0.14 mL	0.28 – 0.56 mL	0.09 – 0.19 mL	0.47 mL	MAX 0.11 mL	MAX 0.11 mL
150	0.15 mL	0.30 – 0.60 mL	0.10 - 0.2 mL	0.50 mL	MAX 0.12 mL	MAX 0.12 mL

Appendix 2 – Standard analgesia and monitoring requirements for rodent procedures
SOP.ACC.815.Administration of pain control to hamsters 2023

Analgesia requirements		
	Minor pain[+]	**Moderate – severe pain[+]**
Example procedures	• Subcutaneous implant • Intramuscular injection • Cancer cell injection • Tracheal injection • Skin biopsy	• Castration • Ovariectomy • Laparotomy • Thoracotomy • Jugular catheter placement • Craniotomy +/- implant • Spared nerve injury
Standard pre-procedural analgesic regimen	• Buprenorphine[*] (SR or regular depending on procedure) OR NSAID • +/- Lidocaine or bupivacaine (for surgery, 5 or10 mins pre incision at planned site, respectively)	• SR buprenorphine[*] (immediately after induction of anesthesia) AND • Bupivacaine (10 mins pre incision at planned site)
Standard post-procedural Analgesic regimen	• +/- Buprenorphine[*] OR NSAID if painful on assessment	• NSAID (immediately after procedure, while under anesthesia) at loading dose AND • NSAID again at 24 and 48 hours at maintenance dose • +/- SR buprenorphine at 48 hours if painful on assessment
Total # of days (including day 0)	1	3 – 5
Monitoring requirements		
	Minor pain	**Moderate – severe pain**
# Total # of days (including day 0)	2	5 – 7
# Of times/day	1 – 2	2 – 3

[+]Any procedure may warrant reclassification into a higher category by the ACC based on the severity of the anticipated pain level, which can vary according to skill of surgeon.

[*]Or other appropriate opioid, administered at suitable intervals

Appendix 3 - Dilution instructions and drug labels
SOP.ACC.815.Administration of pain control to hamsters 2023

Table A.3.1: Drug dilution instructions and example calculations

Calculation steps	General formula	Carprofen (for 10 mL of solution)	Meloxicam (for 10 mL of solution)	Buprenorphine (for 10 mL of solution)	Lidocaine (for 4 mL of solution)	Bupivacaine (for 4 mL of solution)
Step 1: confirm stock and desired concentration	Mg/mL stock to mg/mL dilution	50 mg mL to 5 mg/mL	5 mg/mL to 0.5 mg/mL	0.3 mg/mL to 0.03 mg/mL	20 mg/mL to 5 mg/mL*	5 mg/mL to 2.5 mg/mL
Step 2: calculate volume of stock solution	**mL stock =** $\frac{\text{concentration required (mg/mL)}}{\text{stock concentration (mg/mL)}}$ * volume required (mL)	= (5 / 50) * 10 **= 1 mL stock**	= (0.5 / 5) * 10 **= 1 mL stock**	= (0.03 / 0.3) * 10 **= 1 mL stock**	= (5 / 20) * 4 **= 1 mL stock**	= (2.5 / 5) * 4 **= 2 mL stock**
Step 3: calculate volume of sterile diluent	**mL dilutant =** volume required (mL) – volume of stock (mL)	= 10 – 1 **= 9 mL saline**	= 10 – 1 **= 9 mL saline**	= 10 – 1 **= 9 mL saline**	= 4 - 1 **= 3 mL saline**	= 4 - 2 **= 2 mL saline**
Step 4: confirm dilution concentration	**mg/mL dilution =** $\frac{\text{Volume stock (mL) * concentration stock (mg/mL)}}{\text{Total dilution volume (mL)}}$	= (1 * 50) / 10 **= 5 mg/mL**	= (1 * 5) / 10 **= 0.5 mg/mL**	= (1 * 0.3) / 10 **= 0.03 mg/mL**	= (1*20) / 4 **= 5 mg/mL**	= (2 * 5) / 4 **= 2.5 mg/mL**
Step 5: LABEL AND STORE IN A GLASS, AMBER, MULTI-USE VIAL - PROTECT FROM LIGHT Label contents: drug name, concentration, stock concentration, volume prepared, date of preparation, discard date (usually 30 days), initial of preparer, additional storage instructions Protect label with clear tape or use a heat fixed label						

*Or 2.5 mg/ml for very small mice, see Table A3.2

Figure A.3.1. Example drug dilution label.