

## STANDARD OPERATING PROCEDURE

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**TITLE:** Post-Operative Analgesia in Large Mammals, Western  
**SOP NO.:** 356-01  
**REVISION:**  
**EFF. DATE:** May 2010  
**SUPERSEDES:** NA

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### APPROVALS

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Reviewed by (print name): S. Fussell Dept.: ACVS

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Signature: \_\_\_\_\_ Date: \_\_\_\_\_

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### 1.0 PURPOSE

- 1.1 To outline standards of care to ensure optimal *post-operative analgesia in large mammals* used in biomedical research, testing or teaching at UWO.
- 1.2 Animal welfare regulations require that procedures involving research animals avoid or minimize discomfort, distress, and pain.
- 1.3 Pain causes many physiologic alterations, therefore the most sound scientific data is retrieved from research subjects that do not suffer from post-operative pain.
- 1.4 Procedures causing *more than momentary or slight pain and discomfort* to research animals require the appropriate use of sedatives, anesthetics, or analgesics.
- 1.5 Because the anatomic structures and neurophysiologic mechanisms leading to the perception of pain are similar in humans and non-human animals, it is reasonable to assume that if a stimulus is painful to humans, is damaging or potentially damaging to tissues, or induces escape and emotional responses in an animal, it must be considered to be painful to that animal.
- 1.6 Failure to provide post-operative analgesics is a serious offence according the requirements of **University Council on Animal Care**, the guidelines of the **Canadian Council on Animal Care**, the **Ontario Animals for Research Act** and the **Criminal Code of Canada**.

### 2.0 SCOPE

- 2.1 This SOP details commonly used *post-operative analgesic regimes in large mammals*. Investigators may refer to this SOP in their Animal Use Protocol (AUP) or discuss an alternate SOP with an ACVS veterinarian prior to submission of their AUP, related renewals or modifications and obtain approval from the Animal Use Sub-committee (AUS) on that alternate SOP.
  - 2.2 Analgesic regimes used to treat pain and/or distress associated with *non-surgical* procedures is not considered in this SOP.
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## 3.0 RESPONSIBILITIES

- 3.1 Investigator
  - 3.1.1 Ensure that an appropriate post-operative analgesic regime is approved on their AUP.
  - 3.1.2 Ensure that the person performing the procedure is properly trained, is listed on the approved AUP and has access to the appropriate analgesic drugs.
  - 3.1.3 Ensure appropriate approvals from Health Canada for the use of opioids (ie. fentanyl, buprenorphine) in his/her research laboratory
- 3.2 Person administering the post-operative analgesic.
  - 3.2.1 Ensure timely administration of post-operative analgesics as outlined in the approved AUP.
  - 3.2.2 Contact an ACVS veterinarian if the animal exhibits signs of pain (see point 7.3) in spite of analgesic administration. The animal may require additional medications or treatments.

## 4.0 PROCEDURES

- 4.1 **Level 1 Procedures**
  - 4.1.1 **Representative Procedures:** Orthopedic (including cranial procedures, thoracotomy and limb Amputation)
  - 4.1.2 **Minimum Analgesic Requirement:** Pre-emptive administration of an NSAID\* or opioid, then additional administration of an NSAID or opioid, such that effective analgesic levels maintained for **72 hrs post-operatively**
- 4.2 **Level 2 Procedures**
  - 4.2.1 **Representative Procedures:** Laparotomy, Procedures involving skin incision and extensive tissue manipulation
  - 4.2.2 **Minimum Analgesic Requirement:** Pre-emptive administration of an NSAID\* or opioid, then additional administration of an NSAID or opioid, such that effective analgesic levels maintained for **48 hrs post-operatively**
- 4.3 **Level 3 Procedures**
  - 4.3.1 **Representative Procedures:** Skin incision and vessel cannulation, skin incision and subcutaneous implant
  - 4.3.2 **Minimum Analgesic Requirement:** Pre-emptive administration of an NSAID\* or Buprenorphine, then additional administration of an NSAID or opioid, such that effective analgesic levels maintained for **24 hrs post-operatively**

**\*pre-emptive unless specific otherwise, see recommendation for cats**

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### 5.0 RECOMMENDED DRUGS, DOSES AND SCHEDULE FOR LARGE ANIMAL SPECIES

#### 5.1 For swine:

##### 5.1.1 *Recommended opioid:*

Fentanyl patch and buprenorphine combination: Place fentanyl patch at the time of surgery, to deliver 50 µg/hour (swine ≤ 150 kg) or 2 x 100 µg/hour patches (swine ≥ 150 kg); takes 24 hours to reach effective blood levels, during which time, opioid analgesia provided by pre-emptive (at time of induction) dose of buprenorphine then 2 post-operative doses 8 hours and 16 hours following at 0.02 mg/kg SC.

##### 5.1.2 *Recommended NSAID\*\*:*

Meloxicam 0.2 – 0.3 mg/kg SC or Ketoprofen 1.0 – 2.0 mg/kg SC, pre-emptively (at time of induction), then post-operatively every 24 hours, up to 4 days  
\*\* Note that prolonged use (> 4 days) of any NSAID can cause renal, gastrointestinal and other problems.

##### 5.1.3 *Recommended local anesthetic:*

Bupivacaine: dilute to 0.25 – 0.5%, infiltrate locally prior to making skin incision, slower onset of action (ie. 5 minutes) compared to lidocaine however longer (6-8 hr) duration of analgesia in larger mammals. Use a maximum of 2 mg/kg per patient to avoid cardiotoxicity.

#### 5.2 For cats:

##### 5.2.1 *Recommended opioid:*

Fentanyl patch and buprenorphine combination: Place fentanyl patch at the time of surgery to deliver 25 µg/hour (cover ½ patch for cats ≤ 2 kg); takes 12 hours to reach effective blood levels, during which time, the opioid analgesia is provided by a pre-emptive dose of buprenorphine then a second dose 6 hours following at 0.02 mg/kg orally (i.e. buccal absorption).

##### 5.2.2 *Recommended NSAID\*:*

Ketoprofen 1.0 mg/kg SC, post-operatively\*\*, then 0.5, 0.25 mg/kg SC at 24 and 48 hrs following.

Tolfenamic acid 4 mg/kg SC or PO post-operatively and at 24 and 48 hrs following.

\*Note that prolonged use (> 4 days) of any NSAID can cause renal, gastrointestinal and other problems.

\*\*Never administer NSAIDs pre-emptively in cats due to potential for renal damage in the face of hypotension

##### 5.2.3 *Recommended local anesthetic:*

Bupivacaine: dilute to 0.25 – 0.5%, infiltrate locally prior to making skin incision, slower onset of action (ie. 5 minutes) compared to lidocaine however longer (6-8 hr) duration of analgesia in larger mammals. Use a maximum of 2 mg/kg per patient to avoid cardiotoxicity.

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### 5.3 **For dogs:**

#### *5.3.1 Recommended opioid:*

Fentanyl patch and buprenorphine combination: Place fentanyl patch at the time of surgery, to deliver 4 µg/kg/hr; takes 24 hours to reach effective blood levels, during which time, opioid analgesia provided by a pre-emptive (at time of induction) dose of buprenorphine then 2 post-operative doses 8 hours and 16 hours following at 0.01 – 0.02 mg/kg SC\*.

Note: buccal delivery is not suitable for dogs.

#### *5.3.2 Recommended NSAID\*:*

Meloxicam 0.2 mg/kg SC or PO pre-emptively (at time of induction), then 0.1 and 0.05 mg/kg at 24 hr and 48 hr, respectively.

\* Note that prolonged use (> 4 days) of any NSAID can cause renal, gastrointestinal and other problems.

#### *5.3.3 Recommended local anesthetic:*

Bupivacaine: dilute to 0.5 – 1.0%, infiltrate locally prior to making skin incision, slower onset of action compared to lidocaine however longer (6-8 hr) duration of analgesia in larger mammals.

Use a maximum of 2 mg/kg per patient to avoid cardiotoxicity.

### 5.4 **For sheep:**

#### *5.4.1 Recommended opioid:*

Fentanyl patch and buprenorphine combination: Place fentanyl patch at the time of surgery, to deliver 50 µg/hour; takes 24 hours to reach effective blood levels, during which time, opioid analgesia provided by pre-emptive (at time of induction) dose of buprenorphine then 2 post-operative doses 8 hours and 16 hours following at 0.01 – 0.015 mg/kg SC.

#### *5.4.2 Recommended NSAID:*

Aspirin 100 mg/kg PO, post-operatively every 12 hours or Flunixin meglumine 1.1 mg/kg IV, pre-emptively (at time of induction), then post-operatively every 24 hours

#### *5.4.3 Recommended local anesthetic:*

Bupivacaine: dilute to 0.25 – 0.5%, infiltrate locally prior to making skin incision, slower onset of action (ie. 5 minutes) compared to lidocaine however longer (6-8 hr) duration of analgesia in larger mammals.

Use a maximum of 2 mg/kg per patient to avoid cardiotoxicity.

### 5.5 **For non-human primates:**

#### *5.5.1 Recommended opioid:*

Buprenorphine: 0.02 – 0.03 mg/kg SC, pre-emptively (at time of induction), a post-operative dose 6 hours following initiation of surgery, and then a second dose 8 hours later, then every 12 hours for 72 hours

#### *5.5.2 Recommended NSAID:*

Meloxicam 0.2 mg/kg SC or PO, pre-emptively (at time of induction), then 0.1 and 0.05 mg/kg at 24 hr and 48 hr, respectively.

#### *5.5.3 Recommended local anesthetic:*

Bupivacaine: dilute to 0.25 – 0.5%, infiltrate locally prior to making skin incision, slower onset of action (ie. 5 minutes) compared to lidocaine however longer (6-8 hr) duration of analgesia in larger mammals.

Use a maximum of 2 mg/kg per patient to avoid cardiotoxicity.

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5.6 **For rabbits:**

*5.6.1 Recommended opioid:*

Fentanyl patch and buprenorphine combination: Place fentanyl patch at the time of surgery to deliver 25 µg/hour (cover ½ patch for rabbits ≤ 2 kg); takes 24 hours to reach effective blood levels, during which time, opioid analgesia provided by a pre-emptive (at time of induction) dose of buprenorphine then 2 post-operative doses 8 hours and 16 hours following at 0.01 -0.02 mg/kg SC\*.

*5.6.2 Recommended NSAID\*:*

Meloxicam 0.2 mg/kg SC or PO pre-emptively (at time of induction), then 0.1 and 0.05 mg/kg at 24 hr and 48 hr, respectively.

\* Note that prolonged use (> 4 days) of any NSAID can cause renal, gastrointestinal and other problems.

*5.6.3 Recommended local anesthetic:*

Bupivacaine: dilute to 0.5 – 1.0%, infiltrate locally prior to making skin incision, slower onset of action compared to lidocaine however longer (6-8 hr) duration of analgesia in larger mammals. Use a maximum of 2 mg/kg per patient to avoid cardiotoxicity.

## 6.0 SUMMARY

6.1 This SOP outlines a regime for post-operative analgesic administration for larger mammals.

## 7.0 REVISION HISTORY

Revision	Reason(s) for Revision	Initiated by

## 8.0 REFERENCES / ASSOCIATED MATERIALS

### 8.1 Definitions

8.1.1 Pre-emptive: defined as SQ, IM or IP analgesic administration shortly (ie. up to 30 minutes) before making an incision or other painful procedure.

8.1.2 NSAID: Non-steroidal anti-inflammatory drug

8.1.3 SQ: subcutaneous

8.1.4 IM: intramuscular

8.1.5 IP: intraperitoneal

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### 8.2 Pain Assessment Protocol

From Recognition and Alleviation of Pain in Laboratory Animals (2009), Institute for Laboratory Animal Research (ILAR) page 49

The following approach can be helpful for assessing pain in particular animal models:

Prepare a checklist of the examinations to be undertaken, allow space for a general comment, and perhaps include an overall assessment tool (e.g., a visual analogue scale (VAS) score sheet). Familiarize all staff who will be involved in the assessment with this checklist and any other assessment tools that will be used.

Whenever possible, the same staff member should conduct each assessment of the same animal. Specific training must be provided for new or inexperienced staff.

Begin by observing the animal without disturbing it. If the animal's behavior changes markedly in the presence of an observer (e.g., as is the case with nonhuman primates, rabbits, and guinea pigs) it may be more practical to assess postoperative or postprocedural behavior by setting up a video camera or viewing panel.

Assess the animal's response to the observer (the technician who routinely cares for the animal may be best able to assess this).

Examine the animal and assess its response to gentle palpation or handling of any presumed painful areas (e.g., the site of surgery, the site of a lesion) when practicable.

Weigh the animal, record its food and water consumption if possible, and examine the cage or pen for signs of normal or abnormal urination or defecation.

Administer analgesic treatment if necessary, and repeat the assessment outlined above 30-60 minutes after treatment to determine whether the drug and the dose administered have been effective. In the absence of certainty about the presence of pain, assessing the response to an analgesic can be helpful.

Review these protocols regularly.

Remember that:

the signs described here can be caused by conditions other than pain,  
the signs may vary between animals of the same species, even after the same procedure, and  
the signs will vary between different strains and breeds.

8.2.1 Research and/or animal care staff must contact ACVS veterinarians if signs of pain are evident at any point during the post-operative procedure.

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### 8.3 Behavioral signs of persistent pain

From Recognition and Alleviation of Pain in Laboratory Animals (2009), Institute for Laboratory Animal Research (ILAR) page 50

**Table 3-1 Behavioral signs of persistent pain**

<u>Sign</u>	<u>Explanation</u>
Guarding	The animal alters its posture to avoid moving or causing contact to a body part, or to avoid the handling of that body area.
Abnormal appearance	Different species show different changes in their external appearance, but obvious lack of grooming, changed posture, and a changed profile of the body are all observable signs. In species capable of some degree of facial expression, the normal expression may be altered.
Altered behavior	Behavior may be depressed; animals may remain immobile, or be reluctant to stand or move even when disturbed. They may also exhibit restlessness (e.g., lying down and getting up, shifting weight, circling, or pacing) or disturbed sleeping patterns. Large animal species may grunt, grind their teeth, flag their tail, stomp, or curl their lips (especially sheep and goats). Primates in pain often roll their eyes. Animals in pain may also show altered social interactions with others in their group.
Vocalization	An animal may vocalize when approached or handled or when a specific body area is touched or palpated. It may also vocalize when moving to avoid being handled.
Mutilation	Animals may lick, bite, scratch, shake, or rub a painful area.
Sweating	In species that sweat (horses), excessive sweating is often associated with some types of pain (e.g., colic).
Inappetence	Animals in pain frequently stop eating and drinking, or markedly reduce their intake, resulting in rapid weight loss.

### 8.4 References

- 8.4.1 [Recognition and Alleviation of Pain in Laboratory Animals](#), Institute for Laboratory Animal Research (ILAR) The National Academies Press, Washington DC, 2009
- 8.4.2 [http://www.iacuc.ucsf.edu/Proc/awA&A\\_O.asp](http://www.iacuc.ucsf.edu/Proc/awA&A_O.asp)
- 8.4.3 Egger DM, Glerum L, Haag EM, Wohrbach BW. Efficacy and cost-effectiveness of transdermal fentanyl patches for the relief of post-operative pain in dogs after anterior cruciate ligament and pelvic limb repair. 2007. *Veterinary Anaesthesia and Analgesia*. 34: 200-208
- 8.4.4 Riviere JE, Papich MG. Potential and problems of developing transdermal patches for veterinary applications. *Adv Drug Deliv Rev*. 2001 50:175-203.