1. PURPOSE

The intent of this Standard Operating Procedure (SOP) is to describe methods of assessing pain in cats and mitigating pain by administration of analgesic medications.

2. RESPONSIBILITY

Principal investigators (PI) and their research staff, veterinary care staff.

3. GENERAL CONSIDERATIONS

3.1. A procedure which would be expected to be painful if it were done on humans must be considered painful to the animal.
3.2. When there is a question of whether or not a procedure is painful, the animal should receive the benefit of analgesia.
3.3. Analgesia should be provided at an appropriate dose and frequency to control pain.
3.4. Any deviation from this procedure must be justified by the investigator and approved by the appropriate Facility Animal Care Committee (FACC).

4. PAIN RECOGNITION AND ASSESSMENT

4.1. Adapt the frequency of observation to the invasiveness of the procedure (minimum once a day).
4.2. Start by observing the animal from a distance so the animal's behavior is not altered by the presence of the observer. Then proceed to observe the animal more closely.
4.3. Look for any changes in behavior. Report animals which appear to be in pain to the veterinary care staff.
4.4. Common clinical signs indicative of pain or distress include:
   4.4.1. Avoidance
   4.4.2. Vocalization
   4.4.3. Eyebrow movements
   4.4.4. Escape, aggressiveness
   4.4.5. Spontaneous activities are reduced; the animal is isolated from the social group
   4.4.6. Apathy, anxiety, whining
   4.4.7. Altered gait
   4.4.8. Excessive nibbling, licking, scratching, rubbing
   4.4.9. Eyes are semi-closed
   4.4.10. Head shaking (ear pain)
   4.4.11. Reduced appetite and subsequent weight loss
   4.4.12. Excessive reaction to otherwise normal stimulus/hypersensitivity

   Note: The most reliable signs of pain and distress are the changes in behavior. This implies a good knowledge of species and individual normal behavior by the observer.

4.5. The cat grimace scale is a standardized behavioral coding system that demonstrates facial expressions which can be used to assess pain in the cat. Refer to Annex 1.
5. ANALGESIA PLAN

5.1. If possible, provide analgesia before the painful stimulus, as it is more effective in preventing pain (e.g. give analgesic before surgery).

5.2. Use a combination of analgesics, which is often more effective than using a single agent. For example, a combination of opioid, non-steroidal anti-inflammatory drug (NSAID), and infiltration of a local analgesic.

5.3. For surgical procedures, extend analgesia from pre-op to 72 hours post-op, unless specified otherwise in the Animal Use Protocol (AUP) and approved by the FACC.

6. LOCAL ANALGESIA

6.1. Infiltrate or apply local analgesic to areas where a painful stimulus may be induced. Repeat application of local agent at specified intervals to maintain analgesia. In some cases a sedative is recommended when using local analgesia.

<table>
<thead>
<tr>
<th>Analgesic</th>
<th>Dose</th>
<th>Route</th>
<th>Duration</th>
<th>Note</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lidocaine</td>
<td>&lt; 2 mg/kg</td>
<td>SC, Infiltration of surgical wounds</td>
<td>30–60 min.</td>
<td>Use lidocaine HCl 2% (20mg/ml) injectable solution. Because this drug is acidic, it is recommended to dilute it 3:1 with sodium bicarbonate injectable solution (at 5 or 8.4%). Dilution must be prepared immediately before use and should not be stored. Diluted solution is as effective but induction of analgesia is slightly prolonged. *Dilution with sodium bicarbonate is not necessary if lidocaine is to be administered to an anesthetized animal.</td>
</tr>
<tr>
<td>Bupivacaine</td>
<td>&lt; 2 mg/kg</td>
<td>SC, Infiltration of surgical wounds</td>
<td>3–4 hr.</td>
<td>Use bupivacaine HCl 0.50% (5mg/ml) injectable solution. Same comment as for lidocaine.</td>
</tr>
<tr>
<td>* Lidocaine-bupivacaine mixture</td>
<td>&lt; 2 mg/kg</td>
<td>SC, Infiltration of surgical wounds</td>
<td>30 min. to 4 hrs.</td>
<td>Same comment as for lidocaine. Combining both drugs allows for rapid induction and prolonged effect. Use a 1:1 mixture of lidocaine HCl 2% (20mg/ml) injectable solution and bupivacaine HCl 0.50% (5mg/ml) injectable solution. Discard mixture after 3 months.</td>
</tr>
<tr>
<td>EMLA cream</td>
<td>Thick spread</td>
<td>Topical</td>
<td>30–60 min.</td>
<td>Shave fur and apply a thick layer of cream ideally 10 minutes before the painful procedure. Apply only to intact skin.</td>
</tr>
</tbody>
</table>

*most commonly used
### 7. GENERAL ANALGESIA

<table>
<thead>
<tr>
<th>Analgesic</th>
<th>Dose</th>
<th>Route</th>
<th>Frequency</th>
<th>Note</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Buprenorphine</em></td>
<td>0.005–0.01 mg/kg</td>
<td>Sublingual, gingival, IM, IV</td>
<td>8–12 hr.</td>
<td>Controlled drug.</td>
</tr>
<tr>
<td>Buprenorphine Slow Release (SR)</td>
<td>0.12 mg/kg SC</td>
<td>72 hrs</td>
<td></td>
<td>Buprenorphine SR (3mg/ml) is a sustained release buprenorphine product that has been developed to provide up to 72 hours of analgesia in cats. See administration instructions in section 7.1. Controlled drug.</td>
</tr>
<tr>
<td>Fentanyl Patch</td>
<td>Patch</td>
<td>Every 3 days, starting 24h prior to surgery</td>
<td>25μg (&lt;7.5 kg) Controlled drug.</td>
<td></td>
</tr>
<tr>
<td>Morphine-Lidocaine-Ketamine Combination</td>
<td>2 ml/kg/hr IV</td>
<td>Constant rate infusion</td>
<td>To a 500 ml bag of fluids add morphine 60 mg, lidocaine 750 mg and ketamine 150 mg. Controlled drugs.</td>
<td></td>
</tr>
<tr>
<td>Ketamine</td>
<td>0.1-1.0 mg/kg SC, IM, IV</td>
<td>-</td>
<td></td>
<td>After initial bolus, constant rate infusion of 0.1-0.3 mg/kg/hr. Controlled drug.</td>
</tr>
<tr>
<td>Meloxicam</td>
<td>0.1-0.2 mg/kg SC, IM, PO</td>
<td>once</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*most commonly used

#### 7.1. Administration instructions for buprenorphine slow release (SR):

7.1.1. Avoid contact with the skin to prevent the development of injection site reactions.

7.1.2. Use a 23g needle to draw up and administer the buprenorphine SR.

7.1.3. Administer slowly and finish injecting before the needle is pulled out.

7.1.4. Pinch the injection site for approximately 10 seconds after removing the needle.

#### 7.2. Administration of non-steroidal anti-inflammatory drugs (NSAIDs):

7.2.1. NSAIDs include carprofen, ketoprofen and meloxicam.

7.2.2. Ensure good water intake and monitor hydration status during the treatment period.

7.2.3. To minimize chances for adverse drug interactions, a washout period of 5-7 days is recommended before switching between NSAIDs.

### 8. REFERENCES


2015.04.22  Use lidocaine HCl 2% (20mg/ml) injectable solution.

2015.04.22  Use bupivacaine HCl 0.50% (5mg/ml) injectable solution.

2015.04.22  Lidocaine-bupivacaine mixture: Discard mixture after 3 months.

2016.02.01  Buprenorphine Slow Release (SR)
Dose: 0.12 mg/kg
Route of administration: SC
Frequency: 72-120 hrs
Note: Buprenorphine SR (3mg/ml) is a sustained release buprenorphine product that has been developed to provide up to 120 hours of analgesia in NHPs. See administration instructions in section 7.1.

2016.02.01  Discard mixture after 3 months.

2016.09.02  Buprenorphine Slow Release (SR)
Dose: 0.12 mg/kg
Route of administration: SC
Frequency: 72-120 hrs
Note: Buprenorphine SR (3mg/ml) is a sustained release buprenorphine product that has been developed to provide up to 120 hours of analgesia in NHPs. See administration instructions in section 7.1.

2016.09.02  Lidocaine-bupivacaine mixture:
Use a 1:1 mixture of lidocaine HCl 2% (20mg/ml) injectable solution and bupivacaine HCl 0.50% (5mg/ml) injectable solution.

2016.09.02  EMLA cream: Apply only to intact skin.

2016.09.06  Buprenorphine route of administration: SC-Sublingual, gingival, IM, IV

2017.01.27  Administration of non-steroidal anti-inflammatory drugs (NSAIDs):
NSAIDs include carprofen, ketoprofen and meloxicam.

2017.01.27  Ensure good water intake and monitor hydration status during the treatment period.

2017.01.27  Suspend water restriction prior to administration of NSAIDs.

2017.01.27  To minimize chances for adverse drug interactions, a washout period of 5-7 days is recommended before switching between NSAIDs.

2018.10.12  Do not combine the buprenorphine SR with any other drugs in the same syringe and do not attempt to dilute the formulation.

2020.05.13  Use a combination of analgesics, which is often more effective than using a single agent. For example, a combination of buprenorphine opioid, carprofen non-steroidal anti-inflammatory drug (NSAID), and local infiltration of lidocaine/bupivacaine a local analgesic.


2020.05.13  The cat grimace scale is a standardized behavioral coding system that demonstrates facial expressions which can be used to assess pain in the cat. Refer to Annex 1.

2020.05.13  Annex 1 – Feline Grimace Score Training Manual

2021.11.03  Use a combination of analgesics, which is often more effective than using a single agent. For example, a combination of buprenorphine opioid, carprofen non-steroidal anti-inflammatory drug (NSAID), and local infiltration of lidocaine/bupivacaine a local analgesic.

2021.11.03  Use a 23g needle to draw up and administer the buprenorphine SR with an 18g needle and change to a 23g needle prior to administration.

2021.11.03  Suspend water restriction prior to administration of NSAIDs.
Facial expressions of pain in cats: the development and validation of a Feline Grimace Scale
Marina C Evangelista, Ryota Watanabe, Vivian SY Leung, Beatriz Monteiro, Elizabeth O’Toole, Daniel SJ Pang, Paulo V Steagall

TRAINING MANUAL

FELINE GRIMACE SCALE

Instructions for using the scale

Rate each action unit from 0 to 2:
0 = action unit is absent
1 = moderate appearance of the action unit, or uncertainty over its presence or absence
2 = obvious appearance of the action unit

If the action unit is not visible, please mark the option “not possible to score”
## Feline Grimace Scale

### Ear Position

<table>
<thead>
<tr>
<th>Score</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>Ears facing forward</td>
</tr>
<tr>
<td>1</td>
<td>Ears slightly pulled apart</td>
</tr>
<tr>
<td>2</td>
<td>Ears rotated outwards</td>
</tr>
</tbody>
</table>

### Orbital Tightening

<table>
<thead>
<tr>
<th>Score</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>Eyes opened</td>
</tr>
<tr>
<td>1</td>
<td>Partially closed eyes</td>
</tr>
<tr>
<td>2</td>
<td>Squinted eyes</td>
</tr>
</tbody>
</table>
## Feline Grimace Scale

### Muzzle Tension

<table>
<thead>
<tr>
<th>Score</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>Absent</td>
</tr>
<tr>
<td>1</td>
<td>Moderately Present</td>
</tr>
<tr>
<td>2</td>
<td>Markedly Present</td>
</tr>
</tbody>
</table>

- **Relaxed (round shape)**
- **Mild tension**
- **Tense (elliptical shape)**

### Whiskers Change

<table>
<thead>
<tr>
<th>Score</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>Absent</td>
</tr>
<tr>
<td>1</td>
<td>Moderately Present</td>
</tr>
<tr>
<td>2</td>
<td>Markedly Present</td>
</tr>
</tbody>
</table>

- **Loose (relaxed) and curved**
- **Slightly curved or straight (closer together)**
- **Straight and moving forward (rostrally, away from the face)**
**Head position**

<table>
<thead>
<tr>
<th>0 = absent</th>
<th>1 = moderately present</th>
<th>2 = markedly present</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image1.png" alt="Diagram" /></td>
<td><img src="image2.png" alt="Diagram" /></td>
<td><img src="image3.png" alt="Diagram" /></td>
</tr>
<tr>
<td><strong>or</strong></td>
<td><strong>Head aligned with the shoulder line</strong></td>
<td><strong>Head below the shoulder line or tilted down (chin toward the chest)</strong></td>
</tr>
<tr>
<td><img src="image4.png" alt="Diagram" /></td>
<td><img src="image5.png" alt="Diagram" /></td>
<td><img src="image6.png" alt="Diagram" /></td>
</tr>
<tr>
<td><strong>Head above the shoulder line</strong></td>
<td><strong>or</strong></td>
<td><strong>Head below the shoulder line or tilted down (chin toward the chest)</strong></td>
</tr>
</tbody>
</table>