Proceeding
Can we treat pain in cats?

In humans pain is……

.....what the patient says it is

In cats…..

.....pain is what we say it is

Unidimensional pain scales

<table>
<thead>
<tr>
<th>Simple Descriptive (SDS)</th>
<th>Numerical rating (NRS)</th>
</tr>
</thead>
<tbody>
<tr>
<td>No pain 0</td>
<td>0</td>
</tr>
<tr>
<td>Mild pain 1</td>
<td>1</td>
</tr>
<tr>
<td>Moderate pain 2</td>
<td>2</td>
</tr>
<tr>
<td>Severe pain 3</td>
<td>3</td>
</tr>
<tr>
<td>Very severe pain 4</td>
<td>4</td>
</tr>
</tbody>
</table>

0 Visual Analogue (VAS) 100

no pain worst pain

What is this thing called pain?

PHYSICAL

SENSORY

DISCRIMINATIVE

PSYCHOLOGICAL

EMOTIONAL

AVERSIVE

QUALITY

OF LIFE

QUALITY

OF LIFE

QUALITY
What is this thing called pain?

<table>
<thead>
<tr>
<th>PHYSICAL</th>
<th>PSYCHOLOGICAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>HOW IT FEELS</td>
<td>HOW IT MAKES THEM FEEL</td>
</tr>
<tr>
<td>SENSORY DISCRIMINATIVE</td>
<td>EMOTIONAL AVERSIVE</td>
</tr>
<tr>
<td>QUALITY OF LIFE</td>
<td></td>
</tr>
</tbody>
</table>

If you cannot measure it you cannot improve
Lord Kelvin 1824 - 1907

Scientific assessment

The Wine Advocate Rating System

What do cats do when they hurt?

10 assessment domains
Includes
- Blood pressure
- Appetite
Maximum score = 30
Intervention ≥ 7

Validation of the English version of the UNESP-Botucatu multidimensional composite pain scale for assessing postoperative pain in cats
Brondani et al 2013

Appetite
Zeiler et al 2014
Definitive Glasgow acute pain scale for cats: validation and intervention level
Reid et al 2017

7 Questions
Facial expression
Maximum score is 20
Suggested intervention level is > 5
www.newmetrica.com

Normal Behaviors

Normal behaviors

Question 2 - Posture

Glasgow CMPS - Feline

Question 2 – is it?

<table>
<thead>
<tr>
<th>Behavior</th>
<th>Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>Relaxed</td>
<td>0</td>
</tr>
<tr>
<td>Licking lips</td>
<td>1</td>
</tr>
<tr>
<td>Restless/cowering</td>
<td>2</td>
</tr>
<tr>
<td>Tense/crouched</td>
<td>3</td>
</tr>
<tr>
<td>Rigid/hunched</td>
<td>4</td>
</tr>
</tbody>
</table>

Calvin
Mission

SPRINKLES
Postures - abdominal surgery

<table>
<thead>
<tr>
<th>Posture</th>
<th>Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>Relaxed</td>
<td>0</td>
</tr>
<tr>
<td>Licking lips</td>
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<td>3</td>
</tr>
<tr>
<td>Rigid/hunched</td>
<td>4</td>
</tr>
</tbody>
</table>

Glasgow CMPS

Question 3

<table>
<thead>
<tr>
<th>Behavior</th>
<th>Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ignoring wound or painful area</td>
<td>0</td>
</tr>
<tr>
<td>Attention to wound</td>
<td>1</td>
</tr>
</tbody>
</table>

THE PAIN FACE

Evaluation of facial expression in acute pain in cats
Holden et al 2014
Question 5
Approach the cage, call the cat by name and stroke along its back from head to tail. Does the cat:

- Respond to stroking? 0
- Is it unresponsive? 1
- Is it aggressive? 2

Question 6
If the cat has a wound or painful area, gently apply pressure around the site. Does it:

- Do nothing 0
- Swish tail or flatten ears 1
- Cry/hiss 2
- Growl 3
- Bite/lash out 4
Putting things together

Is it ever straightforward with cats?
Individual temperament and personality
Fear and stress
Anesthetic drugs – ketamine
Upper respiratory tract disease

Temperament and personality
Zeiler GE et al 2014

Clinical application
- Not all cats have a score of 0 before surgery
- Fear, anxiety and stress can look like pain
- Trust yourself and not just the number
- Look for changes

Questions

Postoperative analgesia between non-pregnant healthy cats versus pregnant or cats with upper respiratory tract disease
Benito & Steagall 2016
PRAKTISCHE ÜBUNGEN – GEMEINSAMES BEURTEILEN VON VIDEOS

Sheilah A Robertson BVMS (Hons) DACVAA, CVA, DACAW, PhD
Senior Medical Director
Lap of Love

BEFORE AND AFTER COMPARISONS

Smokey Joe

Smokey Joe

Crying 1
Rigid 4
Ignoring wound 0
Ears/muzzle 3
Unresponsive to stroking 1
Cries when palpated 2
Depressed 4
Total 15/20

Intervention recommended at > 5
**Smokey Joe**

<table>
<thead>
<tr>
<th>Behavior</th>
<th>Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>Meowing</td>
<td>0</td>
</tr>
<tr>
<td>Licking lips</td>
<td>1</td>
</tr>
<tr>
<td>Ignoring wound</td>
<td>0</td>
</tr>
<tr>
<td>Ears/muzzle</td>
<td>0</td>
</tr>
<tr>
<td>Responds to stroking</td>
<td>0</td>
</tr>
<tr>
<td>Palpation – tensed, flattened ears</td>
<td>1</td>
</tr>
<tr>
<td>Content</td>
<td>0</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>2/20</td>
</tr>
</tbody>
</table>

**CAT 03b**

**Cat 01b**

**BEFORE AND AFTER COMPARISONS**

**MAX**

**04.07.2017**
Cat 02

Neutering Procedures

Who need help?
PAIN ASSESSMENT IN CATS
A GENERAL OVERVIEW

Sheilah A Robertson BVMS (Hons)
DACVAA, CVA, DACAW, PhD
Senior Medical Director
Lap of Love
Seminar: “Pain assessment in companion animals”
Wienna 1.7.2017

(Chronic) pain assessment tools in dogs,
a general overview

Anna Hielm-Björkman, DVM, PhD, Docent, CVA
DOGRISK research group leader
University of Helsinki

Some slides were made together with Dr. Paula Larenza in Helsinki for a talk!
Outline of the talk today

- Pain assessment tools in dogs, a general overview
  - Different types of chronic pain
  - Pain assessment tools for dogs
    - Diagnosing pain
    - Evaluating treatment need
    - Evaluating treatment success
    - Assessing pain in trials (before-after / Test-retest))
  Subjective, semi-objective, objective?
- Validated, reliability tested, psychometrically sound?
Chronic pain in animals

- True incidence unknown
- Specific chronic pain syndromes not as well characterized as in humans
- Pain a common reason for owners to seek veterinary care
- Mild to moderate chronic pain may go unrecognized for long periods
- Undertreated compared to human chronic pain
- Inflammatory / neuropathic / somatic pain
Chronic pain in animals

- Veterinarians should be aware of conditions that may be associated with chronic pain so discussions regarding quality of life can be initiated with owners early in the disease process.

Pain assessment as the 5th vital sign?
New class of chronic pain: post surgery chronic pain

- 22.8 % of chronic pain cases in humans (Crombie et al. 1998)
- Chronic post surgical pain (CPSP) P. Lavand’homme·158 (2017) S50–S54

<table>
<thead>
<tr>
<th>Population</th>
<th>Preoperative pain</th>
<th>Severe acute postoperative pain</th>
<th>CPSP moderate/severe</th>
</tr>
</thead>
<tbody>
<tr>
<td>Crombie et al.8</td>
<td>Adult patients in pain clinics</td>
<td>22%</td>
<td></td>
</tr>
<tr>
<td>Macrae,25</td>
<td>Adult population</td>
<td>10%-50%/4%-10%</td>
<td></td>
</tr>
<tr>
<td>Johansen et al. 2012</td>
<td>General adult population</td>
<td>18.3% (6.2% without preoperative pain)</td>
<td></td>
</tr>
<tr>
<td>Fletcher et al.13</td>
<td>Adult inpatients</td>
<td>35%-60%</td>
<td>30%</td>
</tr>
<tr>
<td>Hoofvijk et al.13</td>
<td>Adult outpatients</td>
<td>37.7%</td>
<td>26.7%</td>
</tr>
<tr>
<td>Nikolaesen and Birke29</td>
<td>Pediatric population</td>
<td>13% (with NRS &gt; 3)*</td>
<td></td>
</tr>
</tbody>
</table>

*NRS: Numeric rating score on a scale from 0 (no pain) to 10 (worst possible pain). CPSP, chronic postsurgical pain.

- Prevalence not evaluated in animals yet
Why is pain a diagnostic challenge?

- Animals do experience pain in a similar way to that of humans (Morton & Griffiths 1985).
- Animals do not show pain in a similar way.
- Species differences (also between dogs and dogs).
- Different signs between different chronic pains…

- Have to study animals with chronic pain
  - Compare them to healthy / acute pain /…
  - Compare them to ”old”, obese, lazy (?), non-active…
  - Compare before and after pain medication/treatment
  - Compare before and after placebo
Why is pain a diagnostic challenge?

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  - Compare them to healthy / acute pain /…
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  - Compare before and after pain medication/treatment
  - Compare before and after placebo
Diagnosing and assessing chronic pain

1. Subjective measures
2. Semi-objective measures
3. Objective measures
Diagnosing and assessing chronic pain

1. Subjective measures:
   - The pet’s disease history from colleagues and owner
   - The clinical assessment by the veterinarian
   - The owner’s thoughts

2. Semi-objective measures
   - Visual analogue scales of pain / mobility / quality of life (the owner)
   - Non validated pain questionnaires / mobility questionnaires / Quality of life questionnaires / functional tests…
   - (Validated owner or veterinary scales)
Veterinary evaluation: - Disease history

- When started? How?
- Old trauma? Old surgery? Rescue animal?
- Clinical signs? Time of day when best/worst?
- Did it start slowly/fast and how has it progressed?
- Usual behaviours (since puppy)? New behaviours? Behaviours falling away? (stretching?)
- Hygiene related behaviours (Grooming, defecating)
- Socialization related behaviours (less/withdrawn/..)
- Eating related behaviours (more/less/how?)
- Sleep related behaviours (more/less, how, where?)
Veterinary evaluation:
- Ask about behaviour

- **Behaviour**
  - Positive ↓
  - Negative ↑
  - Social behaviour ↑ ↓
  - Work, play ↓
  - Mood ↓
  - Vocal or other communication ↑ ↓
  - ”Pain faces” ↑
Veterinary evaluation:
- Stance in hospital / at home?

- **Stance**
  - Owner, vet or PT
  - Sit / up
  - Position of the back
  - Praying position
...or maybe this?

- Seen in dogs with abdominal pain (visceral pain)
Veterinary evaluation:
- Clinical exam

- Body condition / BW
- ”Normal” clinical exam
  - 3 vital signs
- Skin temperature
- Soft tissue exam
- Orthopedic exam
- Spine and joint mobility
- Short neurological exam
- Neuropathic exam
- (acupuncture diagnostic points, osteopathy diagnosing, trigger points,
## Veterinary evaluation: - Movement

<table>
<thead>
<tr>
<th>Lameness:</th>
<th>0. Totally normal, no lameness</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Slightly stiff, not so keen to move, minor lameness</td>
</tr>
<tr>
<td>2.</td>
<td>Clearly stiff, clearly does not move freely, pacing, slightly lame</td>
</tr>
<tr>
<td>3.</td>
<td>Clear lameness</td>
</tr>
<tr>
<td>4.</td>
<td>Totally lame, avoids weight-bearing on affected limb</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Jumping:</th>
<th>0. Jumps normally, well</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>A slightly careful jump</td>
</tr>
<tr>
<td>2.</td>
<td>Jumps with a bit of difficulty, climbs up</td>
</tr>
<tr>
<td>3.</td>
<td>Jumps or climbs with great difficulty</td>
</tr>
<tr>
<td>4.</td>
<td>Will not even try because of difficulty/pain</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Stairs:</th>
<th>0. Walks stairs normally</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Slightly careful, uses both paws successively, not so keen to move</td>
</tr>
<tr>
<td>2.</td>
<td>Sometimes uses both paws at the same time, clearly does not move freely</td>
</tr>
<tr>
<td>3.</td>
<td>Bunny-hops all the time, walks stairs with great difficulty</td>
</tr>
<tr>
<td>4.</td>
<td>Will not even try because of difficulty/pain</td>
</tr>
</tbody>
</table>
Veterinary evaluation:  
- Movement dysfunction

- Lameness
- Not using the limb
- ”Bunny-hopping”
- Pacing
- Does not jump
- Bad in stairs
- Does not move…
3. Objective measures:

- In orthopaedic chronic pain:
  - Force platform and pressure carpet – vertical force from the footfall
  - Static weight bearing

- Activity measures (Accelerometers)

- Validated chronic pain indecies

- Physiological measures (pulse, stresshormones, urine retention, temperature etc.)
Psychometric properties of a scale/assessment method
Validity

**Validity** is the quality of a scale, its ability to measure what it is supposed to measure. Validity can be divided into four different types: face validity and content validity rely on the internal logic of the measure; criterion validity and construct validity are less subjective and more empirical.

- **Face validity** is the extent to which the scale or index is subjectively viewed by knowledgeable individuals as covering the concept, e.g. that each variable in the questionnaire measures chronic pain in some way.

- **Content validity** is related to face validity, being based on logic and expertise. It asks whether the scale or index covers all of the generally accepted variables of for example, chronic pain, i.e. is it sufficiently comprehensive?.

- **Criterion validity** is used when describing the correlation between a scale and another already validated external measurement of the same phenomenon.

- **Construct validity** has to do with the ability of the scale or index to measure variables that are theoretically related to the variable that the scale purports to measure.
Reliability

RELIABILITY refers to the extent to which the measure yields the same score each time it is administered, all other things being equal. There are four types of reliability. Thus, reliability can be measured in different ways and is always inexact. More tests done, strengthen the index.

- **Internal consistency** or **equivalence** is when the reliability of the instrument is judged by estimating how well the items that reflect the same construct yield similar results or how consistent the results are for the different items for the same construct within the measure and the *Cronbach’s coefficient α* (Cronbach 1951) is the best known method for this. (e.g. questions vague or confusingly worded).

- **Repeatability** (also called **stability**, **test-retest**, **temporal reliability** and **intra-observer/rater reliability**) is when a test is given twice to the same people and thereby evaluated by the test-retest method. When the measure is taken over intervals of time, the scores of the owners should remain consistent. This is often tested using *intra-class correlation* (Streiner & Norman 1995) but also many other tests are possible, e.g. *Cohen’s Kappa* (Cohen 1988), *Spearman* (Siegel 1956) or *Pearson* (Streiner & Norman 1995) correlation tests.
Reliability cont.

- **Inter-rater reliability** (also called **Inter-observer reliability**) is when two observers rate the same phenomenon at the same time, e.g. two veterinarians evaluating the same dog at the same time using the same scale. Same tests as in repeatability.

- **Responsiveness** (also called **sensitivity to change**) of the scale reflects the capability of the instrument to measure changes in levels of pain over time, in particular, in responses to clinical interventions such as analgesics.

- **Cut-off points** on pain scales are points on the scale that differentiate between mild, moderate, and severe pain, between pain being tolerable and intolerable, thus indicating where (additional) analgesics are needed because the dog is experiencing too much pain. Cut-off points must be reliable and valid for each population.
Veterinary evaluation:

- Adding diagnostic tools
Thermal imaging camera (Flir T425)
- used for pain diagnosing and follow-up


Veterinary evaluation:  
- Provoked pain

Behaviour also directly affects objective measurements

- Dolorimeter
  - Pressure
- Von Frey filament
  - Reaction time
- Steps off ice pack
  - Reaction time

- Scale
- Validated only for humans
- Used also for dogs

Used for dog's nocturnal activity

Accelerometer
Measuring physical endurance

-We have both a dry and an underwater treadmill at the university in Helsinki
We can all assess chronic pain from faces - hard when "sneaks" upon the owner or in clinics...


No grimace scale for dogs yet
Force platform (Kistler®)

- Force plate
- Piezoelectric scales
- Validated for dogs
Pressure Carpet (GAITFour® - USA)

- Not thoroughly validated yet
Chronic pain owner questionnaires

- Helsinki chronic pain index (HCPI),
- Canine Brief Pain Inventory (CBPI),
- Cincinnati Orthopedic Disability index (CODI),
- Health-Related Quality of life (HRQL), (GUVQuest)
- Liverpool Ostearthritis in Dogs (LOAD),

- Feline Musculoskeletal Pain Index (FMPI).
Questions about: "Positive" behavior
<table>
<thead>
<tr>
<th></th>
<th>CHD-dogs (n=40)</th>
<th>Sound dogs (n=24)</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>median</td>
<td>min/max</td>
<td>median</td>
</tr>
<tr>
<td>(1) Appetite</td>
<td>0</td>
<td>0-3</td>
<td>0</td>
</tr>
<tr>
<td>(2) Mood</td>
<td>1</td>
<td>0-3</td>
<td>0</td>
</tr>
<tr>
<td>(3) Dog making contact with human family</td>
<td>1</td>
<td>0-2</td>
<td>0</td>
</tr>
<tr>
<td>(4) Tail wagging</td>
<td>1</td>
<td>0-3</td>
<td>0</td>
</tr>
<tr>
<td>(5) Activity</td>
<td>1.5</td>
<td>0-4</td>
<td>1</td>
</tr>
<tr>
<td>(6) Play and games</td>
<td>1</td>
<td>0-4</td>
<td>0</td>
</tr>
</tbody>
</table>

"Negative" behavior

<table>
<thead>
<tr>
<th></th>
<th>CHD-dogs (n=40)</th>
<th>Sound dogs (n=24)</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>median</td>
<td>min/max</td>
<td>median</td>
</tr>
<tr>
<td>(7) Excessive panting</td>
<td>1</td>
<td>0-3</td>
<td>0</td>
</tr>
<tr>
<td>(8) Licking of lips</td>
<td>0</td>
<td>0-4</td>
<td>0</td>
</tr>
<tr>
<td>(9) Audible complaining</td>
<td>1</td>
<td>0-3</td>
<td>0</td>
</tr>
<tr>
<td>(10) Complaining when stretching hind legs caudally</td>
<td>2</td>
<td>0-4</td>
<td>0</td>
</tr>
<tr>
<td>(11) Aggressive towards humans</td>
<td>0</td>
<td>0-3</td>
<td>0</td>
</tr>
<tr>
<td>(12) Aggressive towards other dogs</td>
<td>2</td>
<td>0-3</td>
<td>1</td>
</tr>
<tr>
<td>(13) Aggressive towards dogs in its own pack</td>
<td>1</td>
<td>0-4</td>
<td>1</td>
</tr>
<tr>
<td>(14) Subduing in the pack</td>
<td>1.5</td>
<td>0-4</td>
<td>2</td>
</tr>
</tbody>
</table>

Locomotion

<table>
<thead>
<tr>
<th></th>
<th>CHD-dogs (n=40)</th>
<th>Sound dogs (n=24)</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>median</td>
<td>min/max</td>
<td>median</td>
</tr>
<tr>
<td>(15) Walking</td>
<td>1</td>
<td>0-3</td>
<td>0</td>
</tr>
<tr>
<td>(16) Trotting</td>
<td>1.5</td>
<td>0-4</td>
<td>0</td>
</tr>
<tr>
<td>(17) Pacing</td>
<td>1</td>
<td>0-4</td>
<td>2</td>
</tr>
<tr>
<td>(18) Galloping</td>
<td>1</td>
<td>0-4</td>
<td>0</td>
</tr>
<tr>
<td>(19) Jumping</td>
<td>2</td>
<td>0-4</td>
<td>0</td>
</tr>
<tr>
<td>(20) Climbing stairs</td>
<td>2</td>
<td>0-4</td>
<td>0</td>
</tr>
<tr>
<td>(21) Descending stairs</td>
<td>2</td>
<td>0-4</td>
<td>0</td>
</tr>
<tr>
<td>(22) Laying down</td>
<td>2</td>
<td>0-4</td>
<td>0</td>
</tr>
<tr>
<td>(23) Getting up</td>
<td>2.5</td>
<td>0-4</td>
<td>0</td>
</tr>
<tr>
<td>(24) Difficulties to move post-resting</td>
<td>2</td>
<td>0-4</td>
<td>0</td>
</tr>
<tr>
<td>(25) Difficulties to move after major activity</td>
<td>3</td>
<td>1-4</td>
<td>0</td>
</tr>
</tbody>
</table>

Chronic pain index (2,6,9,15,16,18,19,22,23,24,25) | 19 | 7-35 | 2 | 0-5 | 8.8 $10^{-11}$ |

Two extreme groups of dogs; CHD with pain symptoms and healthy. No treatment.

25 "questions"

In these we could see a significant difference between the painful and the healthy (18).
Difference between a group getting analgesics (carprofen) or not - Responsiveness

<table>
<thead>
<tr>
<th>MDS questions</th>
<th>$W_4$</th>
<th>$W_0$</th>
<th>$W_4$</th>
<th>$W_0$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mood*</td>
<td>0,879</td>
<td>0,319</td>
<td>&lt;0,001</td>
<td>&lt;0,001</td>
</tr>
<tr>
<td>Frequency of tail wagging</td>
<td>1,000</td>
<td>0,803</td>
<td>0,006</td>
<td>0,029</td>
</tr>
<tr>
<td>Play and games*</td>
<td>0,459</td>
<td>0,184</td>
<td>0,013</td>
<td>0,033</td>
</tr>
<tr>
<td>Walking*</td>
<td>0,576</td>
<td>0,737</td>
<td>0,071</td>
<td>0,002</td>
</tr>
<tr>
<td>Trotting*</td>
<td>0,616</td>
<td>0,108</td>
<td>0,073</td>
<td>0,035</td>
</tr>
<tr>
<td>Pacing</td>
<td>0,786</td>
<td>0,770</td>
<td>0,883</td>
<td>0,797</td>
</tr>
<tr>
<td>Galloping*</td>
<td>0,522</td>
<td>0,663</td>
<td>0,005</td>
<td>0,170</td>
</tr>
<tr>
<td>Bunny hopping</td>
<td>0,397</td>
<td>0,961</td>
<td>0,002</td>
<td>0,002</td>
</tr>
<tr>
<td>Activity</td>
<td>0,579</td>
<td>0,848</td>
<td>0,428</td>
<td>0,003</td>
</tr>
<tr>
<td>Difficulty moving after first major</td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>activity and then rest*</td>
<td>0,249</td>
<td>0,434</td>
<td>&lt;0,001</td>
<td>&lt;0,001</td>
</tr>
<tr>
<td>Jumping*</td>
<td>0,750</td>
<td>0,584</td>
<td>0,053</td>
<td>0,002</td>
</tr>
<tr>
<td>Climbing stairs</td>
<td>0,961</td>
<td>0,752</td>
<td>0,006</td>
<td>0,025</td>
</tr>
<tr>
<td>Descending stairs</td>
<td>0,911</td>
<td>0,615</td>
<td>0,025</td>
<td>0,030</td>
</tr>
<tr>
<td>Laying down*</td>
<td>0,299</td>
<td>0,705</td>
<td>0,073</td>
<td>0,005</td>
</tr>
<tr>
<td>Getting up*</td>
<td>0,799</td>
<td>0,737</td>
<td>0,035</td>
<td>&lt;0,001</td>
</tr>
<tr>
<td>Excessive panting</td>
<td>0,938</td>
<td>0,583</td>
<td>0,002</td>
<td>&lt;0,001</td>
</tr>
<tr>
<td>Vocalization (audible</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>complaining)*</td>
<td>0,481</td>
<td>0,452</td>
<td>0,018</td>
<td>0,004</td>
</tr>
<tr>
<td>Vocalization when stretching leg</td>
<td>0,377</td>
<td>0,208</td>
<td>0,096</td>
<td>0,002</td>
</tr>
<tr>
<td>* Chronic pain index$^{10}$</td>
<td>0,555</td>
<td>0,546</td>
<td>&lt;0,001</td>
<td>&lt;0,001</td>
</tr>
<tr>
<td>pain VAS</td>
<td>0,751</td>
<td>0,344</td>
<td>&lt;0,001</td>
<td>&lt;0,001</td>
</tr>
<tr>
<td>locomotion VAS</td>
<td>0,242</td>
<td>0,376</td>
<td>&lt;0,001</td>
<td>&lt;0,001</td>
</tr>
</tbody>
</table>

Two groups of dogs, one group got analgesia between week 0 and 8 ($W_0\rightarrow W_8$) the other group not.

18 "questions"
In these 16 questions there was a significant difference between groups at $W_8$.

HCPI ="Helsinki Chronic pain Index" (11 quest.)
-Validated for dogs
-Reliable
-Responsive
Chronic pain evaluation
The Helsinki chronic pain index (HCPI)

Psychometric testing of the Helsinki chronic pain index by completion of a questionnaire in Finnish by owners of dogs with chronic signs of pain caused by osteoarthritis

Anna K. Hielm-Björkman, DVM, PhD; Hannu Rita, PhD; Riitta-Mari Tulamo, DVM, PhD

- Developed by us in Helsinki
- Translated into several languages
HELSINKI OSTEOARTHRITIC CANINE CHRONIC PAIN INDEX

Name of Dog __________________ Owner ____________________________ Diagnosis ____________________

Date ______ Questionnaire no. ______

Tick only one answer – the one that best describes your dog during the preceding week

Points

1. Rate your dog’s mood:
   Very alert  alert neither alert, nor indifferent  indifferent very indifferent
   
   0

2. Rate your dog’s willingness to participate in play:
   Very willingly  willingly reluctantly very reluctantly does not at all
   
   2

3. Rate your dog’s vocalization (audible complaining such as whining or crying out):
   Never  hardly ever sometimes often very often
   
   

4. Rate your dog’s willingness to walk:
   Very willingly  willingly reluctantly very reluctantly does not walk at all
   
   

5. Rate your dog’s willingness to trot:
   Very willingly  willingly reluctantly very reluctantly does not trot at all
   
   

6. Rate your dog’s willingness to gallop:
   Very willingly  willingly reluctantly very reluctantly does not gallop at all
   
   

7. Rate your dog’s willingness to jump (eg. into car, onto sofa…)
   Very willingly  willingly reluctantly very reluctantly does not jump at all
   
   
29/06/2017
Visual Analogue Scale
= VAS

- Validated for humans
- Pain VAS not possible to give to owners as they do not recognize pain behaviour as pain symptoms
- Mobility and QOL VAS can be used but not entirely validated yet

Conclusions and Clinical Relevance—Although valid and reliable, the pain VAS was a poor tool for untrained owners because of poor face validity (i.e., owners could not recognize their dogs’ behavior as signs of pain). Only after owners had seen pain diminish and then return (after starting and discontinuing NSAID use) did the VAS have face validity. (Am J Vet Res 2011;72:601–607)
<table>
<thead>
<tr>
<th>HCPI item</th>
<th>Variable</th>
<th>All dogs†</th>
<th>Carprofen†</th>
<th>Placebo†</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Week -4</td>
<td>Week 0</td>
<td>Week 8</td>
</tr>
<tr>
<td>Mood</td>
<td></td>
<td>0.07</td>
<td>0.13</td>
<td>-0.10</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0.04</td>
</tr>
<tr>
<td>Vocalization</td>
<td></td>
<td>0.31</td>
<td>0.19</td>
<td>0.25</td>
</tr>
<tr>
<td>Walking</td>
<td></td>
<td>0.32</td>
<td>0.27</td>
<td>0.39</td>
</tr>
<tr>
<td>Trotting</td>
<td></td>
<td>0.34</td>
<td>0.425</td>
<td>0.43</td>
</tr>
<tr>
<td>Galloping</td>
<td></td>
<td>0.05</td>
<td>0.12</td>
<td>-0.22</td>
</tr>
<tr>
<td>Jumping</td>
<td></td>
<td>0.398</td>
<td>0.21</td>
<td>0.14</td>
</tr>
<tr>
<td>Lying down</td>
<td></td>
<td>0.31</td>
<td>0.31</td>
<td>0.54</td>
</tr>
<tr>
<td>Getting up</td>
<td></td>
<td>0.32</td>
<td>0.32</td>
<td>0.56</td>
</tr>
<tr>
<td>Difficulty</td>
<td></td>
<td>0.365</td>
<td>0.33</td>
<td>0.18</td>
</tr>
<tr>
<td>Difficulty</td>
<td></td>
<td>0.18</td>
<td>0.17</td>
<td>0.02</td>
</tr>
<tr>
<td>Total HCPI</td>
<td></td>
<td>0.455</td>
<td>0.405</td>
<td>0.27</td>
</tr>
</tbody>
</table>
Cannot ask...

”Does your dog/cat have pain?”
Hard to find symptoms that change in the same way in all dogs. Index numbers are individual and can be followed per individual.
INDEXED TESTING BATTERY MEASURING STIFLE FUNCTIONALITY: THE FINNISH CANINE STIFLE INDEX (F-CSI)

Visual evaluation of 3.-4. functional active range of motion (AROM) and 5.-6. thrust in hind limbs

“Sit (3.) and sit-to-move (4.)” The dog was lead over a 20 m distance and asked to sit and sit-to-move 3 times within equal distances. Any functional limitation or compensation of the sitting position, such as external rotation, abduction, limited flexion of the hind limbs, was marked. Observed weakness or asymmetry in thrust in hind limbs from the ground was noted.

“Lie down (5.) and lie-to-move (6.)” was done using a similar protocol.

Diagnosing by drug trial with owner questionnaire

1. No drug + HCPI questionnaire for 1 week
2. NSAID + HCPI: 1-2 weeks
3. No drug + HCPI: 1 week
   → If step 2 helped the dog has inflammatory pain
   → as owners cannot see a slow ameleriosation they often need step 2 + 3

- Gabapentin / Pregabalin: slowly up (+/- NSAID)
- Amantadine
- Amitriptylline
- Selegiline
Assessing drug use can also be used as an outcome measure...

- In trials we can give them all 1 package of e.g. an NSAID, topical cortisone, other analgesics...
- Measure how much it is used in different study groups

Group 1
Group 2
Group 3…
In studies also final questions to assess a pain treatment:

1. Please guess if you were in the
   - X treatment group
   - Positive control group / e.g. NSAID
   - Evasive control group / Placebo

2. Would you recommend this treatment to a friend or someone in the family, for their dog?

3. If a new dog of your was diagnosed with the same problem, whould you use this same treatment again?
   - Why? Why not?
Pain parameters in the blood?

<table>
<thead>
<tr>
<th>HORMONE</th>
<th>CHD group (n=41)</th>
<th>control group (n=23)</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>mean ± sd</td>
<td>min - max</td>
<td>mean ± sd</td>
</tr>
<tr>
<td>Epinephrine (nmol/l)</td>
<td>1.37 ± 0.73</td>
<td>0.52-4.40</td>
<td>1.00 ± 0.55</td>
</tr>
<tr>
<td>Norepinephrine (nmol/l)</td>
<td>3.42 ± 1.22</td>
<td>1.54-6.36</td>
<td>3.64 ± 1.02</td>
</tr>
<tr>
<td>Beta-endorphin (pg/ml)</td>
<td>85.4 ± 25.8</td>
<td>47-150</td>
<td>125.0 ± 60.0</td>
</tr>
<tr>
<td>Cortisol (nmol/l)</td>
<td>83.5 ± 55.9</td>
<td>26.6-271.0</td>
<td>46.0 ± 18.4</td>
</tr>
<tr>
<td>Vasopressin (pg/ml)</td>
<td>12.45 ± 9.67</td>
<td>3.92-57.35</td>
<td>8.77 ± 6.18</td>
</tr>
</tbody>
</table>

- Statistical differences in 4 hormones but variations in normal are so large that it is not usable as a pain variable.
Inflammatory markers?

- We have been working with intra-articular (=inside the joint) samples and blood (serum, plasma or whole blood) samples

- E.g. IL1-β, IL6, PGE2, Cox 1 and 2, TNF-α, SP
- CRP
- Fatty acids
- Leucogram
- Hormones
- Nutritional profiles
- Etc.
# Testing carprofen, green lipped mussel, zeel and placebo in same trial

<table>
<thead>
<tr>
<th></th>
<th>Carprofen (n=15)</th>
<th>GLM (n=15)</th>
<th>HCP (n=14)</th>
<th>Placebo (n=15)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Owner: Chronic pain index HCPI</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Improved %, P-value</td>
<td>80.0 % 0.028</td>
<td>80.0 % 0.028</td>
<td>57.1 % 0.364</td>
<td>40.0 % -3 (-25-8)</td>
</tr>
<tr>
<td>Improvement Median (range)</td>
<td>9 (-9-19) &lt;0.001</td>
<td>2 (-2-6) 0.102</td>
<td>2 (-6-9) 0.049</td>
<td></td>
</tr>
<tr>
<td><strong>Owner: Pain VAS</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Improved %, P-value</td>
<td>85.7 % 0.001</td>
<td>66.7 % 0.011</td>
<td>57.1 % 0.043</td>
<td>20.0 % -1.7 (-3-3.2)</td>
</tr>
<tr>
<td>Improvement Median (range)</td>
<td>1.4 (-6-8.4) &lt;0.001</td>
<td>0.6 (-3.3-3.3) 0.004</td>
<td>0.2 (-3.5-4.9) 0.020</td>
<td></td>
</tr>
<tr>
<td><strong>Owner: Locomotion VAS</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Improved %, P-value</td>
<td>85.7 % 0.002</td>
<td>60.0 % 0.070</td>
<td>57.1 % 0.102</td>
<td>26.7 % -1 (-6-5)</td>
</tr>
<tr>
<td>Improvement Median (range)</td>
<td>3.1 (-1.9-6.2) 0.001</td>
<td>0.2 (-3.8-3.5) 0.057</td>
<td>0.7 (-5.4-8.0) 0.205</td>
<td></td>
</tr>
<tr>
<td><strong>Veterinary mobility index</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Improved %, P-value</td>
<td>66.7 % 0.031</td>
<td>66.7 % 0.031</td>
<td>71.4 % 0.018</td>
<td>26.7 % -3 (-14-3)</td>
</tr>
<tr>
<td>Improvement Median (range)</td>
<td>3 (0-8) 0.001</td>
<td>1 (-3-7) 0.012</td>
<td>1.5 (-5-7) 0.015</td>
<td></td>
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<tr>
<td><strong>Force plate PVF</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Improved %, P-value</td>
<td>66.7 % 0.031</td>
<td>46.7 % 0.264</td>
<td>78.6 % 0.006</td>
<td>26.7 % -0.9 (-33.6-10)</td>
</tr>
<tr>
<td>Improvement Median (range)</td>
<td>3.2 (-8.2-11.8) 0.079</td>
<td>0.17 (-5.6-12) 0.201</td>
<td>2.3 (-3.4-10.2) 0.028</td>
<td>n=13</td>
</tr>
<tr>
<td><strong>Force plate impulse</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Improved %, P-value</td>
<td>80.0 % 0.011</td>
<td>53.3 % 0.277</td>
<td>64.3 % 0.101</td>
<td>33.3 % -0.0 (-3.3-0.8)</td>
</tr>
<tr>
<td>Improvement Median (range)</td>
<td>0.4 (-0.5-1.3) 0.009</td>
<td>0.20 (-1.1-1.54) 0.123</td>
<td>0.2 (-1.3-1.3) 0.093</td>
<td>n=13</td>
</tr>
</tbody>
</table>
Animals with suspected Neuropathic pain or NeP

- Intervertebral disc disease
- Chiari-like malformation and Syringomyelia
- Lumbosacral pain
- Any nerve damage
  - Post-op
  - Trauma
  - Nerve entrapment
  - Chronic skin disease
- Chronic osteoarthritis (all joints, also facet and facial joints)
Neuropathic pain signs
(Cashmore et al. 2009):

- **Allodynia** (normally not pain provoking)
- **Hyperalgesia** (normally pain provoking, but alot of pain!)
- **Dysaesthesia** (unpleasant abnormal sensations)
  - Looking at its behind, chasing the tail, scratching, attacking…
- **Paraesthesia** (abnormal; not pain/unpleasant)
  - Tickling sensation…
- **Paroxymal** (sudden, quick) **pain episodes**
  - Shooting, stabbing, burning, throbbing, burning pain in humans

www.helsinki.fi/yliopisto
Neuropathic pain signs
(Pickering, 2002)

- Musculoskeletal – muscle waisting, deformity, osteopenia
- Trophic changes – hair loss, skin thickening, callus, ulcers
- Vasomotor - Temp. and colour differences
- Sudomotor – Hyperhidrosis or dryness
We need different clinical indicators for assessing neuropathic pain:

- Pain from stroking with a pen (von frey filament…)
- Muscle atrophy
- Poor weight bearing
- Proprioception deficiencies, dragging the paw
- Hyperkeratosis of the paw
- Hyperasesthesia
- EMG: Abnormal activity in affected muscles (nerves affected); reduced motor action potential (24-26 → 1-3)
- Self-mutilation of skin
Neuropathic pain symptoms

Ask both about quality and quantity of symptoms:

• Sleep
• Attention span
• Social / withdrawnness
• Excessive scratching
• Excessive licking
• Clumsyness
• Resist patting, stroking,…
• History of trauma or surgery
• Treatment history
Diagnosing neuropathic pain

- Lack of response to NSAIDs or opiates (Tramadol)

- The Von Frey filament

- Sensitivity to cold thermal stimuli has been evaluated in dogs
Some things are still hard to assess: Amputee neuropathic pain
Visceral pain

- Often a mixture of inflammatory and neuropathic pain
- May include referred pain
- On the trunc (abdomen / thorax)

- How do we assess that?
Pain? – in distress, ill at ease...

True ethical problem
...and even more difficult – how do these show pain?
RAW FOOD SEMINAR
15-16.9.2017 (Fri-Sat) in Helsinki

Welcome!

E-mail list
on paper outside
Thank you!
Kiitos!
Tack!
Danke!
Merci!

Questions?

anna.hielm-bjorkman@helsinki.fi
Some of our references


- Contact: anna.hielm-bjorkman@helsinki.fi
The Equine Pain Face
Karina Bech Gleerup, DVM, PhD
Assistant professor
Department of Clinical Veterinary Sciences
University of Copenhagen

Large Animal Teaching Hospital
University of Copenhagen

Pain evaluation in cattle and horses
A study of behavioral responses to pain

29/06/2017
Why is systematic pain evaluation important?

“Evidence based pain management in domestic animals depends on two factors: first, an ability to assess pain effectively and accurately under clinical conditions and, second, having the tools with which to alleviate the identified pain.”

Systematic pain evaluation is the key to successful analgesic treatment!

Valid behavioral indicators are those that clearly identify illness. These can be positive (i.e., behaviors that increase in frequency or magnitude when the animal is ill) or negative indicators (i.e., behaviors that reduce in frequency or magnitude with illness). Some measures may be useful for detecting intra-individual effects over time, and others may be useful for distinguishing sick and healthy individuals at a given time. The best indicators are those with both high sensitivity and high specificity. Tests should rarely yield false positives (type I error; test shows actually healthy) or false negatives (false negative) when the animal is ill.
Identification of potential physiological and behavioral indicators of postoperative pain in horses after exploratory celiotomy for colic
Lori C. Pritchett\textsuperscript{a}, Catherine Ulbom\textsuperscript{b}, Malcolm C. Roberts\textsuperscript{c}, Robert K. Schneider\textsuperscript{d}, Debra C. Sellon\textsuperscript{a,1}

The physiological parameters do not add much information

Preliminary evaluation of a behaviour-based system for assessment of post-operative pain in horses following arthroscopic surgery
EJ Price\textsuperscript{a,2}, two others, Suagee Coetsee\textsuperscript{a}, two others, Elizabeth M. Welsh\textsuperscript{a,2}, two others, two others, and two others.
Department of Veterinary Clinical Studies, Royal Veterinary College, University of London, North Mymms, Herts, United Kingdom

The subjective factor
Table 2 Definitions of the composite measure pain scale

<table>
<thead>
<tr>
<th>Pain score</th>
<th>0</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Behaviour category</td>
<td>None</td>
<td>Occasional</td>
<td>Continuous</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gross pain behaviour</td>
<td>Normal weight bearing or walking</td>
<td>Resting, plantarflexion or turning</td>
<td>Continuously turning or lying on the ground or the ground in front of or beside the animal</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Weight loss</td>
<td>No weight bearing</td>
<td>Plantarflexion, or turning</td>
<td>Continuously turning or lying on the ground or the ground in front of or beside the animal</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Head position</td>
<td>Above normal level</td>
<td>Below normal level</td>
<td>Lying on its side</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Position in stall</td>
<td>Standing in the middle</td>
<td>Sitting in the middle</td>
<td>Resting in the middle, facing the side, or standing at the back</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Response to agitator</td>
<td>Moves to door</td>
<td>Licks at door</td>
<td>No response</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Reaction to pain</td>
<td>No apparent pain</td>
<td>Mild discomfort</td>
<td>Severe pain</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Gross pain behaviour is defined as both grunting, lip curling, pacing, vocalising.

Lindegaard et al 2010

Some Observations on the Behaviour of the Horse in Pain

By J. A. Piver, Royal (Dick) School of Veterinary Studies, Edinburgh, and F. S. M. H. H. R. E. I.

The facial expression is quite characteristic in many cases. There is a fixed stare, the eyes tend to be pocketed slightly, the ears held slightly back, nostrils dilated and the animal generally presents a ‘woolly’ expression. The head is

Guidelines for the recognition and assessment of pain in animals

Prepared by a working party of the Association of Veterinary Teachers and Research Workers

This is an important supplement to postural change as a means of communicating in some species. The various emotions of facial expression have not been mapped from the viewpoint for most species. However, people who work with particular species often become aware of such things without being able to describe them so clearly; or to demonstrate any consistent relationship to other means of assessing pain.

The Compassionate Brain: Humans Detect Intensity of Pain from Another’s Face

Understanding another person’s experience depends on ‘mirror systems’ brain circuits activated when the subject witnesses the same brain areas activated when the subject undergoes painful sensory stimulation and when he/she observes others suffering from pain. Recent studies show remarkable overlap between brain areas activated when a subject undergoes painful sensory stimulation and when he/she observes others suffering from pain. Using functional magnetic resonance imaging, we show that not only the presence of pain but also the intensity of the observed pain is encoded in the observer’s brain—as occurs during the observer’s own pain experience. When
Facial expressions of pain

- Innate response reflecting activity within the nociceptive pathways (Esteve et al. 2011)
- Facial expressions of pain are difficult to suppress (Mathi et al. 2000)
- Humans are specialized for decoding faces (Mathi et al. 2002)
- Humans may interpret micro-expressions of < 0.5 seconds (Mathi et al. 2004)
- Many species use facial cues for social communication (see 1996)

Methods

- Semi-randomized controlled cross-over trial with 6 horses
- Observer/no observer
  - Do horses suppress pain in the presence of humans
- Noxious stimulation
  - Blood pressure cuff
  - Capsaicin
Pain score
- Significantly higher at T10 and T20 during noxious stimulation
## Results

<table>
<thead>
<tr>
<th>Category</th>
<th>Control (n = 8) mean ± SD</th>
<th>Control (n = 8) SD</th>
<th>Control (n = 8) p</th>
<th>Transport (n = 8) mean ± SD</th>
<th>Transport (n = 8) SD</th>
<th>Transport (n = 8) p</th>
</tr>
</thead>
<tbody>
<tr>
<td>For movements</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ataxia</td>
<td>36 ± 14%</td>
<td>15 ± 14%</td>
<td>0.06</td>
<td>17 ± 14%</td>
<td>0.09</td>
<td></td>
</tr>
<tr>
<td>Ataxia</td>
<td>40 ± 15%</td>
<td>17 ± 9%</td>
<td>0.08</td>
<td>61 ± 9%</td>
<td>0.00</td>
<td></td>
</tr>
<tr>
<td>Ataxia</td>
<td>37 ± 12%</td>
<td>16 ± 12%</td>
<td>0.07</td>
<td>52 ± 12%</td>
<td>0.08</td>
<td></td>
</tr>
<tr>
<td>Correct seeing behavior</td>
<td>5 ± 0.5%</td>
<td>2 ± 0.5%</td>
<td>0.06</td>
<td>6 ± 0.5%</td>
<td>0.01</td>
<td>15 ± 7%</td>
</tr>
<tr>
<td>Correct seeing behavior</td>
<td>5 ± 0.5%</td>
<td>2 ± 0.5%</td>
<td>0.06</td>
<td>6 ± 0.5%</td>
<td>0.01</td>
<td>15 ± 7%</td>
</tr>
<tr>
<td>Spasticity group</td>
<td>2 ± 0.5%</td>
<td>1 ± 0.5%</td>
<td>0.02</td>
<td>3 ± 0.5%</td>
<td>0.04</td>
<td>4 ± 0.5%</td>
</tr>
<tr>
<td>In group 3</td>
<td>3 ± 0.5%</td>
<td>2 ± 0.5%</td>
<td>0.02</td>
<td>2 ± 0.5%</td>
<td>0.04</td>
<td>1 ± 0.5%</td>
</tr>
</tbody>
</table>

Restrictive eye opisthoton p = 0.06.
The equine pain face

An equine pain face
Development of the Horse Assessment Tool in Horse Castration

Emanuela Bello Costa, Michela Miniero, Matthew C. Lenox

Clinical Veterinary Science

Monitoring acute equine visceral pain with the Equine Brief University Scale for Composite Pain Assessment (EQBUC-OMPAS) and the Equine Brief University Scale for Facial Assessment of Pain (EQBUC-FA) A scale-construction study

Johannes F.A.K. van der Velden, Ingrid E. van der Heijden, Ingrid T. Kvandal, Anouschka de Vries, Maartje C. van den Bosch, Charlotte Eddinger, Joost A.M. van der Heijden, Mark H.E. van Beek

Clinical Veterinary Science

Table 3

Title: Table 3

<table>
<thead>
<tr>
<th>Variable</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Note 1</td>
<td>Description 1</td>
</tr>
<tr>
<td>Note 2</td>
<td>Description 2</td>
</tr>
<tr>
<td>Note 3</td>
<td>Description 3</td>
</tr>
</tbody>
</table>
How can we use the equine pain face?

- It should be measuring pain - preferably low-degree pain
- It should be applicable

Owner:

“I will probably use my experience and your research to be more observant of his signals and most of all: no longer interpret his signs and facial expressions as him being lazy or spoilt”
RESEARCH PAPER

Analgesic efficacy of intra-articular morphine in experimentally induced radiocarpal synovitis in horses

Copper Lindhaug1, Maj H Thomassen², Mag Leonsen1 & Pha H Anderson²

Clinical application and reliability of a pent abdominal surgery pain assessment scale [PASPAS] in horses

G. Graubner1, V. Gorber1, M. Dalby1, C. Spadavecchia1

The Equine Pain Scale

<table>
<thead>
<tr>
<th>Behavior Category</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pain face</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>Vocal noise</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>Restlessness</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>Activity</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>Sensitivity to pain</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>Muscle tone</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>Vocal noise</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>Retention</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>Defensive reactions</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>Agitation</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>Behavior in food</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
</tbody>
</table>
The Equine Pain Face

- Horses have altered facial expressions when experiencing pain
- The Equine Pain Face is not static and not all changes are necessarily present simultaneously
- The overall impression is important
- Facial expressions of pain may be present even without any gross pain behaviour
- The Equine Pain Face is quick and readily usable, even in the field
Thank you for your attention
The equine pain face

- Ears
  - Increased distance
  - Opening of the ears facing the sides
  - Both ears moving asymmetrically
- Eyes
  - Tension of the m. levator anguli oculi medialis
  - Tense stare – appears withdrawn

The equine pain face

- Ears
  - Increased distance
  - Opening of the ears facing the sides
  - Both ears moving asymmetrically
- Eyes
  - Tension of the m. levator anguli oculi medialis
  - Tense stare – appears withdrawn
- Facial muscles
  - Tension
The equine pain face

- **Ears**
  - Increased distance
  - Opening of the ears facing the sides
  - Both ears moving asymmetrically
- **Eyes**
  - Tension of the m. levator anguli oculi medialis
  - Tense stare – appears withdrawn
- **Facial muscles**
  - Tension
- **Nostrils**
  - Dilated medio-laterally
- **Muzzle**
  - Increased tonus of the lips
  - Edged shape of the muzzle

---

**Relaxed horse**

- Normal elongated comma-shaped nostril
- Rounded shape of the muzzle – relaxed

**Horse in pain**

- Contracted character of the muzzle
- Edged shape of the muzzle with lips pressed together
- Lowered ears (basis)

Illustrations: Andrea Klintbjer

---

**No pain**

Illustrations: Andrea Klintbjer
Pain face – asymmetrical ears

Pain face – low ears (‘lambs ears’)

Quiz
Thank you for your attention

Special thanks to my collaborators:

Pia Madsen Andersen
Casper Lindgaard
Søren Horkman
Andreas Klostger
Femke Boven Konink at 1885
Composite Pain Scales in pain assessment in the Horse

American Pain Society (APS) 1996:

Introduction of “pain as the 5th vital sign”
This initiative emphasizes that pain assessment is as important as assessment of the standard four vital signs (HR, RR, Temp, BP) and that clinicians need to take action when patients report pain.
How do we measure pain in horses?

- VAS (Visual Analog Scale)
- NRS (Numerical Rating Scale)
- SDS (Simple Descriptive Scale)
- TBA (Time Budget Analysis)
- CPS (Composite Pain Scale)
- FE (Facial expression)
What is a composite pain scale???

A pain scale that includes multiple variables (behavioural, physiological or both) that are scored individually using well-defined classes by means of Simple Descriptive Scale (SDS), which are then combined to provide an overall CPS score.

What makes a pain scale reliable?

- Reproducibility
  - Inter- and intra-observer reliability/variability
- Validity
  - Face validity: does the test look ok?
  - Content validity: do the test items correspond with the symptom content?
  - Concrete validity: is the outcome of the test related to the clinical outcome?
  - Construct validity: is the test really measuring what it claims to be measuring?
- Sensitivity: true positive rate (colic patients with high pain scores)
- Specificity: true negative rate (controls with low pain scores)
- Response to intervention: painful event or analgesic treatment
what makes a pain scale practically useful?

- Easy
- Understandable
- Short
- Instant results

Composite Pain Scales (CPS)

Bussieres et al. (1998): CPS for acute orthopaedic pain
Lindegaard et al. (2010): CMPS for acute orthopaedic pain
Pritchett et al. (2003): visceral postoperative pain
Graubner et al. (2011): PASPAS for visceral postoperative pain
van Loon et al. (2014): CPS for viscerale postoperative pain
Taffarel et al. (2015): UESP-Botucatu pain scale for postoperative pain
van Loon and van Dierendonck (2015): CPS for acute colic pain

CPS in experimental lameness
CPS
according to Bussières et al. (2008) and van loon et al. (2010 and 2014)

Physiological parameters (4 elements)
(heart frequency, respiratory frequency, rectal temp, borborygmi)

Behavioural parameters (7 elements)
(head movement, sweating, pawing etc.)

Interactive parameters (2 elements)
(reaction to noise and touch)

In total maximally 3 x 13 = 39 points

Synovitis induction:
Amphotericine B in talocrural joint

C = control
E = experimental group
C0 = sedation+epidural sham
C1 = sedation + epidural saline
C2 = sedation + epidural analgesics
E0 = rescue bute + epidural saline
E1 = preemp saline + epidural analgesics
E2 = preemp bute + epidural analgesics

Epidural mixture of:
Ropivacaine (0.15 mg/kg)
Detomidine (0.02 mg/kg)
Morphine (0.05 mg/kg)
Ketamine (0.5 mg/kg)
CMPS Lindegaard et al. (2010)

CPS in individual patients

van Loon et al. (2010)
CPS in individual patients

van Loon et al. (2010)

---

CPS in postoperative colic patients

van Loon et al. (2014)

---

CPS in postoperative colic patients

van Loon et al. (2014)
Clinical application and reliability of a post abdominal surgery pain assessment scale (PASPAS) in horses

- Based on clinical experience and published literature (Pritchett et al. 2003)
- Physiological and behavioural parameters, including general subjective behavioural pain category
- Interobserver variability of PASPAS was low (CV 0.3 ± 0.1)
- Heart rate was moderately correlated with the total pain index (r² = 0.57; P < 0.001)
- Respiratory rate was poorly correlated with the total pain index (r² = 0.36; P < 0.001)

<table>
<thead>
<tr>
<th>GA: general anaesthesia</th>
</tr>
</thead>
<tbody>
<tr>
<td>GAA: + analgesia</td>
</tr>
<tr>
<td>GC: castration + postop analgesia</td>
</tr>
<tr>
<td>GCA: preemp analgesia + castration</td>
</tr>
</tbody>
</table>

### Table 3 Median (minimum and maximum) pain score

<table>
<thead>
<tr>
<th>Trait/Parameter</th>
<th>GA</th>
<th>GAA</th>
<th>GC</th>
<th>GCA</th>
</tr>
</thead>
<tbody>
<tr>
<td>T1</td>
<td>3.2 (1.0 - 10.4)</td>
<td>9.0 (4.0 - 14.0)</td>
<td>11.0 (7.0 - 20.0)</td>
<td>5.0 (2.0 - 12.0)</td>
</tr>
<tr>
<td>T2</td>
<td>4.0 (1.0 - 12.0)</td>
<td>9.0 (5.0 - 13.0)</td>
<td>10.0 (5.0 - 10.0)</td>
<td>5.0 (2.0 - 11.0)</td>
</tr>
<tr>
<td>T3</td>
<td>1.0 (0.0 - 5.0)</td>
<td>7.0 (3.0 - 11.0)</td>
<td>6.0 (2.0 - 12.0)</td>
<td>5.0 (2.0 - 12.0)</td>
</tr>
</tbody>
</table>
EQUUS COMPASS (van Loon and van Dierendonck 2015, 2016)
Equine Utrecht University Scale for Composite Pain Assessment

Assessment of whole horse, based on 14 criteria:

<table>
<thead>
<tr>
<th>Physiological:</th>
<th>Behavioural:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Breathing, heart frequency, temperature, borborygmi</td>
<td>Lying down, rolling</td>
</tr>
<tr>
<td></td>
<td>Sweating</td>
</tr>
<tr>
<td></td>
<td>Tail flicking</td>
</tr>
<tr>
<td></td>
<td>Kicking at abdomen</td>
</tr>
<tr>
<td></td>
<td>Pawing at floor</td>
</tr>
<tr>
<td></td>
<td>Head movements</td>
</tr>
<tr>
<td></td>
<td>Pain sounds</td>
</tr>
</tbody>
</table>

Interaction:
- Overall appearance: reaction to observer
- Reaction to palpation

Minimal total score: 0
Maximal total score: 42

n = 72
r² = 0.94
ICC = 0.98
P < 0.001

EQUUS COMPASS in acute colic: scale construction study

van Loon and van Dierendonck (2015)
EQUUS COMPASS in acute colic: validation study

van Dierendonck and van Loon (2016)

Composite Pain Scales in case reports with non-validated scales

Case Report
Managing severe hoof pain in a horse using multimodal analgesics and a modified composite pain score
Dutton et al. (2009)

Minghella en Auckburally (2014)
Composite pain scales in Facial Expression of Pain

Horse Grimace Scale (HGS)

Equine Pain Face (EPF)
Gleerup et al. (2014)
Gleerup and Undegaard (2016)

Facial Assessment of Pain (FAP)
van Loon and van Dierendonck (2015, 2017)
van Dierendonck and van Loon (2016)

Facial Expressions in ridden horses (FEReq)
Mullard et al. (2017)
Dyson et al. (2017)

EQUUS FAP (van Loon and van Dierendonck 2015, 2016)
Equine Utrecht University Scale for Facial assessment of Pain

Assessment of head of horse on 9 criteria:
- Head
- Eyes
- Nose
- Eyes
- Mouth
- Teeth
- Muscular tone
- Min. total score: 0 – Max. total score: 18
EQUUS FAP in acute colic

van Loon and van Dierendonck (2015)

EQUUS FAP in pain originating from the head

14-year old KWPN gelding
- Alveolitis 107
- Premolar extraction under sedation and local blocks, finally dental root repulsion under GA

Day 1 postop before tramadol: FAP score = 9
Day 1 postop 1 hour after tramadol: FAP score = 1

van Loon and van Dierendonck (submitted data)
Measurement of nociception in experimental studies

1st Vienna Pain Day, 1-2 July 2017

Prof. C. Spadavecchia

Anaesthesiology and Pain Therapy Section
Department of Clinical Veterinary Medicine
Vetsuisse Faculty, University of Bern

Issues in Veterinary Pain Research

Pain Assessment in research settings

• Physiological parameters
  • HR, HRV, BP, cortisol, β-endorphin

• Behavioural based scoring systems
  • Facial pain scales, DIVAS, HCPI

• Nociceptive thresholds determination
  • Quantitative Sensory Testing methods

Pain Assessment in research settings

• Physiological parameters
  • HR, HRV, BP, cortisol, β-endorphin

• Behavioural based scoring systems
  • Facial pain scales, DIVAS, HCPI

• Nociceptive thresholds determination
  • Quantitative Sensory Testing methods
Nociception

from the Latin “nocere” (to harm)

“The neural process of encoding noxious stimuli”

Note: Consequences of encoding may be autonomic (e.g., elevated blood pressure) or behavioral (motor withdrawal reflex or more complex nocifensive behavior).

Pain sensation is not necessarily implied.

Nociception has an important warning function

«Nociceptive» Threshold Determination

Quantitative Sensory Testing (QST)

Psychophysical testing
- Sensory stimulus is an objective physical event
- Response is the subjective conscious report/reaction

Neurophysiological testing
- Sensory stimulus is an objective physical event
- Response is the evoked neurophysiological response

Quantitative Sensory Testing (QST)

Assessment of peripheral nociceptive sensory function
- Central sensitization and integration
- Multimodal/multi-tissue approach

- Basic mechanistic studies in healthy subjects
- Clinical studies for diagnostic and monitoring purposes
- Pharmacological studies to evaluate analgesic efficacy

Arendt-Nielsen et al. 2009

Quantitative Sensory Testing (QST)

- Threshold determination

Dynamic
- Stimulus-response curve
- Spatial summation
- Temporal summation
- Diffuse noxious inhibitory control (DNIC)
Psychophysical QST

- Outcome is a (nocifensive) behavioural reaction
- The reaction has to be interpreted
- Thresholds/reaction times are measured
- Pharmacological threshold changes are detected
- Low threshold mechano- and thermoreceptors are activated
- Influenced by drugs altering behaviour
- Learning effect can occur

Psychophysical QST: thermal threshold

- Threshold determination: heat and cold
- Methods: thermode, Peltier cell, radiant heat, immersion
- Skin properties and contact surface
- Thermal stimulation is always progressive: reaction time

  - Heating slope
    - 1°C/s: C fibers
    - 6.5°C/s: Aδ fibers
  - Cut off values

Behavioural response to heating: determinants
Psychophysical QST: mechanical threshold

- Threshold determination
  - Von Frey filaments
  - Algometry

- Methods
  - Hand-held or fixed actuator
  - Manual or computer-recorded

- Rate of force increase
- Stimulating surface

Psychophysical QST: electrical threshold

- Stimulation of nociceptors is elicited by pressure

\[ p = \frac{F}{A} \]

- Pressure depends on the stimulation surface
- Force is independent from the stimulation surface

Psychophysical QST: electrical threshold

- Direct versus alternating current
- Constant current/voltage stimulation
- Electrodes impedance/resistance

\[ \text{Ohm's law: } I = \frac{V}{R} \]

Psychophysical QST: electrical threshold

- Electrical waveforms

Constant current surface electrode stimulations were the most repeatable and gave clearer responses.
Neurophysiological QST

- Outcome is a recorded evoked reaction
- The reaction can be quantified
- Thresholds and stimulus-response curves can be determined
- Pharmacological modulation can be detected
- Less influenced by drugs altering behaviour
- Low threshold mechano- and thermoreceptors are not activated if electrical stimulation is used

The NWR: Nociceptive Withdrawal Reflex

Stimulus-response function

Temporal summation: biomarker for neurogenic pain

Nociceptive Withdrawal Reflex (NWR)
Trigemino-Cervical Reflex (TCR)

The Veterinary Journal 99 (2012) 130-137

Nociceptive trigeminal reflexes in non-sedated horses

K.D. Verre, M.J. Spalding, C. Spalding

Department of Clinical Veterinary Medicine, Nociception, Trigemino-Cervical, University of Rome, Lingotto, Rome, Italy (K.D.V.) Department of Clinical Veterinary Medicine, Trigemino-Cervical, University of Rome, Lingotto, Rome, Italy (M.J.S.) Department of Clinical Veterinary Medicine, Trigemino-Cervical, University of Rome, Lingotto, Rome, Italy (C.S.)
Neurophysiological QST

Conditioned Pain Modulation (CPM)

Extent of threshold change during application of a conditioning noxious stimulus

28. Juni 2017

QST in pre- and para-clinical drug testing

- Species-specific approach
- Focus on antinociceptive activity
- New and existing drugs
- Insight into mechanisms of action
- Investigation of several doses and infusion rates
- Support from/for clinical studies

Aim = Optimization of clinical veterinary practice

QST in clinical pain syndromes

- Characterization of spontaneously occurring pain syndromes
- Understanding of involved processing mechanisms
- Diagnosis of peripheral (and central) sensitization
- Mechanisms-based approach to therapy
- Treatment follow up

Aim = complementary tool for a thorough understanding of clinical pain conditions

Future development

- Improve quality and standardization of QST methods for nociceptive threshold determination
- Explore mechanisms of nociceptive processing involved in threshold determination methods to increase specificity
- Develop multi-tissue nociceptive markers and experimental sensitization methods