Visceral pain
– a minor or overlooked problem in cattle?

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Overlooked in science?

- Search at Web of Science
  - Topic = "visceral pain" OR "adominal pain" AND
  - Topic = cattle OR cow* OR bovin*
  - Topic = pain NOT visceral OR abdomen AND
  - Topic = cattle OR "cow* OR bovin*

- Refined for veterinary and Agricultural Dairy animal science
- Non-bovine, non-case reports, exotic and non-English:
  - 14 hits

Visceral pain
Non-visceral pain

603 hits
54 hits
Overlooked clinical?

Clinical signs

- Depression
- Colic
- Teeth grinding
- Resistance to pressure in xiphoid area or downward at the thoracic part of the back
- Head and/or ear position
- Facial expression
- Increased heart and respiratory rate
- Piloerection

Diseases

- Abomasal ulcer – also minor types
- Abomasal distension – volvulus
- Displacements/torsions of intestines
- Intussusception
- Peritonitis
- Reticuloperitonitis
- Pyelonephritis
- Vagal indigestion
- Metritis
- And more….
Pain mechanism - periferal

- Polymodal visceral nociceptors
- Normally high threshold
- Sensitization lower the threshold
- Also activation of silent nociceptors (upon inflammation)
  => Periferal hypersensitivity
- Afferents mostly in association with sympathetic fibers
- Explains increase in sympathicus (heart rate, blood pressure, respiratory rate, piloerection)

Anderson and Muir, 2005
Pain mechanism - central

- Cell bodies in DRG
  - Also from somatic system
- Convergens and wide dynamic range neurons
- Segmental overlap - aborize over several segments
- Poorly localized
  - Except peritoneal/pleural pain
- Referred pain
- Central up- or down regulation
- Terminates at same brain sites as somatic pain

Anderson and Muir, 2005
Plastic changes indicates central sensitization – an example

• Experimental induced reticuloperitonitis (model)
• Validate pain assessments methods (acute and chronic pain)
• In response to analgesic treatment:
Rialland et al 2014

- A 10-cm-diameter stainless steel circular claw inserted into the wall of the reticulum at day 0
- Treatment:
  1) Aspirin (4 cows) at day 0
  2) tolfenamic acid im. (5 cows) at – 2h and d 2
  3) polymodal analgesia: tolfenamic acid + epidural morphine + butorphanol, sc. (3 cows) at -2 h and d 1 and 2
- Day -21 – 0 (baseline) and day 0-21 (treatment period)
- Measured: Cerebrospinal fluid biomarkers, mechanical pain threshold, behaviour, pain scoring (VAS/VPS)
**Rialland et al 2014**

- Mechanical pain threshold:
  - Cuff devise attached to the cannon, activator driven 2 mm steel pin until avoidance response (Chambers et al., 1994)

**Anderson and Muir, 2005**

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**Rialland et al., 2014**
Some distinctive features of visceral afferents relative to somatic

Lack of specialized nerve terminals

Limited number of stimulus responses (distension, ischemia, and inflammation)

Widely overlapping receptive fields

First-order afferents arborize over several spinal segments

Visceral hyperalgesia and hypersensitivity – eg. mb. Crohns. Is Johnes Disease painful??

Convergence of afferents on somatic and other visceral afferents within the spinal cord

Visceromotor responses and referred pain to somatic sites innervated by the same spinal cord level

Greater emotional and autonomic responses to pain than somatic pain
Pain and abomasal ulcer

- No reports on pain related to abomasal ulcers
- Growing attention on abdominal pain in horses related to equine gastric ulcer syndrome
- In humans diverse results:
  - Even bleeding ulcers may not be associated with detectable pain (Wilcow and Clark, 1997)
  - Abdominal pain associated with "minor" CT-scan signs of gastric ulcers (Tonolini et al., 2017)
- "The abomasal ulcer project" will go further into possible associations between abdominal pain and discomfort and low-grade abomasal ulcers.
Pain and chronic inflammation

- Johne’s disease
  - Morbus Crohn in humans are part of Inflammatory Bowel Disease
    - Are painful in humans
  - Reports on Johne’s Disease and pain in cattle are lacking
  - If visceral pain related to Johne’s Disease exist, it may underline the advice to cull red cows
Treatment of visceral pain – basics concepts

• Drugs normally used to treat somatic pain may have lesser effect in treating visceral pain

• Adverse effects of analgesics are mostly targeting visceral organs (bleeding, ulcer, decreased motility)

• NSAID’s
  • Drugs of choice in cattle practice
  • OK for acute visceral pain
  • Long term treatment may not be problematic, however, increased dosage may
  • CAVE: In humans NSAID’s may deteriorate clinical symptoms in patients with gastric ulcer
  • Good for peritoneal and plural pain
Treatment of visceral pain – basics concepts

• α-2 agonists
  • Sedative effects
  • Decreases gastrointestinal motility
  • Works better in combination with opioids
  • Epidural administration

• Opioids
  • Controversal to use in cattle practice!
  • Kappa-receptor agonist (e.g. butorphanol) may work better for visceral pain than mu-receptor (e.g. morphine)
    • lesser adverse effects on GI motility
Visceral pain
• A minor problem?
  • Probably not!
  • As somatic pain, visceral pain is capable of inducing sensitization

• Overseen?
  • In some cases
  • Referred pain may be mis-interpretated
  • Some conditions may not be judged as painful

Thank you for paying attention