Identifying Pain Behaviors in Dairy Cattle

Karina Bech Gleerup

University of Copenhagen, Department of Large Animal Sciences, Hojbakkegaard Alle 5, Taastrup, 2630, Denmark
Email: kbg@sund.ku.dk

Take Home Messages

- There is nothing in the anatomy and physiology of the cow that suggests that cows are less sensitive to pain than other mammals.
- Cows in pain are likely to have different behavioural priorities compared to healthy cows.
- Pain is a serious welfare problem that needs to be addressed to meet consumer requests in the future. Farmers and veterinarians must address efficient pain treatment, prevention of pain, and early intervention when the cow is in pain.
- Too few veterinarians give proper pain relieving treatments, and a major factor influencing the decision to give pain relieving medicine is the inability to assess pain in cattle.
- Tooth grinding, vocalizing, head pressing or colic behaviour all indicate severe pain.
- A pain scoring regime exists; 'The cow pain scale' is fast and easy to use for both veterinarians and farmers.
- Cows will display some signs of pain whenever they are in pain. These signs are only valuable if someone recognizes them and acts upon them.

Cattle are often described as stoic animals [stoic, from latin 'stoicus': "a person who accepts what happens without complaining or showing emotion"], which may be the main reason why pain evaluation in cattle is not performed often enough. There is nothing in the anatomy and physiology of the cow that suggests that they are less sensitive to pain than other mammals. With the high prevalence of potentially painful conditions like lameness and mastitis in dairy herds, pain evaluation should be part of the daily routine; however, that is not the case. In recent years, scientists from several countries have investigated factors influencing the decision to use analgesia for cattle. The studies have been conducted as surveys including veterinarians and farmers. Certain potentially painful conditions were rated very low; however, only a

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minority of the survey respondents considered cattle unable to experience the emotional components of pain (Hewson et al., 2007; Kielland et al., 2010). Veterinarians and farmers generally agreed that cattle suffer from painful conditions, and that pain relieving treatment is an advantage for the animals. Despite this overall agreement on painful conditions in cattle, still too few veterinarians give proper pain relieving treatments and farmers are even more reluctant to use analgesics (Thomsen et al., 2012). The reasons for this restricted use of analgesics may be many: economic reasons, practical reasons, habits and lack of knowledge. As cattle are production animals, drug regulations are very restricted and complicated, which also influences the choice of treatment. Another major factor influencing the use of pain relieving medicine is the inability to assess pain in cattle (Flecknell, 2008). This inability to assess pain influences the perceived effect of the given pain medication. This may mean that the initial pain state of the cow is difficult to evaluate, and also, the improvement of the cow's pain state may not seem obvious enough. The lack of a visible benefit of the analgesic treatment will further demotivate the use of pain relieving drugs in the future. Untreated pain may therefore be a consequence of poor pain evaluation tools.

■ Functions and Effects of Pain

Acute pain is a protective mechanism. People with congenital insensitivity (a complete lack of pain sensitivity) will experience repeated injuries like self-mutilation and bone fractures; they have a greatly reduced life expectancy because they never learn to correlate pain to injury. Pain sense is therefore essential for maintaining bodily integrity. The emotional and aversive component of the pain experience promotes the protective motor and learned avoidance response. It supports convalescence and serves a learning function for the animal to avoid a similar injury in the future. This does not mean that cows should not be given pain medication as this does not completely cut off the pain sensation; rather, it reduces the negative effects of pain. Treating post-surgical pain in animals reduces weight loss and speeds up recovery and it is a well-known fact that pain in humans is accompanied by reduced welfare, poor condition and increased death rate.

When a cow is subjected to pain, it evokes an immediate withdrawal response and vigorous activity to escape the pain stimulus and to seek protection from further damage. This is the first line of defence against threats to the integrity of the body. In the case of trauma, this is followed by behaviours to support resting the injured area to promote healing. Licking or rubbing near the painful area can sometimes be seen, as it may soothe pain by segmental inhibition where signals from one part of the body can help reduce pain in another part. Animals may take on abnormal postures to avoid or reduce stimulation of sensitive areas as may be seen in cows with pain standing with an arched back or lying down only on the non-painful side. Quiescence promotes convalescence and this may be seen as a change in social

behaviour like isolation from group members, e.g., feeding when it is not so crowded.

Pain is a dynamic condition, which means that if left untreated or if the animal is not protected from further stress, pain may increase in magnitude and may lead to chronic changes in perception of tactile stimuli. This means that a cow suffering long-term pain may begin to perceive a non-painful normal touch as being painful.

■ Why is Pain Evaluation Important?

There is a growing concern about production animal welfare among various stakeholders, including the general public (de Graaf et al., 2016). Farmers are likewise concerned about the welfare of the animals in their care (Von Keyserlingk et al., 2009). Pain is a serious welfare problem that needs to be addressed to meet consumer requests in the future. This includes efficient pain treatment, including prevention of pain and early intervention when a cow is in pain. Some countries have taken legislative actions towards reducing pain caused by husbandry procedures, for example, by proposing compulsory use of local analgesia before a painful event and systemic analgesia after the painful event. Naturally occurring pain cannot always be prevented and for this type of pain, early recognition facilitates timely treatment, which increases the treatment success considerably. Researchers have investigated different measures for pain in dairy cattle and the duration of lying bouts is one example of a behaviour that is adjusted to the wellbeing of the animal; the duration of lying bouts increases when cows are lame. Mastitis also has an impact on cow behaviour; a recent study found that cows have reduced feed intake in the days before mastitis was diagnosed and this continued for up to 10 days after antibiotic treatment. The same cows had an increased kicking rate during milking in the same period (Fogsgaard et al., 2015). The reduced feed intake and the increased kicking may be pain related and could possibly be avoided or reduced by adding analgesia to the traditional treatment.

Since animals do not communicate verbally, veterinarians and farmers include behavioural changes when evaluating cows. Some well recognized pain manifestations are tooth grinding, vocalizing, head pressing, or rarely, colic behaviour. These behaviours will most often be noticed in dairy cattle, but it is important to realize that these are all pain behaviours indicating severe pain. It is necessary to also be aware of more subtle pain behaviours to prevent cows with low to moderate pain proceeding to experience prolonged periods of pain, which becomes difficult to treat and has a poor prognosis for the future.

Our group evaluated pain behaviours in 2 high yielding Danish dairy herds (Gleerup et al., 2015) and found that 40 of 100 randomly selected dairy cows displayed pain behaviours supportive of mild to moderate pain. A thorough

clinical examination revealed clinical findings indicative of pain in all the animals, despite the fact that they were supposedly healthy, high-yielding cows. This is a welfare concern as well as a production concern as pain has a negative effect on both milk yield and welfare.

■ Measuring Pain

Pain cannot easily be measured — not in humans and not in animals. There is no one good physiological measure for pain. Behavioural changes can however, be a very important indicator of the presence of pain, as behaviour reflects the internal state of a human or an animal. Severely lame cows or cows with other severe diseases may receive extra care and consideration, whereas cows with mild to moderate cases of clinical disease are more difficult to detect. The risk of failing to see animals in pain increases as farms expand and available labour decreases, resulting in less time spent on each cow. More automated systems are introduced to detect disease and activity as well as milk yield and milk quality, which can all indicate illness or pain. These are all very important resources in modern dairy production but direct animal-based measures may give an earlier warning of pain, and it is therefore important to keep looking at the animals. Cows will display some signs of pain whenever they are in pain (Figure 1) but these signs are only valuable if someone recognizes them and acts upon them.

Figure 1: This photo shows a dairy cow that is in pain and is expressing it with an abnormal positioning of the hind limbs (in front of each other), slightly lowered head carriage and a changed facial expression. (Photo by Karina Bech Gleerup).

The Cow Pain Scale

The cow pain scale (Figure 2) was developed to be quick and easy to use, making it applicable to every day routines in a busy dairy herd (Gleerup et al., 2015). The cow pain scale is intended for veterinarians as well as dairy

farmers. Very obvious and well recognized signs of severe pain, like tooth grinding, vocalization, head pressing or kicking toward the belly are not included in the pain scale, but these should always be considered alarming signs of severe pain. The cow pain scale is focused on cows with less obvious pain behaviours as these are often overlooked. The cow pain scale consists of 7 behaviours, evaluated from 0-2 and combined into a total pain score. This pain score is guiding, but if the pain score is above 5, the cow could be in pain and should be observed and re-evaluated or examined by the veterinarian.

The 7 behaviours are:

- **Attention towards the surroundings** — if a cow is in pain, she tends to be less focused on the environment.
- **Head position** — pain will often result in lower head carriage. This behaviour may have several explanations, two of them being an overall changed posture or avoiding social interaction.
- **Ear position** — cows in pain keep their ears straight backwards or very low like lamb's ears
- **Facial expression** — the cow has a changed facial expression when in pain, a so-called pain face.
- **Response to approach** — a cow in pain is less interested in social interaction and will therefore try to avoid an approaching person (described in more detail below).
- **Back position** — pain in legs or abdomen may result in an arched back.
- **Lameness** — lameness is a result of pain in one or several limbs. Pain in more than one limb may result in a very careful walk, rather stand a limp.

The first 4 behaviours are evaluated from a distance, while the cow is not yet alerted to the person observing. Then the cow is approached and the response to approach is evaluated. When the cow is standing up, the back position may be evaluated, and finally the lameness is evaluated. Once accustomed to the scale, this does not take more than about a minute. The pain scoring is obviously not intended routinely for all animal; rather, it is a tool for evaluating the cows that are noticed to look different than normal during the daily round through the barn.

Score	0	1	2
Attention towards the surroundings	Active and attentive 	Not attentive 	
Head position	Head held high 	Lower than withers 	Very low 
Ear position	Both ears forward or actively moving 	Both ears back 	Lamb's ears (low ears) 
Facial expression	Attentive or neutral look 	Tense expression 	
Response to approach	Look at observer, head up, ears forward or occupied with activity (grooming, ruminating)	Look at observer, ears *not* forward, leave when approached	May/may not look at observer, head low, ears *not* forward and may leave slowly
Back position	Straight line 	Slightly arched back 	Arched back 
Lameness	Not lame Normal and rhythmic strides	Lame Shorter and non-rhythmic strides	Very lame No support on one leg or very unequal and short strides

Figure 2: The Cow Pain Scale. The Cow Pain Scale is modified from the original version published in "Pain Evaluation of Dairy Cattle", Appl. Animal Behavioural Science, 2015, Open Access Pain evaluation in dairy cattle

The Cow Pain Face

The spontaneous facial expression of pain is believed to be an innate response, reflecting activity within the pain pathways. Facial expressions of pain are very difficult to suppress and the use of facial expressions is therefore considered a reliable and objective measure of pain. Recently, facial expressions of pain have also been described for several animal species: mice, rats, rabbits, cats, horses, sheep, lambs and cows. In humans, facial expressions of pain may be evident even if other pain behaviours are suppressed. This is very interesting as humans have a specialized neural apparatus for processing facial cues. This is useful when interacting with other people, as facial expressions provide important social information, like mood and level of interest, and it facilitates verbal communication. This may be useful for evaluating facial expressions in animals too (see Figure 3). It is well recognized that people working with a particular species for many years become very skilled at observing different behaviours. If it could be possible to get better at interpreting these behaviours, this may be a quick and useful tool for improving welfare and hence production.

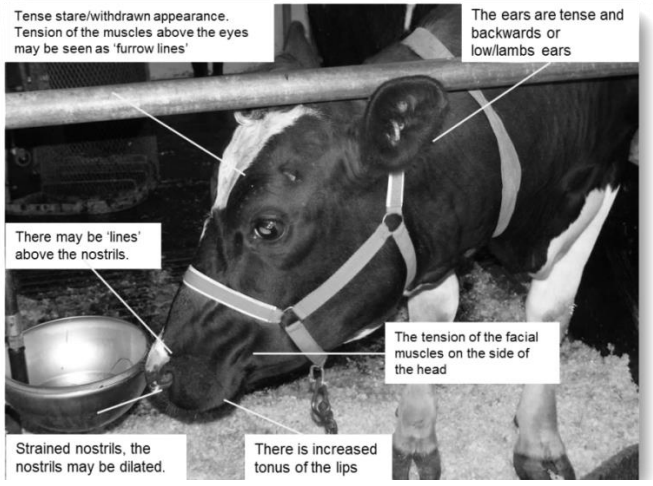

Figure 3: The cow pain face. The different changes occurring on the facial expression of a cow in pain, here pointed out on a cow in pain following surgery.

Response to Approach

Cows are generally curious animals and gentle contact makes the animals more likely to approach people resulting in a shorter avoidance distance (Lensink et al., 2000). When cows are in pain they react differently to an approaching person. They may avoid contact by keeping their heads low with

no eye contact, or they may leave before the person is close (Figures 4a and 4b). This behavioural response is also related to the age of the cow, as a young heifer may not be as confident with an approaching person as an older cow may be.

Figure 4a: 'Response to approach', score '0'. As soon as the cow sees a person approaching, she is attentive with her head high and ears forward. This cow is not scared and remains lying, sniffing the hand (after this, she got up and walked off). A sound cow that is less sociable with humans will usually remain lying down with a high head and ears forward until the person approaching is getting near, then she will get up and walk off in a hurry. (Photo by A. M. Michelsen)

Figure 4b: 'Response to approach', score '2'. The cow in this photo is not looking at the person approaching and keeps her ears back. The cow is not interested in contact, and even when the approaching person gets close to her head, she does not look. Had the cow been scared, she would have left but when a cow is in pain, she is not so motivated to get up, especially if the pain comes from the legs or claws. (Photo by A M Michelsen)

Conclusion

Pain evaluation is important to ensure animal welfare in dairy production. Computer technology can assist with surveillance of the animals but it is important to use the option of looking directly at the animals as well. This is useful only if a systematic approach is taken and if there is an action plan if a cow is found to have a high pain score. It is important to recognize abnormal behaviours, like pain behaviours, from normal behaviours. This may be even more difficult in stressed animals, which should further motivate a gentle handling of the animals to reduce stress to a minimum and to facilitate pain evaluation.

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