

Pain management in cattle

Societal pressures are pushing for more pain management in livestock; however, measuring pain and effects of analgesia prove difficult.

By Geni Wren

"I solemnly swear to use my scientific knowledge and skills for the benefit of society through the protection of animal health, the relief of animal suffering, the conservation of animal resources, the promotion of public health, and the advancement of medical knowledge".

"The relief of animal suffering." That concept has gained more importance to society and animal health professionals worldwide. One just has to look at the European situation to get a sense for where the puck might be heading regarding pain management of cattle, says Hans Coetzee BVSc, Cert CHP, PhD, DACVCP, Kansas State University.

Coetzee says in the United Kingdom, the Protection of Animals (Anesthetics) Act of 1954 states that "... it is an offense to castrate calves that have reached two months of age without the use of an anesthetic. Furthermore, the use of rubber ring or other device to restrict the flow of blood to the scrotum is only permitted without an anesthetic if the device is applied during the first week of life".

Immature calves may not be able to mount as high of a cortisol response to pain as an older animal.



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Cattle are adept at hiding signs of pain, but cues such as a dull and depressed appearance and reluctance to move can indicate pain.

However, this is the opposite of the draft NCBA *Guidelines for Care and Handling of Beef Cattle* which states that: “Calves weighing more than 500 pounds should be castrated using a bloodless castration technique, such as an elastic banding device, unless pain management is used (e.g. local anesthesia)”.

“If anything, this illustrates the critical shortage of scientific information regarding the welfare implications of the various methods of castration,” notes Coetzee, who has been researching pain and castration of calves. “In Britain, it is also a legal requirement for calves over 2 months of age to be castrated by a veterinarian. While I’m not suggesting that a similar legal framework will be established here in the United States, I do believe we as veterinarians need to be aware of what has happened across the pond and be proactive in addressing these concerns so that we can adequately respond to any attempt to impose unscientific, activist driven regulations on the

way in which we practice veterinary medicine.”

Different types of pain

Anthropomorphism is the attribution of human characteristics and qualities to non-human beings. It’s the personification of animals. Pain in cattle evokes empathy. “Pain is considered the fifth vital sign in human intensive care units, and there are pain scoring systems that are utilized,” explains Paul Walz, DVM, PhD, Auburn University. “Pain management is an important issue in human medicine, and with urbanization and less people involved in animal agriculture, this issue will become increasingly important in veterinary medicine.”

Not all types of pain are the same. “When we talk about minor surgical pain, there are agents available to prevent pain and distress; however, control of pain associated with infectious or chronic disease processes is very difficult to manage in cattle,” Walz says.

It’s important to understand the ter-

The issue of animal welfare

Animal welfare issues are at the forefront and are being driven by a variety of interested parties including activists, food companies and even consumers. “I think the biggest incentive for developing less painful methods of castration or instituting effective analgesia at the time of castration is likely to come from the people who buy the products that we are responsible for producing,” says Hans Coetzee BVSc, PhD. “One only has to look at the websites of the major fast food chains. McDonalds has developed a set of ‘Animal Welfare Guiding Principles’ which includes a statement that ‘animals should be free from cruelty, abuse and neglect while embracing the proper treatment of animals and addressing animal welfare issues.’”

Coetzee adds that thus far it appears that the focus has been on meat processing plant audits and animal handling in slaughter plants, but from there it is not inconceivable that there could be a greater interest in what is happening at the farm level. “As bovine veterinarians, we need to be prepared to face these challenges and represent our profession while also supporting our clients and the beef industry,” he says. “Without consumers, there will be no beef industry and we must be able to produce what the customer demands. If that includes the routine use of analgesics at the time of castration or dehorning, so be it. We can no longer use cost and convenience as reasons why we do not routinely provide pain relief to the livestock in our care.”

Pain management

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minology of pain. Walz says many people use the terms pain and suffering interchangeably, but they are not.

- **Pain** An unpleasant sensory and emotional experience associated with actual or potential tissue damage or described in terms of such damage (International Association for the Study of Pain). "We all must remember that pain is an important physiologic process intended to prevent further tissue damage following injury," Walz says.

- **Suffering** Conscious endurance of pain or distress. Physical and/or psychological. "This is a term frequently used with pain, but in reality, suffering is different than pain," Walz notes. "Distress is another term that is used interchangeably with suffering. Chronic pain can lead to distress."

- **Distress** A state in which an animal cannot escape from or adapt to the internal or external stressors or conditions it experiences, resulting in negative effects on its well-being (USDA-APHIS working definition).

Pain's purpose

Pain can be a very important behavior for an animal. Keeping an animal with a broken limb from further damaging it by walking on it is a function of pain. "We don't want to totally mitigate pain in an animal with a fracture because that may result in more tissue trauma or damage to that limb," Walz says.

When talking to lay people about managing and treating pain, the important thing to convey is that pain is a normal physiologic process and it should only be managed and controlled if it becomes a pathologic process. Chronic and unrelieved pain induces suffering, maladaptive physiologic process and behaviors and causes a catabolic state. Hydrocortisone is a central player in chronic pain and distress and induces catabolism and negative well-being that may be manifested in poor production. "I like to believe that we as veterinarians believe there are no beneficial effects of unrelieved, unremitting chronic pain

in the animals we work with," Walz states.

Pain may be divided into acute or chronic. A classic paralumbar incision for a c-section is a classic definition of acute pain that doesn't usually result in distress. In contrast, chronic pain may lead to distress, and a classic example is lameness in feedlots and dairies. "Many lame animals have chronic pain, especially if the lameness involves synovial structures," Walz explains. "In those animals, chronic pain can result in negative well-being. A major reason that pain is a difficult topic to address in cattle is the difference between pain and suffering." The division between pain and suffering is very gray as viewed by many people.

Unfortunately, there is tremendous individual animal variation within the cattle species in how they react to pain. Some cattle may have mild amounts of pain that will alter their well-being versus others that seem to do well and continue to carry on normal metabolism in spite of chronic pain.

Different types of pain responses exist. Some pain responses exist to modify behavior such as learning fence lines. Other pain responses include automatic nerve responses that protect the animal such as withdrawal reflexes. Responses that assist healing are normal physiologic pain responses. "Where we have to intervene is the pathologic pain responses," Walz says. "These are important points to set the stage for some of the things we do."

Pain and cattle behavior

Assessment of individual animal behavioral changes in response to pain is very subjective and can be influenced by differences in individual perception and interpretation. Since cattle were the natural prey of several predators, it is their nature to disguise signs of pain as much as possible. "The generally stoic nature of most of our livestock species often complicates our ability to intervene in a timely fashion to alleviate pain or treat disease,"

There is tremendous individual animal variation within the cattle species in how they react to pain.



Hans Coetzee BVSc, PhD, says U.S. veterinarians need to be aware of what is happening in other countries regarding pain management in cattle.

Coetzee notes. "Escape behaviors that are present during castration but not seen afterwards may reflect a specific acute pain or may be a behavioral response indicative of a desire to escape confinement."

A major problem remains that the relative level of pain signified by the different behaviors seen after castration, for example, has not been quantified. Coetzee adds that just because an animal does not express signs of pain, it does not mean that the animal is not in pain. "We need more objective assessments of pain rather than subjective cues that we have relied on for years," Walz adds.

There are a lot of behavioral cues, that may help us recognize pain in cattle, Walz says. The following can all be signs of central sensitization of pain. These are all relatively non-specific signs, some of which are observed with many conditions affecting cattle:

Recognition of pain in cattle:

- Turning toward site of stimulus
- Restlessness, pacing
- Reluctance to move
- Kicking, stamping
- Rolling
- Licking/biting at site of damage
- Vocalization
- Limping
- Dull and depressed appearance
- Inappetance
- Weight loss
- Decreased milk yield
- Grunting
- Bruxism
- Colic (signs less pronounced than horses)
- Tachycardia
- Tachypnea
- Plasma cortisol

The difficulty in measuring pain

Our ability to measure pain objectively using robust and repeatable science-based criteria is probably the biggest impediment to developing efficacious analgesic drug regimens in food animals. For this reason, the development of novel methods of assessing

pain has become a research focus of the Beef Cattle Institute (BCI) at Kansas State University.

"A lot of practitioners may not be aware of the fact that there are actually no analgesic drugs formally approved by the FDA for the alleviation of pain in food animals," explains Coetzee. The U.S. Food and Drug Administration, Center for Veterinary Medicine (FDA-CVM) guidance for the development of effectiveness data for non-steroidal anti-inflammatory drugs (NSAIDs) (Guidance Document 123), states that validated methods of pain assessment must be used in order for a drug to be indicated for pain relief in the target species. "This requirement explains the absence of analgesic drugs approved for pain relief in livestock in the United States, since there are currently no validated methods of pain assessment in food-producing animals," Coetzee says.

Research to evaluate animal well-being is mostly predicated on the assessment of the sympatho-adrenal (SA) and hypothalamic-pituitary-adrenal (HPA) hormones, such as cortisol. Several studies have evaluated acute cortisol response to determine the extent and duration of distress associated with castration and dehorning. However, applying this research to livestock in typical production settings is confounded by several reports that handling alone can stimulate significant cortisol responses. The majority of published studies that have used plasma cortisol response as a surrogate for measuring pain in animals have acclimated the animals for at least one week prior to study commencement which is not feasible in a typical production setting.

Coetzee's group has published the results of a study in non-acclimated bulls that showed that cortisol response in castrated and uncastrated calves was almost identical. "I think we are more likely to see a difference in cortisol response in castrated and uncastrated control animals if these have been acclimated," Coetzee says.

This may be further complicated by the diurnal rhythm of endogenous cortisol secretion reported in several studies. "We have also shown that increases in plasma cortisol in response to pain can reach a 'ceiling' beyond which an increase in the noxiousness of a stimulus does not seem to result in a proportional increase in plasma cortisol," explains Coetzee. "Our studies have also shown that there is a lot of variability in some of these parameters and so a large number of animals are required in order to demonstrate statistically significant differences."

Cortisol response is also an imprecise measure of chronic pain. These factors significantly diminish the utility of plasma cortisol measurement in assessing animal well-being in typical livestock production environments.

Chronic pain such as lameness may be more accurately quantified through the use of technologies such as pressure mats and accelerometers. Coetzee is involved in a program of research with David Anderson, DVM and Brad White, DVM, Kansas State University, to validate some of these models using a controlled experimentally induced lameness model.

So is it better to do surgical procedures on younger animals than older animals? Coetzee says just because we see a low cortisol response in calves at castration, that doesn't necessarily mean younger animals don't feel pain or feel less pain. "If we take into account there is a lot less tissue involved and the structures are less developed and less vascularized at that age, I think it makes intuitive sense that if we castrate them at that age there will be less long-term effects than if they were 800-900 lbs.," he explains. "Same with dehorning. Disbudding an animal without developed horn vs. a fully developed horn makes a difference. Calves may just be less capable of mounting a high cortisol response when they are that young." ■

Next issue: Using pain medication in cattle.

Production effects of pain

Production parameters are often too imprecise to reflect the pain experienced by animals following castration. Furthermore, weight gain following castration may be negatively influenced by a decrease in testosterone following



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Some studies show that cattle castrated later had poorer growth rates than those castrated at weaning.

removal of the testes. However, assessment of production parameters is critical if animal well-being research is to have relevance to livestock producers, says Hans Coetzee BVSc, PhD. These assessments may take the form of a cost-benefit analysis or a measure of animal performance.

In some studies, Burdizzo or surgical castration was found to have no effect on average daily gain (ADG) over a three month period following castration. However, the ADG of 7 week-old calves followed for five weeks after castration with rubber rings, Burdizzo clamp or surgery was reported to be lower than non-castrated control calves but similar between the different castration methods.

Rubber ring and surgical castration have been reported to cause a decrease in ADG of 50% and 70% respectively in cattle aged 8 to 9 months.

When 8, 9 and 14-month-old cattle were castrated surgically or using latex

bands, cattle castrated later had poorer growth rates than those castrated at weaning. Furthermore, cattle castrated with latex bands were found to have lower growth rates than those castrated surgically during the following 4-8 weeks.

In an Oklahoma State University study, bulls that were banded at weaning gained less weight than bulls that were banded or surgically castrated at 2 to 3 months of age. In a second study, purchased, castrated males gained 0.58 lbs more and consumed 1.26 lbs more feed per day than intact males surgically castrated shortly after arrival.

In a Kansas State University study, castrating feeder cattle was found to decrease performance post-castration. Calves surgically castrated had improved ADG relative to calves castrated by banding. Furthermore, local anesthesia with lidocaine had no effect on performance, post-castration behavior or vocalization during castration