

Introduction: Pain: An Issue of Animal Welfare

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There has been considerable progress since the early 1990s in pain research in animals and in our understanding of related physiology and pharmacology, enabling great strides to be made in pain management. But pain is still a huge welfare issue for animals: farm animals are routinely subjected to painful husbandry procedures with no anesthesia or analgesia; perioperative pain management in small and exotic animals is inconsistent; and management of cancer-related and chronic pain remains a challenge. Pain can diminish animal well-being substantially due to its aversive nature, the distress arising from the inability to avoid such sensations, and the secondary effects that may adversely affect the animal's quality of life (QOL). Pain may affect an animal's appetite, sleep habits (e.g., fatigue), grooming (e.g., self-mutilation), ability to experience normal pleasures (e.g., reduced play and social interaction), personality and temperament, and intestinal function (e.g., constipation), and may prolong the time needed for recovery from the underlying condition (ACVA, 1998; McMillan, 2003). Untreated pain may also result in systemic problems; for example, hepatic lipidosis in cats as a result of inappetence and inadequate caloric intake (Mathews, 2000).

Much is known about the recognition and assessment of pain in animals; however, more work is needed to develop valid and reliable pain scoring systems for all species that are practical in real-life situations. Perception of animal pain directly affects analgesic usage, and there is a wide range in attitudes among veterinarians, farmers, and pet owners. This can best be addressed through education. There are also economic, regulatory, and other constraints to effective pain management, particularly in large animals.

RECOGNITION AND ASSESSMENT OF PAIN IN ANIMALS

Pain is an unpleasant sensory and emotional experience associated with actual or potential tissue damage, or described in terms of such damage (IASP, 1994). The experience of pain is always subjective. Self-reporting is the gold standard in people, yet how can we know the experience of animals?

Three approaches are used in the recognition and measurement of pain in animals. The first approach includes measures of gen-

eral body function or productivity (e.g., food and water intake, weight gain) that are relatively easy to quantify; such measures reflect what was happening to the animal over the period between observations. The second approach includes physiological measures (such as changes in heart rate or cortisol concentrations) that are widely used in studies assessing pain in animals (Stafford & Mellor, 2005; Vickers et al., 2005; Whay et al., 2005) and are, in principle, particularly useful in prey species that are considered stoic and therefore unlikely to show pronounced behavioral responses until injuries are advanced (Phillips, 2002; Rutherford, 2002). However, the physical restraint required to obtain such measurements may itself be stressful and confound the results (Weary et al., 2006). Also, while cortisol measurements are useful for comparing treatments and controls, they are not useful in assessing the degree of pain an individual animal is experiencing (Rutherford, 2002).

Behavioral measures—the third approach—represent a way in which animals can “self-report.” Weary (2006) provides a comprehensive review of the ways such measures are used to recognize and quantify animal pain, and discusses the evidence necessary to ensure that the measures are valid (i.e., that the measure provides useful information about the pain the animal is experiencing) and reliable (i.e., repeatable). The three main classes of behavior used in pain assessment are pain-specific behaviors (e.g., gait impairment in lame dairy cows (Flower et al., 2008) or head shaking and rubbing in dehorned dairy calves (Vickers et al., 2005)); a decline in frequency or magnitude of certain behaviors (e.g., locomotory behaviors in rats postoperatively) (Roughan & Flecknell, 2003); and choice or preference testing (e.g., hens' responses to different concentrations of carbon dioxide used in stunning) (Webster & Fletcher, 2004). Rutherford (2002) discusses the usefulness of behaviors associated with acute, subacute, and longer-lasting pain in assessing the experience of pain in animals, including specific parameters that may be useful for veterinarians in clinical assessment of pain and by scientists studying pain in animals. These include simple and more complex behavioral responses, both qualitative and quantitative, which may or may not be adaptive, such as behaviors associated with escape or avoidance, guarding or protection (e.g., postural changes), and depression or “learned helplessness.”

Pain Recognition Tools

Pain researchers and clinicians alike agree that there is a need for sensitive and specific measures that are practical for real-time assessments in a variety of animal settings including farms, veterinary clinics, and laboratories (Viñuela-Fernández et al., 2007). Multidimensional pain scales that integrate objective and subjective behavioral observations with various other measures can be used to characterize an individual animal's experience of pain (Rutherford, 2002). Another approach is to develop questionnaires for use by animal owners that can be used in the assessment of pain and its impact on QOL (McMillan, 2003; Wiseman-Orr et al., 2004; Yazbek & Fantoni, 2005). Wiseman-Orr (2006) provides a thorough discussion of the approaches and potential pitfalls of designing and validating questionnaires where self-reporting is not possible and the questionnaires are designed for use by a proxy, as in the case of animals. Work continues in the development of scientifically validated pain recognition tools for veterinarians for clinical assessment of pain and for scientists studying pain in large, small, exotic, and laboratory animals (Roughan & Flecknell, 2003; Wiseman-Orr et al., 2004; Yazbek & Fantoni, 2005; Morton, 2005; Wojciechowska et al., 2005; Föllmi et al., 2007; Flecknell et al., 2007; Weary & Fraser, 2008).

PAIN AND CONSCIOUSNESS

Pain is always subjective and psychological variables such as past experience, attention, and other cognitive activities affect the individual's experience of pain (Melzack, 1993). Self-reporting is the gold standard in people and, because of the subtlety of communication possible with language, the understanding of pain has been greatly advanced through human subjects' descriptions of pain and the effects of different modalities of analgesia (Johnson, 2008). However, "The inability to communicate verbally does not negate the possibility that an individual is experiencing pain and is in need of appropriate pain-relieving treatment" (IASP, 1994).

If we cannot know the subjective emotional experiences of other human beings, how can we possibly know the emotional experience of animals? For most people, the evidence that animals have nociceptive receptors and pathways, physiological responses, and behavioral reactions to pain similar to that of people, is sufficient to accept that animals experience pain and suffer as a result. However, some scientists, surprisingly, suggest that animals are not capable of experiencing pain. Psychologist Bermond (2001), for example argues that animals other than anthropoid apes have an "irreflexive consciousness" (a consciousness without past or future) due to the lack of a well-developed prefrontal cortex, and that reflection is a requirement to experience suffering and pain as unpleasant. Therefore, he distinguishes between "the registration of pain as a stimulus, which does not induce feelings of suffering and the experience of pain as an emotion, which does induce suffering" (Bermond, 2001).

What kind of observations can provide evidence for or against the experience of pain and other affective states in animals? The neurophysiologist Gentle (2001) carried out an elegant series of studies to provide information on cognitive perception of pain in chickens by looking at the effect of selective attention on pain-related behavior. Noting that the human experience of pain can be modulated by shifts in attention through such modalities as relaxation

training, hypnosis, and other therapies, he reasoned that if a chicken's response to a painful event was simply an unconscious automatic reaction the response would not be influenced by shifting the bird's attention. On the other hand, if the bird actually felt the pain as an unpleasant experience, redirecting its attention might reduce the signs of pain, as in people (e.g., installation of overhead television screens in dental offices). In his work, Gentle induced gout in one leg of chickens by injecting sodium urate crystals. Chickens kept in barren cages avoided placing weight on the affected leg and, if encouraged to walk, did so with a limp. These pain-related behavioral signs were greatly reduced or eliminated in chickens given a variety of motivational changes including nesting, feeding, exploration, and social interaction. The shifts in attention not only reduced pain but also reduced peripheral inflammation.

This work has far-reaching consequences. The evidence that motivational changes, by altering the birds' attention, significantly altered pain-related behaviors, and hence probably the pain experience for the animal, indicates a cognitive component of pain in the chicken and provides evidence of consciousness. On a practical level, these results also reinforce the importance of environmental enrichment, which will promote shifts in attention and, thereby, potentially improve the welfare of birds suffering pain under commercial conditions. Strategies, such as distraction and refocusing attention through positive interaction, are very familiar to veterinarians and animal health technicians as adjuncts to pain management in small animals in clinical settings.

ATTITUDES TOWARD ANIMAL PAIN

"Freedom from pain, injury, or disease (by prevention or rapid diagnosis and treatment)" is one of the Five Freedoms widely accepted as the major components of good animal welfare (Farm Animal Welfare Council, 2009). The recognition and effective treatment of pain is central to animal welfare (Rutherford, 2002). There is a strong emphasis on pain among animal welfare researchers, with the number of pain-related articles in scientific journals considerably outweighing articles on the other Freedoms (freedom to behave normally, freedom from fear and distress, freedom from hunger and thirst, and freedom from discomfort) (Phillips, 2008).

National animal welfare advisory bodies in Australia, New Zealand, and the European Union have recommended steps to avoid or minimize animal pain and associated suffering, and the World Organization for Animal Health (OIE) produced a special edition in its Technical Series on "Scientific assessment and management of animal pain" (Mellor et al., 2008). Veterinary associations commonly have positions or policies advocating the effective management of pain in animals (CVMA, 2007; AVMA, 2011).

In theory, then, we agree that animals should not be in pain, yet studies show that attitudes toward pain vary greatly among societal groups responsible for animal care, including veterinarians. Veterinary attitudes toward pain and pain management in companion and production animals have been studied in Canada (Dohoo & Dohoo, 1996; Hewson et al., 2006b, 2007a, 2007b), the United States (Hellyer et al., 1999), the United Kingdom (Lascelles et al., 1999; Capner et al., 1999; Huxley, 2006), Finland (Raekallio et al., 2003), Scandinavia (Thomsen et al., 2010), Europe (Hugonnard et al., 2004; Guatteo et al., 2008), and New Zealand (Laven et al., 2009). Other surveys have looked at the attitudes of veterinary and

animal science students (Levine et al., 2005; Heleski & Zanella, 2006; Kielland et al., 2009).

These studies reveal some common themes. Considerable variation in clinical recognition and treatment of pain exists in both companion and production animal practice. A perception that an animal is in pain is a decisive factor in the provision of analgesia, yet there is great variation in pain ratings among veterinarians. Women and more recent graduates generally tended to rate pain more highly and treat it more frequently (Dohoo & Dohoo, 1996; Lascelles et al., 1999; Raekallio et al., 2003; Williams et al., 2005; Huxley, 2006; Laven et al., 2009) and increased usage of analgesics among newer veterinarians may well be due to the changes in emphasis of the treatment of pain that have taken place in veterinary medicine during the past 10–15 years (Thomsen et al., 2010). Although the vast majority of respondents generally agree that provision of analgesia is beneficial, and that animals recover more quickly postoperatively if analgesia is provided, the myth still persists that postoperative pain provides some benefit in preventing animals from being too active (Raekallio et al., 2003; Guatteo et al., 2008), even among veterinarians who graduated in the 2000s (Thomsen et al., 2010)—despite the position, held since 1998, of the American College of Veterinary Anesthesiologists that unrelieved pain provides no benefits to animals (ACVA, 1998). Even where a large majority of respondents agree about the importance of treating pain, there is much variation in the circumstances under which pain is treated (Hellyer et al., 1999; Hugonnard et al., 2004; Whay & Huxley, 2005).

Data from repeat Canadian surveys were somewhat encouraging. A 1994 survey showed that approximately 50% of Canadian veterinarians did not use analgesics postoperatively in dogs and cats (Dohoo & Dohoo, 1996). Usage among the other 50% varied with the procedure, and opioids were used almost exclusively, predominantly butorphanol. A similar survey in 2001 showed a marked increase in analgesic usage, with only about 12% of Canadian veterinarians not using analgesics (Hewson et al., 2006b). Given, however, the low usage of perioperative analgesics for many surgeries, together with a continued overreliance on weak opioids (e.g., butorphanol, meperidine) and under usage of strong opioids and NSAIDs, it was evident that postoperative pain was not being managed effectively much of the time.

In the 1994 survey, pain perception scores attributed to different surgical procedures were one of two primary factors affecting analgesic usage (the second was concern about the use of potent opioid agonists in the postoperative period) (Dohoo & Dohoo, 1996). Perception of pain was also a strong predictor of postoperative analgesic usage in 2001 (Hewson et al., 2006a); ratings of pain caused by different surgeries had increased markedly since 1994. In both surveys, veterinarians identified lectures and seminars at the regional level, as well as review articles, as the preferred way to receive continuing education regarding pain and analgesia.

PAINFUL HUSBANDRY PRACTICES IN FARM ANIMALS

The use of at least some degree of perioperative analgesia is fairly widespread in small animal practice (Lascelles et al., 1999; Hugonnard et al., 2004; Hewson et al., 2006b), even if consistency is lacking and there is much room for improvement to provide truly effective, multimodal analgesia. The same cannot be said

with large animals, where it remains customary to perform many procedures without anesthesia or analgesia, particularly in North America (Hewson et al., 2007b; Fulwider et al., 2008). However, in some countries analgesia is legally required when carrying out certain husbandry procedures. For example, all the Scandinavian countries now have regulations governing the use of anesthesia and analgesia for procedures such as dehorning and castrating calves (Thomsen et al., 2010). In New Zealand, analgesia is required for castration of cattle over 6 months and for dehorning in those over 9 months (Laven et al., 2009).

Surveys that have compared attitudes toward, and frequency of, pain alleviation in different species pointed out large differences among different animal species undergoing similar operations and among clinical conditions that received equal pain ratings (Hellyer et al., 1999; Raekallio et al., 2003). Even though there is no physiological basis for this differentiation, the discrepancy between practice in companion and production animals is pronounced (Stookey, 2005).

Roadblocks to Treating Pain in Farm Animals

There are many practices carried out routinely in the management of livestock and poultry that cause pain and distress (e.g., castration, tail docking, dehorning, branding, beak trimming). Many of these husbandry procedures are carried out on very young animals (e.g., tail docking in piglets and lambs, beak trimming in poultry); yet there is mounting evidence that such tissue damage early in life may program the animal to a lasting state of somatosensory sensitization and increased pain (Viñuela-Fernández et al., 2007).

Cost–benefit analyses of performing such procedures as an aid to management have too often ignored the costs to the animals themselves in terms of pain and suffering (Hewson, 2006). Increasingly, the public expects pain relief to be provided to farm animals (Phillips et al., 2009; Whay & Main, 2009), yet there are economic, practical, and regulatory constraints, such as the cost of treatment relative to the monetary value of the individual animal, limited availability of licensed analgesic drugs in food animals, and concern about drug residues and food safety (Viñuela-Fernández et al., 2007; Mellor et al., 2008a).

In considering a harm/benefit analysis of husbandry procedures, we should first attempt to minimize the harm (Weary et al., 2006) by asking questions such as:

1. Is the procedure necessary? Is it justified in terms of direct benefit to the animals and/or to the farming enterprise? For example hot iron branding is a cause of avoidable pain to animals and yet, since 2005, a US trade rule has required that all feeder cattle entering the United States from Canada be branded, despite the fact that Canadian cattle for export already bear an ear tag traceable to the farm of origin through the Canadian Cattle Identification infrastructure (Whiting, 2005). Is there another way of achieving the same end, for example, the development of polled breeds to eliminate the need for dehorning calves or immunocastration in calves, piglets, and lambs (Stafford & Mellor, 2009)?
2. What harms are caused, how bad are they, can they be avoided or reduced (e.g., through treatment of pain)?
3. What are the availability, cost, effectiveness, and ease of administration of pain-relieving drugs? Are there adverse effects or residues? Is administration by a veterinarian required?

Husbandry practices with no benefits for animals or farmers may become entrenched. For example, studies have shown no benefits of tail docking in dairy cows, and yet this practice, which has been shown to cause acute and chronic pain, as well as increased fly numbers, and to which the American and Canadian Veterinary Medical Associations are officially opposed (AVMA, 2009, CVMA, 2010), is still widespread in the United States (Fulwider et al., 2008).

The recognition of pain in species such as cattle and sheep may be more difficult because, as prey species, there was strong evolutionary pressure to mask signs of pain and associated weakness (Phillips, 2002; Rutherford, 2002). A large European survey describing pain management practices in cattle (Guatteo et al., 2008) showed very high variability among veterinarians in the knowledge of and sensitivity to pain in cattle. Again, awareness of and ability to assess an animal's pain were critical to the decision on whether to treat pain. In a similar survey in the United Kingdom, cattle practitioners who did not use analgesics assigned significantly lower pain scores to painful procedures or conditions (Huxley, 2006).

In such studies, veterinarians expressed the concern that producers would be unwilling to pay additional costs of providing analgesia (Whay et al., 2005; Huxley, 2006; Hewson et al., 2007a; Guatteo et al., 2008). However, a follow-up study (Huxley & Whay, 2007) showed that, for a significant minority of cattle farmers, the cost of providing analgesia may not be a barrier. For castration and dehorning, for example, 40% and 25% of respondents, respectively, were prepared to pay additional fees sufficient to cover the cost of appropriate analgesic drugs (local anesthesia and NSAIDs). Fifty-three percent of farmers surveyed agreed with the statement "Veterinary surgeons do not discuss controlling pain in cattle with farmers enough."

As well, there are costs to NOT providing analgesia. Apart from causing animal suffering, pain can cause significant economic losses (Denaburski & Tworowska, 2009; Whay & Main, 2009; Grandin, 2009). Yet, a UK study (Leach et al., 2010) showed that, despite a high prevalence of lameness in dairy cows (36% in farms surveyed in 2006–2007), the majority of farmers did not perceive lameness to be a problem on their farm, and underestimated the cost of pain to production.

Management of pain is dependent on the stockperson (or animal caregiver) and the veterinarian. Effective pain management requires recognition of the pain, provision of an environment where the animal can recover, and knowledge about and provision of appropriate analgesic drugs. The ways in which an animal is handled and cared for can exacerbate or mitigate pain and distress. Studies in all major farm animal species have confirmed a strong relationship between the methods used in handling animals, the degree of fear the animals show toward people, and the productivity of the farm (Rushen & Passillé, 2009). For example, a large study of US dairy farms showed lower somatic cell counts in the milk and tendencies to lower percentages of lame cows and shorter calving intervals on farms where the cows were more willing to approach the observer (Fulwider et al., 2008).

A special issue of *Applied Animal Behaviour Science*, "Pain in Farm Animals," summarizes current knowledge about addressing many of the major causes of such pain, for example, disbudding and dehorning in cattle (Stafford & Mellor, 2011a), castration in pigs and other livestock (Sutherland & Tucker, 2011), identification and

prevention of intra- and postoperative pain (Walker et al., 2011), and pain issues in poultry (Gentle, 2011).

THE WAY FORWARD

There have been many advances in the understanding of and ability to treat pain in animals in recent decades. We have the knowledge to effectively manage perioperative pain through multimodal analgesia and there are practical resources available to assist veterinarians to do so (Tranquilli et al., 2004; Cracknell, 2007; Flecknell et al., 2007; Lemke & Crook, 2011). There are published recommendations for managing painful procedures in large animals (Lemke et al., 2008; Stafford & Mellor, 2011b), although there are still many constraints. The management of chronic pain continues to present a challenge.

The widespread finding that a veterinarian's perception of pain is a significant predictor of analgesic usage is a major concern, especially considering pain ratings vary so markedly. A persuasive case is made in pediatric medicine against allowing personal beliefs about the experience of pain to prevent "optimal recognition and treatment of pain for all children" (Hagen et al., 2001). Veterinary practitioners must adopt the same approach for animals.

Veterinarians commonly feel their knowledge of issues related to recognition and management of pain is inadequate, and are interested in continuing education opportunities to address this lack. There is a great deal of information available on assessment and management of pain, which needs to be better communicated to veterinary students and veterinarians.

So what can veterinarians do to better manage pain in animals? Veterinarians working with all species should avail themselves of continuing education regularly to ensure they have current knowledge about recognizing, assessing, and managing pain. Veterinarians working with large animals should ensure that they inform farmers of the strategies available to mitigate pain associated with production practices and with chronic conditions, and of the resulting benefits to the animal and to the bottom line. And veterinarians, as a profession, can work with other stakeholders, as expected of them by society as advocates for animals, to address regulatory, technological, and economic constraints.

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