Where are we with Pain Recognition and Management in Cattle?

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Abstract

Pain is both a sensory and emotional experience, and while no absolute insight into an animal's pain experience is possible, studies of physiology, behavior and responsiveness to analgesia all indicate that animals, including cattle, are likely to sense pain in similar ways to humans[7]. While there has been considerable research into both pain recognition and management in cattle, practical application of this knowledge on-farm has not progressed as rapidly. Failure to acknowledge and manage pain is likely to lead to slower healing, decreased productivity and compromised animal welfare. Recognition of pain is a key determinant of whether pain management is likely to be implemented. A survey examining analgesia use by UK veterinary practitioners[4] revealed that respondents who assigned lower pain scores to a range of procedures and conditions seen in cattle were less likely to give analgesia.

Résumé

La douleur est une expérience à la fois sensorielle et émotionnelle et bien qu'il ne soit pas possible d'appréhender entièrement l'expérience de la douleur chez un animal, les études portant sur la physiologie, le comportement et sur la sensibilité à l'analgésie indiquent toutes que les animaux, incluant les bovins, ressentent la douleur de la même façon que les humains7. Bien qu'il existe plusieurs travaux sur l'appréciation de la douleur et sa gestion chez les bovins, les applications pratiques de ces connaissances à la ferme n'ont pas progressées aussi rapidement. Ne pas reconnaître et gérer la douleur va probablement ralentir la guérison, décroître la productivité et compromettre le bien être de l'animal. L'appréciation de la douleur détermine essentiellement si un programme de régie de la douleur sera adopté. Un sondage sur l'utilisation de l'analgésie par les vétérinaires praticiens du Royaume-Uni4 indiquait que les répondants qui attribuaient des scores de douleur moins élevés à plusieurs procédures et conditions rencontrées chez les bovins recouraient à l'analgésie moins souvent.

Introduction

The physiological process of pain is described as follows:[3] pain results from chemical, mechanical or thermal stimulation of free nerve endings containing nociceptors. Injury to cells in tissues causes release of inflammatory mediators (e.g. prostaglandins, histamine and bradykinin), which stimulate nociceptors in nearby nerve endings. This is an amplification process; a stimulus affecting a relatively small number of nerve endings stimulates many more. Impulses resulting from this stimulation are conducted via the ventrolateral part of the spinal cord to the brainstem and thalamus. There is further amplification at this level (centrally); this is known as "wind-up". Conscious perception of pain is a result of activation of certain areas of the cerebral cortex (via the thalamus). Theoretically, pain is a central "experience" that occurs as a result of nociception in peripheral nerves.

Tissue injury results in acute pain, which stimulates muscular action to avoid the noxious stimulus (either as a result of reflex limb flexion or via conscious mechanisms) and causes sympathetic autonomic nervous system activation and a heightened state of arousal. Increased sympathetic tone can become persistent if the insult is prolonged or severe. In chronic pain ("pain which has persisted beyond normal tissue healing time", IASP), the presence of high levels of inflammatory mediators around the site of injury and persistent activation of pain fiber pathways in the spinal cord leads to a decrease in pain threshold, so that stimuli are perceived as more painful than would be normal for the individual concerned. This is known as hyperalgesia. Another phenomenon associated with chronic pain is allodynia, whereby similar mechanisms lead to perception of normally non-painful stimuli as painful. Prevention or modulation of hyperalgesia and allodynia is one of the main objectives of analgesia. For example, a chronically lame cow may over time perceive the lesion as more painful than it was initially (hyperalgesia) and perceive pain in undamaged surrounding tissues on touch (allodynia).

Domesticated cattle (*Bos taurus*) are descended from ranging herbivores prone to predatory attack and,

as a consequence, there is a strong evolutionary pressure to mask pain and associated weakness.[7] However, this does not mean that signs of pain are not observable and cannot be identified as part of a complete clinical examination. Documented indicators of pain in cattle include:

- Decrease in movement/locomotion
- Decreased interaction with other animals in the group
- Decreased feed intake (e.g. "hollow" left flank caused by an empty rumen)
- Changes relevant to the source of the pain being experienced (e.g. altered locomotion, flank watching or kicking, ear twitching)
- Level of mental activity/responsiveness (animals in severe pain often show reduced responsiveness to stimuli)
- Changes in normal postures associated with pain (e.g. lateral recumbency, standing motionless, drooping of the ears)
- Easily measurable indicators of physiological stress (e.g. increased heart rate, increased pupil size, altered rate and depth of respiration, trembling)
- Bruxism (tooth grinding)
- Poor coat condition (e.g. rough, dusty or unkempt) caused by decreased grooming

Many aspects are likely to be of importance in influencing a veterinary practitioner or farmer's recognition of pain in cattle and their decisions about offering pain relief. Firstly, an acknowledgement that cattle do experience pain and an understanding and experience of recognizing signs of pain are important. Knowledge of appropriate routes of administration, availability and licensing of analgesic drugs is also important. Some classic misunderstandings about pain, which are often used as excuses for poor practices, include beliefs that young animals experience less pain than adults, that pain restricts potential damaging movement and that analgesics mask signs of a deteriorating condition. Finally, practitioners often believe that farmers are unwilling to pay for analgesia or more costly treatment options. However, there is evidence that a significant number of farmers would be prepared to pay more than their clinician realizes,[5] which suggests that it is appropriate to present a range of analgesic options to the farmer.

The study described below contains some results of a questionnaire survey of UK veterinary practitioners designed to assess their views of, and attitudes towards, pain and the use of analgesics in cattle.

Materials and Methods

A questionnaire was designed and produced to assess the attitudes of cattle veterinary surgeons practicing in the UK towards pain and the use of analgesics in cattle. It was similar to a questionnaire used previously to investigate the use of analgesia in companion animals.[2,6] The initial section of the questionnaire collected background data such as sex, year of graduation, veterinary school attended, the respondent's practice (size, type and location), continuing education and the amount of time the respondent spent working with cattle. Respondents were then asked what analgesic agents (non-steroidal anti-inflammatory drugs [NSAIDs], α2 adrenoceptor agonists, local anaesthetics and other agents) were available in their practice; which they used when treating cattle; and how important they rated a number of factors when they considered the use of NSAIDs, α2 adrenoceptor agonists and local anaesthetics in adult cattle and calves. The questionnaire went on to ask about the drug regimes the respondent would use to provide analgesia during a selection of procedures and conditions in cattle; in what range they considered an *acceptable* cost for the course of analgesia fell; how severe they considered the pain would be for cattle undergoing a series of procedures or suffering from a variety of conditions if *no* analgesic drugs were administered (estimated on a 10-point scale) and whether they agreed or disagreed with a number of statements on the use of analgesics in cattle. The final section of the questionnaire asked about where they had gained most of their knowledge on recognizing and treating pain in cattle and whether they considered themselves to have adequate knowledge in the area.

A total of 2,391 questionnaires were posted in individually addressed envelopes to cattle veterinarians in Great Britain and Northern Ireland on the mailing list of a UK pharmaceutical company. A header letter sent with the questionnaire explained the purpose of the project, assured respondent of its complete anonymity, estimated the amount of time required for its completion (based on "trial" completion) and thanked them in advance for their participation. Letters explaining the rationale behind the questionnaire and asking for its completion and return were placed in *The Veterinary Record* and *The Veterinary Times* on two occasions, approximately one month apart. No individually addressed written reminders were distributed.

Results

An additional seven questionnaires were requested by practitioners who had not received them in the initial mailing. A total of 616 questionnaires were returned, equivalent to a response rate of 25.7%. However, this is only an approximation, because a number of questionnaires were returned from practitioners stating they no longer conducted any farm animal practice. It can therefore only be presumed that other questionnaires were received by practitioners who did not conduct any

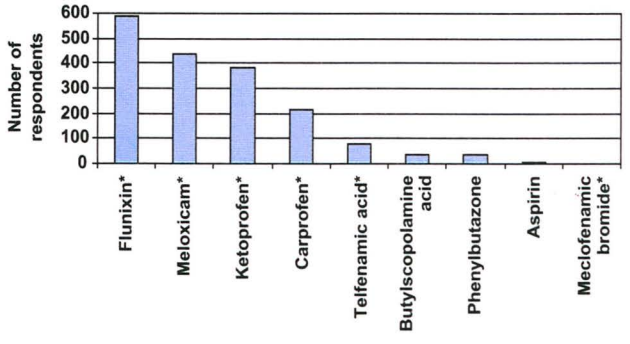
farm animal practice but did not return them to us, i.e., some questionnaires were distributed inappropriately.

Questionnaires were returned from practitioners who graduated between 1961 and 2004. Respondents had graduated from a total of 21 veterinary schools, although the majority, 92.8%, had graduated within the UK. Overseas veterinary schools represented in the study included Dublin (Ireland), Massey (NZ), Utrect (Holland), Leige and Ghent (Belgium), Berlin, Hanover, Leipzig and Giessen (Germany), Thessalonkia (Greece), Pretoria (South Africa), Sydney, Perth and Queensland (Australia) and Zimbabwe. The percentage of respondents' practice devoted to cattle ranged from 0 to 100% with a mean value of 50%.

When asked to name the analgesic agents available in their practices for the treatment of cattle, respondents cited a total of nine NSAIDs (Figure 1). The number available to individual respondents ranged from zero to six, with a median of three. Four α2 adrenoceptor agonists were quoted (Figure 2). The number available to individual respondents ranged from one to four, with a median of one. Eight local anaesthetic agents were named (Figure 3). The number available to individual respondents ranged from one to four with a median of one. A total of 17 other agents were named when respondents were asked to outline any other analgesic agents they had available in their practice (Figure 4). The number of other agents available ranged from zero to four with a median of zero.

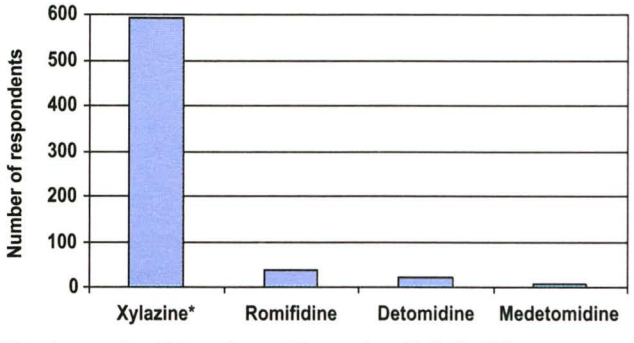
Practitioners were asked to outline what categories of analgesic agents they used during a variety of procedures and conditions in adult cattle, in what proportion of cases they used these products and what they considered as an acceptable cost for a course of treatment. The results are outlined in Table 1.

Respondents were asked to rate the severeity of pain for cattle undergoing a range of procedures or suf-



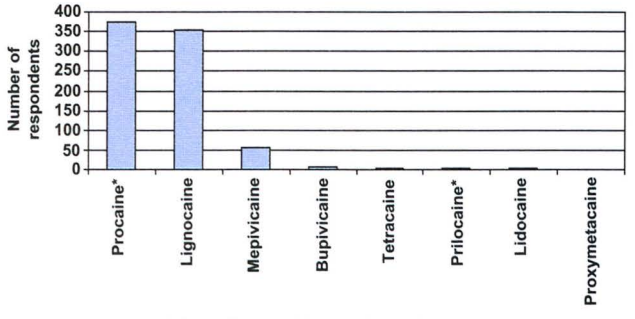
*Denotes agents which are licensed for use in cattle in the UK.

Figure 1. Number of respondents who stated the following NSAIDs were available in their practice for the treatment of cattle.



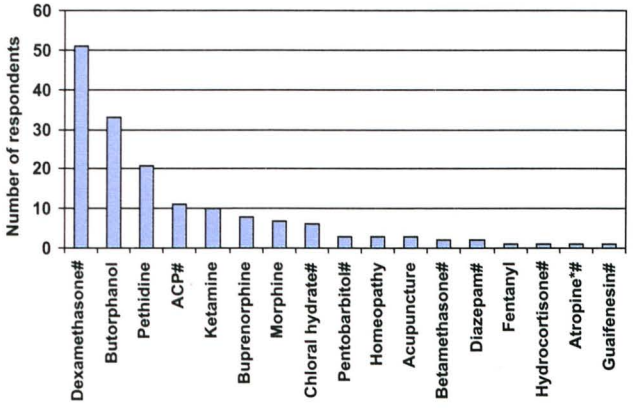
*Denotes agents which are licensed for use in cattle in the UK.

Figure 2. Number of respondents who stated the following α2 adrenoceptor agonists were available in their practice for the treatment of cattle.



*Denotes agents which are licensed for use in cattle.

Figure 3. Number of respondents who stated the following local anaesthetics were available in their practice for the treatment of cattle.



*Denotes agents which are licensed for use in cattle
#Denotes agents with no known analgesic properties

Figure 4. Number of respondents who stated the following other analgesic agents were available in their practice for the treatment of cattle.

Table 1. Use of analgesic agents by practitioners during a number of procedures and conditions of adult cattle.

Procedure / condition	Proportion of respondents who use the following agents in *some* cases				Mean proportion of cases where analgesic agents were used, by respondents who stated they employed them.			
	NSAID	α2 Agonist	Local	None	NSAID	α2 Agonist	Local	Median acceptable cost*
Treatment of a solar ulcer	42.7	9.5	23.3	43.2	49.8	38.8	34.9	£5 - 10
Claw amputation	61.2	55.8	96.4	0.3	90.4	75.2	99.3	£11 - 20
Caesarean section	68.1	60.3	98.4	0.3	76.4	50.8	99.4	£11 - 20
Dystocia	66.0	11.8	37.1	23.0	53.9	15.7	35.3	£11 - 20
Dehorning	2.6	26.1	99.0	1.0	51.3	41.7	99.4	<£5
Uveitis	46.4	2.3	13.6	44.3	58.5	53.7	63.3	£5 - 10
Debriding a digital dermatitis lesion	18.3	16.8	41.0	43.2	58.3	53.4	61.7	£5 - 10

* The median cost range practitioners considered acceptable.

fering from a variety of conditions if no analgesic drugs were administered. The degree of pain was graded on a 10 point scale, where 1 was no pain and 10 was the worst pain imaginable. Results are outlined in Table 2.

The proportion of respondents who agreed with a number of statements on the use of analgesics in cattle is outlined in Table 3.

Some 45.5% of respondents considered their knowledge to be adequate in the area of study. When asked to state where they had obtained most of their knowledge on recognizing and treating pain in cattle, the most frequent response given was "experience gained in practice" (63.9% of respondents) followed by "undergraduate training" (17.2%), "journals" (8.7%), "continuing education lectures" (6.0%), "commercial literature" (2.7%) and "other sources" (1.5%).

Discussion

While it would be impossible to accurately calculate the response rate in this survey, it is certainly greater than 25%. This is good for this type of survey especially considering that no reminders were sent, although it is not as high as the 48% response rate achieved by researchers who sent a similar questionnaire to small animal practitioners[2,6].

The "average" practitioner had three NSAIDs, one α2 adrenoceptor agonists and one local anaesthetic agent available in their practice for use in cattle. The most frequently cited NSAIDs were flunixin, meloxicam, ketoprofen and carprofen. Xylazine dominated α2 adrenoceptor agonist availability, and procaine and lignocaine were the common local anaesthetic agents. Perhaps of most significance is the number of products identified that do not currently have a licence for use in cattle (in fact, the majority do not have a licence for any food-producing species). This includes lignocaine, which is currently only licensed for use in horses, dogs and cats. Current guidance on the use of medicines states: "*If the animal is a food-producing animal, the veterinarian or person acting under his/her direction may only administer a product that contains substances found in a product authorised in the UK for use in food-producing animals. This applies whichever tier of the cascade is used. Pharmacologically active substances which are not contained in products currently authorised for food-producing species, must not be administered to food-producing animals under the cascade.*"[1]

The use of unlicensed products should therefore be avoided, especially considering that suitable licensed alternatives are available in all drug classes (NSAIDs – flunixin, meloxicam, ketoprofen, carprofen and telfenamic acid; α2 adrenoceptor agonists – xylazine; local anaesthetic – procaine and prilocaine). The only slight exception to this guidance is the use of general anaesthetic. Currently no agents are licensed for use in food-producing animals; however, the Veterinary Medicines Directorate (VMD) has issued guidance that states "*it may be considered inappropriate to take action against veterinary surgeons prescribing and using anaesthetics and analgesics which are necessary for the health and welfare of animals in circumstances where there is no viable authorised product and where the imposi-*

tion of the withdrawal period set down in the regulations would protect consumers." Also of concern is the number of products listed by respondents as available analgesic agents which lack any known analgesic properties, including dexamethasone, ACP, chloral hydrate, pentobarbitol, betamethazone, diazepam, hydrocortizone, atropine and guaifenesin.

Preliminary analysis of the results have yielded some fascinating insights into how practitioners perceive and treat pain in cattle. Less than half (45.5%) of respondents feel that they have adequate knowledge in this area. Considering the huge impact that recognizing and managing pain has on the welfare of the affected animal, this is a cause for concern.

Table 2. Estimations of severity of pain in adult cattle undergoing or suffering from a variety of conditions.

	Median	Mean	Range	Rank position (Based on median)
Procedures				
Treatment of a sole ulcer	6	5.5	1 - 10	6
Claw amputation	10	9.1	2 - 10	1
Caesarean section	9	8.8	1 - 10	2
Dystocia*	7	6.3	2 - 10	5
Dehorning	8	7.6	2 - 10	4
Debriding a digital dermatitis lesion	6	5.8	1 - 10	6
Left-displaced abomasum (surgery)	9	8.1	2 - 10	2
Conditions				
Uveitis	6	6.1	1 - 10	4
Fracture of tuber coxa	7	7.2	2 - 10	1
Left displaced abomasums	3	3.9	1 - 10	8
Digital dermatitis	6	5.7	2 - 10	4
Acute metritis	4	4.6	1 - 10	7
Swollen hock	5	4.8	1 - 10	6
Hock with hair loss	3	3.3	1 - 10	8
Acute toxic *E. coli* mastitis	7	6.2	1 - 10	1
Mastitis (clots only)	3	3.1	1 - 10	8
Neck calluses	2	2.3	1 - 7	11
White line disease with sub-sole abscess	7	6.4	1 - 10	1

*Fetal-maternal disproportion requiring traction alone.

Table 3. Proportion of respondents who agreed with a number of statements on the use of analgesics in cattle.

Statement	Proportion of respondents who agreed
Analgesics may mask deterioration in the animal's condition	41.0%
Cattle benefit from receiving analgesic drugs as part of their treatment	98.4%
Some pain is necessary to stop the animal becoming too active	17.4%
Cattle recover faster if given analgesic drugs	91.3%
Drug side effects limit the usefulness of giving analgesics to cattle	4.8%
Farmers are happy to pay the costs involved with giving analgesics to cattle	36.3%
Farmers would like cattle to receive analgesia but cost is a major issue	65.3%
E.U. legislation limits my ability to use analgesic drugs in cattle	37.5%

When asked to identify where they had gained most of their knowledge on the recognition and management of pain in cattle the most frequent response was "experience gained in practice" (63.9%) and the next most frequent answer was "undergraduate training" (17.2%). While it is admirable that practitioners are educating themselves based on their experiences and the authors in no way wish to criticize this approach, it is also an area for concern. Farm animal practice can be very insular, with practitioners largely having to work on their own. This makes it difficult to discuss the presentation and management of cases with colleagues unless it is done "over a coffee" without the animal present. In this situation it is also possible that one's perceptions, opinions and treatment protocols may be out of step with the majority of other practitioners working in the field.

When asked to estimate, on a 10-point scale, the severity of pain for a number of identified conditions and procedures if no analgesic agents were administered, claw amputation, caesarean section and left-displaced abomasums (LDA) surgery were considered the most painful procedures. Fracture of the tuber coxae, acute toxic *E. coli* mastitis and white line disease with a subsolar abcess were considered the most painful conditions. Individual perceptions varied hugely between respondents: there was a range of 10 points for 11 procedures or conditions, 9 points for six and a seven point range for one. This suggests a huge variation in individual perceptions of pain in cattle. One strength of a survey such as this is, it allows the estimation of the "majority" opinion, i.e., what the "average" practitioner's views are. It is hoped that the results presented here and in future publications will allow practitioners to compare their opinions, attitudes and treatment regimes to those of the "average" practitioner and adjust them accordingly if it is appropriate for them to do so. In that way, existing knowledge and best practice can be shared if it is presented in an accessible and appropriate form.

The use of analgesic agents for a variety of conditions and procedures was widespread (Table 1), although there were wide variations in agents used and in what proportion of cases they were administered. However, it can still be considered disappointing that only 61 and 68% of respondents used NSAIDs to control pain after the major surgical procedures of claw amputation and caesarean section, and even then they were not administered in all cases seen. This is especially true considering they were two of the procedures considered most painful (given median pain scores of 10 and 9, respectively) and over 90% of respondents agreed with the statements "Cattle benefit from receiving analgesic drugs as part of their treatment" and "Cattle recover faster if given analgesic drugs." A possible explanation for this apparent dichotomy is that practitioners know or perceive that farmers are unwilling to pay the costs associated with a course of analgesia (65% or respondents agreed with the statement "Farmers would like cattle to receive analgesia but cost is a major issue"). The authors have recently secured charitable funding to repeat this style of questionnaire with cattle farmers. This will allow issues such as this to be investigated further.

Of most concern is the fact that 0.3% of respondents stated they did not use any analgesic agents when performing claw amputations or caesarean sections. This seems hard to believe, although theoretically both operations could be performed using physical restraint alone. Alternative explanations include the operations being performed under general anaesthesia or errors made when completing the questionnaire.

The results presented here are a provisional analysis of some of the data collected. A full analysis and description of the results gained from this survey will be submitted for publication in a peer-reviewed journal in the near future.

Acknowledgements

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References

1. Bishop Y: *The Veterinary Formulary*, ed 6. London, Pharmaceutical Press, 2005.
2. Capner CA, Lascelles BDX, Waterman-Pearson AE: Current British veterinary attitudes to perioperative analgesia for dogs. *Vet Rec* 145:95-99, 1999.
3. Huddson C, Whay HR, Huxley JN: Recognition and management of pain in cattle. *In Practice* 30:126-134, 2008.
4. Huxley JN, Whay HR: Current attitudes of cattle practitioners toward pain and the use of analgesics in cattle. *Vet Rec* 159:662-668, 2006.
5. Huxley JN, Whay HR: Is mastitis painful? *Proc British Mastitis Council Conference 2007*, Warwickshire, Stoneleigh Park, 10 October 2007.
6. Lascelles BDX, Capner CA, Waterman-Pearson AE: Current British veterinary attitudes to perioperative analgesia for cats and small mammals. *Vet Rec* 145:601-604, 1999.
7. Phillips C: *Cattle Behaviour & Welfare*, ed 2. Oxford, Blackwell Science Ltd, 2002.