Clinician attitudes to pain and use of analgesia in cattle: where are we 10 years on?

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Pain in cattle can arise though disease or injury or may result from veterinary or husbandry procedures. Controlling pain is important to safeguard animal welfare. Previous studies indicated that the use of analgesics in cattle has lagged behind use in companion animals. Over the last decade, more analgesic products have become available for use in cattle and there have been increased efforts to communicate the importance and benefits of analgesia. A questionnaire (based on that used in a similar study published in 2006) was sent to UK cattle practitioners asking them to score pain severity for several conditions of cattle and asking about their attitudes towards and use of analgesic medicines. A total of 242 surveys were returned. Male clinicians and those graduating before 1990 scored pain severity significantly lower and were significantly less likely to use NSAIDs. Generally, use of NSAIDs was more common for conditions assigned higher pain scores. However, uptake of NSAID use was much lower for a number of routine procedures in calves than would be expected from the pain scores they were assigned. A need remains to increase use of analgesic products, especially NSAIDs in calves, in line with best practice recommendations.

Introduction

Painful conditions are frequently encountered in cattle, whether disease-associated or iatrogenic following veterinary or husbandry interventions. Pain responses have been demonstrated in cattle with various diseases including lameness\(^1\) and mastitis\(^2\), and it is logical to assume that they occur for other common diseases and conditions. Pain has also been identified in cattle following veterinary or husbandry procedures including surgery\(^3\), castration\(^4\) and disbudding\(^5\) and can arise as a result of inappropriate handling or management. While prevention and avoidance is important, some degree of disease and the necessity of some husbandry procedures currently remain unavoidable. Reducing the pain caused by these diseases and procedures is an important aspect of maintaining farm animal welfare.

Numerous analgesic and anaesthetic products are available and licensed for use in farm animals, including non-steroidal anti-inflammatory drugs (NSAIDs) and local anaesthetics. The reduction in pain associated with using these products during routine husbandry procedures is well documented,\(^4,\)\(^6\) and there is increasing evidence to support the benefits in painful diseases as well, including lameness,\(^6\) mastitis\(^8\) and metritis.\(^9\)

Cattle are naturally stoical animals, and while there are a number of pain assessment tools available for research, the use of analgesics in cattle relies heavily on the recognition and perception of pain by both producers and prescribing veterinarians. A previous large-scale survey evaluating the attitudes of UK cattle practitioners to pain and the use of analgesics identified that pain scores for different conditions varied markedly between individuals, with significant effects of gender and decade of graduation.\(^10\)

The authors suggested that more work was needed to disseminate up-to-date knowledge to cattle practitioners. A similar approach in New Zealand\(^11\) revealed similar findings.

In the time since the previous survey, there has been an increase in the number of analgesics available, along with substantial efforts to promote the use of analgesics through knowledge exchange activities. The aim of this study was to assess whether perceptions of pain in cattle by cattle practitioners have changed in the intervening decade.

Materials and methods

Data were collected by questionnaire. The questionnaire was deliberately designed to be similar to that used by Huxley and Why\(^12\) to allow comparisons to be made (see online supplementary material). Paper copies of the questionnaire with a reply paid envelope were sent to 650 UK veterinary practices randomly selected from the mailing list of a pharmaceutical company (Boehringer Ingelheim). An electronic copy of the questionnaire was also created and distributed online using a web-based system (SurveyMonkey, California, USA, www.surveymonkey.com). Paper surveys were accompanied by a cover letter that also contained a link to the electronic survey and made it clear that multiple responses from a practice were allowed by either copying the paper version or by the electronic version. The survey was promoted with a letter in The Veterinary Record two weeks after being mailed out, emails promoting the survey were also circulated to members of the British Cattle Veterinary Association and around a network of independent farm animal practices (XLVets). These emails were sent approximately five and eight weeks after mailing the paper questionnaire. A copy of the paper version is included in the online supplementary material. The questionnaire consisted of six parts:

1. Part 1 collected demographic information including gender, year and place of graduation, level of qualification and practice details.
2. Part 2 asked respondents to list the analgesic agents used for cattle in their practice.
3. Part 3 reviewed the use of analgesics in adult cattle, with factors affecting their use, followed by a list of conditions and procedures with questions regarding the respondent’s use of analgesia for these conditions. Participants were also asked to score the expected pain severity (in the absence of any analgesia or anaesthesia) on a 10-point scale and what they would consider an acceptable cost for analgesia for each condition/procedure.
4. Part 4 was similar to part 3 but related to calves.
5. Part 5 gathered information about the participant's opinions on analgesics by asking their agreement with a series of statements and whether their opinions had changed in the previous 5–10 years.
6. Part 6 asked about continuing education and where participants had gained their knowledge on pain in cattle.

Data from paper surveys were input into a spreadsheet (Microsoft Excel 2016; Microsoft) and merged with data from online respondents. Error checking and data audit were carried out at this stage. For pain score data, the distributions of scores across conditions and procedures were presented as boxplots. Pairwise associations between pain score assigned and various demographic factors were tested using Mann-Whitney U tests for factors with two categories and Kruskal-Wallis tests for factors with more than two categories. As there were substantial correlations within some of these demographic factors (eg, the higher proportion of female graduates in later years), a multivariable linear regression model was constructed with pain score as the outcome variable, using a respondent-level random effect to account for repeated scores within individuals. The model was built using forward selection, and visual assessment of distribution of residuals and influence plots was used to assess model fit.

Factors associated with use of analgesia were investigated in detail. The two main types of analgesia available (NSAIDs and local anaesthesia) were considered separately. Respondents were asked to estimate the proportion of cases in which they used each form of analgesia across a range of conditions and procedures. For NSAID use, the distribution of these responses was strongly bimodal, with respondents mostly giving values very close to either 0 per cent or 100 per cent for a given condition. NSAID use was therefore recoded as a binary outcome (using 50 per cent as the threshold percentage). This was compared graphically across conditions and procedures, and used as the outcome for a logistic regression model to investigate other factors associated with NSAID use. The model was built using forward selection, again using a respondent-level random effect to account for repeated responses within individual. Final parameter estimates were generated using a Markov Chain Monte Carlo procedure, and model fit checked using a Hosmer-Lemeshow test. Data analysis was carried out in R V.3.2.5 with MLwiN V.2.36 used for regression model building and parameter assessment.

**Results**

**Demographic data**

A total of 102 paper questionnaires were returned, of which 5 were mostly incomplete. The response rate for the paper questionnaire was 16 per cent (102/650). A further 145 responses were received via the online survey, so a total of 242 questionnaires were analysed. It was not possible to calculate a response rate for the online survey because the extent of distribution was unknown. Where questions were omitted or filled in illegibly, those questions were not analysed for that respondent, but the remainder of the questionnaire was included in other analyses where possible. Demographic data are shown in Table 1.

**TABLE 1: Demographic data for respondents to a survey investigating attitudes to pain and the use of analgesia in cattle**

| Variable            | Percentage of respondents (n=242) |
|---------------------|-----------------------------------|
| Gender              |                                   |
| Male                | 56                                |
| Female              | 44                                |
| Year of graduation  |                                   |
| Before 1991         | 24                                |
| 1991–2000           | 17                                |
| 2001–2005           | 13                                |
| 2006–2010           | 26                                |
| After 2010          | 20                                |
| School of graduation|                                   |
| Bristol             | 19                                |
| Cambridge           | 8                                 |
| Edinburgh           | 17                                |
| Glasgow             | 16                                |
| Liverpool           | 13                                |
| Nottingham          | 6                                 |
| Royal Veterinary College | 17                           |
| Other               | 4                                 |
| Practice position   |                                   |
| Employees           | 61                                |
| Employers           | 37                                |
| Additional qualifications |                                 |
| Certificate level   | 11                                |
| Diploma level       | 7                                 |
| Proportion of time spent treating cattle |     |
| Median time         | 70                                |
| Lower and upper quartile | 40–90                      |

**Pain assessment**

The distributions of estimated pain score across conditions and procedures are shown in Fig 1. Ranked by median pain score, neck calluses and hock hair loss were considered the least painful (median score 3), while digit amputation was considered the most painful (median score 10). For most conditions, the interquartile range (IQR) of scores covers 2–3 points on the scale, while most of the full range of scores was used for almost all conditions. For example, 21 out of the 27 conditions and procedures covered had some respondents scoring them at score 2 or 1. Conversely, while hock hair loss was generally considered the joint least painful condition (based on median score), eight respondents scored this at ≥8.

For 12 of the 27 conditions and procedures, the median score had increased compared with a previous survey using the same questions and structure. 11 The median score assigned to surgery to correct a left displaced abomasum was the only one to have decreased since the earlier work. In all of these cases, the change in median score was by one point.

Aggregating scores across all conditions, male respondents assigned lower scores (median score difference of one point, P<0.01). Initially, significant differences were also observed between year and school of graduation, preuniversity background (all P<0.01) and attainment of a clinical postgraduate qualification (P<0.05). Only gender of respondent and year of graduation remained in a multivariable linear model with pain score as the outcome, suggesting that the other pairwise associations were mostly confounded by gender and year of graduation. Female gender was associated with an increase of 0.36 in pain score. Year of graduation before 1990 was associated with a decrease of 0.48 in pain score compared with graduates since 2010, but graduation between these years was not significantly different to either group.
disbudding and following dystocia were allocated the lowest acceptable cost (55–65 per cent of respondents considering less than £2 per case acceptable). Acceptable costs were also compared with estimated approximate costs of providing analgesia for each condition or procedure. For adult cattle, the cost of providing analgesia was considered acceptable where the respondent had selected a cost of £10–20 or above (as £20 would cover an NSAID treatment plus local anaesthetic treatment where appropriate). For calves, the cost of treatment was considered acceptable where a cost of £0.01–2 or above was selected (on the same basis). The estimated cost of analgesia was below or within the respondents’ acceptable range for a very high proportion of respondents across most conditions (for greater than 90 per cent of respondents for caesarean section, surgical castration, digit amputation, calf disbudding, umbilical hernia surgery, joint ill and distal limb fracture). However, there were a small number of conditions where the estimated cost more commonly fell above the respondent’s acceptable range (with 80 per cent of respondents selecting an acceptable cost below the estimated true cost for adult dehorning, 72 per cent for uveitis and 40 per cent for treatment of a sole ulcer).

Use of analgesia
The two main methods of providing analgesia (NSAIDs and local anaesthesia) were considered separately. Fig 2 shows the proportion of respondents using NSAID in at least 50 per cent of cases across a range of conditions and procedures, plotted alongside the distribution of pain scores for the same conditions and procedures. Generally, it is clear that the conditions scored as more painful tended to receive NSAID treatment more commonly. However, a number of conditions were associated with a much lower degree of NSAID use, despite being assigned similar pain scores to conditions much more likely to receive NSAID. This was particularly marked for disbudding and surgical castration in calves and dehorning in adult cattle, with only 20–30 per cent of respondents using NSAID in at least half of the cases they saw, despite all three having median pain scores of 7–8.

Factors associated with NSAID use were explored further in a multivariable multilevel logistic regression model, with the binary outcome of a respondent stating that they used NSAID in at least 50 per cent of cases for a given condition or procedure. Parameter estimates for this model are shown in Table 3. As with the model for assignment of pain scores, both year of graduation and gender were retained in the model (suggesting that these are additive and independent effects); the odds of NSAID use were significantly higher for respondents graduating after 2000 and lower for male

### Table 2: Acceptable costs of analgesia for various procedures and conditions of adult cattle and calves given by respondents in a survey investigating attitudes to pain and the use of analgesia in cattle (n=242)

| Condition/Procedure | Acceptable Cost (£) | Adult | Calves |
|---------------------|---------------------|-------|--------|
|                     | Sole ulcer (%)      | Claw amputation (%) | Caesarean (%) | Dystocia (%) | Dehorning (%) | Uveitis (%) | LDA surgery (%) |
| None                | 7                   | 0     | 0      | 1           | 3            | 17          | 1           |
| 0-10                | 27                  | 8     | 7      | 19          | 66           | 44          | 11          |
| 10-20               | 33                  | 40    | 29     | 42          | 16           | 19          | 33          |
| 20-35               | 15                  | 25    | 35     | 22          | 1            | 3           | 31          |
| >35                 | 3                   | 14    | 17     | 3           | 0            | 0           | 10          |
| No response         | 14                  | 13    | 12     | 13          | 14           | 16          | 14          |

Survival and categorical data analysis were conducted using Stata (version 15.1) and R (version 3.5.1).
clincherns. The odds of NSAID use were higher where the estimated true cost of NSAID treatment was within the respondent’s acceptable range.

Pain score was also associated with the odds of NSAID use: conditions scored ≤3 were associated with significantly lower odds of use compared with those scored 4, 5 or 6, which in turn were associated with lower use than conditions scored ≥7. Several of the conditions also had significant associations with use of NSAID, even after accounting for the other factors in the model (including the pain score assigned by that respondent to that condition). This was most marked for disbudding, castration and dystocia in calves, and dehorning in adult cattle, all of which were associated with much lower levels of NSAID use. This effectively demonstrates that the ‘decoupling’ of pain score from NSAID use across these conditions highlighted in Fig 2 is a statistically significant effect, and that it persists when other potential confounding variables have been accounted for.

The vast majority of respondents used local anaesthesia for all of the surgical procedures. Over 95 per cent of respondents reported that they used local anaesthesia in all cases for caesarean sections, digit amputation and dehorning adult animals, and between 90 and 95 per cent of respondents used local anaesthesia for all left displaced abomasum surgery and calf disbudding. Two-thirds of respondents (67 per cent) used local anaesthesia for all left displaced abomasum surgery and calf disbudding. Two-thirds of respondents (67 per cent) used local anaesthesia for all left displaced abomasum surgery and calf disbudding. Two-thirds of respondents (67 per cent) used local anaesthesia for all left displaced abomasum surgery and calf disbudding. Two-thirds of respondents (67 per cent) used local anaesthesia for all left displaced abomasum surgery and calf disbudding. Two-thirds of respondents (67 per cent) used local anaesthesia for all left displaced abomasum surgery and calf disbudding. Two-thirds of respondents (67 per cent) used local anaesthesia for all left displaced abomasum surgery and calf disbudding. Two-thirds of respondents (67 per cent) used local anaesthesia for all left displaced abomasum surgery and calf disbudding. Two-thirds of respondents (67 per cent) used local anaesthesia for all left displaced abomasum surgery and calf disbudding. Two-thirds of respondents (67 per cent) used local anaesthesia for all left displaced abomasum surgery and calf disbudding. Two-thirds of respondents (67 per cent) used local anaesthesia for all left displaced abomasum surgery and calf disbudding. 

Opinions regarding analgesia and pain

Just under 70 per cent of respondents (142 of 203) felt that their knowledge of this area was adequate. Two-thirds of respondents (138 of 209) stated that their use of analgesia had increased in the last 5–10 years. Where use had increased, changes in farmer attitude were cited as the most common reason for change (mentioned by 77 per cent of those reporting increased use, n=106/138). Changes in respondent perception of pain in cattle, new scientific evidence and decreasing medicine costs were the next most common reasons (59 per cent, 56 per cent and 43 per cent; n=82, 78 and 59/138, respectively). Influence of colleagues (35 per cent, n=48/138) and practice policy (28 per cent, n=38/138) were less commonly mentioned. Further responses to the questions regarding opinions on analgesia and pain in cattle are summarised in Table 4.

Discussion

The results of the current study suggest that perception of pain in cattle by cattle practitioners has increased since the work of Huxley and Whay,13 with over 40 per cent of the procedures and conditions listed being given a higher median pain severity score. Despite the trend for increasing pain severity scores, there is still a large degree of variation between practitioners. Some of this variation is explained by the gender of the participant, with male practitioners on average giving lower pain severity scores than female practitioners. This is consistent with previous findings in the UK.13 from overseas17–19 and in small animal practice.20 Year of graduation also had a significant association with pain score, with respondents graduating before 1990 giving significantly lower pain scores than those graduating after 2010. This is also consistent with the previous findings15 and findings outside the UK.17–21 This is one of the first studies in this area to use a multivariable technique to confirm that the associations with gender and year of graduation exist independently and are not confounded by the changing gender balance of veterinary graduates over time. This may reflect advances in our understanding of pain and pain management as well as increased importance placed on pain recognition and management in undergraduate veterinary curricula. Variables that initially appeared to be associated with pain scores, such as school of graduation, preuniversity background and postgraduate qualifications were not retained in the multivariable model, suggesting that the apparent associations initially identified were confounded by correlations with gender and year of graduation. Other factors not measured here, such as empathy of the respondents, have also been shown to affect participants’ perception of pain in cattle, although

![Graph showing proportion of respondents using NSAID treatment in more than 50% of cases across a range of conditions and procedures.](image-url)

**FIG 2:** Proportion of respondents using NSAID treatment in more than 50% of cases across a range of conditions and procedures (blue bars, inner vertical scale). Distribution of pain scores assigned to the same conditions and procedures is also shown (red boxplots, outer vertical scale). Boxes show the interquartile range (IQR) of scores for each condition, horizontal black lines the median score and vertical lines the range (where any scores lie outside the IQR by more than 1.5 times the size of the IQR, they are represented by points beyond the line). LDA, left displaced abomasum.
empathy is also associated with gender and pain perception tends to be strongly correlated with empathy. The apparent increased perception of pain by more recent graduates is encouraging and suggests that things are changing; however, another possible explanation is that veterinary surgeons’ sensitivity to signs of pain declines with experience. It has been shown that experienced human acupuncturists’ brains react differently to control groups when viewing videos of needles being pushed in to patients.

As with previous studies, the perception of pain severity by respondents broadly correlated with an increased willingness to administer analgesics. Therefore, an increased ability to recognise and identify pain in cattle is likely to result in increased administration of analgesics to animals in pain or animals undergoing painful procedures. This is supported by the majority of respondents stating that their use of analgesia had increased over the previous 5–10 years. Although these results are broadly positive, a potential area of concern was the apparent decoupling of analgesic use from perceived pain severity in routine calf procedures. Calves undergoing painful husbandry procedures such as disbudding and castration were significantly less likely to receive NSAID treatment despite these procedures receiving a pain severity score similar to other conditions and procedures in adult cattle. These findings suggest that in these animals the main barrier to administration of analgesic medicines by veterinary surgeons is no longer the ability to identify or recognise pain. Both disbudding and castration have been shown to be painful to calves. While most (although not all) respondents reported using local anaesthesia when castrating and disbudding calves, the addition of an NSAID to the protocol has been shown to further control the pain associated with these procedures, particularly the postoperative pain as the local anaesthetic wanes. The use of NSAID (ideally pre-emptively) in addition to local anaesthetic for both disbudding and castration of calves is considered best practice and this approach has been described in numerous reviews and continuing education journals. It is worth highlighting that legislation in this area is often dated (eg, over 50 years old in the UK) and can be slow and difficult to change. Legislation may lag behind scientific understanding, societal opinion and available pharmaceuticals. At times, legislation can be used to defend and legitimise protocols which many would find outdated and even unacceptable. Industry-led initiatives and codes of practice provide an opportunity to encourage best practice and respond to developments in a more dynamic way.

As the existing barriers to NSAID use are reduced, it is important that new barriers are not created. Informal feedback from producers suggests that there may be two challenges with terminology in this area (at least in English—the same may not be true in other languages). First, ‘NSAIDs’, ‘non-steroidals’ and ‘anti-inflammatories’ are more widely understood and user-friendly terms than ‘analgesics’. This is particularly the case for NSAIDs because of the incorrect perceived similarities/associations between antibiotics and anti-inflammatories. It is imperative that the drive to reduce, refine and replace antibiotic usage does not lead to a reduction in anti-inflammatory administration. It is also important to ensure that public perception of the use of NSAIDs and other analgesics
is considered and that the benefits of analgesics are effectively communicated to all stakeholders in the supply chain. If recognition, perception and awareness of pain is becoming less of a barrier to the use of NSAIDs then there is a need to explore further barriers. Cost is often identified as a barrier to analgesic use, in the earlier work of Whay and Huxley30 over 65 per cent of respondents agreed that ‘farmers would like cattle to receive analgesia but cost is a major issue’; in the current study this has reduced to 45 per cent. Similarly, the percentage of respondents agreeing that ‘farmers are happy to pay the costs involved with giving analgesics to cattle’ has increased from 36 per cent to 52 per cent between the two studies. This suggests that, whilst cost is still an issue, attitudes in this area are changing. In this study, procedures such as disbudding and castrating calves were allocated the lowest acceptable costs of analgesia by respondents. However, the estimated cost of providing NSAID analgesia for these procedures was still within the acceptable range given for disbudding for over 90 per cent of respondents.

This is a positive sign and may reflect the decreasing price and increasing availability of NSAIDs licensed for use in cattle in the UK. Interestingly, in a study of Danish veterinarians and dairy farmers, whilst less farmers than veterinarians agreed that using analgesics makes economic sense (64 per cent and 85.1 per cent, respectively) this is a positive sign and may reflect the decreasing price and increasing availability of NSAIDs in Denmark that veterinary surgeons with an interest in analgesia and animal welfare might be more inclined to complete the survey and also to use analgesics. Similarly there is risk of respondent answering in line with expectations. Both these potential biases would likely result in overestimation of analgesic use.

The response rate to the paper questionnaire was 16 per cent, lower than that reported in the original study by Whay and Whay.33 However, an electronic version of the questionnaire was also created in this study and sent and completed in the paper copy. While care needs to be taken in generalising the results from this survey, there was a wide distribution of years since graduation and an increased proportion of female respondents compared with the previous study. This may reflect changing demographics within the profession. The multivariable regression models used in the analysis should account for any effect of the increased proportion of female respondents. There is a concerning mismatch between respondents agreed that ‘farmers would like cattle to receive analgesics’ but cost is a major issue’ in the current study this has reduced from over 65 per cent.

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Competing interests None declared.

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