Evaluation of treatments for claw horn lesions in dairy cows in a randomized controlled trial

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ABSTRACT

Lameness is one of the most significant endemic disease problems facing the dairy industry. Claw horn lesions (principally sole hemorrhage, sole ulcer, and white line disease) are some of the most prevalent conditions. Despite the fact that thousands of animals are treated for these conditions every year, experimental evidence is limited on the most effective treatment protocols. A randomized, positively controlled clinical trial was conducted to test the recovery of newly lame cows with claw horn lesions. Animals on 5 farms were locomotion scored every 2 wk. Cows were eligible for recruitment if they had 2 nonlame scores followed by a lame score and had a claw horn lesion on a single claw of a single foot. Following a therapeutic trim, enrolled cows were randomly allocated to 1 of 4 treatments: treatment 1—no further treatment (positive control; TRM), treatment 2—trim plus a block on the sound claw (TB), treatment 3—trim plus a 3-d course of the nonsteroidal anti-inflammatory drug (NSAID) ketoprofen (TN), treatment 4—trim plus a block plus ketoprofen (TBN). The primary outcome measure was locomotion score 35 d after treatment, by an observer blind to treatment group. Descriptive statistics suggested that treatment groups were balanced at the time of enrollment, that is, randomization was successful. Based on a sound locomotion score (score 0) 35 d after treatment, the number of cures was 11 of 45 (24.4%) for TRM, 14 of 39 (35.9%) for TB, 12 of 42 (28.6%) for TN, and 23 of 41 (56.1%) for TBN. The difference between TBN and TRM was significant. To test for confounding imbalances between treatment groups, logistic regression models were built with 2 outcomes, either sound (score 0) or nonlame (score 0 or 1) 35 d after treatment. Compared with TRM, animals that received TBN were significantly more likely to cure to a sound outcome. Farm, treatment season, lesion diagnosis, limb affected, treatment operator, and stage of lactation were included in the final models. Our work suggests that lameness cure is maximized with NSAID treatment in addition to the common practices of therapeutic trimming and elevation of the diseased claw using a block when cows are newly and predominantly mildly lame.

Key words: dairy cow, lameness, claw horn lesion, randomized clinical trial

INTRODUCTION

Lameness in dairy cattle is a significant problem in intensive dairy industries around the world, causing production losses (Huxley, 2013) and discomfort, undermining animal welfare (Whay et al., 1997). Achieving sustainable reductions in the levels of disease on farm requires a combination of 2 approaches: first, the implementation of effective farm-specific prevention strategies to decrease the rate at which new cases develop, and second, early identification and prompt and effective treatment of clinical cases to reduce the duration of time over which animals are lame. Whereas the emphasis of the majority of recent research has rightly focused on identifying risk factors for lameness and disease prevention, the treatment of animals once they become lame must not be neglected.

Sole hemorrhage, sole ulcer, and white line disease (the most common claw horn lesions) are some of the most prevalent conditions causing lameness (Capion et al., 2008; Cramer et al., 2008).* Despite the fact that many thousands of animals are routinely treated for these diseases, a recent systematic review of the peer-reviewed literature on the prevention and treatment of foot lameness in cattle highlighted the deficit of information in this area (Potterton et al., 2012). In literature published between 2000 and 2011, no papers were identified that were concerned with the treatment of white line disease and only 3 were concerned...
with the treatment of sole ulcers. Of these, 2 were case studies (i.e., not experimental), and although the third was composed of primary research, it assessed dietary supplementation with biotin (Lischer et al., 2002) and is of limited use in the field. The authors concluded that virtually all the existing information on the treatment of claw horn lesions appeared to be from anecdotal reports based on the experience and knowledge of experts working in the field. This does not mean to say that current treatment protocols are ineffective, rather it highlighted the deficit of experimental evidence on the most effective treatment, that is, those that lead to the highest cure rates in the shortest time.

An extension of the literature search described above confirms that very little primary research work has ever been published testing treatments for claw horn lesions; only 2 other peer-reviewed papers were identified. The first describes a randomized study conducted in Australia that tested wooden blocks, rubberized shoes, and padded bandages containing copper sulfate for the treatment of a variety of claw horn lesions (Pyman, 1997). Three and 7 d after treatment, a significantly high number of cows had recovered in the block and shoe groups compared with the bandage group; outcome assessment was limited to 14 d after treatment by which time no differences between groups were apparent. In the second, dairy cows managed under New Zealand’s extensive pasture-based systems were randomly treated with a plastic shoe and the nonsteroidal anti-inflammatory drug (NSAID) tolfenamic acid, following corrective trimming (Laven et al., 2008). The authors concluded treatments did not significantly differ in either nociceptive threshold or locomotion score over the 100-d outcome period. The objective of the present study was to compare 4 treatments for claw horn lesions in a randomized study under UK field conditions.

**MATERIALS AND METHODS**

**Study Design and Reporting**

A positively controlled, randomized clinical trial (RCT) with blind outcome observations was designed to test the recovery of dairy cows with claw horn lesions, treated using different protocols. The study hypothesis stated that the likelihood of claw-horn-lesion recovery depended on the treatment administered. Based on a binary primary outcome measure (lame or not lame) after treatment, a power calculation suggested that treatment group sizes of 58 would detect a 25% difference in recovery rate between treatments (power value of 0.8, \( P \leq 0.05 \)). A difference of 25% was selected because it was considered clinically meaningful and likely to be large enough to warrant the additional cost of the treatments tested should they prove superior.

The study was positively controlled (i.e., no animals were left untreated) and conducted under the Veterinary Surgeons Act 1966, which regulates acts of veterinary surgery in the UK. The protocol was reviewed and approved by the University of Nottingham’s School of Veterinary Medicine and Science Ethical Review Committee before study instigation.

The study manuscript has been prepared in accordance with the guidelines outlined in the REFLECT statement for reporting randomized controlled trials in livestock (O’Connor et al., 2010).

**Herd Selection**

A convenience sample of 5 commercial dairy farms was recruited in the East Midlands area of the UK, within close proximity to the University of Nottingham. To be eligible for enrollment, farms were required to have a herd lameness prevalence of above 20% at the start of the study and be undertaking routine measures to control digital dermatitis at the herd level (e.g., regular foot bathing). Farms were either known to the trial coordinators or were recruited through their veterinary surgeons, who were asked to nominate clients they considered met the criteria and would be willing to participate. A short list of suggested farms were approached and visited to discuss the trial and to assess their lameness prevalence. Following an introductory phone call, one farm elected not to participate because they thought the trial would interfere with their day-to-day farm management.

The 5 farms were between 187 and 353 (median 241) cows in size with 305-d adjusted milk yields ranging from 7,394 to 11,579 L (median = 10,381 L). Three of the farms (farms 2, 4, and 5) housed lactating cows continuously; the other 2 farms managed cows at pasture during the summer (~March–October) and in housing during winter. On all farms, lactating cows were accommodated in stalls with mats, mattresses, or waterbeds. Two farms (farms 2 and 4) milked cows in an automatic milking system; the remaining farms milked cows in conventional parlors, 2 times daily. All walkways and standing areas were concrete on all farms except farm 2, which had rubber matting throughout, and farm 3, which had rubber matting at the feed face of the high-yielding group. All farms undertook routine foot trimming, although scheduling ranged from as required to weekly sessions. Two farms (farms 1 and 2) used an external professional foot trimmer, and on the other farms, trimming was conducted by farm staff.