

Practical and sustainable analgesia for livestock husbandry – the role of topical anaesthesia

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Husbandry procedures in livestock cause significant pain and suffering, yet are invariably performed without analgesia. This is a major welfare omission with important social and trade implications. Whilst the ideal solution is to breed animals that do not require these procedures or to find painless alternative practices, this is likely to take time. A mechanism is needed to address welfare concerns in the interim while long term solutions are pursued. In every other field of medicine this 'interim' role is filled by the use of analgesia, yet this is an option that is unavailable for the vast majority of farm animals.

There is a virtual absence of medications licenced for use in farm animals and a lack of practical or affordable methods of delivery, such that farmers have few options available to treat pain in their animals. This has set the scene for conflict between animal advocacy groups and farmers as is evidenced by mulesing-related boycotts of Australian wool, and retailer boycotts of meat from piglets castrated without analgesia in the EU.

The vast majority of veterinary administered general or local anaesthetic regimens are impractical or commercially unviable for use in farming practices. To address pain in livestock, new analgesic regimens are required which meet the practical and economic constraints of farming practice. A step-wise approach is needed to ensure that analgesic regimens develop in a viable and sustainable manner.

The use of topical anaesthesia shows promise as a "first step" to begin to address farm animal pain. This has been exemplified by the success of Tri-Solfen® , which is the first "farmer applied" analgesic product to become commercially available to alleviate pain associated with Mulesing. It is a multifunction spray-on topical anaesthetic, haemostatic and antiseptic agent that is applied to numb the wound immediately post

mulesing. It has a significant analgesic effect eliminating or significantly reducing wound pain and pain-related behaviour up to, and including, 8 hours post mulesing. It also lowers peak cortisol response, reduces bleeding and speeds up wound healing^{1,2}. Subsequent research has identified that pre-operative administration of a non-steroidal antiinflammatory agent (Carprofen) significantly enhances the analgesic effect such that the combination not only abolishes pain-related behaviour up to and including 12 hours post mulesing, but also abolishes the acute cortisol response.² In terms of pain alleviation and mitigation of stress response, this exceeds that which is achieved during equivalent surgical procedures in pets, such as ovariohysterectomy (spaying) of cats and dogs^{3,4}, and provides a means to perform the procedure humanely while genetic breeding and other long term alternative solutions are pursued.

Similarly effective and sustainable “farm based” analgesic regimens are required for other husbandry procedures. Topical anaesthesia is being investigated to alleviate pain associated with other husbandry procedures including castration, tail docking and dehorning. This paper discusses the use of topical anaesthesia as a potential sustainable “first step” to alleviate pain associated with castration and tail docking in sheep.

Procedure

Randomised, placebo-controlled trials were performed on 8 groups of 6-12 week old lambs (n=8 in each group) undergoing routine castration and tail docking. Castration with surgical or hot knife tail docking was performed with and without topical anaesthetic or placebo application, and compared with ring castration and tail docking or handled but unmarked controls.

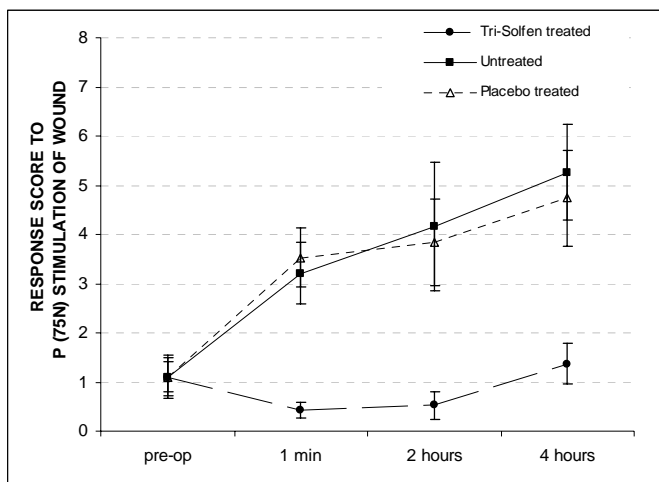
In treated lambs, Tri-Solfen® or placebo gel was applied by spray-on metered dose directly to the tail docked wounds and onto each of the exteriorized spermatic cords (prior to their being severed), as well as to the scrotal sac and cut skin edge immediately post castration.

Wound pain was assessed using 10 and 75 gram calibrated Von-Frey monofilaments to determine response to light touch and pain stimulation over a 4 hour period. Pain-related behaviour was assessed by trained, blinded observers using a numerical rating scale over a 5 hour period. Wound healing was assessed by veterinary inspection and palpation 14 and 28 days following the procedures.

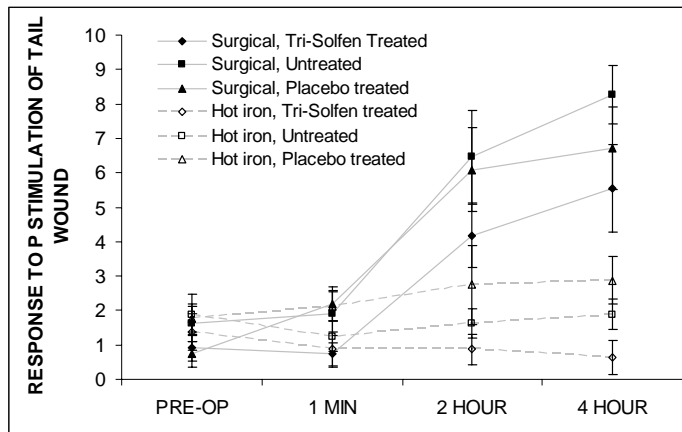
Plasma lignocaine and bupivacaine levels were determined using HPLC from jugular venous blood samples collected at 0, 30, 90 and 120 minutes following the procedures.

Results

Castration wound pain: Rapid (1min) and prolonged (up to 4 hr) primary hyperalgesia developed in untreated and placebo treated sheep but not in Tri-Solfen® treated sheep ($p < 0.0001$).



Tail docking wound pain; a) Surgical; Primary hyperalgesia ($p = 0.02$) and primary allodynia ($p = 0.01$) developed post surgical tail docking in untreated and placebo treated sheep. This was either abolished ($p = 0.009$, primary allodynia) or significantly reduced ($p = 0.02$, primary hyperalgesia) in Tri-Solfen treated sheep. *b) Hot-Iron docking* abolished the development of primary allodynia and hyperalgesia in all treatment groups. However pain-stimulus response scores were significantly lower in Tri-Solfen treated sheep compared with untreated and placebo treated sheep 4 hours post hot-iron docking ($p = 0.03$).



Pain-related behaviour, There was a significant change over time ($p < 0.001$) with a significant group effect ($p < 0.001$). Behaviour scores in Tri-Solfen® treated sheep were not significantly different from unmarked controls and were below untreated and placebo treated sheep throughout the observation period. The highest pain related behaviour scores occurred in lambs that were castrated and docked with rings, particularly during the first 2 hours after application.

Plasma lignocaine and bupivacaine levels; Mean plasma lignocaine levels were 0.17 ± 0.09 , 0.12 ± 0.06 and 0.1 ± 0.06 mg/L at 30, 90 and 120 minutes post treatment, which is well below the toxic threshold of 6 mg/L (humans) and toxic convulsive plasma levels (of 40 mg/L) in sheep. The maximum recorded level at any time point was 0.39 mg/L at 30 minutes post treatment. Mean plasma bupivacaine levels were below the level of detection (< 0.0025 mg/L) or quantification (< 0.01 mg/L) in 5 sheep, with a mean value of 0.014 ± 0.003 mg/L in the remaining sheep 30 minutes after treatment. Thereafter bupivacaine levels at 90 and 120 minutes were either at or below the level of quantification in 10 sheep with mean \pm SD of 0.013 ± 0.003 in remaining sheep and were well below toxic thresholds in all tested sheep.

Ongoing Investigations: Studies investigating biochemical pain and stress responses, plus the effect of additional pre-operative analgesic regimens, such as non steroidal anti-inflammatory administration or the use of cryoanaesthesia are currently under way.

Discussion

Effective and affordable “farm-based” analgesia is required to alleviate pain associated with surgical husbandry procedures in livestock. This is needed to “fill the gap” and provide a means to address welfare concerns and prevent welfare-related conflicts while long term alternative solutions are pursued and implemented. This is likely to

require a stepwise approach aimed at developing effective analgesic combinations for each indication in each species.

The use of topical anaesthesia is effective to alleviate pain associated with mulesing in sheep^{1,2}. Our results indicate that it also can be highly effective to alleviate wound pain and diminish pain-related behaviour post castration and tail docking in sheep. Studies are underway to investigate similar applications in cattle and pigs.

Other well known and affordable analgesic medications such as proprietary non-steroidal anti-inflammatory agents, used alone or in combination with topical anaesthesia have proven to be effective to reduce pain associated with mulesing. Studies are required to investigate whether similar synergistic pain-alleviating effects occur for castration and tail docking.

Studies will also be required to establish residue markers and set MRLs for basic analgesic medications in each species. These complex and costly studies are required to meet stringent new food safety laws. The cost and complexity of these studies is a key inhibitory factor that is preventing the development and commercialisation of effective analgesic agents for livestock world wide. Addressing this issue requires a united commitment and co-operative approach involving government, industry and welfare groups. It is to be hoped that this can be achieved, as the development of effective, practical and affordable analgesics for on-farm use will provide a means to protect welfare and prevent welfare-based conflicts while longer term solutions are pursued.

Conclusion

A concerted research and development effort is required to develop effective and affordable medications for on-farm use to alleviate pain associated with husbandry procedures in livestock. Topical anaesthesia shows promise as an effective means to achieve this aim. The use of a topical anaesthetic formulation, originally developed to alleviate pain associated with mulesing, is also effective dramatically reduce pain associated with surgical castration and tail docking in sheep. Topical anaesthesia therefore has the potential to provide a practical and economic means to improve the welfare of millions of young lambs annually, in both Australian and internationally.

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