TAILING AND CASTRATION PAIN IN LAMBS.

Principles

Veterinary Duty

1. In New Zealand, veterinarians have a codified '… *special duty to protect animal welfare and alleviate animal suffering.*'

> '*Veterinarians are expected to use their training and knowledge for the benefit of society. Animal welfare is more than protecting animals from cruelty. It also relates to promoting their health and wellbeing. Because of their training veterinarians have expert knowledge on how to assess animal health and welfare, and how to optimise the care and management of animals.* ***It follows that veterinarians have an over-riding professional duty to protect animals from unreasonable or unnecessary pain or distress.'***[1] (Emphasis added)

Animal Welfare

2. The Five Domains model of animal welfare assessment is a framework where the mental state of an animal (Domain 5) is influenced by the other four Domains (health, environment, nutrition, and behaviour) that together determine the overall welfare state of the animal.[2]

3. Painful husbandry procedures, disease or injury are likely to negatively influence the Domains of health and behaviour, which in turn effects Domain 5 and negatively influences an animal's overall welfare.

4. Therefore, wherever possible, unnecessary painful husbandry procedures such as tailing[3] and castration should be avoided; when this is not possible, pain relief should be provided.

Provision of Analgesia

5. A precautionary and proactive approach to analgesia should be engaged when addressing tailing and castration pain in lambs; where pre-emptive and sustained ameliorative

[1] Animal Welfare section of the Code of Professional Conduct for Veterinarians; Veterinary Council of New Zealand (pg 5; January 2020)
[2] Mellor DJ, Beausoleil NJ, Littlewood KE, McLean AN, McGreevy PD, Jones B, Wilkins C. The 2020 Five Domains Model: Including Human–Animal Interactions in Assessments of Animal Welfare. Animals. 2020; 10(10):1870. https://doi.org/10.3390/ani10101870
[3] Tailing, tail docking, docking are used interchangeably in New Zealand and refer to the removal of lambs' tails by a variety of mechanisms

analgesia is not possible, imperfect, incremental steps towards provision of such analgesia to reduce lamb suffering should be employed.

6. Practicality and economics provide additional challenges in the provision of analgesia in farmed animals, as does the limited range of registered pharmaceuticals, and their pharmacokinetics (i.e., time to onset and duration of action).

7. While noting New Zealand's regulatory prohibitions relating to tailing and castration, non-pharmaceutical options (e.g., ClipFitter) should be included within the analgesic toolbox; products should be biodegradable, and provide equal or better analgesia than commonly used pharmaceuticals, including through combination use of such products with pharmaceutical analgesia.

Pain

Significant Surgical / Painful Husbandry Procedures

8. A myriad of research exists regarding the painful nature of painful husbandry procedures in lambs (a non-exhaustive list in footnotes follows).

9. Should any doubt exist as to the painful nature of these procedures, and until pain assessment in lambs is perfected, extrapolation from other mammalian species including humans, dogs, cats, and horses should also be made - if the procedure causes pain in a human, dog, cat, or a horse, then it is likely to cause pain in a lamb.

10. If acute pain is untreated, the risk of the development of chronic, maladaptive pain increases. Pain in paediatric humans and animals will interfere with neural development and will increase the risk of altered more profound responses in later life.

11. For tailing and castration in lambs, that they are painful is supported by first principles relating to the pain and inflammation created when mammalian tissue is damaged (e.g., by crushing, cutting, burning); this includes damage from significant surgical procedures.

12. In New Zealand, what constitutes a significant surgical procedure is determined by the criteria set out in section 16 of the Animal Welfare Act 1999:

> ***'16 Criteria to determine whether procedure is significant surgical procedure***
>
> *If any person has to determine whether a procedure carried out on an animal is a significant surgical procedure under this Act, the person must determine the question by considering the following criteria:*

a) *whether the procedure has the potential to—*

i. *cause significant pain or distress; or*

ii. *cause serious or lasting harm, or loss of function, if not carried out by a veterinarian in accordance with recognised professional standards; and*

b) *the nature of the procedure, including whether this involves—*

i. *a surgical or operative procedure below the surface of the skin, mucous membranes, or teeth or below the gingival margin; or*

ii. *physical interference with sensitive soft tissue or bone structure; or*

iii. *significant loss of tissue or loss of significant tissue.'*[4]

13. In the absence of enabling secondary legislation, performing procedures that meet the provision of s 16 is illegal for those other than veterinarians, or veterinary students under supervision of a veterinarian. Accordingly, in New Zealand, both tailing and castration are regulated under the Animal Welfare (Care and Procedures) Regulations 2018, Part 2, Surgical or painful procedures.[5]

Pain Assessment

14. The gold standard for pain assessment in people is self-reporting, which is not possible with animals; to understand animals' pain experiences, researchers resort to composite approaches for pain assessment, including observation.

15. Many consider it difficult to identify pain in lambs by observation. This is because lamb pain responses are not familiar to, and therefore not readily recognised by, humans. Sheep pain-related behaviours are well documented in the literature and identification of these must be taught so pain responses are not missed or misinterpreted by unskilled observers.

16. While measurement of cortisol may be useful, there are limitations to its use as cortisol is non-specific for pain.

[4] Section 16, Animal Welfare Act 1999; accessed November 2024
[5] Animal Welfare (Care and Procedures) Regulations 2018

17. Pain assessment in lambs has included investigation of, but is not limited to:

a. cortisol measurement [6,7,8]

b. behavioural observations [9,10,11,12]

c. blood cell counts [13,14]

d. weight [15,16,17,18]

e. wound inspection [19,20]

f. mothering up times [21]

[6] Dinniss AS, Mellor DJ, Stafford KJ, et al: Acute cortisol responses of lambs to castration using a rubber ring and/or a castration clamp with or without local anaesthetic. N Z Vet J 45:114-121, 1997.
[7] Kent JE, Molony V, Robertson IS: Changes in plasma cortisol concentration in lambs of three ages after three methods of castration and tail docking. Res Vet Sci 55:246-251, 1993.
[8] Lester SJ, Mellor DJ, Ward RN, et al: Cortisol responses of young lambs to castration and tailing using different methods. N Z Vet J 39:134-138, 1991.
[9] Futro A, Maslowska K, Dwyer CM: Ewes Direct Most Maternal Attention towards Lambs that Show the Greatest Pain-Related Behavioural Responses. PLoS One 10:e0134024, 2015.
[10] Hemsworth PH, Barnett JL, Karlen GM, et al: Effects of mulesing and alternative procedures to mulesing on the behaviour and physiology of lambs. Applied Animal Behaviour Science 117:20-27, 2009.
[11] Hild S, Clark CCA, Dwyer CM, et al: Ewes are more attentive to their offspring experiencing pain but not stress. Applied Animal Behaviour Science 132:114-120, 2011.
[12] Lomax S, Dickson H, Sheil M, et al: Topical anaesthesia alleviates short-term pain of castration and tail docking in lambs. Aust Vet J 88:67-74, 2010.
[13] Paull D, Lee C, Colditz I, et al: Effects of a topical anaesthetic formulation and systemic carprofen, given singly or in combination, on the cortisol and behavioural responses of Merino lambs to castration. Australian Veterinary Journal 87:230-237, 2009.
[14] Paull DR, Small AH, Lee C, et al: Evaluating a novel analgesic strategy for ring castration of ram lambs. Vet Anaesth Analg 39:539-549, 2012.
[15] Hemsworth PH, Barnett JL, Karlen GM, et al: Effects of mulesing and alternative procedures to mulesing on the behaviour and physiology of lambs. Applied Animal Behaviour Science 117:20-27, 2009.
[16] Baldridge SL, Coetzee JF, Dritz SS, et al: Pharmacokinetics and physiologic effects of intramuscularly administered xylazine hydrochloride-ketamine hydrochloride-butorphanol tartrate alone or in combination with orally administered sodium salicylate on biomarkers of pain in Holstein calves following castration and dehorning. Am J Vet Res 72:1305-1317, 2011.
[17] Kent JE, Jackson RE, Molony V, et al: Effects of Acute Pain Reduction Methods on the Chronic Inflammatory Lesions and Behaviour of Lambs Castrated and Tail Docked with Rubber Rings at less than Two Days of Age. The Veterinary Journal 160:33-41, 2000.
[18] Lomax S, Sheil M, Windsor PA: Duration of action of a topical anaesthetic formulation for pain management of mulesing in sheep. Aust Vet J 91:160-167, 2013.
[19] Melches S, Mellema SC, Doherr MG, et al: Castration of lambs: a welfare comparison of different castration techniques in lambs over 10 weeks of age. Vet J 173:554-563, 2007.
[20] Mellema SC, Doherr MG, Wechsler B, et al: Influence of local anaesthesia on pain and distress induced by two bloodless castration methods in young lambs. Vet J 172:274-283, 2006.
[21] Lomax S, Sheil M, Windsor PA: Duration of action of a topical anaesthetic formulation for pain management of mulesing in sheep. Aust Vet J 91:160-167, 2013.

g. biomarker measurement (e.g. haptoglobin and beta endorphins) [22,23,24]

h. body temperature measurement [25]

i. nociceptive threshold testing [26,27,28]

j. electrodermal activity and chute exit speed [29]

k. electroencephalography.[30]

Tailing & Castration Pain

18. Although tailing may be less painful than castration, the procedures are often performed simultaneously, so the benefits of administration of analgesia for castration will also be beneficial for tailing pain.

19. For ewe lambs, analgesia is still indicated due to pain from tailing; from a practical perspective, administering pain relief to each and every lamb makes more sense than withholding analgesia from ewes.

20. Hot iron tailing is not as painful as other methods; however, it is still painful [31,32] due to soft tissue and bone destruction, thermal burns, and long term, neuroma formation.[33]

[22] Paull D, Lee C, Colditz I, et al: Effects of a topical anaesthetic formulation and systemic carprofen, given singly or in combination, on the cortisol and behavioural responses of Merino lambs to castration. Australian Veterinary Journal 87:230-237, 2009.
[23] Price J, Nolan AM: Analgesia of newborn lambs before castration and tail docking with rubber rings. Veterinary Record 149:321-324, 2001.
[24] Shutt DA, Fell LR, Connell R, et al: Stress responses in lambs docked and castrated surgically or by the application of rubber rings. Aust Vet J 65:5-7, 1988.
[25] Paull DR, Small AH, Lee C, et al: Evaluating a novel analgesic strategy for ring castration of ram lambs. Vet Anaesth Analg 39:539-549, 2012.
[26] Lomax S, Dickson H, Sheil M, et al: Topical anaesthesia alleviates short-term pain of castration and tail docking in lambs. Aust Vet J 88:67-74, 2010.
[27] Lomax S, Sheil M, Windsor PA: Duration of action of a topical anaesthetic formulation for pain management of mulesing in sheep. Aust Vet J 91:160-167, 2013.
[28] Thornton PD, Waterman-Pearson AE: Quantification of the pain and distress responses to castration in young lambs. Research in Veterinary Science 66:107-118, 1999.
[29] Baldridge SL, Coetzee JF, Dritz SS, et al: Pharmacokinetics and physiologic effects of intramuscularly administered xylazine hydrochloride-ketamine hydrochloride-butorphanol tartrate alone or in combination with orally administered sodium salicylate on biomarkers of pain in Holstein calves following castration and dehorning. Am J Vet Res 72:1305-1317, 2011.
[30] Harris C, White PJ, Mohler VL, et al: Electroencephalography Can Distinguish between Pain and Anaesthetic Intervention in Conscious Lambs Undergoing Castration. Animals (Basel) 10, 2020
[31] Lester SJ, Mellor DJ, Ward RN, et al: Cortisol responses of young lambs to castration and tailing using different methods. N Z Vet J 39:134-138, 1991.
[32] Grant C: Behavioural responses of lambs to common painful husbandry procedures. Applied Animal Behaviour Science 87:255-273, 2004.
[33] Larrondo C, Bustamante H, Paredes E, et al: Long-term hyperalgesia and traumatic neuroma formation in tail-docked lambs. Animal Welfare 28:443-454, 2019.

21. Rubber ring tailing also causes pain that is described;[34] associated pain most likely outlasts the observation duration of most studies, which are mostly limited to only hours after a procedure.

22. Healing following rubber ring tailing is likely to be similar to or longer than rubber ring castration, as bone is within the ring, not just soft tissue.

23. Healing after castration with a ring may take one month, and therefore pain may be experienced for this period of time.[35]

24. With persistent pain, there is less and less correlation between the lesion and the pain; a lesion can cause up-regulation of pain pathways (i.e., wind-up) that can long outlast the presence of the lesion.

Analgesia

Principles

25. To be most effective, analgesic regimes should always be:

    a. **preventive or pre-emptive**

        - administration of analgesia prior to the painful procedure being performed; it is associated with the best results.

    b. **multi-modal**

        - administration of analgesic drugs with different mechanisms of action, that interfere with the pain pathways in multiple ways to optimise the relief of pain.

    c. **last for an adequate duration of time.[36]**

        Provision of adequate longer-term analgesia (i.e., beyond duration of action of the initial pharmaceuticals through to the end of the pain period (days-month; notwithstanding lambs with chronic pain responses)) is not currently practicable for most farming operations.

[34] Lomax S, Dickson H, Sheil M, et al: Topical anaesthesia alleviates short-term pain of castration and tail docking in lambs. Aust Vet J 88:67-74, 2010.
[35] Melches S, Mellema SC, Doherr MG, et al: Castration of lambs: a welfare comparison of different castration techniques in lambs over 10 weeks of age. Vet J 173:554-563, 2007.
[36] Choices B: Better Choices Standards for Analgesia; https://www.betterchoices.com.au/our-standards; 2024.

Pharmaceuticals

26. Realistic pharmaceutical options include:

a. **local anaesthetics (local)**

Local blocks affected nerves (e.g., in damaged tissue) sending pain signals to the brain.

Injectable local anaesthetics (e.g., lignocaine) are readily available, and registered for use in sheep by manual injection (e.g. NumOcaine® for use with the Numnuts® device).

b. **non-steroidal anti-inflammatory drugs (NSAIDs)**

NSAIDs diminish inflammation and its associated pain (the most common type of pain caused by tissue damage).

Meloxicam can be administered by injection or by mouth where it is absorbed across the oral mucous membranes (oral transmucosal absorption); some of these formulations are registered in sheep.

27. Unrealistic pharmaceutical options include:

a. **alpha2 adrenoreceptor agonists**

Alpha2 adrenoreceptor agonists are licensed in sheep but cause sedation, and potentially hypoxaemia due to pulmonary oedema, arising out of an inflammatory effect on type 2 pneumocytes.

Alpha2 adrenoreceptor agonists are therefore not ideal for painful husbandry procedures in lambs; some veterinarians (*pers. Comm* (2024)) consider their use should be ruled out entirely.

b. **opioids**

c. **ketamine**

Farmer use of opioids and ketamine for painful husbandry procedures is difficult as they are controlled drugs, and their authorisation and use are restricted.

Other options and products

28. Local anaesthetic impregnated rubber rings (e.g., Lidobands[37])

    a. Lidobands constrict tissue and provide extended analgesia[38,39] compared with a block performed with a needle and syringe or a NUMNUTS device.

    b. Using Lidobands with oral transmucosal meloxicam would utilise the best of what is currently available for tailing and castration.

    c. A futuristic option would be provision of a NSAID in water or feed for a few days prior to the procedure, and use of Lidobands at the time of the procedure.

29. Burdizzo-type devices (e.g., ClipFitter[40])

    a. ClipFitter severs the tissues across which it is applied (e.g., for castration, the spermatic cord, vessels and nerves).

    b. It has been shown to mitigate pain responses associated with castration in young lambs to a level indistinguishable from uncastrated lambs, and tail docking responses to those achieved with use of local anaesthetic in both young and older lambs. Although pain responses of older lambs castrated with ClipFitter were greater than lambs that were only handled, they were lower than has been seen with rubber ring alone.[41]

    c. Once biodegradable and where legal, ClipFitter is a legitimate castration and tailing option.

Toxicity & Efficacy

30. Toxicity from use of pharmaceutical analgesics is possible, especially with bupivacaine; those administering bupivacaine should be careful to adhere to advised doses and avoid intravenous injections.

31. Toxicity is not common, nor is it reported in sheep to our knowledge.

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[37] http://www.lidoband.com/en/home

[38] Roche, S.M.; Ralston, B.J.; Olson, B.; Sharpe, B.D.; Schatz, C.; Beaugrand, K.; Ross, J.A.; Broomfield, M.A.; Ilan, N.; Olson, M. Efficacy of a Lidocaine-Impregnated Elastrator Band for Castration and Tail Docking in Lambs. nimals 2024, 14, 1403. https://doi.org/10.3390/ani14101403

[39] Ross, J.A.; Roche, S.M.; Beaugrand, K.; Schatz, C.; Hammad, A.; Ralston, B.J.; Hanson, A.M.; Allan, N.; Olson,. Assessment of the Pharmacokinetics and Pharmacodynamics of Injectable Lidocaine and a Lidocaine- mpregnated Latex Band for Castration and Tail Docking in Lambs. Animals **2024**, 14, 255. ttps://doi.org/10.3390/ani14020255

[40] https://eadiebros.wordpress.com/lambkind/

[41] C. Dwyer, J. Donbavand, M. Weston, J. Kent, V. Molony, O-126 Evaluation of a novel method of lamb castration and tail docking in reducing behavioural pain responses in lambs aged <1 week or 5-6 weeks, Animal - science proceedings, Volume 14, Issue 1, 2023, Pages 149-150, https://doi.org/10.1016/j.anscip.2023.01.202.

32. The efficacy of registered pharmaceuticals is established; their safety is assessed and accepted by the Agricultural Compounds and Veterinary Medicines Group of Ministry for Primary Industries, or equivalent.

Conclusion

33. Pre-emptive, multimodal analgesia via use of registered and available pharmaceuticals, and/or other devices, can and should be provided for tailing and castration.

34. With careful planning and a commitment to providing effective analgesia, and alongside advances in pharmaceuticals, technology and modified farm practices, lambs could experience genuinely effective, pre-emptive (i.e., administered and effective at time of tissue insult), multi-modal analgesia during tailing and castration.