An investigation of current trends in cattle dehorning and their impact on calf welfare

Discusses current best practice for pain management during calf dehorning using topical and buccal anaesthetics and analgesics; also discusses the most appropriate age for this husbandry procedure.

Dannielle Allman

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Dehorning and disbudding are common husbandry practices performed in the beef and dairy industry. Disbudding involves the destruction of the horn bud before it attaches to the underlying frontal sinus, while dehorning encompasses the removal after attachment (Hambleton & Gibson 2017). Horn removal is routinely practised to minimise carcass bruising, increase ease of handling, and ensure the safety of both handlers and other animals within the herd (Kling-Eveillard et al. 2015). These procedures, achieved by hot iron, caustic paste or amputation, elicit acute and chronic pain due to the destruction of tissue and the resultant inflammation (Graf & Senn 1999). The welfare of calves undergoing these procedures is of growing concern within the industry, hence pain management is increasing in popularity (Hambleton & Gibson 2017). The most effective way to reduce pain is to remove the need entirely, such as by selecting for polled genes during breeding (Hume, Whitelaw & Archibald 2011). While this is broadly accepted, the introduction of genetic change is a long-term solution and short-term alternatives must be considered (Windig, Hoving-Bolink, & Veerkamp 2015). The research reviewed in this investigation will cover areas such as age and the use of pain relief to address welfare concerns within current practice.

The cautery of superficial skin during disbudding is considered less painful than the amputation of bone during dehorning, a fact supported by the higher cortisol experienced during dehorning (Stafford & Mellor 2005). Thus the Australian Animal Welfare Standards and Guidelines for Cattle currently recommend that horn removal is performed in calves as young as possible to minimise pain (Animal Health Australia 2016). Adcock & Tucker (2018) investigated the effect of age on healing and pain sensitivity after disbudding dairy calves at 3 and 35 days of age. Pain sensitivity was determined by measuring tolerance thresholds using fine tip algometers. Healing was found to occur at the same rate despite age (62 +/- 10 days post disbudding). However, calves disbudded near birth had heightened pain sensitivity at distal sites compared to calves disbudded at one month. Despite these results, younger calves had decreased sensitivity around the horns, independent of disbudding, compared to the 35-day-old calves. It was not determined whether this was due to the reduced learned response of neonates to move away from painful stimuli. This may suggest the need to use additional measurements of pain, for example cortisol, in future studies. Adcock and Tucker (2018) proposed that painful procedures experienced as neonates can affect long-term systemic nociception, which in turn, provides an argument against disbudding at the earliest age possible to avoid chronic sensitisation.

In Australia, local anaesthetics are only compulsory when dehorning calves over six months old (Animal Health Australia 2016). This contrasts to Denmark and the United Kingdom, where local anaesthetics are compulsory during disbudding and dehorning at any age (Hambleton & Gibson

2017; Herskin & Nielsen 2018). While the use of pain relief during dehorning vastly improves calf welfare, common injectable anaesthetics are not widely used in Australia as they are considered impractical and expensive (Petherick 2005). Improving the useability of anaesthetics and analgesics with topical applications may help increase the use of pain relief during common husbandry procedures in Australia. Van der Saag et al. (2018) found calves given topical applications of anaesthetic and buccal meloxicam expressed reduced pain-associated behaviours (i.e. head turning and tail flicking) compared to animals not given pain relief. These calves also expressed increased eating and lying time, which related to better weight gain than the control group. An ethogram, or catalogue of behaviours, was used to minimise the subjective nature of behaviour observation. However, the infrequency in occurrence of head pawing and kicking, leading to their exclusion from this study, highlights that some pain-associated behaviours may be expressed differently by various individuals. Therefore, a degree of caution should be practised when interpreting these behaviours.

While topical applications may be easier to use, Kleinhenz et al. (2018) highlighted that there may be some disadvantages of topical applications due to the influence of pain on absorption. Thus, if pain alters the pharmacokinetics of topical analgesia, and thus changes the absorption of these drugs, it may alter their efficacy compared to the injectable alternative. Kleinhenz et al. (2018) investigated the effect of pain on the pharmacokinetics of transdermal flunixin, a commonly used nonsteroidal anti-inflammatory used during dehorning (Hambleton & Gibson 2017). In this block design study, two groups of calves were exposed to both treatments 14 days apart. The treatments included hot iron dehorning and the control, sham dehorning, performed at ambient temperature. Both groups were administered topical flunixin meglumine at the time of each procedure, and plasma flunixin concentrations were measured. Dehorned calves had both lower bioavailability and plasma flunixin concentrations compared to the control group shortly after the procedure, suggesting reduced absorption. It was postulated that this was due to reduced cutaneous blood flow experienced due to sympathetic nervous system activation secondary to pain, a concept previously explored by Stewart et al. (2007) and Allen et al. (2013). Contrastingly, at 48 and 56 hours after the procedure, flunixin plasma concentrations in dehorned calves were in fact higher than in the control group, suggesting a return to normal cutaneous blood flow. It is important to note other confounding factors, such as stress from handling, may have influenced the results of this study. Nevertheless, Kleinhenz et al. (2018) suggest that the process of dehorning is likely to affect the pharmacokinetics of transdermal flunixin, and topical applications should be used with caution to ensure the desired analgesic effect is achieved.

In conclusion, while polled genes are increasing in prevalence, there is still a need for disbudding and dehorning procedures. The age of disbudding appears to have no impact on the rate of healing, but it does seem to affect the development of chronic pain sensitivity in young neonates. Furthermore, as highlighted by both Van der Saag et al. (2018) and Kleinhenz et al. (2018), the popularity of topical analgesics is rising due to their increased useability compared to injectables. However, further research is needed to establish whether topical analgesics and anaesthetics are as effective in reducing pain as their injectable alternatives.

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