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Research Reports
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Painful memories: using the memory of disbudding to identify less painful methods

Hot iron disbudding is a common procedure on dairy farms. When no pain medication is provided, calves show a strong and immediate response including escape attempts. When a local anesthetic is provided (usually lidocaine, a local block that numbs nerves, preventing pain signals from being transmitted), these immediate pain responses are reduced. Unfortunately, local anesthetics are only effective for a few hours and much remains unknown regarding pain after this local anesthesia wanes.

In a series of recent studies at the University of British Columbia's Dairy Education and Research Centre (Agassiz, BC), we assessed the impact of this 'post-operative' pain by measuring the calves' memory of this experience. To do so, we built an apparatus divided in three pens, as illustrated in Figure 1. Two of these pens were mounted with distinctive panels (red squares and blue triangles), making it easier for calves to associate the memory of the post-operative pain with a specific pen. Calves were always sedated using xylazine and given a lidocaine nerve block to prevent pain during disbudding. Calves were then allowed to recover in one of the distinctive pens for 6 h, enough time for the effects of the lidocaine to wane and calves to feel the effects of the post-operative inflammatory pain.

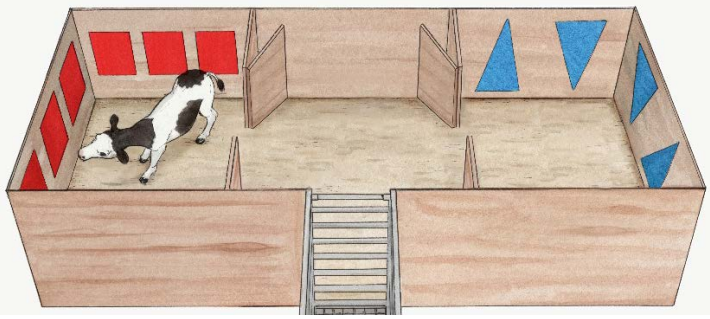

Figure 1: *Experimental apparatus. Calves received different procedures in the pens (red squares and blue triangles). During test sessions, gates were taken out, allowing the calf to freely roam between pens.*

In one study calves were disbudded in one of the two distinctive pens, and experienced a sham procedure (i.e. xylazine sedation but no disbudding) in the other. A few days later, the memory of the two experiences was tested by bringing calves back to the apparatus and allowing them to move freely between the two distinctive pens. We predicted that calves would avoid the pen that they associated with a more a negative experience. Consistent with this prediction, calves avoided the pen where they were disbudded, indicating that (even with a sedative and lidocaine nerve block) calves experienced pain in the hours after disbudding and associated this pain with features of the pen (fig. 2a). In a second experiment we tested the effect of providing a post-operative analgesic (meloxicam), in addition to the sedative and lidocaine block. In this case calves spent more time in the pen where they had received the meloxicam versus the pen where they did not, suggesting that the analgesic helped to reduce post-operative pain thus making the experience less aversive to the calves (fig. 2b).

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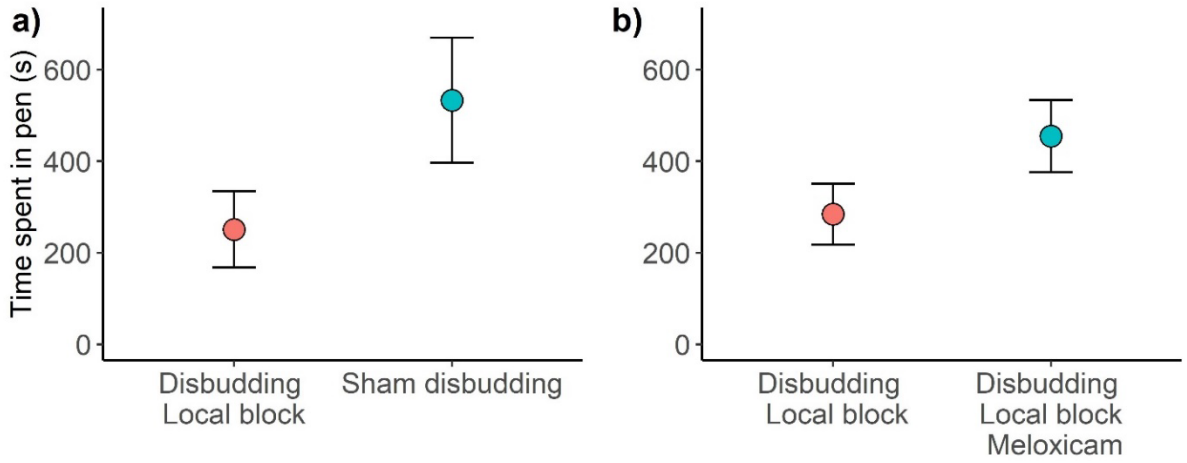

Figure 2: *Aversion test results. Amount of time spent in pens where calves had previously received different disbudding procedures. Calves spent more time in the pen where they had experienced sham disbudding versus real disbudding with a local block (fig. 2a), and spent more time in the pen where they had experienced disbudding with both a local block and a post-operative analgesic versus disbudding with only a local block only (fig. 2b).*

These results indicate that calves remember the pain they experience after disbudding, and associate these painful memories with where the procedure happened. More practically, the results illustrate the importance of providing calves with both a local block and an analgesic like meloxicam to treat the pain that occurs in the hours after disbudding. Alternatively, disbudding can be avoided using polled genetics.

For further information please contact Thomas Ede (thomas.ede92@gmail.com), Marina von Keyserlingk (nina@mail.ubc.ca) or Daniel Weary (dan.weary@ubc.ca). *The results described in this article are based on 2 published articles:*

Ede et al. 2019, Scientific Reports, https://doi.org/10.1038/s41598-019-41798-7.
Ede et al. 2019, Biology Letters, https://doi.org/10.1098/rsbl.2019.0642.

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Research Reports

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