

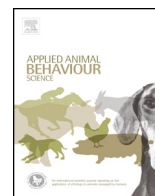


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A comparison of welfare outcomes for weaner and mature *Bos indicus* bulls surgically or tension band castrated with or without analgesia: 2. Responses related to stress, health and productivity

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ABSTRACT

Tension banding castration of cattle is gaining favour because it is relatively simple to perform and is promoted by retailers of the banders as a humane castration method. Two experiments were conducted, under tropical conditions using *Bos indicus* bulls comparing tension banding (Band) and surgical (Surgical) castration of weaner (7–10 months old) and mature (22–25 months old) bulls with and without pain management (NSAID (ketoprofen) or saline injected intramuscularly immediately prior to castration). Welfare outcomes were assessed using a range of measures; this paper reports on some physiological, morbidity and productivity-related responses to augment the behavioural responses reported in an accompanying paper. Blood samples were taken on the day of castration (day 0) at the time of restraint (0 min) and 30 min (weaners) or 40 min (mature bulls), 2 h, and 7 h; and days 1, 2, 3, 7, 14, 21 and 28 post-castration. Plasmas from day 0 were assayed for cortisol, creatine kinase, total protein and packed cell volume. Plasmas from the other samples were assayed for cortisol and haptoglobin (plus the 0 min sample). Liveweights were recorded approximately weekly to 6 weeks and at 2 and 3 months post-castration. Castration sites were checked at these same times to 2 months post-castration to score the extent of healing and presence of sepsis. Cortisol concentrations (mean \pm s.e. nmol/L) were significantly ($P < 0.05$) higher in the Band (67 ± 4.5) compared with Surgical weaners (42 ± 4.5) at 2 h post-castration, but at 24 h post-castration were greater in the Surgical (43 ± 3.2) compared with the Band weaners (30 ± 3.2). The main effect of ketoprofen was on the cortisol concentrations of the mature Surgical bulls; concentrations were significantly reduced at 40 min (47 ± 7.2 vs. 71 ± 7.2 nmol/L for saline) and 2 h post-castration (24 ± 7.2 , vs. 87 ± 7.2 nmol/L for saline). Ketoprofen, however, had no effect on the Band mature bulls, with their cortisol concentrations averaging 54 ± 5.1 nmol/L at 40 min and 92 ± 5.1 nmol/L at 2 h. Cortisol concentrations were also significantly elevated in the Band (83 ± 3.0 nmol/L) compared with Surgical mature bulls (57 ± 3.0 nmol/L) at weeks 2–4 post-castration. The timing of this

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elevation coincided with significantly elevated haptoglobin concentrations (mg/mL) in the Band bulls (2.97 ± 0.102 for mature bulls and 1.71 ± 0.025 for weaners, vs. 2.10 ± 0.102 and 1.45 ± 0.025 respectively for the Surgical treatment) and evidence of slow wound healing and sepsis in both the weaner (0.81 ± 0.089 not healed at week 4 for Band, 0.13 ± 0.078 for Surgical) and mature bulls (0.81 ± 0.090 at week 4 for Band, 0.38 ± 0.104 for Surgical). Overall, liveweight gains of both age groups were not affected by castration method. The findings of acute pain, chronic inflammation and possibly chronic pain in the mature bulls at least, together with poor wound healing in the Band bulls support behavioural findings reported in the accompanying paper and demonstrate that tension banding produces inferior welfare outcomes for weaner and mature bulls compared with surgical castration.

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1. Introduction

As indicated in the first paper of this pair (Petherick et al., 2014), tension-banding castration of bulls is gaining favour and this may be a consequence of claims made by manufacturers and retailers of banding devices that banding is humane and less stressful than surgical castration. The experiments were conducted to determine whether this is, indeed, the case by comparing the welfare outcomes for weaner and mature Brahman bulls from castration by surgery and tension banding with or without analgesia. We have found that for farmers to accept scientific findings and modify practices accordingly, they need to perceive that the research is directly relevant to them i.e. it used the same “type” of animal that they farm and was performed in the same “type” of environment in which they farm. Thus, whilst there have been previous evaluations of tension banding of bulls, none have previously used *Bos indicus* cattle in a tropical environment and measured as broad a range of welfare-related parameters as in this study.

In the first paper we reported on the behavioural responses of the bulls to castration by tension banding and surgery, with and without analgesia (a non-steroidal anti-inflammatory drug, NSAID) and drew conclusions about relative welfare based solely on those behavioural responses (Petherick et al., 2014). In this paper we report on other measures that are widely accepted in the scientific community as being indicative of welfare status, in order to augment the behavioural findings. Plasma cortisol concentrations have previously been used as an indicator of pain associated with invasive livestock husbandry procedures (Mellor et al., 2000) and castration of cattle specifically (Bretschneider, 2005). Creatine kinase (CK) is an indicator of muscle damage, stress and fatigue (Braun et al., 1993; Garcia-Belenguer et al., 1996; Knowles and Warriss, 2007) and decreases in both total protein (TP) and pack cell volume (PCV) are indicative of blood loss (Carlson, 1997). We predicted that, due to the cutting and tearing of tissue, cortisol and CK concentrations would initially be higher in surgical than band castrates due to the greater pain and stress, and TP and PCV would decline only in the surgical castrates. Further, although this could not be tested statistically because separate experiments were conducted for the two age cohorts, we predicted greater pain, stress, tissue damage and blood loss in the mature than weaner bulls due to their greater size. We were unsure of the likely longer-term impacts of castration methods on

cortisol responses, although there is some behavioural evidence of chronic pain in tension-banded calves (Gonzalez et al., 2010) which would suggest that cortisol concentrations may be elevated for some weeks post-tension banding.

We used ketoprofen as the NSAID as it has previously been shown to be effective for the alleviation of castration-related pain in cattle (Earley and Crowe, 2002; Stafford et al., 2002). We chose to administer it immediately prior to castration in order to simulate what would likely happen in a commercial situation, as this would be a practicable method that would also minimise repeated handling and restraint of cattle unaccustomed to those procedures and allow castration of large numbers of cattle in a short time as possible. We were aware that it would take some time for analgesia to develop and, thus, there may be no effects due to pain alleviation during castration, and for up to about 1 h post-castration. It was also improbable that analgesia would last for more than 12–24 h post-castration (Landoni et al., 1995) and, thus, it would not impact on the measures after this time.

Haptoglobin is an acute-phase protein indicative of inflammation (Horadagoda et al., 1999). Due to the difference in tissue damage from the castration methods, we predicted greater inflammation with surgical than tension banding castration during the first few days post-castration. Thereafter, haptoglobin concentrations would likely reflect the healing process and any wound infections. We had no reason to believe that these would differ with castration method and, therefore, expected no differences in haptoglobin concentrations or the wound healing process.

Liveweight changes are an important measure as they have implications for the profitability of livestock operations and may, thus, influence adoption of practices. In addition, liveweight changes are also welfare indicators because states such as pain and stress may reduce feeding behaviour e.g., due to a reluctance of cattle to walk (e.g. see Gonzalez et al., 2010), or alter energy partitioning for anabolism and catabolism (Elsasser et al., 2000). We anticipated no difference between the two castration methods given that previous studies comparing tension banding and other castration methods (mainly surgical and burdizzo) have produced mostly consistent findings of no differences in liveweight or average daily gains in bulls (e.g. ZoBell et al., 1993; Chase et al., 1995; Knight et al., 2000; Fisher et al., 2001; Stafford et al., 2002; Pang et al., 2008; Repping et al., 2013).

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