Practical Alternatives for Managing Castration Pain in Piglets

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The Canadian Code of Practice requires that swine producers provide analgesics to piglets at castration to help control post-procedural pain. However, complete information on the different analgesics available to control post-procedural pain, their effectiveness and optimized procedures for delivering pain control have not been identified. This project set out to identify which analgesics provide effective pain relief to piglets, at what age castration should be performed to minimize stress and production losses, and to determine how the timing of drug administration affects piglets' pain responses following castration.

Results from two studies indicate lower cortisol concentrations are seen in sham castrates 45 minutes after treatment compared with pigs that were castrated with intermediate cortisol concentrations in piglets given an analgesic. This suggests that the analgesic, ketoprofen, has a positive influence on pain responses when given 30 minutes before castration.

INTRODUCTION

Castration is a common procedure performed on male piglets at an early age to prevent the development of boar taint. Previous research has determined that piglets experience significant pain and stress during the procedure, and the pain may last for up to five days thereafter (Marchant-Forde et al. 2014). To address this problem, the Canadian Code of Practice for the Care and Handling of Pigs now requires that castration be done with analgesics to help control post-procedural pain (NFACC 2014). However, the Code does not provide specifics regarding the appropriate analgesics or protocols for their administration. The Canadian Veterinary Medical Association (CVMA) and Canadian Pork Council have provided some guidance on the issue, however, several questions remain.

MATERIALS AND METHODS

Study 1. Comparing the effectiveness of three NSAIDs

Three NSAID analgesics were compared: meloxicam, ketoprofen, and paracetamol, with 167 male piglets from 33 litters being randomly assigned to one of five treatments:

1. castration with meloxicam (Metacam ® 0.4 mg/kg [0.3 ml/kg]) (CAM),
2. castration with ketoprofen (Anafen ® 3 mg/kg [0.3 ml/kg]) (CAA),
3. castration with acetaminophen (Pracetam ® 60 mg/kg [1.0 ml/kg]) (CAP),
4. castration control (CA), and
5. sham castration (SCA).

The analgesics were administered immediately before to castration; meloxicam and ketoprofen were given intramuscularly, while paracetamol was administered orally.

Behavioural observations and physiological measures of stress (serum cortisol) were done on separate litters to avoid the stress of blood collection influencing piglet behaviour. In total, 106 male piglets were studied for behaviour post castration, and blood samples were taken from 61 piglets.

Study 2. The effect of piglet age at castration on pain response and weight gain following castration.

117 male piglets were randomly assigned within each litter to six treatments with three castration treatments and two ages.

For piglets that received ketoprofen (Anafen ® 3 mg/kg [0.3 ml/kg]), the drug was provided intramuscularly 30 min prior to castration. Piglets were weighed and individually marked at 2-3 days of age, and trained to navigate a handling chute one day prior to treatment.

Castration treatments:

1. castration with ketoprofen (A),
2. castration control (C), and
3. sham castration control (S)

Ages:

1. 3 day old piglets (Y), and
2. 10 day old piglets (O)

Study 3. Determination of optimal timing of analgesic administration

Male piglets from 35 litters were randomly assigned to one of five treatments:

1. castration with ketoprofen, administered 1 hour before castration (HK),
2. castration with ketoprofen, administered immediately before castration (IK),
3. sham castration with saline administered 1 hour before (HS),
4. sham castration with saline administered immediately before (IS), and
5. castration control, saline administered immediately before castration (IC).

Piglets were handled twice for all treatments where the analgesic (or saline) is administered one hour prior to castration, and once where the analgesic (or saline) is administered at the time of castration. Thirty-five litters of pigs were used, with each treatment represented and randomly assigned within each litter (n=35 piglets/treatment).

Behavioral Observations

In all studies, behavioural observations were taken on piglets using a specially designed handling chute developed and validated as an objective behavioural measure of pain in castrated piglets. The duration of time piglets take to navigate the chute has been shown to take significantly longer in piglets castrated without pain control, compared to those handled but not castrated (Bilsborrow et al., 2016). Training involved four runs through the chute at intervals of 15 minutes, with the first run containing no hurdles, and the next three with increasing hurdle heights. This training was given to ensure piglets were familiar with how to transverse the chute prior to treatment application.

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On the day of treatment application, all piglets were first given a pre-treatment run at 30 min prior to the administration of treatment. Following treatment piglets were required to navigate the chute at 15, 40, 60 and 120 minutes post-treatment. Piglets were given a total of two minutes to navigate the chute unaided. If a piglet laid down in the chute it was assigned a navigation time of two minutes and was gently pushed through the chute towards the farrowing pen.

RESULTS AND DISCUSSION

Study 1. Comparing the effectiveness of three NSAIDs

In Study 1 there was a significant effect of treatment on navigation times. Comparing overall navigation times, castration control (CA) piglets had a significantly slower navigation time than castration with ketoprofen (CAA) piglets (Figure 1). CAA piglets also had a significantly faster navigation time than both castration with acetaminophen (CAP) and sham castration (SCA) piglets. There was a trend for CAA piglets to navigate the chute faster than CAM piglets. These results did not agree with our hypothesis or previous studies; sham castrates were expected to show shorted navigation times, which was not the case. This result led to questioning of the validity of the chute navigation test and a re-evaluation of chute navigation methods.

Initial results for cortisol levels showed that at 45 min post-castration, piglets castrated without analgesics had higher cortisol levels than those that were sham castrated, and piglets castrated with ketoprofen were intermediate (Castration control:194.6±131.8 nmol/L; Sham handled: 81.6±42.8 nmol/L; Castration with ketoprofen: 142.1±105.6 nmol/L, mean ± SD. $P<0.05$). No other significant differences were found among treatment groups.

Study 2: The effect of piglet age at castration on pain response and weight gain following castration

There was no significant effect of age at castration on pain responses, nor any interaction between treatment and run time (Figure 2). Preliminary results for cortisol concentrations show a significant interaction between treatment and sample (Figure 3). Piglets that were sham castrated showed no significant change in cortisol concentration across the four time-points, while those castrated showed a large increase in cortisol at 45 minutes post-treatment. Similarly, those given ketoprofen showed an intermediate rise in cortisol 45 minutes post-treatment. A significant interaction was found between treatment and age. Younger piglets had higher cortisol levels, and older pigs showed a benefit from receiving pain control while younger pigs did not (Figure 3).

CONCLUSION

Based on the cortisol levels obtained in the first two studies there appears to be a benefit of providing pain control, although significant benefits were only observed in older piglets in the second study. The results of physiological measures from these studies are preliminary, however show a promising positive influence of ketoprofen on stress levels of piglets, and confirm that castration is painful.

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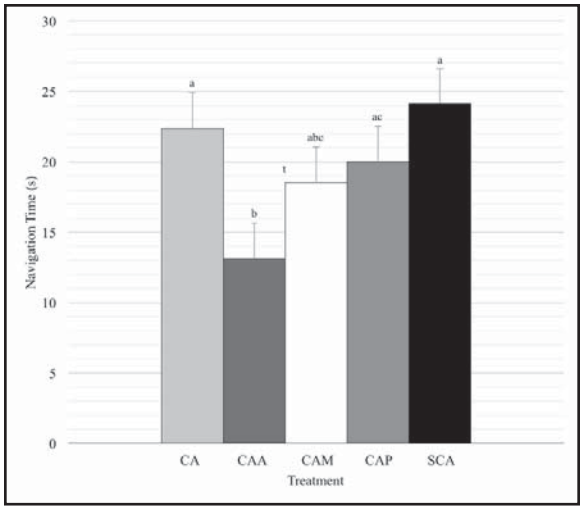

Figure 1. Overall navigation time after treatment (Four chute runs, mean and SEM in sec) for pigs given one of five treatments. Treatments: castration control (CA), castration with ketoprofen (CAA), castration with meloxicam (CAM), castration with paracetamol (CAP), and sham castration (SCA).

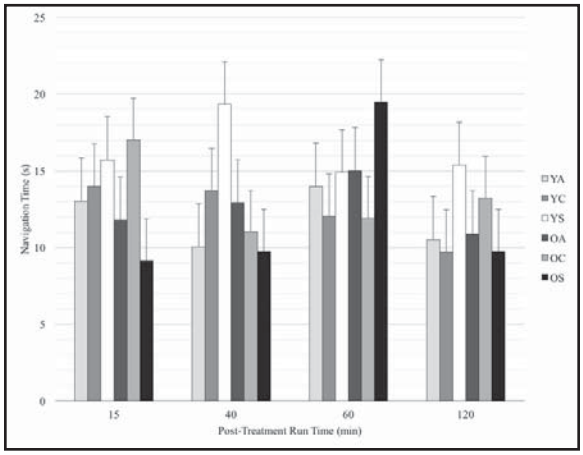

Figure 2. Mean chute navigation time (s, ±SEM) at four time points post-treatment. The six treatments included: castration at 3 days of age with ketoprofen (YA), castration at 3 days of age (YC), sham castration at 3 days of age (YS), castration at 10 days of age with ketoprofen (OA), castration at 10 days of age (OC), and sham castration at 10 days of age (OS).

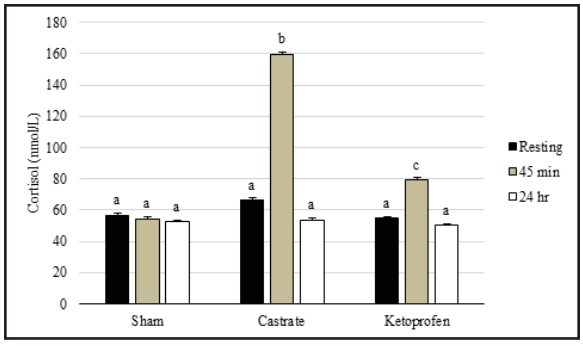

Figure 3. Study 2. Bar graph showing the interaction between analgesic treatment and sample time point for mean cortisol concentrations (nmol/L). Different superscripts indicate a significant difference ($P < 0.05$).