

# Practical Alternatives for Managing Castration Pain in Piglets

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## Summary

The objective of this project was to evaluate drugs and administration procedures to help identify effective and practical pain control strategies for piglets at castration across three different studies. Results indicate the analgesic, ketoprofen, has a positive effect on reducing pain following castration when given 30 minutes to 1 h before castration. Drug provision immediately before castration appears to be better than providing no pain control. Older piglets showed a clearer response when given pain control than young piglets, and could be used as a model for young pigs when evaluating pain control options.

## Introduction

The Canadian Veterinary Medical Association (CVMA) and Canadian Pork Council (CPC) have provided some guidance on appropriate drugs and dosage to be used during castration, however, several questions remain. The NSAID drug Metacam has received regulatory approval for treating pain at castration, but options such as ketoprofen and acetaminophen may also be effective. Castration is typically performed at 3 to 5 days of age however some studies have suggested that it may be less stressful in older pigs - but clear evidence is lacking. Timing of drug administration has also been questioned; providing pain control 30 minutes prior to castration may be more effective than at the time of castration. However, this would require producers to handle pigs twice, coordinating injection and castration times at processing. The overall objective of this project was to study the effectiveness of procedures for controlling post-procedural pain in piglets at castration. Three specific objectives were: 1. to compare the effectiveness of different analgesics; 2. to study the effect of piglet age at castration on pain responses, and; 3. to study the timing of drug administration.

## Experimental Procedures

### *Study 1. Comparison of the effectiveness of three NSAIDs*

Three NSAID analgesics were compared for their effectiveness at reducing pain responses following castration: meloxicam, ketoprofen, and acetaminophen. A total of 167 male piglets

were randomly assigned to one of five treatments. Data collection was completed in two parts with behavioural observations and physiological measures of stress (serum cortisol) measured in 106 and 61 piglets, respectively. Treatments consisted of:

- Castration with meloxicam (Metacam ® 0.4 mg/kg [0.3 ml/kg]) (CAM),
- Castration with ketoprofen (Anafen ® 3 mg/kg [0.3 ml/kg]) (CAA),
- Castration with acetaminophen (Pracetam ® 60 mg/kg [1.0 ml/kg]) (CAP),
- Castration control (CA), and
- Sham castration (SCA).

### *Study 2. Effect of age at castration on pain responses following castration*

A total of 117 male piglets were randomly assigned within litter, with three castration treatments applied to piglets at either 3 days (Y), or 10 days of age (O). Piglets that received ketoprofen (Anafen ® 3 mg/kg [0.3 ml/kg]) received the drug intramuscularly at 30 min prior before castration.

- Castration with ketoprofen (A),
- Castration control (C), and
- Sham castration control (S).

### *Study 3. Determination of optimal timing of analgesic administration*

Male piglets from 35 litters (n = 175) were randomly assigned to one of five treatments. Piglets were handled twice in treatments where the analgesic (or saline) was administered one hour prior to castration, and once where the analgesic (or saline) was administered at the time of castration. A total of 7 litters per treatment was used, with each treatment represented and randomly assigned within each litter.

- Castration with ketoprofen, administered 1 hour before castration (HK),
- Castration with ketoprofen, administered immediately before castration (IK),
- Sham castration with saline administered 1 hour before (HS),
- Sham castration with saline administered immediately before (IS), and
- Castration control, saline administered immediately before castration (IC).

### *Behavioral Observations*

In all studies, behavioural observations were taken on piglets using a specially designed handling chute developed as an objective behavioural measure of pain in castrated piglets. The length of time required to navigate the chute has been shown to be significantly longer in piglets castrated without pain control, compared to those handled but not castrated.

In study three, piglet behaviour in the farrowing crate was recorded after castration. Each litter of piglets was videotaped and observed at six time points: 0, 15, 30, 120 min, 24, and 25 hours post-treatment, with each observation period lasting 10 minutes. The frequency of 'event' behaviours was recorded in six 10 min continuous video recordings, beginning immediately after treatment, and at 15, 30 and 120 min, and 24 and 25 hours after treatment. Scan sampling of postural behaviours as well as location in the farrowing crate were recorded at 1 minute intervals over 10 minutes, resulting in 11 observations per piglet per video recording.

### *Blood Collection for Cortisol*

A first blood sample was collected the day before castration, when pigs were selected and assigned to treatments. A second blood collection was taken at 45 minutes post treatment. During blood sampling, piglets were restrained within the farrowing crate under a heat lamp using a wooden board. One-by-one, male piglets were removed by a trained technician and held upside down underneath the left arm. Blood was then collected from the lacrimal caruncle of the eye, with 5 ml of blood being collected in a 10 ml collection tube. Once the initial baseline sample was collected, the piglet was marked, weighed, and replaced in the farrowing crate. The time taken to collect blood was recorded for each sample.

*Ketoprofen can reduce cortisol levels following castration, similar to changes seen with meloxicam in other studies*

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### Body Weight

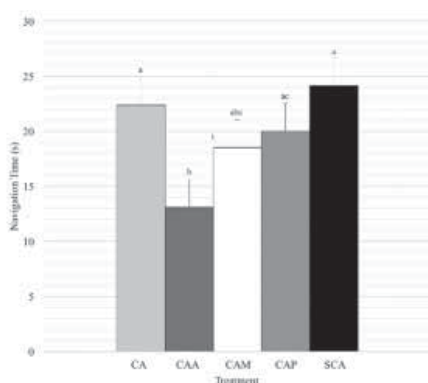
All piglets in study 2 were weighed at five time points: at selection on day 2-3 of age, on day 6-7 (3 days after younger animals received treatments), day 9-10 (before older animals received treatments), day 13-14 (3 days after older animals received treatment) and at weaning (approx. 28 days of age).

## Results and Discussion

### Study 1: Comparing the effectiveness of three NSAIDs

Comparing overall navigation times, castration control (CA) piglets had a significantly slower navigation time than castration with ketoprofen (CAA) piglets (Figure 1), in addition CAA piglets also had a significantly faster navigation times than castration with acetaminophen (CAP) and sham castration (SCA) piglets. There was a trend for CAA piglets to navigate the chute faster than those given metacam (CAM).

Overall, the results of this comparison of NSAID drugs were not conclusive: a direct comparison using meloxicam and ketoprofen with a larger sample size and including measures of cortisol response and behaviour in the farrowing pen is recommended. A dose-response study would also be beneficial to confirm the appropriate dosage.



**Figure 1:** Study 1. Overall navigation time after treatment. Average of chute runs at 15, 40, 60 and 120 minutes post-treatment (LS means  $\pm$  SEM in sec) for pigs given one of five treatments. Treatments: CA: castration control; CAA: castration with ketoprofen; CAM: castration with meloxicam; CAP: castration with paracetamol; and SCA: and sham castration. Bars with different superscripts are significantly different,  $P \leq 0.05$ .

### Study 2: The effect of piglet age at castration on pain responses following castration

No significant differences in navigation time were found between drug or age treatments, nor any interaction between treatments and run time. At 15 min post-castration, 10 day old castrated piglets (OC) had the longest chute navigation time, with 10 day old sham and ketoprofen treated piglets (OS, OA) having numerically lower navigation times.

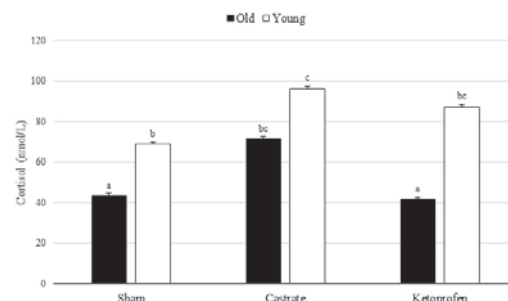
Piglets that were sham castrated (YS, OS) showed no significant change in cortisol concentration over time, whereas castrated piglets (YC, OC) showed a large increase in cortisol at 45 minutes post-treatment. Piglets given ketoprofen showed significantly lower cortisol concentrations compared to castrates at 45 minutes post-treatment, indicating a benefit of analgesia when provided at 30 min before castration. A significant interaction was found between treatment and age. Younger piglets had higher cortisol levels overall, and older pigs showed reduced cortisol concentrations when provided pain control while younger pigs did not (Figure 2).

In Study 2, no effect of age at castration on weight gain was found. Overall, the results of Study 2 indicate that it may be easier to measure benefits of pain control in older piglets. Thus, for future studies evaluating pain control methods could potentially use older piglets as a model for younger animals.

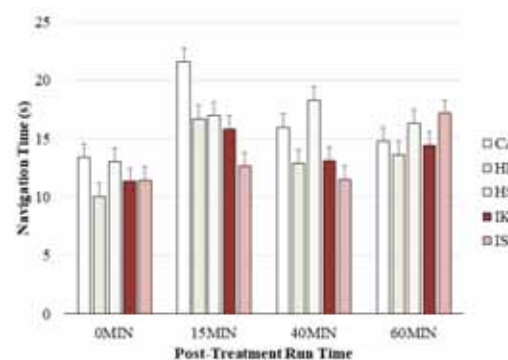
### Study 3: Determining the optimal timing of analgesic administration

Navigation time in the handling chute showed no significant effect of treatment (Figure 3). However, the 15-minute chute time for CA was numerically the longest, while analgesic (HK, IK) and sham treated piglets (HS, IS) had shorter navigation times. Across all treatments a significant effect of time was found, with longer navigation times observed at the 15-minute time point, and shortest navigation times at 0 min (i.e. immediately after castration). The shorter navigation times at 0 min may be due to fear responses following handling.

Regarding piglet behaviour in the farrowing crate, no significant effects of treatment were found for any behaviour in the repeated measures model, however tail wag showed a tendency for a treatment by time interaction ( $P = 0.083$ ). Tail wag behaviour was subsequently analyzed separately for each observation period. Significant treatment effects were found for tail wag in the 20 and 120 min observation periods (20-30 min and 120-130 min after treatment). In the 20-30 min period, tail wagging was more frequent in pigs that were castrated (CA, HK and IK treatments) than in pigs that were sham castrated (HS and IS;  $P = 0.001$ ). In the 120-130 min period, CA, IK and IS pigs did more tail wagging than HK and HS pigs. The results confirm earlier work by Hay et al (2003) which found greater tail wagging behaviour in castrated piglets compared to controls.



**Figure 2:** Study 2. Interaction effects of treatment and age on cortisol concentrations (LS means  $\pm$  SEM, nmol/L). Treatments included Sham castration, Castration control and Castration with ketoprofen. Ages: Old: castration at 10 days of age, Young: castration at 3 days of age. Bars with different superscripts are significantly different ( $P < 0.05$ ).



**Figure 3:** Study 3. LS Means ( $\pm$  SEM) for chute navigation times (s) for castration treatments at four time points. There was no effect of treatment over time. Treatments: CA: castration control, HK: castration with ketoprofen given 1 h before, HS: sham castration with saline given 1 h before, IK: castration with ketoprofen given immediately before, IS: sham castration with saline immediately before.

Cortisol samples collected at 30 minutes after treatment in Study 3 showed a significant effect of treatment. Castrated controls (CA) had significantly higher cortisol levels than all other treatments, IK pigs were intermediate (lower than CA but higher than the remaining treatments), followed by sham treatments (HS and IS), and HK cortisol levels were lowest, indicating a clear benefit of providing pain control one hour before castration. The similar cortisol results for HS and IS sham treatments suggests that handling the piglet twice (HS) vs once (IS) did not result in significantly more stress on piglets.

## Implications

Results of the project indicate that ketoprofen can reduce cortisol levels following castration, similar to changes seen with meloxicam in other studies. Providing ketoprofen 1 h before castration was more effective in terms of lowering cortisol levels than administering the drug immediately before castration. Giving pain control immediately before castration resulted in lower cortisol levels compared to castration with no pain control, but providing the drug 1 h earlier was significantly better. When comparing older and younger piglets, older piglets (castrated at 10 days of age) showed a significant benefit of pain control in terms of reduced cortisol

levels, while those castrated at 3 days of age showed no significant benefits. The results indicate that it may be easier to measure benefits of pain control in older piglets. Results from the chute navigation studies were unreliable and did not provide any clear recommendations. While Ketoprofen may be a suitable alternative to meloxicam for treatment of pain following castration, a product claim for a ketoprofen specific for pain control at castration is needed before producers under CQA and PQE programs can readily implement it in their procedures.

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