Brief Communication Communication brève

Preoperative ketoprofen administration to piglets undergoing castration does not affect subsequent growth performance

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Abstract — The purpose of this study was to determine if treatment of pigs with ketoprofen (3 mg/kg body weight) before castration at 7 days of age would affect subsequent growth during the suckling period. Piglets from 301 litters were treated with ketoprofen or a placebo and weighed at castration and at weaning. There was no difference in growth rate between the 2 groups of pigs.

Résumé — L'administration préopératoire de kétoprofène aux porcelets subissant une castration n'affecte pas la performance de croissance subséquente. Cette étude avait pour but de déterminer si le traitement des porcs avec le kétoprofène (3 mg/kg poids corporel) avant la castration à l'âge de 7 jours affecterait la croissance subséquente durant la période d'allaitement. Les porcelets provenant de 301 portées ont été traités à l'aide du kétoprofène ou d'un placébo et pesé à la castration et au sevrage. Il n'y avait aucune différence au niveau du taux de croissance entre les 2 groupes de porcs.

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The issue of pain as it affects animal welfare and performance in swine production has been widely discussed. In addition to the need for treatment of pain in farmed animals for ethical and moral reasons, pain management can have economic ramifications (1). Pain may be viewed as not being an end point in itself, but might be considered in the same manner as a "pathogen" (2). Pain may cause discomfort, impaired physiological functions, suppression of immune responses, negative energy balance, and self-mutilation (3). The report of the Scientific Panel for Animal Health and Welfare (2004) summarized the physiological and behavioral signs exhibited by piglets undergoing castration based on research studies (4). The procedure is generally performed without anesthesia or analgesia, although it has been demonstrated that it is painful, both during the surgery and for some hours later, and has become a welfare concern (5–8). Castration results in acute pain, particularly with the severing of the spermatic cord, but piglets also continue to experience pain for several hours and possibly days following castration. Anesthetics can block the acute pain, but are of little value in suppressing the chronic pain that occurs in the post-surgical period (5,8). Most studies in this field have evaluated the effect of analgesics on controlling pain, using small numbers of animals under controlled conditions to carry out intensive behavior and physiological studies.

In order to improve the adoption of analgesia into the standard operating procedures of commercial farms it is important that producers know whether or not analgesics given at the time of castration will result in an increased performance in growth rate or piglet survival so that they can better determine the economic cost. In order to determine the effect on performance, large numbers of animals are required and trials need to be performed under commercial farming conditions. Ketoprofen, a non-steroidal anti-inflammatory drug (NSAID), was chosen for this study because it is one of the few pain control products approved for use in swine in Canada. The primary goal of the trial was to determine if preoperative treatment with ketoprofen would result in an improvement in suckling pig performance.

A field trial was conducted on a commercial 650-sow farrow-to-feeder pig operation near Guelph, Ontario. The protocol was approved by the Animal Care Committee of the University of Guelph and followed the guidelines of the Canadian Council on Animal Care. A total of 1416 7-day-old piglets from 301 litters were alternately assigned to: i) Control — saline given by IM injection 30 min before castration (n = 703), or ii) Treatment — ketoprofen (Anafen; 100 mg/mL; Mérial Canada, Baie d'Urfé, Quebec) given by IM injection, 3 mg/kg body weight (BW) 30 min before castration (n = 713). The first male piglet caught in a litter was randomly assigned (by coin toss) to control or treatment and subsequent piglets were assigned alternately. Placebo and treatment were given in equal volume and researchers were blinded to treatment. All piglets were ear notched for identification within 24 h of birth and individually weighed at the time of castration and at 21 d of age to determine average daily weight gain (ADG).

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Table 1. Growth rate and mortality for piglets treated with ketoprofen[a] or placebo at castration

	Placebo $n = 703$	Ketoprofen $n = 713$	P-value
Litter size at castration	10.16 ± 1.62[b]	10.15 ± 1.61	0.9
Weight at castration (kg)	2.78 ± 0.61	2.85 ± 0.61	0.06
Weight at 21 d (kg)	6.63 ± 1.46	6.76 ± 1.46	0.11
ADG (7 to 21 d) (g)	271 ± 0.70	276 ± 0.70	0.08
Mortality	2.7%	2.5%	0.83

[a] Anafen; 100 mg/mL; Mérial Canada, Baie d'Urfé, Quebec, given by IM injection (3 mg/kg BW) 30 min before castration at 7 days of age.
[b] ± standard deviation.

Mortality between the 2 weighing periods was recorded. Piglets were returned to their litters after castration and observed for approximately 15 to 20 min after castration for signs of discomfort, including isolation or abstention from suckling with littermates. In addition, a total of 120 blood samples from piglets in 23 litters were collected at 30 min, 60 min, 90 min, and 4 h following castration for determination of cortisol concentrations. An individual pig was only bled once, and therefore, in general, 4 littermates in the same treatment group were used where possible. The blood samples were centrifuged at 3900 × *g* at 5°C for 20 min, within 1 to 3 h after collection. The plasma samples were stored in 2-mL polypropylene micro tubes (Sarstedt Canada, Saint-Léonard, Quebec) at −20°C until they were analyzed for cortisol with a solid-phase, competitive chemiluminescent enzyme immunoassay (Immulite/Immulite Cortisol 1000; Siemens Healthcare Diagnostic Products, Los Angeles, California, USA). The test had an analytical sensitivity of 5.5 nmol/L with a calibration range of 28 to 1380 nmol/L.

Descriptive statistics and quantitative statistical analysis were completed in Statistix (Statistix10, Version 10.1; College Station, Texas, USA). Each continuous variable was plotted and tested for normality using the Shapiro-Wilk test. The correlation among continuous variables was tested using pairwise correlations. The simple association between continuous variables with treatment were evaluated with a 2 sample *t*-test when continuous variables were normally distributed and with the Wilcoxon rank sum test when variables were not normally distributed. The simple association of continuous variables with categorical variables was analyzed with a one-way analysis of variance (ANOVA). A Chi-square test was used to determine the simple association between treatment and dichotomous or categorical variables.

Weight at castration was not normally distributed. Mean ADG, weight at castration, and weight at weaning between treatment and control groups are summarized in Table 1. No significant difference was observed for these parameters between the 2 groups. Weight at castration, and weight at weaning and ADG were highly correlated ($P < 0.001$). Mortality rates were similar for pigs in the 2 groups ($P = 0.83$). A total of 2.7% (19/703) of pigs died in the control group, and 2.5% (18/713) of pigs died in the treatment group. No significant differences were observed between treatment and control groups among parity categories ($P = 0.8$). However, ADG varied significantly among sow parity categories ($P = 0.004$). Piglets born from the oldest sows (> 6 parity) had lower ADG [263 g/d; ± 80 g/d standard deviation (SD)] compared to pigs born from parity 3 to 6 sows (279 g/d; ± 70 g/d SD). There was a tendency for better growth for piglets nursing sows in parity 1 to 2 (276 g/d; ± 70 g/d SD) compared to piglets of sows in parities > 6 (263 g/d; ± 80 g/d SD) ($P = 0.08$). No significant differences in ADG were observed for piglets nursing sows in parity 1 to 2 compared to piglets of sows in parity 3 to 6. Based on subjective evaluation by an observer who was blinded to treatment, there was little evidence of behavior suggesting discomfort in either treatment or control group for 15 to 20 min after castration. Plasma cortisol concentrations were significantly higher in the placebo group at 30 min, 60 min, and 90 min following castration but not at 4 h (Figure 1).

When an injectable analgesic drug is given 30 min before castration, piglets need to be handled twice, and the process of castration may take twice as long. Because of practical considerations most pork producers will want to administer an analgesic at the time of castration in order to minimize time and labor, as well as reduce the stress for the pig of being handled twice. Research suggests that analgesia does not reduce the acute pain associated with castration so there may be limited advantage in administering ketoprofen 30 min prior to castration. Treatment at the time of castration should still result in reduced pain over the next few hours. The cost of drugs, syringes, and needles is approximately 15 cents per castrated piglet. The cost of analgesia is small on a per pig basis, but for a moderate-sized pig operation the cost associated with extra labor and drug costs represents thousands of dollars. In the present study, ketoprofen administered 30 min before castration did not result in an improvement in ADG or survival. Because piglet performance is not improved there is no obvious economic incentive to help encourage producers to implement this practice.

An additional reason producers may be hesitant to use an analgesic is that it is difficult to assess pain in piglets, and they may not be convinced of the need from a welfare standpoint. In the present study observations over the first 15 to 20 min post-surgery failed to note a difference in behavior between piglets treated with ketoprofen and those receiving the placebo. Other studies that have followed pigs for a longer period of time and used more intensive observation methods have noted more isolation behavior and sometimes other changes. Generally, most studies have found that castrated piglets continue to nurse with littermates whether or not they have received analgesia (7,9), and one explanation that has been presented is that the activity of suckling provides some analgesia or calming effect (10).

Blood cortisol concentrations are often used as an objective indicator of stress and pain in response to painful procedures such as castration, but handling alone may not result in elevated blood cortisol (5,11). The present study found that plasma cortisol levels were significantly reduced for up to 90 min after castration in piglets that received ketoprofen compared with those that received the placebo. The rise in cortisol for up to 3 h is similar to that reported in other studies (5,12). Other researchers reported that peak values of plasma cortisol were found between 30 and 60 min after surgical castration, and that the return to pre-surgery levels occurred within 3 h after the procedure (13). The difference found in cortisol levels between treatment and

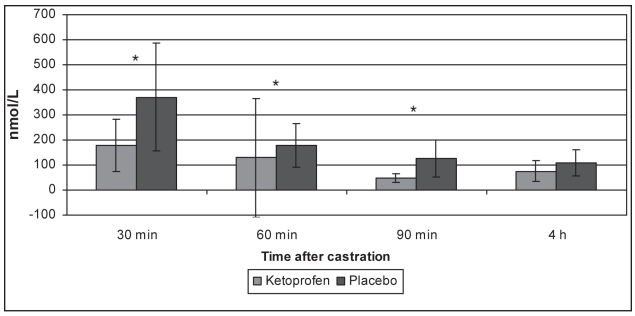

Figure 1. Average plasma cortisol concentrations (nmol/L) from male piglets at various times after castration following ketoprofen[a] or placebo treatment.
[a] Anafen; 100 mg/mL, Mérial, Canada, Baie d'Urfé, Quebec, given by IM injection (3 mg/kg body weight) 30 min before castration at 7 days of age.
* Significantly different at 30, 60, 90 min ($P < 0.01$).

controls in the present study is a useful objective indicator that the castrated pigs did experience pain and that ketoprofen was of some benefit in reducing the pain.

The impact of surgical castration of male piglets on subsequent weight gain during the suckling period has been previously studied, but results are mixed (12). Pre-weaning growth rates and subsequent weaning weights in pigs can be quite variable depending on a variety of factors, including genetics, environment, sow health, and nutrition (14). When a field trial is conducted on a commercial farm it is difficult to control for all the factors that may influence piglet growth. In the present study it was shown that parity, litter size, and starting weight were important factors influencing growth and were controlled for in the analysis. The present study is in agreement with other reports, which found no relationship between pain control treatment at castration and weight gain, using other analgesics, and in other species (8,12,15). There is limited research on the use of ketoprofen for the treatment of pain associated with routine practices such as castration and tail-docking in swine, but research in cattle has demonstrated ketoprofen to be effective in the treatment of pain in bulls after castration (15).

There is growing concern from consumers regarding best welfare practices including the incorporation of pain control into routine farm practices (12). This current study illustrates that pigs receiving analgesia grew the same as pigs not receiving pain control and that farmers are unlikely to see an economic return associated with using analgesia at the time of painful procedures in order to provide better welfare for their animals.

Ketoprofen seems to be of benefit in the treatment of post-operative pain associated with surgical castration of male piglets based on plasma cortisol results. No negative side-effects were noted in this trial. Overall, the results of this study are supportive of the use of ketoprofen as a practical method of reducing post-operative pain associated with castration.

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