NSAIDs – an effective way of reducing post-operative castration pain

By Laurent Goby, Boehringer Ingelheim Animal Health, Corporate Marketing, Ingelheim am Rhein, 55216, Germany.

In many countries worldwide, castration of piglets is a routine practice often performed by the farmer himself.

Male piglets are castrated in order to prevent the development of boar taint, an alteration of smell and taste in pork meat due to the presence of a sexual hormone, androstenone.

In Europe, millions of male pigs are slaughtered every year. The rate of castration differs substantially between countries and ranges from no castration in the UK and Ireland to castration rates of almost 97% in large pig producing countries such as Germany, France, the Netherlands or Denmark. Accordingly, 97 millions barrows are fattened and slaughtered in Europe per year compared to 25 millions boars.

Animal welfare concerns

Regulations in the European Union allow the castration of piglets without any pain control up until seven days after birth. As of then, castration of piglets must be performed by a veterinarian under anaesthesia with subsequent analgesic treatment.

However, about 80% of male pigs surgically castrated in the EU every year do not

receive any appropriate analgesic treatment. The awareness of animal welfare in farm animals is rising and consequently the scientific opinion that newborns have reduced pain perception has long since been revised.

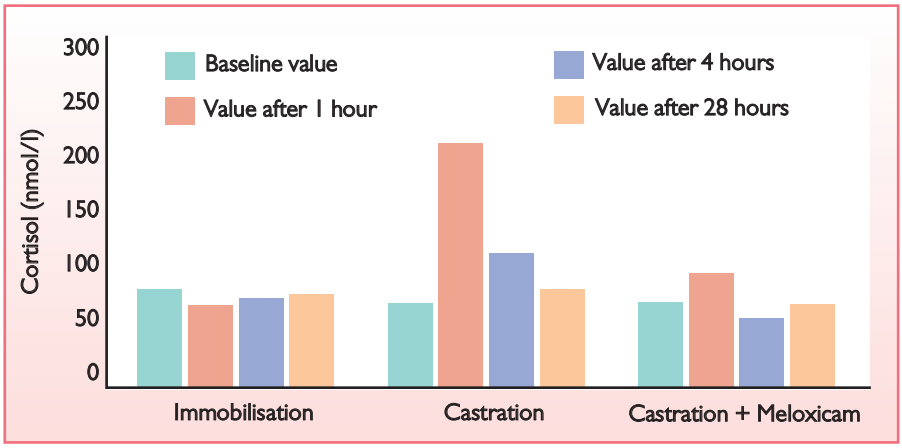
It is now well accepted that castration performed without anaesthesia and post-operative analgesia is very likely to induce pain, irrespective of age and, therefore, is both painful and stressful to the piglet.

Hence, the current procedure is increasingly criticised not only by animal welfare organisations but also by the public and science, and pressure on governments, marketer and trade is growing.

Alternatives are discussed today which either aim at production systems that will not require castration any more (for example boar fattening or immunocastration); or at requiring appropriate ways of anaesthesia and/or analgesia.

Inhalation anaesthetics such as isoflurane or carbon dioxide cause unconsciousness. However, while pain perception is reduced during unconsciousness, there is no analgesic effect to minimise the pain and no effect on the post-operative pain.

Fig. 1. Cortisol concentrations (nmol/l) before, one, four and 28 hours after immobilisation or immobilisation and castration.



Pain expression studied

The research team from the pig clinic at the Ludwig Maximilian University in Munich, Germany, recently investigated not only the pain expressed during castration (caused by mechanical destruction of the tissues and activation of the nociceptors), but also the long lasting pain associated with tissue damages, which is felt long after the surgery.

The pain following surgical intervention is caused by sensitisation of the nociceptors. Tissue damage and associated inflammation induce prostaglandins synthesis by which nociceptors are sensitised and pain thresholds are reduced which, in turn, leads to lasting pain by non-painful stimuli.

According to several studies, this pain lasts up to 24 hours, but there are also other investigations which reported behavioural changes for up to four days.

Non-steroidal anti-inflammatory drugs (NSAIDs) block the expression of cyclo-oxygenase, an enzyme in the cell wall that metabolises arachidonic acid into prostaglandins after tissue damage.

This inhibition reduces prostaglandins synthesis in inflamed tissue, hence decreasing the sensitisation of the nociceptors and consequently the post-operative pain.

This class of agents is not able to modulate the acute intra-operative pain induced by mechanical stimulation of the nociceptors.

However, it has been shown that pre-operative administration of NSAIDs can provide an analgesic effect in the post-operative period for more than 24 hours depending on drug and species considered.

Pain assessment plays a pivotal role in the investigation of pain. Pain is a subjective emotion that is variably perceived by individuals which makes objective assessment very

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difficult, especially in animals. Many studies followed the modification of cortisol concentrations in blood serum to identify a stressful stimulus. Stress-stimuli such as fear or pain influence the cortisol level via the hypothalamic-pituitary-adrenal axis.

Prunier et al. (2005) detected rising cortisol concentrations from two up to 90 minutes after castration with a maximum level of 30 minutes after castration. Similar variations of cortisol levels after castration were also observed in several research works by the pig research team from Munich.

Effect of anaesthesia

In a first trial, they assessed the effect of isoflurane anaesthesia on the pain expressed by the piglet during castration using serum cortisol concentrations as a surrogate to pain-induced stress reaction. Piglets were castrated with or without anaesthesia.

A group of piglets also received an intramuscular injection of 0.4mg/kg bw of meloxicam (Metacam) in combination with inhalation anaesthesia. As controls, two additional groups of piglets (with or without anaesthesia) were considered which were only restrained but not castrated.

Cortisol concentration increased significantly in castrated animals with or without anaesthesia compared to non-castrated animals. The mean cortisol concentration in piglets having received meloxicam prior to the procedure in addition to the isoflurane anaesthetic was found to be significantly lower than that of the animals castrated with anaesthesia only and of the non-anaesthetised animals.

These first results show that general anaesthesia with isoflurane does not sufficiently alleviate post-operative pain following piglet castration but that the pre-operative administration of meloxicam can reduce it significantly.

A second study investigated the impact of pre-operative application of meloxicam on the post-operative castration pain of four to six days old male piglets.

Piglets were randomly distributed between three treatment groups: in the first one, animals were only immobilised but had no surgery, in the second one they were castrated without analgesics, and the third group of animals received 0.4mg/kg of meloxicam i.m. 15 minutes before surgical castration.

Blood samples were taken immediately before immobilisation, castration or application of the NSAID as well as one, four and 28 hours after the procedure and plasmatic concentration of cortisol were determined.

All piglets castrated without pre-operative application of meloxicam showed significantly increased cortisol concentrations one and four hours after castration.

In contrast, piglets having received meloxicam did not show any significant increase in cortisol concentration during the entire experiment (Fig. 1).

Behavioural parameters

In a more recent study, behavioural parameters were assessed to confirm the previous findings. A change in behaviour was considered as pain-induced if a significant difference in the frequency of occurrence could be detected between non-castrated and castrated animals.

Castration induced signs of pain were parameters such as 'tail wagging', 'tremor of the hind limbs' and 'scratching of the scrotum', 'drooping the tail' or 'changing the position'.

These parameters were recorded by focal sampling in a similar experimental setup five minutes, 60 minutes and three hours following castration and compared to those obtained on handled but not castrated animals.

The frequency of observation of these parameters was significantly reduced in animals that were treated with an NSAID.

The behavioural observations confirmed the previous findings from cortisol investigations: pre-operative analgesic treatment with an NSAID is an effective way of reducing post-operative castration pain. ■