Physiological and Behavioural Responses in Piglets Submitted to Castration: Preliminary Study

Chiara LONARDI [1] (✉)
Marta BRSCIC [1]
Simona NORMANDO [2]
Annalisa SCOLLO [1]
Annalisa STEFANI [3]
Flaviana GOTTARDO [1]

Summary

With the perspective to test drugs that may reduce pain due to surgical castration, this preliminary study tries to find out a robust and valid method for pain assessment in piglets. In the present study three treatments were applied: handling (H), tail docking (TD) and surgical castration + tail docking (CTD). To evaluate pain response to the treatments different variables were analyzed: movement latency (time from placing back the piglet inside the farrowing crate after treatments and its first movement towards the nest or the sow), rectal temperature and plasma cortisol and lactate levels. Movement latency was measured for all treatments. Rectal temperature was measured before treatments H and CTD, and 1, 3, 5, 24 hours later. Blood samples for cortisol and lactate determination were collected 1 hour before treatments H and CTD, right after and 3, 5, 24 hours later.

The significant increase of movement latency for CTD compared to H showed that pain can be assessed by this type of measure. Rectal temperature was significantly affected by time ($P < 0.01$) but not by treatment likely due to several factors that might have confounded the studied effect. Cortisol was significantly affected by interaction time*treatment ($P < 0.01$) particularly due to the high peak for CTD right after the surgical procedure. Lactate was modified only by time ($P < 0.01$).

This preliminary study suggests that a non invasive and easy measure such as movement latency is a promising method to assess pain in piglets after surgical castration and tail docking.

Key words

piglets, castration, cortisol, lactate, pain assessment

[1] University of Padua, Department of Animal Science,
viale dell'Università 16, 35020 Legnaro (PD), Italy
✉ e-mail: chiara.lonardi.1@studenti.unipd.it
[2] University of Padua, Department of Experimental Veterinary Science,
viale dell'Università 16, 35020 Legnaro (PD), Italy
[3] Experimental Zooprofilactic Institute of Padua,
viale dell'Universita' 10, 35020 Legnaro (PD) Italia

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Aim

Surgical castration is a painful practice in piglets considering that it is carried out without using anesthesia therefore it represents an important welfare issue (EFSA, 2004). With the perspective to test drugs that may reduce pain during and after castration, it is necessary to establish a protocol for the assessment of pain in piglets in a standardized way. The objective of this study was to identify a robust and valid method for the evaluation of pain in piglets after surgical castration and tail docking carried out without the use of anesthesia and performed before seven days of age according to D.lgs 53/04.

Material and methods

The study was carried out between January and April 2011 in a commercial sows' farm located in San Vito al Tagliamento in the Province of Pordenone (PN) in the north-east of Italy. The experimental measurements were taken in different farrowing rooms since farrowings occur every week in different rooms taking in account for the rotational management of the farm. All piglets in the study belonged to a commercial hybrid (75% Large White 25% Landrace Belga) and were aged between four and seven days. Castration and tail docking procedures were carried out without administration of anesthesia or painkillers according to D.lgs 53/04.

Three different treatments were considered: handling (H), tail docking (TD) and tail docking + surgical castration (CTD). The variables detected to evaluate signs of pain for each treatment were: movement latency, rectal temperature, and plasma levels of cortisol and lactate. Movement latency was measured for all treatments while the other variables were recorded only for H and CTD.

Movement latency

The time required by the piglets to make the first step after placing them back to the farrowing crate subsequent to handling (H), tail docking (TD) and castration + tail docking (CTD) procedures was recorded. This measure was taken on all males (257 piglets) of 35 litters chosen and assigned randomly to the different treatments: 31 piglets were only handled, 83 were tail docked, and 143 were surgically castrated and tail docked.

Rectal temperature

The measurement was carried out on all male piglets (32) of nine litters chosen and assigned randomly to the different treatments. Twelve piglets were only handled (H) and twenty were surgically castrated and tail docked (CTD). Male piglets of all litters were identified by numbers before mutilations and then individual rectal temperature was measured in order to obtain the basal temperature. The same measurement was repeated 1, 3, 5, and 24 hours after the treatment in all piglets.

Cortisol and lactate

Cortisol and lactate were measured on blood samples collected from all male piglets (32) of nine litters after their identification by numbers. Twelve piglets were only handled (H) and twenty were surgically castrated and tail docked (CTD). Blood samples were collected from the anterior vena cava using 2.5 ml syringe and then stored in vacuum tubes (Vacutest Kima srl, Arzergrande, PD, Italy). The sampling was repeated 1 h before, immediately after castration (time 0) and 3, 5, 24 hours post treatment.

At the laboratory, blood samples were centrifuged at 2500 × g for 10 min at 20°C. Serum cortisol concentration was determined with chemiluminescent assay (LKCO1, Medical System, Genova, Italy) performed with automated analyzer Immulite One (Medical System, Genova, Italy). Lactate was determined with a commercial kit for colorimetric assay (L-Lactate, Randox Laboratories Ltd., Co Antrim, UK) performed with automated analyzer Cobas 501 (Roche Diagnostics, Mannheim).

Statistical analysis

The normal distribution of all variables was tested using PROC UNIVARIATE (SAS, 2008). Variables with Shapiro-Wilk values (W) ≥ 0.95 were considered as normal, whereas all other variables were log transformed before analysis.

Movement latency was analyzed using a mixed model procedure (SAS, 2008) considering the treatment (H, TD, and CTD) as fixed and the litter as random effect. Data on rectal temperature, cortisol and lactate were analyzed using the same statistical procedure considering the effects of treatment (H vs. CTD), time from the treatment, the interaction time*treatment and the random combined effect of animal - litter within treatment.

Results and discussion

Movement latency

Data reported in Figure 1 show that there is a different latency between piglets that were only handled compared to those surgically castrated and tail docked. Alterations of the normal behavior of piglets are reported in the literature as indicators of discomfort subsequent to surgical castration (McGlone et al., 1993; Keita et al., 2010), therefore it is assumed that the increased movement latency observed in our study is an indicator of pain and distress. This is supported also by the fact that piglets after surgical castration show a change in locomotion, posture, contact with the sow and they display pain related activities such as tremors or spasms and vocalizations (Taylor and Weary, 2000; Llamas Moya et al., 2008; Waldmann et al., 2010). From results

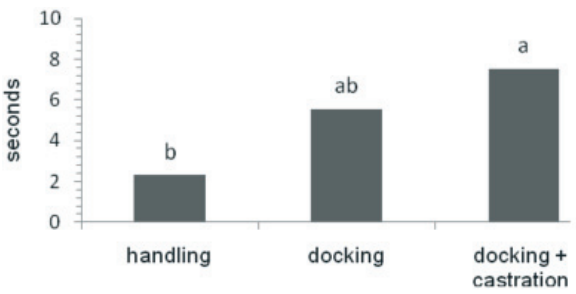

Figure 1. Latency (sec) from placing back the piglet to the farrowing crate and the first movement towards the nest or the sow after handling (H), tail docking (TD) and surgical castration + tail docking (CTD). Means with different letters differ significantly ($P < 0.05$) according to the Bonferroni test

obtained in the present study it is clear that piglets subjected only to tail docking are always slower to resume movement after the mutilation but their reaction time has an intermediate value between handled and surgically castrated piglets. This underlines that the real difference is due to the pain experienced by males subjected to castration.

Rectal temperature

Rectal temperature was significantly affected by time (Figure 2) but not by treatment or by the interaction time*treatment. Although literature reports a temperature increase due to stress in animals (Takakazu et al., 2001), in the present study it is likely that several other factors affected rectal temperature that did not allow us to find a relation between the temperature and the surgical procedure. These factors could be the presence of heat lamps, time from milk intake, activity performed by the piglet just before the measurement (sleeping or walking). It seems therefore that body temperature is not a useful indicator of stress/pain in piglets after castration.

Cortisol and lactate

As shown in Figure 3, cortisol levels of piglets that were only handled remained fairly constant but higher than those reported by several studies (Prunier et al., 2005; Llamas Moya et al., 2008; Waldmann et al., 2010), probably because handled piglets were sampled after the surgically castrated piglets but in the same room, so they heard all the vocalizations of the CTD piglets. As expected, piglets of CTD have had a significantly higher cortisol peak ($P<0.01$) right after mutilations and its concentration returned to baseline three hours post treatment. This result is in agreement with findings by Prunier et al. (2005) and Waldmann et al. (2010) while Llamas Moya et al. (2008) describes also a second peak three hours after the treatment.

Lactate was significantly affected only by time (Figure 4) whereas CTD piglets showed similar concentrations to those of H pigs. This result is in contrast with the literature that reports an increase of the lactate concentration after castration as a consequence of the release of the glycogen reserve (Prunier et al., 2005).

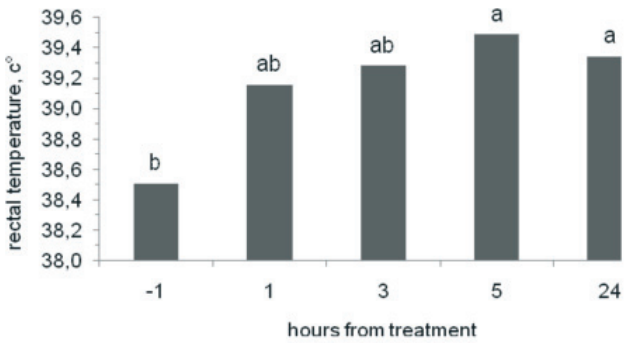

Figure 2. Rectal temperature (C°) at different hours from the treatment (H vs. CTD). Means with different letters differ significantly ($P < 0.05$) according to the Bonferroni test

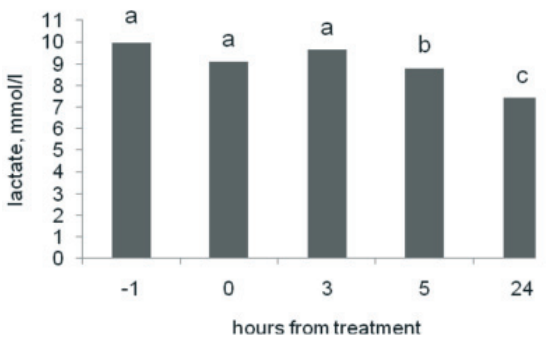

Figure 4. Lactate level (mmol/l) in piglets subjected to handling (H) and castration+tail docking (CTD). Means with different letters differ significantly ($P < 0.05$) according to the Bonferroni test

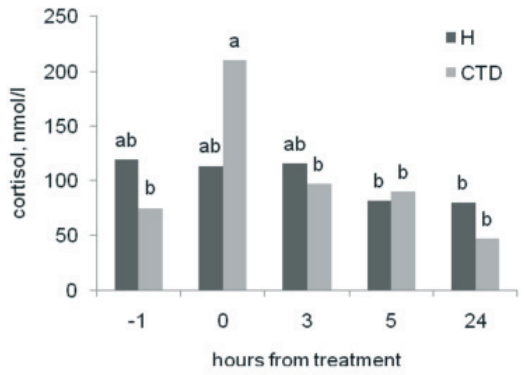

Figure 3. Blood cortisol levels (nmol/l) in piglets subjected to handling (H) and surgical castration + tail docking (CTD). Means with different letters differ significantly ($P < 0.01$) according to the Bonferroni test

Probably it is necessary to repeat the experiment with larger number of animals to see the real effect of CTD on blood parameters.

Conclusions

According to our results movement latency seems to be a reliable parameter. However the same measurement should be repeated at different time before and after castration in order to evaluate the duration of animal pain. Significant changes in cortisol levels have been observed only immediately after castrations therefore cortisol can be used as marker of acute stress.

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