



Evaluation of meloxicam and EMLA® for pain mitigation in piglets undergoing surgical castration

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BACKGROUND

In North America, commercial boars undergo surgical castration to prevent boar taint and to minimize aggression. While castration is known to be a painful procedure, piglets do not currently receive analgesic or anesthetic for pain management. Analgesia recommendations for boar piglet castration have been developed in the EU, but doses of drugs, such as meloxicam, have been extrapolated from sows and growing pigs and have had limited efficacy when administered to piglets.

OBJECTIVES

- To determine if piglets given an analgesic (meloxicam) prior to castration demonstrate reduced pain behaviours
- To determine if piglets given a topical anesthetic (EMLA®) prior to castration demonstrate reduced pain behaviours

METHODS

Boar piglets from 4 litters were used for this study ($n=19$). Boars were randomly assigned to one of five possible treatments across litters:

1. Meloxicam + EMLA®
2. Meloxicam + unmedicated cream
3. Saline + EMLA®
4. Saline + unmedicated cream
5. No treatment

Symbols were allocated to each treatment group and marked on the forehead and back of piglets. Animals were castrated (~5 days old) by an experienced animal technician.



Piglets were videotaped at 24h pre-procedure for 1h, from 0-7h post-castration and at 24h post-castration for 1h. Behavioural scoring of piglets was conducted by an individual blinded as to animal treatment using a detailed ethogram (Table 1) and Observer XT software. Behaviour was scored continuously for the first 15 minutes at: -24, 0, 1, 2, 3, 4, 5, 6, 7, and 24h post-castration.

Piglet behaviours were analyzed individually for a treatment, time or litter effect and then grouped into active and inactive behaviours for further analysis.

METHODS

Behaviours	Description
Suckling	Teat in mouth and suckling movements
Nosing udder/looking for teat	Nose in contact with udder, up and down head movements
Chewing	Snout in contact with a substrate
Licking	Nibbling at littermates or substrates
Playing	Rubbing the tongue over littermates, floor or pen walls
Agnostic	Springing/bouncy movements with littermates
Walking	Biting or fighting other littermates
Running	Moving forward at a normal pace
Awake inactive	Trot or gallop
Sleeping	No special activity, but awake
Stiffness	Lying down, eyes closed
Trembling	Lying with extended and tensed legs
Spasms	Shivering (as with cold)
Scratching	Quick and involuntary contractions of the muscles
Tail wagging	Rubbing the tail against the floor or pen walls
Lying	Tail's movements from side to side (or up and down)
Sitting	Body weight supported by side or belly
Standing	Body weight supported by hindquarters and front legs
Kneeling	Body weight supported by four legs
Isolated	Body weight supported by two or three carpal joints and hind legs
Desynchronized	Alone or with one littermate at most, distance of 40cm separates the animal(s) from the closest group of littermates
	Activity different from that of most littermates (at least 75%)

Table 1: Ethogram adapted from Hay et al. (2003)

RESULTS

The total duration of piglet behaviours was converted into proportions prior to analysis to account for periods of time when the piglet was not in view and unable to be scored. No effect of litter was noted after analysis and data was combined across litters.

Piglets demonstrated significant behavioural changes, when compared to baseline behaviours, up to 7 hours post-castration (for most behaviours, $p < 0.0001$). There was no difference in behaviour at -24h and 24h post castration for any treatment group. None of the analgesic or anesthetic treatments were able to significantly reduce pain behaviours (see Table 2 for summary).

Behaviour	$F_{1,190}$	P	Treatment				
			Meloxicam + EMLA® cream (n=5)	Meloxicam + non-medicated cream (n=3)	Saline + EMLA® cream (n=2)	Saline + non-medicated cream (n=5)	No Treatment (n=9)
Playing	0.62	0.6928	0.81 ± 0.41	2.32 ± 1.25	1.86 ± 0.61	0.85 ± 0.38	0.90 ± 0.66
Walking	1.34	0.2587	11.17 ± 2.05	9.48 ± 1.84	8.91 ± 1.97	8.21 ± 1.74	5.78 ± 2.33
Running	0.56	0.6945	0.05 ± 0.03	0.01 ± 0.01	0.07 ± 0.07	0.04 ± 0.04	0.05 ± 0.02
Awake Inactive	1.36	0.2519	45.50 ± 3.83	45.60 ± 4.3	51.47 ± 5.97	41.46 ± 3.95	35.47 ± 5.55
Sleeping	1.99	0.0997	42.74 ± 4.83	43.09 ± 5.79	38.08 ± 7.30	45.25 ± 5.01	57.47 ± 7.00
Suckling	1.05	0.3861	15.61 ± 2.77	14.30 ± 3.35	19.81 ± 5.30	13.50 ± 2.46	7.83 ± 3.9
Nosing Udder	0.95	0.4855	6.02 ± 1.52	3.84 ± 1.16	6.00 ± 1.65	7.15 ± 1.88	1.64 ± 0.98
Nosing	0.77	0.5474	7.18 ± 1.57	6.74 ± 1.81	6.07 ± 1.62	5.67 ± 1.68	5.94 ± 3.01
Chewing	1.48	0.211	1.34 ± 0.14	1.23 ± 0.53	0.47 ± 0.26	0.29 ± 0.14	0.27 ± 0.13
Stiffness	0.75	0.5614	7.82 ± 0.19	0.54 ± 0.13	0.81 ± 0.26	0.67 ± 0.19	0.95 ± 0.36
Trembling	0.95	0.4473	0.85 ± 0.53	0.40 ± 0.26	0.63 ± 0.34	0.04 ± 0.03	0.50 ± 0.30
Spasms	0.43	0.7845	1.12 ± 0.23	1.57 ± 0.77	1.46 ± 0.53	0.90 ± 0.53	1.12 ± 0.25
Scratching	0.14	0.8675	0.33 ± 0.13	0.45 ± 0.27	0.05 ± 0.36	0.29 ± 0.17	0.88 ± 0.33
Tail Wagging	2.65	0.0367	2.68 ± 0.77	2.18 ± 0.81	3.06 ± 1.01	0.60 ± 0.16	0.96 ± 0.58
Lying	0.94	0.4411	58.21 ± 4.88	66.67 ± 5.32	64.68 ± 6.36	64.33 ± 4.93	75.70 ± 7.19
Sitting	1.17	0.327	4.89 ± 1.11	2.43 ± 0.57	5.04 ± 1.80	2.95 ± 0.11	4.13 ± 1.61
Standing	1.99	0.0992	36.45 ± 2.64	30.13 ± 4.98	29.47 ± 5.51	32.55 ± 4.77	19.87 ± 6.70
Kneeling	2.43	0.051	0.44 ± 0.22	0.69 ± 0.42	0.44 ± 0.34	0.17 ± 0.11	0.92 ± 0.49
Isolated	4.67	0.0015	3.08 ± 2.50*	0.04 ± 0.04*	18.09 ± 11.59*	0.15 ± 0.15*	0.0 ± 0.0*
Desynchronized	0.45	0.7717	1.92 ± 1.40	2.00 ± 1.68	3.32 ± 2.36	1.56 ± 0.88	1.94 ± 1.4

*Statistical significance after post-hoc Tukey test ($P < 0.05$)

Sample sizes for each treatment group

Interactions were not statistically significant after post-hoc Tukey test

Table 2: Behavioural analysis of castrated piglets across all treatments

Both behaviour categories (active/inactive) had a significant time effect, with piglets displaying more inactive behaviours than active behaviours up to 7h post-castration (Figure 1).



RESULTS

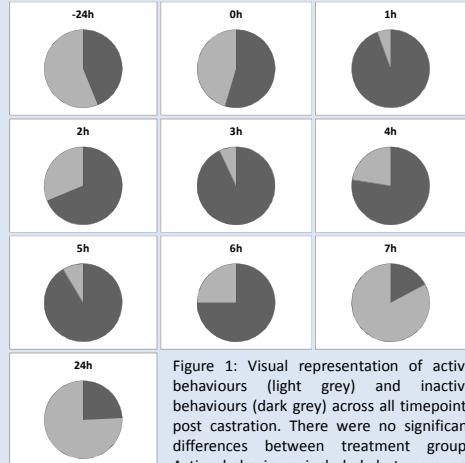


Figure 1: Visual representation of active behaviours (light grey) and inactive behaviours (dark grey) across all timepoints post castration. There were no significant differences between treatment groups. Active behaviours included, but were not limited to, suckling, walking, playing, and nosing, while inactive behaviours included lying and sleeping.

SIGNIFICANCE

- Castration causes significant pain to piglets, lasting up to 7h post-procedure (demonstrated by the reduction in active behaviours and increase in castration-related pain behaviours)
- Treatment of piglets with 0.4mg/kg meloxicam IM and/or topical EMLA® cream 30 minutes prior to castration does not provide sufficient analgesia or anesthesia to mitigate these effects
- Piglets may require a higher dose of meloxicam than what is currently being recommended (0.4mg/kg)

FUTURE WORK

- Pharmacokinetic trial with 1mg/kg meloxicam
- Evaluation of a variety of topical anesthetics for boar piglets undergoing castration and boar/gilt piglets undergoing tail docking
- Evaluation of two analgesics (meloxicam at 1mg/kg and ketoprofen at 6mg/kg) for pain relief in piglets undergoing tail docking or castration

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