The Effect of Early Post-Natal Castration on Subsequent Electroencephalogram Response to Tail Docking in Lambs

A thesis presented in fulfilment of the requirements of the degree of

Master of Veterinary Science

at Massey University, Palmerston North,
New Zealand.

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2015

Abstract

The objective of this study was to investigate the effect of early age painful stimulation on the cortical response to subsequent painful stimulation in lambs. Using the electroencephalogram (EEG), the current study measured the effect of early age castration at one day of age on the cortical pain response to tail docking at 23 days of age in lambs.

Lambs were randomly assigned to rubber ring castration (n=12) or handling (n=12) at one day of age. At 23 days of age lambs were tail docked under a minimal plane of anaesthesia maintained using halothane in oxygen (P_EHal = 1%). EEG data was recorded for two minutes pre-docking, and for eight minutes following tail docking. EEG median frequency, spectral edge frequency and total power were derived using fast Fourier transform. Data were analysed for group (castrated versus handled), time and group by time effects using mixed model analysis, as well as for the effect of group on pre-docking EEG.

Castrated lambs showed an increased cortical response to pain, demonstrated by a greater increase in EEG median frequency (Mixed model analysis; F = 5.45, P = 0.03) and greater reduction in total power (F = 5.15, P = 0.03) in response to subsequent tail docking.

These findings indicate that early age noxious stimulation results in an increased cortical response to subsequent noxious stimulation at approximately three weeks of age in lambs. The greater cortical response in the castrated lambs would likely correspond to an increased perception of pain, and therefore the potential for a greater degree of suffering and welfare compromise in response to subsequent painful injuries, for example lambing, injury and footrot.

There was also a tendency toward a higher pre-docking total power of the EEG in the castrated lambs when compared with handled lambs (Satterthwaite's t-test; T = 1.86, P =

0.08). The higher pre-docking total power may indicate a greater background activity in the nociceptive centres of the castrated lambs. However, the significance of this finding is not clear at this stage, and further work is necessary to better define the basis and clinical importance of this observation.

Key Words: Pain, electroencephalogram, sheep, lamb, castration, hyperalgesia

Acknowledgements

This study was approved by the Massey University Animal Ethics Committee (MUAEC Protocol 11/46).

Without the ongoing encouragement and supervision of Dr Ngaio Beausoleil this thesis would likely not have been completed. Thank you, Ngaio, for your efforts and for your thorough and valuable contributions toward improving the quality of my thinking and consequently my work.

Many thanks also to Professor Craig Johnson, for leading the research, for his supervision, for teaching me some of his impressive technical expertise, and for his faith in my abilities. To Professor Kevin Stafford, who initially got me involved in research at Massey, and provided continued infectious enthusiasm. And to Debbie Hill, for her patience with my questions throughout, and her help in finalising and submitting the thesis.

I extend my gratitude to the staff at the Massey University Large Animal Teaching Unit, for their assistance in managing the lambs, setting up equipment, and carrying out the procedures. Particular thanks to Robin Whitson, who helped me catch and castrate many of the lambs early in the morning, and provided some great conversation.

On a more personal note, I wish to thank my friends, flatmates and family who have been greatly accommodating in reading and being read drafts, entertaining long ‘discussions’ about neurophysiology, and providing me much needed breaks from reading and writing.

Lastly, to my mother Claire, thank you for your help, advice, and for proof reading the final draft. But more importantly, thank you for your continued support and ongoing encouragement.

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CNS	Central nervous system
CT	Computed tomography
EEG	Electroencephalogram
F50	Median (50^{th} percentile) frequency of the electroencephalogram
F95	Spectral edge (95^{th} percentile) frequency of the electroencephalogram
FFT	Fast Fourier transform
fMRI	Functional magnetic resonance imaging
Hz	Hertz
IASP	International Association for the Study of Pain
KHz	Kilohertz
LTP	Long term potentiation
PHP	Painful husbandry procedure
Ptot	Total power of the electroencephalogram
SE	Standard error