HYPOTENSION IN HEALTHY DOGS UNDERGOING ELECTIVE DESEXING

Submitted by

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This thesis is presented for the degree of Master of Philosophy,

Murdoch University

2014

DECLARATION

I declare that this thesis is my own account of my research and contains as its main content work which has not previously been submitted for a degree at any tertiary education institution.

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Renata Sampaio Costa

2014

DISCLAIMER

This Master in Philosophy (MPhil) thesis consists of chapters that have been prepared as stand-alone manuscripts. These manuscripts have either been published or have been submitted for publication. As a consequence, there may be some repetition between chapters and differences in formatting.

The manuscript "Frequency of hypotension in a historical cohort of anaesthetised dogs undergoing elective desexing" has been published in the Australian Veterinary Practitioner in June, 2013:

- Costa RS, Raisis A, Musk GC and Hosgood G (2013) Frequency of hypotension in a historical cohort of anaesthetised dogs undergoing elective desexing. Aust Vet Pract 43(2), 414-419.

GENERAL ABSTRACT

Hypotension is the most common complication during anaesthesia of dogs and contributes to anaesthetic-related morbidity. The frequency of hypotension reported in anaesthetised dogs is quite variable due to the lack of a standardised definition of hypotension and the number of different factors present in each study that could influence the results. In addition, there is no study in the veterinary literature that has attempted to identify animal factors that may influence perioperative mean arterial blood pressure (MAP).

The aims of this thesis were to document the proportion of healthy dogs developing hypotension during elective desexing at Murdoch University Veterinary Hospital (MUVH) and investigate patient factors influencing perioperative MAP during a surgical plane of anaesthesia. To achieve these aims, a historical cohort study and two prospective studies were performed. These studies were approved by the Murdoch University Animal Ethics Committee (AEC R239611).

The historical cohort study reviewed anaesthetic records from dogs desexed in general practice (GP) between 2007 and 2011. The aim was to determine the frequency of hypotension and explore associations between gender, age, body mass, heart rate and anaesthetic drugs with MAP. Hypotension was defined as MAP <60 mmHg for ≥10 minutes. Records from 188 dogs were included, 87/188 developed hypotension and the frequency of hypotension was higher in younger dogs. However, this study had limitations such as the use of a non-invasive technique for measuring MAP and various anaesthetic protocols were utilised. Prospective studies were thus performed to clarify the previous findings. These studies used invasive blood pressure monitoring (the most accurate method of measuring blood pressure) and a standardised anaesthetic protocol.

A prospective study was performed in dogs undergoing elective desexing in student neutering clinics between 2011 and 2012. To determine the proportion of hypotensive dogs, the average of 10 consecutive MAP measurements were recorded every five minutes. Hypotension was defined as above. To investigate factors that influenced MAP, the area under the MAP*time curve (AUC) from 10 minutes before to 40 minutes after the start of surgery was calculated using the trapezoidal method. Association of explanatory variables including gender, age, body mass, urine specific gravity (USG), packed cell volume and total solids with the AUC were explored using regression models. Thirty five of 71 dogs developed hypotension. The combination of age and USG best explained the MAP with age being positively and USG being negatively associated with MAP.

A second prospective study was performed to determine if the findings of the previous study could be corroborated in dogs undergoing desexing in GP, where dogs were hospitalised for a shorter period and surgery was performed by experienced veterinarians. As duration of anaesthesia was shorter, the AUC was calculated from 5 minutes before to 30 minutes after the start of surgery. Association of explanatory variables with AUC were explored. The proportion of hypotensive dogs was higher than in student neutering clinics with 17 of 24 dogs developing hypotension. Urine specific gravity was also found to be negatively associated with MAP, which was consistent with the previous study.

The observed proportions of hypotensive dogs support the recommendation for blood pressure monitoring during anaesthesia in healthy young dogs and the presence of subclinical dehydration suggested by increases in USG support the administration of intravenous fluids.

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ACKNOWLEDGEMENTS

I would like to express my gratitude to my supervisors Dr Anthea Raisis, Dr Gabrielle Musk and Professor Giselle Hosgood for the valuable comments towards improving my thesis. I would like to thank Murdoch University Research Studentship for providing financial assistance in the form of a scholarship and Interpath services, Epichem and Boehringer Ingelheim for acknowledging our hard work and awarding me prizes throughout my candidature.

Thank you general practice, clinical pathology laboratory and student neutering clinics' staff (especially Ann, Sue and Tania) for your support. I also want to thank the Anaesthesia department at Murdoch University Veterinary Hospital for the kind care and for allowing me to be part of this great team of professionals.

Thank you my dear friends from the Bat Cave and the Dungeon, especially Chelsea, Narelle and Kat, for all your support. Thank you my friends from the Cat Haven. Thank you, Anthea, for sharing your expertise, for your guidance, ethic and friendship.

I would like to express my deepest gratitude to my family, especially my parents Raimundo and Vania, my sister Vanessa, and my husband Joao, for their unconditional love and for always believing in me. Joao, thank you for your patience and for always being by my side, helping me through hard times and celebrating each accomplishment. Thank you all for being such an amazing family.

This thesis represents the work, ideas and assistance from many individuals. To all of you who have been involved in this study, I express my greatest thank you.

ABBREVIATIONS

ACP	Acepromazine
AEC	Animal Ethics Committee
ANP	Atrial natriuretic peptide
ASA	American Society of Anesthesiologists
ATP	Adenosine triphosphate
AUC	Area under the curve
BM	Body mass
BSA	Body surface area
CI	Confidence interval
CO_2	Carbon dioxide
$ETCO_2$	End-tidal carbon dioxide
GP	General practice
HR	Heart rate
HZ	Hertz
IBP	Invasive blood pressure
IM	Intramuscular
IV	Intravenous
l	Length
MAP	Mean arterial blood pressure
mmHg	Millimetres of Mercury
MUVH	Murdoch University Veterinary Hospital
η	Blood viscosity
NIBP	Non-invasive blood pressure
NO	Nitric oxide
O_2	Oxygen

P	Pressure
PCV	Packed cell volume
pH	Potential of hydrogen
Qt	Cardiac output
r	Radius
R	Resistance
SAP	Systolic blood pressure
SpO_2	Oxyhaemoglobin saturation
SV	Stroke volume
SVR	Systemic vascular resistance
T	Ventricular wall tension
TS	Total solids
USG	Urine specific gravity
α	Alpha
β	Beta
π	Constant 3.14