Comparison of blood pressure measurements obtained using non-invasive and invasive techniques, in anaesthetised companion animals

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(Anaesthesia and Critical Care)

This thesis is presented for the degree of Research Masters (with Training) of Murdoch University, 2013
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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Eleanor Drynan
Abstract

Measurement of blood pressure is a critical tool in the monitoring of patients undergoing general anaesthesia and has become standard practice within medical fields. Adequate vital organ perfusion is reported to be achieved if a central mean arterial pressure (MAP) is greater than 60mmHg. In clinical practice, peripheral arterial blood pressure (ABP) is used as an estimate of central ABP. Measurement of peripheral ABP can be performed either invasively or non-invasively. While invasive blood pressure measurements (IBP) are considered to be more accurate than non-invasive blood pressure (NIBP) measurements, several studies comparing the two methods have demonstrated that measurements obtained non-invasively are still clinically useful. As the algorithms used for measuring blood pressure vary between different machines it is not possible to extrapolate results from one machine to another and thus each machine must be assessed separately to ensure interpretation of the measurements obtained in clinical patients is appropriate.

The purpose of this thesis was to compare both NIBP and IBP measured using the multi-parameter Surgivet monitor (V9203) in anaesthetised dogs, horses, and sheep. Concurrent measurements of NIBP and IBP were obtained in each species at different pressure levels. These pressure levels were divided into the following categories: hypotension (< 60mmHg), low blood pressure (60-80 mmHg), normotension (80-100mm Hg), high blood pressure (100-120 mmHg), and hypertension (> 120 mmHg). For pooled data and data subdivided based on BP category the relationship between IBP and NIBP was determined using the Bland-
Altman technique. The bias and precision for concurrently recorded IBP and NIBP measurements was calculated.

In all species, NIBP measurements were generally lower than IBP. Overall for both the dog and the horse data, the mean arterial pressure showed the least bias i.e. the greatest agreement between the two methods. Systolic blood pressure tended to show the least agreement between the methods and this was much more evident in the low blood pressure and normotensive blood pressure groups. Interestingly, from the sheep component of the study, the systolic blood pressure had the greatest agreement in each group.

To determine the clinical usefulness of the NIBP measurements the calculated bias and precision was assessed using the guidelines of the American Association for the Advancement of Medical Instrumentation and the American College of Veterinary Internal Medicine Hypertension Consensus Panel (ACVIMHCP). Using these guidelines, the agreement between NIBP and IBP measurements in greyhounds and horses, were found to be within the limits of agreement recommended by the ACVIMHCP for all pressures except systolic blood pressure. This suggests that the Surgivet NIBP can be used to provide a good estimate of IBP for mean and diastolic pressures in these species.

In conclusion, the results of this study demonstrated that non-invasive measurements of diastolic and mean ABP provide a clinically useful alternative to IBP measurements, particularly in the horses and greyhounds. However systolic BP measured using non-invasive techniques does not, and therefore needs to be interpreted cautiously. The results also demonstrate a tendency for NIBP
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I would like to acknowledge and express my deep appreciation and gratitude to my supervisors, Dr Anthea Raisis and Dr Mark Glyde. For the past five years, Dr Raisis has not only provided guidance on all aspects of my research, but has provided a calm presence and moral support throughout this time. I am pleased not only consider her my mentor but also my friend.

Dr Glyde has also been extremely supportive throughout the entire process of my thesis and I am truly appreciative of his patience and guidance.

As well as my supervisors, I could not have completed my thesis without the help of the members of the Veterinary Anaesthesia Department: Dr Griet Haitjema, Dr Louise Bass, Dr Mara Schier, Joelene Bell, and Ingrid Heslop, who helped me collect my data, helped me keep my sense of humour, and who listened/celebrated/comiserated with all of my successes and failures. I am grateful for all their help.

Finally, I could not have completed this thesis without the help, and love of my husband, as well as my children. Their support and sacrifice have made this thesis possible.
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