

**The nurses' role in intra-abdominal
pressure monitoring in the critical care
setting**

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A thesis submitted to fulfil the requirements of a

Doctor of Philosophy (PhD) Degree

University of Technology Sydney

April 2017

ACKNOWLEDGEMENTS

I wish to thank the University of Technology Sydney for the opportunity to study in a speciality area that I have a passion for. I would like to thank my workload supervisors in the School of Nursing and Midwifery at Western Sydney University for providing me with allocated time to undertake this doctoral thesis.

Thank you to the medical and nursing staff of Liverpool Hospital Intensive Care Unit and Trauma Departments for their ongoing support and encouragement. Your constant support, availability and guidance has enabled me to complete my PhD.

My deepest thanks to the patients who participated in the research, without your participation this PhD would not have been possible.

A special note of thanks to my supervisors Professor Patricia Davidson, Dr Steven Frost and Dr Phillip Newton for your perseverance, supervision, motivation, kindness, personal and professional guidance and understanding. You are what enabled me to see the big picture and the often distant light at the end of what was often a very long and sometimes dark tunnel.

Thank you to Dr Steven Frost and Dr Evan Alexandrou for starting me on the PhD pathway, making me believe I could do it and for making me laugh a lot. Without your constant friendship and mentorship this PhD would not have been possible.

A special note of thanks to a true icon and beautiful man of the intensive care world, Dr Ken Hillman for always providing feedback, guidance, encouragement and just for genuinely caring.

Finally to my wonderful supportive boys. My husband Gavin and son Logan for their understanding, support, patience and belief in me. Their ability to keep me grounded and laughing is always appreciated. Never once did they doubt my abilities to complete and achieve.

STATEMENT OF AUTHENTICATION

The work presented in this thesis is to the best of my knowledge and belief original, except as acknowledged in the text. I hereby declare that I have not submitted this material in full or in part for a degree at this or any other institution.

Leanne Hunt

CERTIFICATE OF ORIGINAL AUTHORSHIP

I certify that the work in this thesis has not previously been submitted for a degree nor has it been submitted as part of requirements for a degree except as part of the collaborative doctoral degree and/or fully acknowledged within the text.

I also certify that the thesis has been written by me. Any help that I have received in my research work and the preparation of the thesis itself has been acknowledged. In addition, I certify that all information sources and literature used are indicated in the thesis.

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This research is supported by an Australian Government Research Training Program Scholarship.

ABSTRACT

Intra-abdominal hypertension (IAH) and abdominal compartment syndrome (ACS) are increasingly recognised as complications for critically ill patients requiring accurate diagnosis and timely management. Increases in intra-abdominal pressure, beyond normal physiological parameters, can alter organ perfusion and as a consequence end organ function. The incidence of IAH is reported to be 50% of the critical care population. Of these 50%, 32.1% develop IAH and 4.2% develop ACS within the first 24 hours in the intensive care unit.

Intra abdominal hypertension and ACS can impact on the care of a range of critically ill patients. Preventing complications, secondary to IAH and ACS, is important to improving patient outcomes. Early detection and intervention of intra-abdominal hypertension and abdominal compartment syndrome has the potential to reduce time in critical care, overall length of hospital stays and improve patient outcomes. Nurses are responsible for measuring and reporting of intra-abdominal pressure measurements, yet there is limited literature specifically focusing on nurses' knowledge regarding IAH and ACS.

An essential component of this thesis was to address the following study aims; establish nurses' knowledge about intra-abdominal pressure measurement, IAH and ACS identification and management, and to assess, develop and refine strategies for intra-abdominal pressure measurement, IAH and ACS identification and management.

These aims were achieved through a series of discrete studies that were undertaken using methodological approaches consistent with the study questions. The studies undertaken were:

Study 1: *Management of intra-abdominal hypertension and abdominal compartment syndrome: a review.*

Study design: Integrative review

This study found that critical care nurses measure intra-abdominal pressure using the modified Kron technique and thus play an important role in recognising and managing IAH and ACS. Despite this role nurses' knowledge about IAH and ACS was poor.

Study 2: *Critical care nurses' knowledge of intra-abdominal hypertension and abdominal compartment syndrome.*

Study design: Survey design

This study found that inadequate or absent evidence based guidelines, policies and procedures and educational support are barriers to monitoring intra-abdominal pressure. This finding underscores the importance of supporting nurses to provide evidence based care.

Study 3: *A retrospective analysis of trauma patients requiring surgical intervention.*

Study design: Registry review

This study identified that trauma was often a pre-cursor to the development of IAH and ACS. The causes of IAH and ACS are multi-factorial highlighting the need for vigilance when monitoring trauma patients.

Study 4: *A comparison of fluid instillation volumes to assess intra-abdominal pressure using Kron's method.*

Study design: Prospective, alternate treatment allocation.

This study found that a volume of 10mL of fluid instilled into the bladder to measure intra-abdominal pressure showed agreement with the current World Society of Abdominal Compartment Syndrome recommendation to instil 25mL. A volume of 10mL of fluid instilled into the bladder showed no agreement with 0mL.

Study 5: *Reliability of intra-abdominal pressure measurements using the modified Kron technique.*

Study design: Prospective, convenience sample.

This study found a single intra-abdominal pressure measurement per measurement period was an accurate indicator of intra-abdominal pressure. Multiple intra-abdominal pressure measurements per measurement period are not necessary.

This thesis provides a unique contribution to the science of IAH and ACS management. Firstly, it has described the state of the science on accepted intra-abdominal pressure measurement techniques, IAH and ACS. Secondly, it has identified that there is a gap in critical care nurses' knowledge in the topic area. Thirdly it has identified that trauma patients are at risk of developing IAH and ACS, particularly in the presence of massive fluid resuscitation. Fourthly, this thesis has challenged current guidelines on intra-abdominal pressure measurement techniques. Fifthly, this thesis has identified the need for standardised practice guidelines and education to strengthen critical care nurses knowledge, skills and competence in assessing and recognising intra-abdominal hypertension and abdominal compartment syndrome.

Future research regarding the effects of intra-abdominal pressure and IAH in discrete patient populations, including post-operative cardiothoracic surgery and type II

respiratory failure patients, as well as alternative routes of measurement such as nasogastric measurement are needed. Nurses are well situated to diagnose IAH and management of ACS. Advancing the science of assessment, measurement and management are essential to improving outcomes for individuals with IAH and ACS.

PUBLICATIONS AND PRESENTATIONS

This thesis is presented as a series of five papers (4 published and 1 under review). I am the first author for each of these papers and had full responsibility for collecting and analysing the data reported in each paper. I prepared the drafts of each paper and my co-authors and supervisors provided leadership, direction and supervision. Co-author and supervisor contributions involved critical revisions to manuscripts for intellectual content. The analysis of all data was undertaken by me. This was then reviewed by my principal supervisor and discussed and confirmed by all authors.

PUBLICATIONS (International Refereed Journals)

Hunt, L., Frost, S. A., Hillman, K., Newton, P. J., & Davidson, P. M. (2014). Management of intra-abdominal hypertension and abdominal compartment syndrome: a review. *Journal of Trauma Management & Outcomes*, 8(1), 1.

Hunt, L., Frost, S. A., Newton, P. J., Salamonsen, Y., & Davidson, P. M. (2016). A survey of critical care nurses' knowledge of intra-abdominal hypertension and abdominal compartment syndrome. *Australian critical care*. DOI <http://dx.doi.org/10.1016/j.aucc.2016.02.001>.

Hunt, L., Frost, S. A., Alexandrou, E., Hillman, K., Newton, P.J., Davidson, P.M. (draft). A retrospective analysis of trauma patients requiring surgical intervention.

Hunt, L., Van Luenen, H., Alexandrou, E., Frost, S. A., Davidson, P.M., Hillman, K., & D'Amours, S. (2012). A comparison of fluid instillation volumes to assess intra-

abdominal pressure using Kron's methods. *Journal of Trauma and Acute Care Surgery*, 73(1), 152 - 5.

Hunt, L., Frost, S. A., Alexandrou, E., Hillman, K., Newton, P.J, & Davidson, P.M. (2014). Reliability of intra-abdominal pressure measurements using the modified Kron technique. *Acta Clinica Belgica: International Journal of Clinical and Laboratory Medicine*. 70(2), 116 - 120.

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GLOSSARY AND ABBREVIATIONS

Abdominal compartment syndrome (ACS): A new or sustained IAP $>20\text{mmHg}$ regardless of the abdominal perfusion pressure (APP) where a new organ dysfunction or failure is present.

Abdominal decompression: A surgical procedure to release the physical pressure within the abdomen.

Abdominal perfusion pressure (APP): $\text{MAP} - \text{IAP}$, indicates abdominal perfusion pressure.

APACHE II: Acute Physiology and Chronic Health Evaluation II. Is an intensive care unit scoring system used to categorise the severity of disease and thus the risk of death.

Bladder compliance: The relationship between the changes bladder volume to detrusor pressure.

Compartment syndrome: When a fixed compartment, defined by bone and myofascia, becomes subject to increased pressure and exceeds perfusion pressure.

Intra-abdominal hypertension (IAH): A sustained or repeated $\text{IAP} \geq 12\text{mmHg}$.

Grade I, IAP 12–15 mmHg

Grade II, IAP 16–20 mmHg

Grade III, IAP 21–25 mmHg

Grade IV, IAP > 25 mmHg

Intra-abdominal pressure (IAP): The pressure concealed within the abdominal cavity.

Mean arterial pressure (MAP): is the average pressure during one cardiac cycle.

Modified Kron technique: Is the measurement technique considered the gold standard of intra bladder measurement of IAP.

Multi-organ failure (MOF): The progressive dysfunction of two or more organs resulting in an inability to maintain homeostasis. Typically a complication of sepsis.

Primary abdominal compartment syndrome: IAP \geq 20mmHg secondary to injury or disease of the abdominopelvic region.

Recurrent abdominal compartment syndrome: Where IAH or ACS redevelops post their initial treatment.

Secondary abdominal compartment syndrome: IAP \geq 20mmHg secondary to injuries that do not originate from the abdominopelvic region.

Septic shock: A condition caused by bacteraemia in the circulatory system. Characterised by persistent hypotension, reduced blood flow to organs, tissue and often organ dysfunction.

Trauma: An injury to living tissue caused by an extrinsic agent.

WSACS: World Society of Abdominal Compartment Syndrome