

The Definition of Polytrauma: The Need for International Consensus

Dr. Nerida Elice Butcher

BEd(Soc Sci)(Hons) (*Sydney*) BMed (*Newcastle*)

PhD (Medicine)

The School of Medicine and Public Health

The University of Newcastle

October 2016

Declarations

Statement of Originality

The thesis contains no material which has been accepted for the award of any other degree or diploma in any university or other tertiary institution and, to the best of my knowledge and belief, contains no material previously published or written by another person, except where due reference has been made in the text. I give consent to the final version of my thesis being made available worldwide when deposited in the University's Digital Repository, subject to the provisions of the Copyright Act 1968.

Nerida Elice Butcher

Signature:

Date:

Thesis by Publication

I hereby certify that this thesis is in the form of a series of published papers of which I am a joint author. I have included as part of the thesis a written statement from each co-author, endorsed by the Faculty Assistant Dean (Research Training), attesting to my contribution to the joint publications.

Nerida Elice Butcher

Signature:

Date:

Statement of Collaboration

I hereby certify that the work contained within the publication found in Appendix 1 of this thesis has been done in collaboration with other researchers of the International Working Group on Polytrauma, of which I am a member. Included within this publication is a statement clearly outlining the extent of collaboration, with whom and under what auspices.

Nerida Elice Butcher

Signature:

Date:

Copyright Statement

I warrant that I have obtained, where necessary, permission from the copyright owners to use any of my own published work in which the copyright is held by another party.

Nerida Elice Butcher

Signature:

Date:

Acknowledgments

I wish to acknowledge my principle supervisor Professor Zsolt Balogh for both his mentorship and dedication to the field of traumatology. He has been a reliable source of wisdom and guidance throughout this journey. He excels both in clinical practice and scientific research and is known for his ability to push the boundaries of current knowledge and for his true commitment to each individual under his care. His commitment to excellence and to each patient, regardless of convenience, has left a lasting legacy in me that I will carry throughout my career.

To my co-supervisor Professor Cate D'Este, I am indebted to her statistical expertise and her guidance in applying sound research methodology throughout this thesis. I thank her for the time she has given to edit and improve my work and also her encouragement to persist with biostatistics as part of my post-graduate study. The skills I learnt from her will be invaluable for my future participation in clinical research.

Under Prof Balogh's leadership, the John Hunter Department of Traumatology was born and has continued to thrive by the hard work of all those involved in the multidisciplinary team. I would like to make special mention of Trauma Consultants, Dr Natalie Enninghorst and Dr Cino Bendinelli, and previous trauma fellows Dr Krisztian Sisak and Dr Tim Söderlund who provided practical assistance in some of my clinical studies and also greatly added to my knowledge of trauma care. I am indebted to many clinicians and nurses involved in daily trauma care, in particular Debra McDougall, Kate King, Julie Evans, Angela Fisher and Natalie Lott. I am exceedingly grateful to Louise Abel, our remarkable Trauma Secretary, who solved many a logistical dilemma throughout my years in the department.

Finally, I would like to thank my husband Aaron Moore, my parents Lyn and Phil Butcher and the wider Butcher and Moore families for their ongoing support and overwhelming encouragement throughout my studies.

Publications

1. **Butcher NE**, Balogh ZJ. The definition of polytrauma: the need for international consensus. *Injury*. 2009; 40 (4): S12-S22.
2. **Butcher NE**, Balogh ZJ. AIS > 2 in at least two body regions: A potential new anatomical definition of polytrauma. *Injury*. 2012; 43 (2): 196-199.
3. **Butcher NE**, Balogh ZJ. The practicality of including the systemic inflammatory response syndrome in the definition of polytrauma: Experience of a level-one trauma centre. *Injury*. 2013; 44 (1): 12-17.
4. **Butcher NE**, Enninghorst N, Sisak K, Balogh ZJ. The definition of polytrauma: Variable interrater versus intrarater agreement- A prospective international study among trauma surgeons. *Journal of Trauma and Acute Care Surgery*. 2013; 74 (3): 884-889.
5. **Butcher NE**, D'Este C, Balogh ZJ. The quest for a universal definition of polytrauma: A trauma registry-based validation study. *Journal of Trauma and Acute Care Surgery*. 2014; 77 (4): 620-623.

Statement of Contribution of Authors

By signing below I confirm that Research Higher Degree Candidate contributed the literature review, drafting the initial manuscript and final review to the paper/publication:

Butcher, N., Balogh, Z.J.

The definition of polytrauma: the need for international consensus
(2009) *Injury*, 40(4): S12-S22

Co-Author, Professor Zsolt Balogh, contributed through mentorship, review of initial manuscript and critical review of final manuscript.

Professor Zsolt Balogh

Signature:

Date:

Faculty Assistant Dean Research Training: **Professor Robert Callister**

Signature:

Date: **4/4/16**

By signing below I confirm that Research Higher Degree Candidate contributed the literature review, research design, statistical analysis, drafting the initial manuscript and final review to the paper/publication:

Butcher, N. Balogh, Z.J.

AIS > 2 in at least two body regions: A potential new anatomical definition of polytrauma (2012) *Injury*, 43 (2): 196-199

Co-Author, Professor Zsolt Balogh, contributed through mentorship, to research design, review of initial manuscript and critical review of final manuscript.

Professor Zsolt Balogh

Signature:

Date:

Faculty Assistant Dean Research Training: **Professor Robert Callister**

Signature:

Date: **4/4/16**

By signing below I confirm that Research Higher Degree Candidate contributed the literature review, research design, statistical analysis, drafting the initial manuscript and final review to the paper/publication:

Butcher, N.E., Balogh, Z.J.

The practicality of including the systemic inflammatory response syndrome in the definition of polytrauma: Experience of a level-one trauma centre

(2013) *Injury*. 44(1):12-7

Co-Author, Professor Zsolt Balogh, contributed through mentorship, to research design, review of initial manuscript and critical review of final manuscript.

Professor Zsolt Balogh

Signature:

Date:

Faculty Assistant Dean Research Training

Professor Robert Callister

Signature:

Date: 4/4/16

By signing below I confirm that Research Higher Degree Candidate contributed the literature review, research design, statistical analysis, drafting the initial manuscript and final review to the paper/publication:

Butcher N.P., Enninghorst N, Sisak K, Balogh Z.J
The definition of polytrauma: Variable interrater versus intrarater agreement: A prospective international study among trauma surgeons.
(2013) Journal of Trauma and Acute Care Surgery, 74(3): 884-889

Dr N Enninghorst and Dr K Sisak contributed to data collection

Professor Zsolt Balogh, contributed through mentorship, to research design, review of initial manuscript and critical review of final manuscript.

Dr N Enninghorst:

Signature:

Date:

Dr K Sisak:

Signature:

Date:

Professor Zsolt Balogh

Signature:

Date:

Faculty Assistant Dean Research Training: **Professor Robert Callister**

Signature:

Date: **4/4/16**

By signing below I confirm that Research Higher Degree Candidate contributed the literature review, research design, statistical analysis, drafting the initial manuscript and final review to the paper/publication:

Butcher N.E., D'Este C., Balogh Z.J. The quest for a universal definition of polytrauma: A trauma registry-based validation study.
(2014) *Journal of Trauma and Acute Care Surgery*. 77(4):620-623.

Professor Cate D'Este contributed through mentorship, statistical analysis, review of initial manuscript and critical review of final manuscript.

Professor Zsolt Balogh contributed through mentorship, to research design, review of initial manuscript and critical review of final manuscript.

Professor Cate D'Este

Signature:

Date:

Professor Zsolt Balogh

Signature:

Date:

Faculty Assistant Dean Research Training:

Professor Robert Callister

Signature:

Date: 4/4/16

By signing below I confirm that Research Higher Degree Candidate contributed the literature review, drafting the initial manuscript and final review to the paper/publication:

Butcher N.E., Balogh Z.J. Update on the definition of polytrauma.
(2014) European Journal of Trauma and Emergency Surgery. 40(2):107-111

Co-Author, Professor Zsolt Balogh, contributed through mentorship, review of initial manuscript and critical review of final manuscript.

Professor Zsolt Balogh

Signature:

Date:

Faculty Assistant Dean Research Training: Professor Robert Callister

Signature:

Date: 4/4/16

Additional Publications

1. **Butcher NE**, Balogh ZJ. Update on the definition of polytrauma. *European Journal of Trauma and Emergency Surgery*. 2014; 40 (2): 107-111.
2. Pape HC, Lefering R, **Butcher NE**, Peitzman A, Leenen L, Marzi I, Lichte P, Josten C, Bouillon B, Schmucker U, Stahel P, Giannoudis P, Balogh ZJ. The definition of polytrauma revisited: An international consensus process and proposal of the new 'Berlin definition'. *Journal of Trauma and Acute Care Surgery*. 2014; 77(5):780-786.

Conference presentations

International meetings:

1. **Butcher NE**. The Definition of Polytrauma: The Need for International Consensus (Invited speaker) Definition of Polytrauma Kick- off Meeting. 11th European Congress of Trauma & Emergency Surgery, Brussels, Belgium. May 15-18, 2010.
2. **Butcher NE**. Consensus Conference Definition of Polytrauma: Facts and Hurdles (Invited speaker). 12th European Congress of Trauma & Emergency Surgery, Milan, Italy. April 27-30, 2011.
3. **Butcher NE**. Consensus Conference Definition of Polytrauma: The Relevance of SIRS in Polytrauma Definition (Invited speaker). 12th European Congress of Trauma & Emergency Surgery, Milan, Italy. April 27-30, 2011.
4. **Butcher NE**, Balogh ZJ. AIS>2 in at least two body regions: A potential new anatomical definition of polytrauma (Oral Presentation). 12th European Congress of Trauma & Emergency Surgery, Milan, Italy. April 27-30, 2011.
5. **Butcher NE**, Balogh ZJ. The practicality of including the Systemic Inflammatory Response Syndrome in the definition of polytrauma (poster presentation). 12th European Congress of Trauma & Emergency Surgery, Milan, Italy. April 27-30, 2011

6. **Butcher NE.** International Consensus Meeting on the Definition of Polytrauma. Hosted by German Society for Trauma Surgery (Deutsche Gesellschaft für Unfallchirurgie – DGU) (Invited speaker). Langenbeck-Virchow Building, Berlin, Germany. May 11, 2012.
7. **Butcher NE.** Inter-observer differences in the classification of the polytraumatized patient. (Invited speaker). 12th Co-operative Polytrauma Management Course- Beyond ATLS. Aachen University Hospital, Aachen, Germany. November 30- December 1, 2012.

National meeting:

1. **Butcher NE.** The Definition of Polytrauma. (Invited speaker). 81st Annual Scientific Congress, Royal Australasian College of Surgeons (RACS). Kuala Lumpur Convention Centre, Kuala Lumpur, Malaysia. May 6 – 10, 2012.

Table of Contents

1. Abstract	xiii
2. Overview.....	1
3. Literature Review	9
Butcher NE, Balogh ZJ. The definition of polytrauma: the need for international consensus. <i>Injury.</i> 2009; 40 (4): S12-S22	10
4. Published Papers	21
i. Butcher NE, Balogh ZJ. AIS > 2 in at least two body regions: A potential new anatomical definition of polytrauma. <i>Injury.</i> 2012; 43 (2): 196-199	21
ii. Butcher NE, Balogh ZJ. The practicality of including the systemic inflammatory response syndrome in the definition of polytrauma: Experience of a level-one trauma centre. <i>Injury.</i> 2013; 44 (1): 12-17	26
iii. Butcher NE, Enninghorst N, Sisak K, Balogh ZJ. The definition of polytrauma: Variable interrater versus intrarater agreement- A prospective international study among trauma surgeons. <i>Journal of Trauma and Acute Care Surgery.</i> 2013; 74 (3): 884-889	33
iv. Butcher NE, D'Este C, Balogh ZJ. The quest for a universal definition of polytrauma: A trauma registry-based validation study. <i>Journal of Trauma and Acute Care Surgery.</i> 2014; 77 (4): 620-623	40
5. Conclusion	45
6. Appendices	46
7. Bibliography	54

Abstract

The use of the term polytrauma is inconsistent and lacks validation. While numerous definitions have been used interchangeably over the last half-century no attempt has been made to validate any of these definitions nor examine their accuracy in defining the polytrauma patient. Out of this setting comes the aim of this thesis- the development of an internationally validated consensus definition of polytrauma.

A universally accepted definition of polytrauma is vital for accurate scientific communication, epidemiological understanding, monitoring of outcomes and benchmarking of trauma care. Without a validated and clear consensus definition, meaningful comparisons between institutional datasets are hampered and further advances hoped for in trauma research may be impeded by imprecise definitions of their included 'polytrauma' patients. To carry out the aim of this thesis a literature review and four clinical studies were conducted. An International Working Group on Polytrauma was also established.

This thesis will describe the historical evolution of the term polytrauma, detailing its peculiar geographical and cultural differences and establish, through a review of the literature, the lack of a consensus and validated definition. Through four clinical studies it will: 1) examine the key components, specifically the anatomical description and physiological parameters, that must be included in any definition of polytrauma; 2) address the challenges faced in defining polytrauma adequately in the current context and; 3) summarise the international consensus process that has evolved out of this thesis to provide the trauma community with a validated and universally agreed upon definition of polytrauma.