



Dispatches from the editor: blast injury is everyone's problem

doi:10.1136/jramc-2018-001081

Jeff Garner,¹ J Breeze²

The blast wave is a shot without a bullet, a slash without a sword. It is present everywhere within its range Theodore Benzing-er (1950)

It is this invisibility, this ubiquity, that contributes to the mystique of blast injury and its perceived rarity. A senior nurse in the Emergency Department of Stepping Hill Hospital, Stockport, said in the aftermath of the Manchester Concert bombing “*We see trauma. We don't see blast injuries. I have never seen a blast injury in my career before*”¹; likewise an orthopaedic surgeon commented “*Short of any military experience, which I don't have, nothing can prepare you for that scale of injury on each individual patient and collectively as a group of patients.*”¹

On the back of nearly 15 years continuous asymmetrical war fighting in Iraq and Afghanistan, the military have unfortunately become only too familiar with the level of devastation that improvised explosive devices create. Even before those campaigns, it was the military who traditionally have provided the evidence base for the management of blast. In 2001, this journal dedicated an entire edition to the effects of novel weapons systems, of which blast weapons were a major part, and the article by Horrocks explaining the basic pathophysiology and management of blast injury remains a clear and accurate ‘primer’ for anyone wishing to understand this mechanism of injury and continues to be one of the journal's most quoted papers.²

Time however has moved on, as has the research around blast injury and the translational impacts into combat casualty care. One simple example regards blast-induced traumatic brain injury. In 2001, Horrocks mentions that “*Early anecdotal reports and recent experimental studies implicate the primary effect of blast as a mechanism of injury to the brain*”, since when there have been

literally hundreds of research papers investigating the ultrastructural, neurodegenerative and cognitive impacts of blast wave injury to the brain, and it is becoming clear that factors such as endothelial inflammatory activation, oxidative stress responses and damage to the blood–brain barrier play an important part in mediating cerebral damage. The effects are significant, far-reaching and long-lasting.³

The public perception is that blast injury remains an uncommon occurrence as the western news services carry only high-profile terrorist incidents such as the Manchester, Paris and Boston attacks which perhaps in part also explains the general reticence of western civilian medical services to embrace blast injury as potential mechanism of injury. Wikipedia lists recognised terrorist acts month by month; February 2018, for example, had 71 terrorist bombing incidents around the world. While certain locations such as Syria, Iraq and Afghanistan had a predictably high number of incidents, they also took place in Somalia, Turkey, Colombia, Pakistan, Thailand, Libya, Mali, India, Algeria, Kenya, Yemen, Nigeria, Philippines, Cameroon and Greece with more than 600 injured aside from the deaths.⁴ This makes blast injury a common worldwide phenomenon. If that is not enough to convince people that blast injury is no longer a ‘niche’ or ‘military’ problem, then in the last 18 years there have been 48 civilian ‘explosive’ incidents such as industrial explosions across the globe including in the USA, Europe, China and Africa with over 300 deaths.⁵ Blast injury is now everyone's problem.

This special edition of the *Journal of the Royal Army Medical Corps (JRAMC)* brings together leaders in blast from a number of aspects—clinicians who have dealt with it, scientists who have researched it and scientists who work to defuse its lethal effects. This journal has long been at the forefront of publishing blast-related research, just as members of the Defence Medical Services have been at the forefront of performing that research in a concerted effort to better understand the way in which explosions

injure people, and thus how we can minimise the risks and treat the resultant injuries better. In many ways, this special edition is the heir to the 2001 blast special edition of the *JRAMC*. We know from experience how arduous and technically challenging performing blast-related research is, in order to yield reproducible and applicable results,⁶ and so it is vital that resources are directed to performing good quality experiments. The five North Atlantic Treaty Organization standards documents contained herein provide a sound scientific basis to conduct blast-related research.^{7–11} There are significant contributions from the two UK blast research establishments—Defence Science and Technology Laboratory, Porton Down, and the Centre for Blast Injury Studies at Imperial College, London, including an editorial from Pearce and Clasper highlighting future research directions.¹²

Civilian literature on blast injury is scarce, but what there is reports injury complexes akin to the military experience—polytrauma with both blunt and penetrating components, with a large burn component, extended intensive care unit stays and an underestimate of transfusion requirements.¹³ As it is unlikely that either industrial accidents or terrorist bombings are going to decrease or disappear anytime soon, it is imperative that civilian medical services take on board the pathophysiology of blast injury. Every National Health Service Major Trauma Network should have plans in place to deal with blast injury, both in the isolated industrial accident and in a mass casualty scenario.

Competing interests None declared.

Patient consent Not required.

Provenance and peer review Not commissioned; internally peer reviewed.

© Author(s) (or their employer(s)) 2019. No commercial re-use. See rights and permissions. Published by BMJ.

To cite Garner J, Breeze J. *J R Army Med Corps* 2019;**165**:1–2.

Received 25 September 2018
Accepted 25 September 2018
Published Online First 4 December 2018

J R Army Med Corps 2019;**165**:1–2.
doi:10.1136/jramc-2018-001081

¹Department of Surgery, Rotherham NHS Foundation Trust, Sheffield, UK

²Academic Department of Military Surgery and Trauma, Royal Centre for Defence Medicine, Birmingham, UK

Correspondence to J Breeze, Academic Department of Military Surgery and Trauma, Royal Centre for Defence Medicine, Birmingham B15 2SQ, UK; editor.jramc@bmj.com

REFERENCES

- 1 Sky news. A night of horror': medics relive night of the Manchester Arena bombing. <https://news.sky.com/story/a-night-of-horror-medics-relive-night-of-the-manchester-arena-bombing-11184467> (accessed 24 Jun 2018).
- 2 Horrocks CL. Blast injuries: biophysics, pathophysiology and management principles. *J R Army Med Corps* 2001;147:28–40.
- 3 Rosenfeld JV, McFarlane AC, Bragge P, *et al.* Blast-related traumatic brain injury. *Lancet Neurol* 2013;12:882–93.
- 4 Wikipedia, 2018. List of terrorist incidents. https://en.wikipedia.org/wiki/List_of_terrorist_incidents_in_February_2018 (accessed 24 Jun 2018).
- 5 Wikipedia, 2018. List of terrorist incidents. https://en.wikipedia.org/wiki/List_of_accidents_and_disasters_by_death_toll (accessed 24 Jun 2018).
- 6 Garner J, Watts S, Parry C, *et al.* Prolonged permissive hypotensive resuscitation is associated with poor outcome in primary blast injury with controlled hemorrhage. *Ann Surg* 2010;251:1131–9.
- 7 Nguyen TT, Pearce AP, Carpanen D. Experimental platforms to study blast injury. *J R Army Med Corps* 2019;165:33–7.
- 8 Josey T, Ouellet S, Bieler D. Guidelines for reproducing blast exposures in the laboratory. *J R Army Med Corps* 2019;165:10–14.
- 9 Watts S, Kirkman E, Bieler D. Guidelines for using animal models in blast injury research. *J R Army Med Corps* 2019;165:38–40.
- 10 Bieler D, Cernak I, Martineau L. Guidelines for conducting epidemiological studies of blast injury. *J R Army Med Corps* 2019;165:41–4.
- 11 Leggieri MJ, Bieler D, Bjarnason S. Environmental toxicology of blast exposures: injury metrics, modelling, methods and standards. *J R Army Med Corps* 2019;165:7–9.
- 12 Pearce AP, Clasper J. Improving survivability from blast injury: 'shifting the goalposts' and the need for interdisciplinary research. *J R Army Med Corps* 2019;165:5–6.
- 13 Kulla M, Maier J, Bieler D, *et al.* [Civilian blast injuries: an underestimated problem? : results of a retrospective analysis of the TraumaRegister DGU®]. *Unfallchirurg* 2016;119:843–53.