

## CBRNE Trauma: A Unified Approach to Clinical Management

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Chemical, biological, radiological, and nuclear hazards currently are grouped together in terms of management of releases and casualties. Explosive hazards recently have been added to this grouping to include hazards from the deliberate use of improvised explosive devices (IEDs). The chemical, biological, radiological, nuclear, and explosive (CBRNE) classification provides a focus for planning, early and effective emergency responses, and emphasizes the inherent secondary dangers to responders and the need for protection. It also provides a controlled, operational framework for the early provision of life support and antidote responses during disasters.

Although the CBRNE grouping has provided common ground for planners, management of the incident, and the provision of emergency medical care, it must be remembered that the nature of the individual CBRNE hazards is very different in terms of immediate effects on victims and the latency with which they are revealed. There are clear, apparent differences in the early management of exposure to a chemical risk compared with the trauma caused by an IED. However, in reality, there are identifiable common pathways of injury from CBRNE hazards which determine both immediate and continuing medical care. For example, blunt and penetrating trauma from blast, together with injury to the lungs has a final pathophysiological pathway of cell injury through initial hypovolaemia, shock, tissue hypoxia, and multiple organ failure. Toxic trauma from chemical and biological agents may have different initial stages, but can lead to a similar clinical result with common pathophysiological end stages.

In recent years, much has been learned from intensive care management of conventional and toxic trauma about appropriate methods of life support, particularly in ventilation strategies. This presentation will review similarities between conventional and toxic trauma from CBRNE hazards and will consider what early life support strategies may be appropriate to alter the course of subsequent clinical development.

**Keywords:** chemical, biological, radiological, nuclear, and explosive (CBRNE); life support; management; responders; trauma

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## Attitude of Physicians Toward Chemical Warfare Casualty Management

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**Introduction:** Chemical warfare agents (CWAs) still are an immanent threat on the military and civilian population. The use of CWAs in wartime or as a terrorist weapon was demonstrated in recent years, and resulted in numerous physical and psychological casualties, and a grave psychological impact. The Tokyo subway sarin attack on 1995

exemplified the vast impact of chemical terrorism in general and the use of CWAs as a terrorist weapon.<sup>1</sup> This event was the trigger for many countries and health authorities to establish preparedness programs to mitigate such an event. As part of the medical management of such an event, medical teams are expected to encounter CWA casualties, in the field or in hospitals.<sup>2</sup> However, most physicians are not prepared or educated for the specific toxidromes and treatment protocols of CWA poisoning.<sup>3</sup> Moreover, the psychological implications of coping with CWA casualties also should be considered, meaning that these scenarios are perceived as unique, and differ from the regular trauma casualties these medical teams are used to manage.<sup>4</sup> A survey indicated that whereas 80% of physician respondents were willing to participate in the diagnosis and treatment of bioterrorism cases, only 21% believed that they were prepared to handle the cases.<sup>5</sup>

**Methods:** Military physicians, on regular duty or reserve, who participated in the mandatory CBRN medicine course during their training at the military medical school. Regarding attitude toward Chemical Warfare Casualties Medical Treatment (CWCMT), using a five-point Likert scale (1 = minimum, 5 = maximum).

**Results:** A total of 239 physicians completed the questionnaire during 2008–2009. Experience was defined as at least two years of service as military medical personnel. There was no significant difference between total attitude scores of experienced and non-experienced physicians (41.7 ± 5.1 and 39.0 ± 0.95,  $p = 0.054$ , respectively) and between those <30 years of age and >30 years (39.2 ± 4.7 and 40.5 ± 5.0,  $p = 0.1$ , respectively).

**Discussion:** The CBRN training and instructions have a positive impact on attitude of physicians toward management to chemical casualties. This has importance as part of the medical teams preparedness toward a toxicological mass-casualty event, in the battlefield or as terrorist attack. In this sample, there was a dramatic increase in knowledge (31%). Data regarding the effect of CBRN education showed that Web-based learning showed no increase of knowledge,<sup>6</sup> thus, it might imply that passive, Web-based education is not enough. Information probably should be transferred by other means such as lectures and hands-on training.

Medical experience had a positive impact on the baseline attitude toward chemical casualties. However, after the training, the non-experienced had a significantly higher increase in attitude score, resulting in similar endpoint scores. This baseline difference was attributed to knowledge and self-perspective regarding capabilities. These findings might demonstrate the importance of training, as it has a positive impact on experienced and non-experienced personnel to achieve similar attitude scores albeit they start on different levels. Interestingly, there was a different effect of age on attitude.

These data exemplify the positive effect of a more elaborated training consisting of both lectures and hands-on training with full protective gear. Attitude scores demonstrated that training has a significantly positive effect on attitude, more prominent on the non-experienced group, and mainly on knowledge and self-perception domains. Although baseline scores were different between age groups and experience groups, at the end of the course,