



Preparedness for Chemical Threats; New Challenges in Management of Trauma and Disasters

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New Challenges for Healthcare; the Chemical Scenario

The “New Chemical Age”, following World War II, has been characterized by a dramatic increase in global chemical output and exposure for chemicals [1,2][6]. Not only are numerous chemicals and chemical products handled and stored in the industry or transported daily through both land and sea, but chemicals are also used as weapons [3,4]. Although most of the chemicals used are in small quantities and only of concern to professional chemists, the general public or workers in common occupations may routinely be exposed to an estimated 50,000–100,000 synthetic chemicals currently used in most industrialized countries [1]. Despite high levels of security in handling and transporting chemicals, accidents may occur and result in considerable damages to human life and the environment due to chemical’s toxic, corrosive and explosive effects [3-7].

The modern use of Chemical Weapons (CW) was first introduced in World War I, and since then CW has caused over one million casualties globally

[7]. In early days CW basically consisted of well-known commercial chemicals put into standard ammunitions such as grenades and artillery shells. Chlorine, phosgene and mustard gas were some of the chemicals used, resulting in nearly 100,000 deaths [6,7]. Chemical agents have been used during other wars and can be considered as *Weapons of Mass Destruction* (WMD), since a single nerve agent attack may kill thousands of innocent people [4]. The magnitude and efficacy of CW in causing casualties and the simplicity of using it has attracted antagonist groups. Although terrorists have previously used more conventional means of violence such as bombings, assassinations and hostage taking to promote their causes, chemicals have also been used in the last decades. The use of Sarin by a Japanese cult in Matsumoto city (1994) and the Tokyo subway system (1995), causing 5500 injured and 12 deaths are proof of the use of CW agents in a domestic terrorist attack [4,8].

The type of chemicals used may be identified rapidly as the effects and symptoms of chemical agents absorbed through inhalation, the skin or mucous membranes are usually easily detected [8].

Nevertheless, gaps in knowledge or awareness of medical teams to the threats of chemical events may lead to a delay in detection and proper treatment [4]. Whilst it is hard to predict when and where such attacks will be carried out, the possibility of chemical terrorism should not be ignored. Preparing countries to address this threat is a formidable challenge, but the consequences of being unprepared could be more devastating. Similar to emerging infectious diseases, early detection and control of biological or chemical attacks depends on a strong and flexible public health system at the local, state and federal levels. In addition, primary healthcare providers throughout the countries must also be vigilant, since they will be the first to observe and report unusual illnesses or injuries. The probability of an occurrence of chemical threats and the severity of potential events varies from country to country. Nevertheless, the need to be prepared and trained is common to all nations [8-12].

Planning for the Unexpected

In many countries The *National Board of Health and Welfare* (or equivalent) should have the main responsibility within the health sector to plan for the unexpected consequences of major incidents and disasters, in peace as well as in wartime [13]. One area of priority for such preparation is threats of CBRNe; Chemical, and Biological, Radiological and Nuclear agents and related international activities [13,14]. The *National Board of Health and Welfare* should have the responsibilities such as the planning and the provision of supplies for health and medical services, environmental health and social services in case of war or crises, but also standardization of the national planning and preparedness for emergency situations, by publishing guidelines for different kinds of disasters. It should also provide funding to the County Councils/Regions for the training of healthcare professionals in disaster medicine and crises management. A “Joint Central Disaster Committee” in each County Council/Region should oversee major incident planning for each county/region, respectively. Disaster Committees exist within hospitals and primary care organizations to ensure that effective planning is carried out at the local level by confirming that: 1) Plans are established and revised; 2) All personnel involved in planning receive adequate information and training; 3) Equipment and supplies are available; and 4) maintenance arrangements are in place [13,15,16].

Training and Education

An effective “disaster/emergency medical response” requires a well-planned and coordinated effort with many trained and experienced professionals who can apply specialized knowledge and skills in critical situations and in cooperation with other

organizations [17]. This can be achieved and deficiencies can be improved by enabling more and continuous education and training. Multidisciplinary cooperation, training and principles of preparedness should be provided to basic medical care units and centres as part of the medical planning aimed at perfect detection, surveillance and emergency response [16].

Medical management of disaster and emergencies requires theoretical and practical knowledge to be transformed to skills by repetitive exercises in an environment where we learn by doing without being afraid of our mistakes. Skills will finally become an ability, which should also be upheld by practicing and training. The use of simulation in medicine has been suggested as a useful teaching method for clinical situations that are uncommon but yet critical in nature and therefore require a high level of skill and preparedness to be maintained. The recommendations from *The International Liaison Committee on Resuscitation* from 2003 include the specific recommendations that training should move towards “scenario-based, facilitated, interactive training” and that “high-fidelity simulation-directed training should increasingly supplement instructor-directed training” in advanced life support courses [18]. Simulation-training improves the team performance resulting in improved efficiency of patient care in the trauma bay and results in significant improvement in leadership, situation monitoring, mutual support and communication as in Advanced Trauma Life Support (ATLS) [19].

Recent publications suggest that blended learning with combination of different teaching methods and final simulation training may be the best alternative for education and training in disaster management [20,21]. In such educational programmes a participant’s knowledge is standardized at the entry and the exit points. They will have the possibility of studying the programmes key lectures through Internet- or distance learning. The first standardization point at the entry to the programme can be the national course in major incidents management e.g. MIMMS (Major Incidents Medical Management and Support) and the last standardization will be the final step in a global education when participants take part in a simulation training [20,21]. The simulation training highlights problems and identifies threats [18] and gives insight to what otherwise would have been kept in the dark. Disaster training is a necessary aspect of hospital/prehospital disaster preparedness [9]. It must be constraint and based on facts and actual resources. It must be played in real time and on the spot where staff knowledge about demography, capacities and limitations will be questioned. Concerning chemical events, knowledge of chemical threats and its clinical picture and treatments, including decontamination process and protective measures, are of high importance. The knowledge of the system, leadership and roles together with

information about the other partner's abilities and limitations, in the multidisciplinary management of a disaster, must be well communicated to improve the outcome of patients and increase the credence of the management teams [12,22,23]. Skills and ability brings the proficiency, which is the most important factor for getting engaged in all events including a chemical event. Training will also raise staff self-confidence that is important in order to improve the level of preparedness and consequently staff availability. In an Australian study, unpreparedness of hospital staff in responding to a disaster due to insufficient knowledge and lack of experience was improved by simulation exercises. The lack of self-confidence, on the other hand, spreads staff anxiety as well as frustration and results in uncertainty that could make the situation even more challenging [24].

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Conclusion

Chemical events may result in severe trauma and disastrous outcomes. There is a need for better preparation in management of both individual trauma case and all organizational aspects of a disaster. It is better to be prepared than to be perplexed when it finally happens. Lessons learnt from previous crises clearly indicate that sound preventive efforts largely pay off in subsequent emergencies. Preparedness programmes are more effective when they are designed and implemented as a continuous process, based on a sound analysis of hazards and vulnerabilities [25].

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