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Toxicological aspects of preparedness and aftercare for chemical-incidents

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Abstract

The threat of using chemical warfare agents still exists despite the 1993 Chemical Weapons Convention. Preparedness for attacks with chemical agents has become an important issue of national security programs. It can be anticipated that toxicologists will be increasingly involved in preparedness programs of their institutions and of the government, no matter whether they work in agencies, industry or universities. Toxicologists must get prepared to give fast and reliable advice in the case of an attack, a sabotage or an accident with release of toxic chemicals. They should be familiar with the principles of hazard management and with incident command structures and cooperate with first responders of other organizations involved such as fire department and medical emergency teams already in the planning phase.

In the emergency planning phase, toxicologists are expected to help identifying possible hazards. Moreover, they consult public health services with regard to toxicosurveillance and advice hospitals regarding antidotes, decontamination procedures and shelters. They may be involved in the procurement of antidotes and of protective equipment and will support qualified analytical laboratories. In the response phase, toxicologists must be ready to gain and to interpret analytical data, to support the medical care of poisoned victims and to provide repeated risk assessment reports. This requires an on-scene access to databases and registries.

The aftercare phase includes the identification of exposed persons, mapping of contaminated areas, organization of decontamination measures and the release of areas. A medical study may be initiated to observe long-term health effects.

Good cooperation between regulatory and clinical toxicologists, specific education of toxicologist in the field of chemical emergencies and regular trainings are essential elements of good preparedness.

Keywords: Chemical warfare; Emergency planning; Preparedness; Stockpiling; Toxic agent

1. Introduction

Since the end of the cold war and the subsequent reduction of civil defense measures in many countries, national and international crisis scenarios have changed (Tzihor, 1992; Fong, 2003; Moores and Moores, 2004). Terrorism and criminal activities achieved a whole new quality after incidents like the Sarin attack on the Tokyo subway in 1995, repeated assaults on the World Trade Center in New York culminating in its destruction on September 11, 2001 and the subsequent dissemination of anthrax-letters. This novel dimension of threat is well described in the 9/11 commission report (Government, 2004). At the same time, the fireworks accident at Enschede (Netherlands) and the explosion at a fertilizer plant in Toulouse (France) also made clear, that there were severe safety gaps to overcome in chemical-incident management (van Walsum et al., 2001; Commission, 2003; Dechy et al., 2004).

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The destructive potential of biological, nuclear or conventional incidents may exceed those of chemical-incidents (Bismuth et al., 2004). Nevertheless, the latter are also highly relevant, since highly poisonous chemicals may have a considerable impact on the health status, infrastructure and public order of a country (Moores and Moores, 2004), even if released in only limited amounts.

Beside the imminent threat of chemical agents having proliferated among the terrorist or criminal field, acts of terrorism might also occur in the form of a toxic industrial chemical release (Small, 2002), e.g. when industrial plants, stocks or transports become a target of terrorist attacks. In this context, a large number of dangerous chemicals and chemical mixtures might be of relevance, including those used in agriculture and medicine. Combustion products have also to be considered. Besides, in the case of sabotage, a criminal background will often not immediately become clear.

After the attack on the world trade center on 9/11, many countries became aware, that preparedness for this kind of disaster so far had been insufficient. As a consequence, there have been extensive efforts and numerous recommendations to improve disaster management structures. It also has been recognized, that experts for nuclear, biological and chemical emergencies were needed to participate in emergency teams. Thus, in case of a chemical-incident, the toxicologist will be expected to be capable of giving fast and reliable advice. His expert opinion in these situations may have far-reaching consequences not only with respect to health and safety of affected persons but also as far as the reputation of his institution is concerned.

In the future, more toxicologists will be involved in crisis planning processes, no matter whether they are clinical toxicologists, research-oriented toxicologists or toxicologists who work for an agency. High priority should be put on the need for toxicologists to be trained to cooperate with the incident command structures and educated in toxicological aspects of emergencies. The present contribution focuses on these aspects of preparedness and aftercare.

Much of the information on chemical weapons and preparedness was published in government reports and commission papers. Examples are the WHO guidance on public health response (WHO, 2004), the textbook of the US army (Sidell et al., 1997), the documents on public health preparedness of the US Center of Disease Control (CDC, 2002a, 2002b), the OPCW-documents and the FOA briefing book on chemical weapons (FOA, 1992) or the documents of EMEA on antidotes (EMEA, 2003), which are altogether available on the Internet. There are many valuable websites such as the official website of the US Department of Homeland Security and the Federal Emergency Management Agency which contain useful training material for the community emergency response teams (FEMA, 2003). Although the topic is also discussed in scientific journals, contributions herein usually are less systematic and detailed.

2. Principles of disaster management

2.1. Toxicologically relevant hazards

Chemical emergencies can arise from natural disasters (e.g. volcano emissions, forest fires), technological accidents (e.g. blast of a chemical factory), major transportation accidents (e.g. chemical spill) or acts of terrorism, sabotage and crime (e.g. attack on a chemical transport). Although chemical weapons are in the focus of the present discussions, highly toxic industrial chemicals also have to be taken into account, as they might be released in the course of an accident, attack or sabotage.

2.1.1. Classification of hazards

Hazards can be classified according to their threat potential in the following manner:

Emergency: A situation, that requires immediate rescue operations.
Accident: A sudden event due to external causes, damaging persons and/or property.
Multiple casualty incidents: An emergency, resulting in a large number of injured or sick persons. The number of harmed individuals can be managed with the available human and material resources.
Disaster: A natural or manmade incident that exceeds the capabilities of the local response resources. Assistance is required from surrounding communities, statewide or even across national borders.

2.1.2. Risk levels of hazardous situations

Some hazards can be foreseen, such as an announced assault, while others can not at all be anticipated, e.g. a covert terror attack. In the first case, the responsible authorities will upgrade the risk response level before the incident even occurs and, at the same time, will try to prevent it and prepare for a worst case scenario. In the latter case, however, the incident will occur without early warning, which means that all response measures must be merely reduced to rescue operations. Threat analysis is a multidisciplinary activity, involving law-enforcement, intelligence and medical as well as scientific communities (WHO, 2004).