Mass casualty management in Europe following chemical agent release

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Abstract

The Mass Casualties and Health project (MASH) is a study financed by DG Health of the European Commission to investigate planning, preparedness and responses within Member States following release of chemical or radiological agents.

As part of the MASH project information was collected using an interactive website containing information about the level of preparedness in each EU Member State for the management of mass casualties following chemical release.

The chemical questionnaire covered planning and organisation together with operational aspects of health systems. The latter included detection, identification and monitoring, decontamination, clinical diagnosis, therapy and dedicated capacity for the management of chemical casualties.

Information received has revealed considerable variations in the management of mass chemical casualties around Europe. This presentation will present an overview of the findings and discuss models for training and response already produced in a small number of Member States which could provide a template for an integrated EU policy.
Introduction

Individual poisoning and its management is a relatively common occurrence in emergency medical practice and rarely causes risk to attending emergency teams due to onward transmission of the hazard. However, exposure to a chemical following or accidental or deliberate releases of domestic or industrial chemicals can cause injury to those directly exposed and to emergency responders. This potential transmission of a health risk is the essential difference between an individual poisoning and a chemical incident. Most chemical incidents involve relatively few casualties but the contamination of only one person however can be classed as a chemical incident. Nevertheless, there is considerable continuing concern over the vulnerability of large populations who have been exposed to chemical agents and the potentially large number of casualties this would cause.

To investigate this problem the Mass Casualties and Health (MASH) study financed by DG Health of the European Commission was set up in 2008 to investigate planning, preparedness and responses within Member States for the management of mass casualties following release of chemical or radiological agents (1).

The scale of the chemical release problem within Europe

Chemical releases occur on a daily basis throughout the EU and reflect the continuing production, storage and transport to toxic industrial chemicals. Control of this important industrial activity is achieved through international bodies such as the UN HAZMAT system and through the EU REACH initiative which gathers information from manufacturers and transporters. (2) So far there have been no major catastrophic chemical releases within the EU. Nevertheless the scale of the movement of toxic industrial chemicals around Europe by rail, sea and mainly road traffic gives cause for concern that a major chemical release may occur either accidentally or deliberately at any time.
Casualties from chemical releases

The classical HAZMAT model for chemical release involves delineating hot, warm and cold zones (3). Within the HAZMAT model there are identified problems in the management of chemical casualties. These are:

1. Integration of the emergency response
2. Delays in providing care during decontamination
3. Triage and diagnosis
4. Protecting the hospital against auto – referring contaminated casualties and worried well

In any chemical incident the numbers of casualties following a release will depend on:

1. Location
   - Urban
   - Rural
   - Enclosed or open
2. The type of incident
   - Explosive
   - Line release
   - Point release with plume due to wind dispersion

The management of any chemical agent release involves:

1. Management of the incident site. The site must be secured to prevent the spread of contamination and production of further casualties. Emergency responders and non – injured persons leaving the site must be decontaminated before leaving the site. Equally, casualties must also be decontaminated before they can be moved onwards to hospital medical care.

If the agent is persistent the release must be contained and controlled. The risk of hazard transmission requires cordon control and procedures for dealing with those who are not contained. There is a need for protection for responders and mass decontamination systems for both contaminated casualties and protected responders leaving the contaminated zone. The
decontamination of casualties causes a potential delay in bringing them to medical care. There is a requirement for detection, identification and monitoring. Management of a chemical scene requires good, planned liaison between different responding emergency services.

(2) Management of the injured

The effects of chemical injury are determined by the toxicity of the agent and by its latency, a measure of the time taken for the effects to appear (4). These, together with the degree of contamination from the chemical agent influence chemical management. Many chemical agents cause life-threatening respiratory failure which requires early treatment. However, if decontamination is required there are potential life threatening delays in providing treatment unless this can be provided by medical responders in a contaminated zone.

The first problem for the management of chemical injury is to recognise that that the injury is toxic in origin. This is done primarily using toxidromes (a collections of signs and symptoms characteristic of the chemical released) supplemented by detection, identification and monitoring (DIM) information.

There are transmission risks to emergency medical responders. If the chemical released is persistent there is a requirement to wear individual protective equipment. In some cases there is a requirement to provide essential early emergency medical care in the form of life support and antidote therapy. This may be required inside a contaminated zone if the agent is persistent. There is a major problem in the provision of triage for chemical casualties and the problem of latency of onset of signs and symptoms. It may be very difficult to predict the degree and final numbers of chemical casualties during an early stage of any chemical release.

Responding to chemical incidents

Large scale chemical releases have been rare in Europe as in the rest of the world but when they occur they may be dramatic with large numbers of casualties. Examples include the accidental release of methyl isocyanate at
Bhopal in India in 1984 (5) and the deliberate release of sarin in Tokyo in 1995. Small scale chemical releases are managed on a daily basis by emergency services with different national approaches. HAZMAT operations are managed by fire and EMS services while potential CBRN releases are crime sites and there is police involvement.

Factors involved in the management of chemical releases are

- Planning
- Training
- Equipping
- Command and control

**MASH: gathering information about mass casualty responses in Europe**

The MASH programme was designed to find out more about the planning, preparations and responses of the emergency systems within the European Union to deal with the potential mass casualties from release of chemical and radioactive substances (1). Information was gathered using an online questionnaire which was distributed to established key agencies and responders around the EU.

The questionnaire structure explored

1. Organizational structures
   - Competence - Performance

2. Health system
   - Pre-hospital triage/
   - Detection in case of a chemical agent release,
   - Identification in case of a chemical agent release
   - Monitoring in case of a chemical agent release

3. Decontamination

4. Approaches to clinical diagnosis

5. Therapy, aftercare
   - Capacity for casualties of chemical agent release
   - Aftercare

6. Further comments and points of contact for further communication.
Findings from the MASH chemical questionnaire

General comments

Responses were obtained from 18 of the 27 EU states but gathering information through the questionnaire proved difficult due to problems in identifying national points of contact, persuading targeted points of contact to answer e-mails and to fill in the questionnaire and an apparent lack of willingness to provide information in some cases. Certain countries have revealed advanced planning for the emergency management of chemical casualties which is published openly. Others seem more reluctant to share information in this way.

Questionnaire analysis

The findings from the MASH chemical questionnaire may be summarised as follows:

Organisation of the management of mass chemical casualties

1. About two thirds of the responding organisations are tasked to assume control
2. All respondents were available on a 24 hour basis
3. Overall, police, fire and emergency medical services (EMS) are arrangements in place. The military are less so
4. Hospital awareness of the organisational structure for dealing releases was moderate with 11/17 indicating >80% awareness
5. Only half the responding states provided an expert team for advice at the incident site. Expert advice is thus not widely available
6. Only a minority or respondents indicated a rapid response time chemical incidents with mass casualties
7. The tasks of expert on-site teams, where provided, include sampling, decontamination, monitoring, and the provision of early medical care.
There was agreement that the provision of specialized teams is essential.

There was unanimous support from respondents for EU co-operation in management of chemical casualties.

A number of respondents provided detailed information about their network structures and planning.
Decontamination arrangements

1. The figures returned for overall national decontamination capacity varied widely.
2. A majority of responding states were able to set up the decontamination capability in less than 10 hours.
3. Decontamination is largely provided by the fire and rescue services.

Pre-hospital medical responses

1. Most respondents did not report a standardised training scheme for the early recognition of chemical injuries.
2. 60% reported arrangements for prehospital examination and triage.
3. Details of triage arrangements were provided in some cases. The importance of triage is recognised.
4. Only about half the respondents reported a special training scheme for physicians in the management of chemical injury.
5. There was a lack of standardised documentation sheets for chemical injury.
6. Only half the respondents reported special training schemes for paramedics.

Clinical diagnosis

1. Toxidromes following exposure to chemical agents are not widely used to assess prognosis.
2. Standardised documentation sheets for clinical management are available in less than half the responding states.

Therapy and aftercare of chemical casualties

1. Less than half of responding states have hospital facilities specialising in the treatment of chemical casualties.
2. The majority or respondents know the quantities of antidotes available nationally.
Examples of model responses for the management of chemical casualties in the EU

The MASH survey revealed a wide range of emergency medical responses for the management of mass casualties from chemical or radiological release. Although there is no unified European model of response the information gathered shows that options can be broadly classified according to whether the emergency service is medically or paramedically manned. Two examples of the polarisation of approach are found between France and the United Kingdom.

France

The French emergency medical service (SAMU) is a service manned by physicians, both in dispatching and on-site provision of care (7). The basic concept is to bring the hospital to the patient and to provide medical care to patients at the point of injury. This process is aided by the fact that many SAMU units operate from hospitals and that the medical staff who work in them are also employed within hospital services.

Prehospital disaster care in France is controlled by two national response plans, called red and white. The red plan (8) concerns the rescue and
evacuation of victims from a disaster site by the fire and rescue service. The plan provides for an overall on-site commander (COS) who controls a fire and rescue and a medical chain. The COS reports to the Prefect of the Departement (in Paris to the Prefect of Police) who then reports directly to the Prime Minister. The fire and rescue chain under the control of the director of fire and rescue (DSIS) is concerned with managing the cause of the disaster, rescuing victims and providing essential primary medical care using their own internal medical resources (all French fire services have medical units and firefighters are trained to emergency medical technician levels). Firefighters rescue victims in a shuttle operation and deliver them to the medical chain at the advanced medical post distant from the site of the disaster. The AMP is under the overall control of the director of medical rescue (DSM) who is usually a fire service medical officer (these are a feature of the French system). Running of the AMP is the responsibility of a physician chosen by the DSM whose responsibilities include triage, immediate casualty care and evacuation of the patients to designated hospitals.

At this point the White Plan (9) begins. This plan is essentially concerned with hospital response to mass casualties caused by disaster. Its provisions include setting up crisis management cells, recalling personnel, freeing hospital resources and organizing controlled reception of mass casualties. The organisation of French emergency medical services is particularly adapted to the management of mass casualties. SAMU is medically-controlled and manned which allows a number of on-site emergency measures which are not easily provided by services led by paramedical staff. Thus patients receive a large degree of care before arriving at the hospital. In addition the SAMU and hospital services are operated by the same organization which allows integration of planning and a continuum of care from the pre-hospital to the hospital under the control of hospital doctors who also control the SAMU.

The integration of pre-hospital and hospital services provided by the white plan this means that the hospital can effectively be extended beyond its boundaries by sending the SAMU mobile medical units to the scene of the
disaster where they link up with the fire service operating the red plan. In effect therefore the AMP is the interface between the on-site and hospital management of casualties. This integration effectively brings the hospital to the multiple casualties using specially trained and equipped SAMU response teams under an integrated command and control system. These teams are also able to operate within contaminated areas following chemical releases, being equipped with personal protective suits and respirators.

Following the terrorist chemical attacks in Tokyo in 1995 both the red and white response plans were modified to provide a special response for chemical and radiological agent. The red plan had originally been modified (Plan Piratox) in 1987 to deal with chemical releases. Plan Piratox provides for detection, triage and decontamination of casualties by fire fighters while providing essential first aid. Decontaminated casualties were then delivered to the SAMU at the AMP. The plan was revised in further government plans issued in 2002 (10) with special reference to the management of possible terrorist chemical, biological, radiological and nuclear (CBRN) incidents. At the same time a further circular was issued to provide specific instructions to hospitals for the management of mass casualties from CBRN incidents (Plan Biotox, 10). This was, in effect, an updating of the White Plan. As part of this SAMU personnel were trained and equipped to operate in a zone of secondary contamination (the warm zone). This allowed provision of essential life support measures by medical personnel for badly injured victims.

In the government plans of 2002, the role of special receiving hospitals is clearly defined. France is divided administratively into seven ‘defence zones’. For each of these a organization for response to CBRN incidents is under the direct control of the defence zone administrator (Prefect). In each zone key hospitals (termed ‘reference hospitals’) are designated to take CB casualties. They are chosen because they contain, as part of their normal daily work expertise and facilities that can be used quickly in the event of a CBRN incidents. The SAMU of each region is co-ordinated by the reference hospital. In addition the reference hospital is linked to specialist poisons centres, infectious disease facilities, nuclear medical facilities and
occupational health organizations in order to provide a broad spectrum approach to CBRN releases.)

United Kingdom

In the United Kingdom the emergency medical service is operated by paramedics instead of doctors as in France although there are special circumstances where emergency medical physicians are deployed outside the hospital, notably in helicopter services. Since 2006 the United Kingdom ambulance services have deployed special paramedical response teams (Hazardous Area Response Teams (HART)) to be able to provide specialised care for casualties following chemical accidents and deliberate CBRN releases (11). Specially-equipped and trained teams of paramedics operate a 24-hour service in London and other regions of the country. Their task is to respond to all incidents which require emergency medical intervention in hazardous surroundings. They respond to large fires and other urban rescue situations such as explosions and building collapse. Having a wide range of everyday tasks means that the teams and their equipment are kept occupied and at a high state of readiness during periods when no chemical or CBRN incidents occur and they are able to respond more efficiently when they do. HART works closely with the other emergency services, notably the fire and rescue services who have primary responsibility for the management of chemical incidents. HART paramedics receive extensive training in personal protection and other aspects of operation in hazardous areas. They are trained to use both level C personal protective suits with filtration respirators and also level B chemical resistant suits with self-contained breathing apparatus.

HART units are self-contained and have specially-equipped and dedicated vehicles to cover command and control of major incidents and to provide an extensive range of equipment and logistic support including oxygen and life support equipment (including airway and ventilation equipment for use in a contaminated zone).
The basic idea behind HART is to provide advanced life support for victims who are contaminated inside an area of secondary contamination (the warm zone) and who must be decontaminated before being moved on to further medical care. This situation may cause life-threatening delays. Thus, casualties who have been brought away from the initial release zone (the hot zone) are triaged and treated by HART paramedics in the warm zone where contamination risks are recued and level C protection, which paramedics can work, can be used. Skills which can be deployed in this situation include advanced life support, with the securing of a vulnerable airway and artificial ventilation. These measures can be continued through decontamination where the HART personnel and not the fire and rescue service have responsibility for decontamination procedures.

HART personnel are under the direct control of regional ambulance control rooms. In a major incident, these are linked with other emergency services through a higher 'gold command' which is usually under the control of a senior police officer (12). The UK command and control system is very different from the French system having more complex reporting stages. The comparison of the two countries reflects the wide national variation in chemical management around the EU.

Conclusions

The Mass Casualties and Health Study, sponsored by the European Commission, has shown considerable variation in the planning and management of casualties following a major chemical incident. Nevertheless, there is growing awareness of the need for a specially trained and equipped pre-hospital response that can provide essential life support measures to casualties who may be confined to a contaminated zone and are awaiting decontamination before being sent to hospital. Such emergency care is being provided by both medical and paramedical teams. Both systems of emergency medical care operate effectively within the EU. The MASH study will identify pathways in the future where the two approaches can be integrated to produce an effective shared European response in the event of
mass casualties from chemical release.
References

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