

Catastrophe medicine as domain of scientific system

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Summary:

The present article concerns civilization requirements for preventing catastrophes and their consequences. Notions such as rescue acquire particular meaning under extraordinary (special) circumstances evoked by both natural causes (floods, hurricanes, earthquakes) as well as by the effects of technological development.

In time, medicine of catastrophe supported by various areas of science such as strategic management, studies in probability and all kinds of environmental engineering, etc. became an important domain of scientific system.

In 1973 in Mainz it was brought to life under the auspices of the United Nations. Therefore, it became necessary to elucidate the concept of a catastrophe as not everyone realizes the difference between a catastrophe, an incident or even a mass incident. This article attempts to present a systematic review of all levels and types of catastrophes as well as their consequences.

Clearing out the effects of a catastrophe becomes an important moment in its management as it involves accumulation of resources – equipment, technical support and human skills.

Key words: catastrophe medicine, scientific system.

The history of humanity and cultural progress always put a human within a system of clashing adverse circumstances, opportunities for functioning, existence. Civilization of the beginning of 21st century put the idea of catastrophe at the center of perception of the phenomena that accompanied the man in his development. In a way, it spread a shadow over the problem of safety of mankind and situation of man entangled in the variety of, unfavorable at times, issues.

Medical aid, which for ages had been applying a model of rationality, not to say a discourse, developed a domain of dynamic, immediate interventions. It is accompanied

by extended resources and forces supporting its structures.

Without them there would be no rationale for its existence and it would not be able to produce the desired results. It is still questionable whether we are dealing with emergency medicine, accident medicine or “catastrophe medicine”.

Etymology of the words „rescue” or „rescuer” has a broader temporal meaning than the notion of catastrophe. The former is associated with all forms of bringing aid in various situations – “sudden incidents posing threat to life and well-being”[1]. The suddenness of incidents was augmented by various causes not

always treated as catastrophes. The concept of an incident was always associated with specific dramaturgy of events and involved one or more people. Its consequences were related to detrimental effects of destruction of property, injury to one's body and often to deadly outcome. The sequence of events in an incident was always quite rational, it could be distinctly defined and directly or indirectly prevented.

Scientific and technological development augmented the resources offered by the modern thought, substantially changed the face of the world, man's environment and his contribution to a broadly defined culture. The surrounding nature as well as the perception of a man exploiting it also changed. The notion of "catastrophe" emerged from actions that allowed it to reach the state of reprehensible devastation and is defined as an unpredictable, sudden event, extent of which is difficult to determine.

The state of disaster is often equaled with the state of calamity as these kinds of events are usually associated with massive tragic consequences. Rising threat to human life and health most often reaches an enormous dimension.

Extraordinary frequency and magnitudes of natural disasters often caused by human activity led to an increase in the number of casualties that is unprecedented in history. Wars, defined as deliberate, multi-dimensional and massive destruction that with time reached a global scale, are effects of human activity. The nature of modern civilization contributed to broadening of the concept of war as a small group of people may destroy any living force with great effectiveness. Naturally, it applies to terrorism which nowadays assumed a global level and became the most important problem of the modern world and humanity. Its effects force us to widen the broadly defined medical aid outside the broadly specialized group of medical workers, i.e. doctors, nurses and associated technical personnel.

All of these occupations situated within social structures more than ever are exposed to an increased level of risk. At the present time it assumed a cultural dimension therefore, the burden of medical aid falls on professions that until now dealt with removing material effects

of various incidents and disasters. On the other hand, functioning of medical personnel becomes specialized in a broader aspect and imposes integrated actions with other emergency services (fire department, law enforcement). Until now, such an integration was known in military medicine, although it is difficult to say whether it was as multidimensional in structure. The entire medical personnel was obliged to focus on medical issues associated with distribution of aid in case of massive damage of an unpredictable diversity. Therefore, the scope of knowledge in this area should be constantly broadened.

Currently, there is a need for effective actions on part of these services under catastrophic conditions, bordering on wars, associated with an unpredictable diversity of accompanying circumstances. In order to protect the humanity from harm and to eliminate unwanted effects related to them, a resolution was adopted during the 51st session of the Economic and Social Council (ECOSOC) of the United Nations regarding worldwide aid in catastrophes, emergencies, collisions and natural disasters.

As a consequence, during the International Symposium on Catastrophe Medicine in 1973 in Mainz, a new field of medicine was called to life – Catastrophe Medicine. Its main goals focus on problems related to its functioning during catastrophic events as well as trainings to exert effective actions on large populations under conditions of unanticipated disasters.

Poland and other countries worked on problems connected to broadly defined catastrophe medicine as a continuance of ideas formulated in Mainz and during subsequent scientific congresses in the following years. Beside a broad range of dissertations, associated issues were introduced in practice.

Medical aid to the casualties of mass disasters encompassed by "catastrophe and emergency medicine" is defined as ensuring survival of the greatest possible number of victims and using scarce resources to mitigate further threats to their lives and well-being. It also involves the responsibility to evaluate, assort and select

casualties according to the urgency of their needs and ensure transportation.

An essential objective of catastrophe medicine is teaching skills for providing medical aid to the victims (injured, ill, disabled) in various conditions, with limited resources and health care supplies. As “various conditions” one should regard extraordinary, even primitive circumstances determined by the pressure of time. These are usually irreversible situations that require rapid and firm decisions. There is obviously a wide range of situations that are difficult to anticipate and are associated with great risk.

Therefore, catastrophe medicine offers knowledge and prophylactic actions that should be applied when the number of fatalities or victims exceeds the resources offered by classical medicine under normal circumstances. An incident should not always be associated with a catastrophe. However, it becomes similar to a model of catastrophe when the needs of rescue workers surpass the means and supplies at a disposal of health care at that particular time.

Observation of the conditions and state of civilization in the 70's of the previous century led to development of catastrophe and emergency medicine. This independent field of medicine collaborates with other medical disciplines. It also benefits from various areas of crisis management by employing their achievements, scientific methodologies and strategies in its own operation. Therefore, it must rely on wide-range systemic research.

Military medicine is closely related to the goals and roles of catastrophe medicine. Therefore, there is a close co-operation between those two fields, especially when it comes to the organization of military health care system. Methods of securing military forces with medical care during combat operations as well as assignments, schemes and organizational structures of military health care are closely associated with catastrophe and emergency medicine.

Medical aspects of catastrophes and emergencies as well as military health care differ from other medical fields. The latter are holding on to the principles of medical deontology and

promote classical doctor-patient relationship. Catastrophe medicine and fields related to it (such as some forms of military medicine) are accompanied by psychological shock. For a doctor it is associated with treating a patient in difficult conditions away from hospital, hindering the process of establishing a relationship, stating a diagnosis, etc.

This area of medicine is often associated with the necessity of saving those who are more likely to survive first. Those with poor prognosis should be provided with appropriate humanitarian care. It may be concluded that the main purpose of catastrophe and emergency medicine is to reduce mortality, morbidity and after-effects of injuries in all disastrous states involving massive losses.

Descriptions and taxonomy of catastrophes

When describing the idea of a catastrophe one must not assume that it is simply an accident on a larger scale, just like a regular car is not a type of truck.

Etymologically, the word “catastrophe” comes from a Latin word “astrum,” meaning “a star.” It implies that a given extraordinary event is caused by an irregular or unusual position of the stars.

Literature on the matter contains many definitions of a catastrophe. Generally, we call it any local or regional event that disrupts normal functioning of a local community and poses a threat to the lives, health and property of the residents [1].

From a semantic point of view, the word “catastrophe” is described as “a sudden, usually unanticipated event of a mechanical, chemical, geophysical or meteorological nature, carrying tragic and extensive consequences, leading to large losses as well as fatalities.” [2]

On the other hand, the penal code states that we may speak of a catastrophe when an event results in considerable destruction of property or harm to people. Such an event must involve at least bodily injury to several people or considerable damage to property. The degree of

bodily injuries is of no significance here. They may be light, as described in article 157 of the Penal Code. Damage to property is regarded considerable when its value exceeds over 200-fold the amount of minimal monthly salary [2].

In medical rescue terminology, “catastrophe” is an extraordinary event resulting in a significant number of casualties and extensive ecological effects, which cannot be managed with available resources and requires outside help [1].

There are fundamental differences between a catastrophe, an incident and a mass incident.

An incident is a limited event, which can be managed with available resources. However, a mass incident is any event involving a number of casualties sufficient to disrupt normal functioning of medical rescue services and hospitals. Such occurrence encompasses small areas and does not pose a threat to a large number of residents. While developing organizational structure and management of such situations we have to employ principles, which could be also applied in case of a mass incident as well as catastrophe.

Classification and nature of catastrophes

There are many classifications of catastrophes. The most popular one divides catastrophes into natural ones – such as floods and hurricanes – and “human,” i.e. caused by a man – collapsing of buildings, plane crashes, train derailment, etc. A more exact classification is presented below:

- 1) Natural disasters (water, earth, fire, air)
 - earthquakes and floods comprise 80% of all natural disasters,
 - floods (high wave), breaching of levees, rapid tides,
 - avalanches, landslides, volcanoes,
 - fires,
 - hurricanes, typhoons,
 - drought.
- 2) Catastrophes caused by people
 - a) wars
 - with the use of classical weapons,
 - with the use of weapons of mass destruction (nuclear, chemical, biological wars)
 - b) civilization-related catastrophes

- communications: - mass collisions on the freeways,
- train crashes,
- plane crashes,
- ship sinking.
- c) industrial and construction:
 - explosions,
 - leakage of poisonous substances,
 - radiation,
 - collapses.
- d) great fires:
 - shopping malls,
 - schools,
 - hospitals,
 - skyscrapers.

- 3) Secondary effects of catastrophes – hunger, infectious diseases, epidemics. Epizootics, damage to natural environment.

An alternative classification of catastrophes had been functioning for some time, which seems to be more useful for planning of necessary measures to be undertaken at the very beginning of their occurrence. It refers to the types of injuries sustained by the victims. Therefore, one may speak of:

- a “surgical” catastrophe, during which the victims suffer from injuries caused by a mechanical factor, burns or gunshot wounds,
- general medical catastrophe involving general injuries that do not require surgical attention.

There are also toxicological, epidemiological catastrophes, etc.

Information regarding the type of catastrophe contributes to better preparation of hospitals providing medical care to the injured

Classification according to the degree of involvement of medical and logistic resources seems to be particularly useful in the structure of management system.

Three stages may be distinguished in this classification:

- 1) **Stage I** – local medical and logistic resources are sufficient for management of catastrophe as soon as the response plan is implemented.
- 2) **Stage II** – local medical and logistic resources

are insufficient and help from neighboring regions is required.

- 3) **Stage III** – local and neighboring rescue services are overwhelmed and crisis management requires help from regional and national resources.

Planning and training programs always have to involve quick classification of events into one of those three stages. If a disaster is classified higher than stage I, one has to take into consideration the time and effort required to obtain help from the outside.

The following three possibilities are important considering the nature of catastrophes:

- disaster occurs in the neighboring region and local services may be asked for help,
- disaster occurs within the area of operation of local rescue services – this is a typical scenario for which the management plans are prepared,
- disaster involves a body of rescue service.

A local catastrophe results in destruction of equipment and facilities (e.g. flood damaging a hospital, fire station, school, etc.). There is also a possibility that a disaster involves the Emergency Call Center. Such scenarios are usually not taken into consideration, but should not be forgotten or one should not exclude the possibility of their occurrence. Various events rescue services had to face in the past emphasized this issue.

Stages of disaster management should be mentioned at this point.

- 1) These are:
 - activation stage
 - implementation stage
 - restoration of previous state.
- 2) Activation stage involves:
 - mobilization and early response,
 - organization of the command and evaluation of the scene of an event.
- 3) Implementation stage involves:
 - search for victims and providing aid,
 - collection of the injured, selection, stabilization and transport,
 - management at the scene.

- 4) Stage of restoration of previous state involves:
 - departure from the scene,
 - return to minimal actions,
 - filing a report.
 - For planning purposes, reaction (response) to a disaster may be divided chronologically into a series of subsequent events, during which services undertake appropriate response actions.

In their activities, doctors usually focus on functions relating directly to saving health and lives of the victims. However, knowledge of organizational and management issues is required for planning and training in preparation for catastrophes. Fire brigades of the State Fire Service, police, ambulance teams, hospitals, non-governmental rescue services, power engineering teams, telecommunications companies, communal services, representatives of local and central government, etc. participate in overcoming the effects of disastrous events.

Stage II and stage III catastrophes require involvement of above mentioned teams from other regions. That necessitates an inclusion in the management plan rules for command, cooperation between units and entities working in different hazardous areas on local, regional and state levels.

Regrettably, there is a common drawback of disaster-management training relating to the fact that it is conducted within the frames of rescue services without involvement of public services, leading to great chaos and confusion in case of a true catastrophe.

Proper training program should be conducted in cooperation with those services so that the personnel becomes acquainted and learns about each other's capabilities. For example, one of such scenarios could involve a plane or helicopter crash in a distant region requiring use of bulldozers to make way to the scene of the event. That would allow to make an assessment of how quickly the Office of Public Works can supply the necessary specialized heavy equipment. Emergency medicine specialists should view the problem of public safety in a face of sudden and extraordinary dangers as a whole in the systemic context. Medical rescue should not be compared to providing emergency medical

care in hospital, but treated as a separate entity encompassing various structures. Continuous assessment of threats and prophylactic measures should be considered as well.

Disaster rescue is not an individual service, but results from co-operation of law enforcement, technical, medical and administrative units. The medical aspect is just a small, although important part of the whole problem. Doctors and other medical professionals are helpless if they are not provided with an access to the victims, places suitable for treatment and if this access is not sustained. According to the definition, during mass incidents and catastrophes there is a disproportion between demand for aid and the means of providing it, between the necessity and the possibility. In such conditions aid is a combination of organization and improvisation.

The better it is prepared, the less room there is for improvisation and disorder in the first hours of the event. All of these problems are subjects of interest for catastrophe medicine. Synchronization of actions between various services and social factors becomes a necessary factor. Intense education conducted in local communities about appropriate local and regional structures is supposed to ensure good teamwork with its advantages.

The following are the components of catastrophe medicine:

- medical aid,
- management of resources and supplies,
- sanitary and epidemiological safety,
- logistics,
- psychological aspects of rescue missions,
- secondary effects,
- continuous education of the medical personnel.

The following constitute medical aid in the context of catastrophe medicine:

- anesthetics,
- surgery,
- internal medicine and toxicology,
- gynecology,
- pediatrics,
- psychiatry,
- radiology.

The most important aspect of crisis response is management of optimal functioning of catastrophe medicine. It includes such elements as: planning, organizing, controlling. Logistics offers material basis and transportation facilities for catastrophe medicine and it provides: medical and technical supplies, food provisions, evacuation and communication. Secondary effects focus planning of medical actions on distant consequences of every disaster including infectious diseases, epizootics, plant diseases. Enormous technological installations, uncommon modes of transportation and communication in the neighborhood of large agglomerations carry the risks of various unforeseeable mishaps, effects of which assume the magnitudes of catastrophes. Handling of such tragedies requires multi-level, rationally conducted actions.

Chaos, surrounding to panic, lack of methodological distance may carry only detrimental effects. Another important effect of a disaster refers to the condition of people who nearly died in its course. Even if previously they were seemingly calm and non-aggressive, following sudden traumatic events they undergo a fundamental change. One may even say that they are different people than before. After many analyses it appears that such disorders are characteristic for people who survived plane, helicopter, car or train crashes, were tortured or sexually assaulted, experienced battery or death of a close one.

As a result, even people close to them cannot exert a calming effect on even strong personalities. This psychiatric condition is called PTSD2 and it affects soldiers who watched violent death during war as well as people who survived terrorist attacks. It also influences a large percentage of victims of severe traffic accidents. Policemen, firemen and rescue workers are also exposed to the risk of PTSD.

However, it should be added that, according to research analyses, PTSD is less common in people who experienced natural disasters not caused by human activity. The shock generated by the forces of nature is much easier to rationalize. Nowadays, the necessity of involving methods used in catastrophe medicine for managing various tragic situations became expedient – the rising of global terrorism with its detrimental

effects on a random individual requires that a whole society as well as smaller communities (cities, villages, regions) should prepare themselves for action. A kind of awareness, constant readiness to help, ability to work together in a society became indispensable. These features can be strengthened by a system of designed training programs and organization of exercises utilizing appropriate resources and supplies. This is an effective way of perpetuating the idea and scope of catastrophe medicine.

In the likelihood of various events it becomes an essential requirement for proper functioning of a society familiar with the values of its environment. This all must be accompanied by a broadly understood interdisciplinary knowledge contained within the scope of broadly understood general medicine, management and control supported by a decision-making process. Information is an important carrier for this complex system. It is a stream of data of particular importance. It is important due to the purpose it serves. Therefore, knowledge becomes a reserve of this information.

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However, one should remember that there are limitations to knowledge among the elements structuring the system of catastrophe medicine. The main ones are: organizational culture and level of education, qualifications and composure within organizational structures of the system as well as in its environment. Acquired, established knowledge in this field allows for creating further possibilities and profits, but also for transforming and modifying the existing ones. It integrates technology, and technology is broadly understood as:

- equipment (technical),
- human skills (humanware),
- information on the properties and capabilities of the equipment (infoware),
- structures forming the frames of human activity (orgware).

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