PRACTITIONERS' SECTION

HEALTH SERVICES RESPONSES TO DISASTERS IN MUMBAI SHARING EXPERIENCES

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ABSTRACT

In mass disaster situations, demands frequently exceed the capacity of personnel and facilities. In the last few years, there has been an increased incidence of civil disasters; the spectrum of possible catastrophes has also dramatically increased as a result of an increasingly technologically sophisticated society. During the last 15 years, varied terrorist activities have become increasingly common as expressions of the opinions of extreme political groups, especially in India. In Mumbai itself, we have witnessed disasters such as widespread riots, terrorist bomb blasts, floods, and fires. There have been other disasters in India, such as earthquakes, floods, cyclones, as well as tsunamis Though most of the hospitals in India manage the medical problems associated with these disasters fairly efficiently, an analysis of the situation is presented so that this may form the basis for future planning in disaster preparedness and provide a template for other communities that may want to implement preparedness protocols. We present our experience with disaster management in Mumbai, India.

A successful medical response to multi-injury civilian disasters, either natural or manmade, dictates formulation, dissemination, and periodic assessment of a contingency plan to facilitate the triage and treatment of victims of disaster.

Key words: Disaster preparedness, triage

INTRODUCTION

A disaster is defined as a sudden massive disproportion between hostile elements of any kind and the survival resources that are available to counterbalance these in the

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Avinash Supe Department of Surgery, Seth G. S. Medical College and KEM Hospital, Mumbai - 400 012, India E-mail: avisupe@vsnl.com shortest period of time. In mass disaster situations, demands frequently exceed the capacity of personnel and facilities. Mass casualties such as sailing ship disasters and war casualties have occupied the attention of surgeons since the 17th century. In the last few years, there has been an increased incidence of civil disasters; the spectrum of possible catastrophes has also dramatically increased as a result of an increasingly technologically sophisticated society. Disaster preparedness plans must encompass the possibility of nuclear accidents, terrorist attacks, aviation

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Table 1: Number of patients in disasters during 1992-93 at the King Edward Memorial Hospital, Mumbai^[1,2]

Disaster	Emergency attendance	Admitted	Operated Major/ Minor	Deaths	
December 92 riots (3 days)	154	40	15/94	2	
January 93 riots (4 days)	432	207	44/169	34	
Bomb- blasts (3 hours)	278	84	18/133	88*	

(Source: Medical Records Department, KEM Hospital) *includes 79 corpses brought to the hospital.

Table 2: Number of cases treated at a tertiary hospital after flooding in July 2005

	OPD attendance	Indoor admissions
Malaria	5514	746
Leptospirosis	626	282
Dengue fever	157	58
Undifferentiated fever	6325	1157
Community patients treated	2,00,516	-

accidents, bomb blasts, riots, and industrial explosions, as well as natural calamities such as floods, epidemics, drought, and cyclones. The emphasis in medical management shifts from individualized treatment to standardized therapy for disaster victims, with the aim of providing maximum benefit to a maximum number of salvageable persons.

The disasters broadly are of two types:

- Medical disorders include situations like food poisoning, methyl alcohol poisoning, poisoning from industrial gas leaks, epidemics following calamites such as flood, draught, cyclones, and tsunamis. Food poisoning, methyl alcohol poisoning, epidemics of malaria, leptospirosis are the usual situations faced by Emergency Medical Services (EMS) in Mumbai.
- Surgical emergencies include house collapse, terrorist attacks, bomb blast, riots, industrial explosions, aviation accidents, railway accidents, and earthquakes. We have responded to isolated instances of railway accidents, communal riots on three occasions (1972, 1991, and 1993)^[1,2]

[Table 1]; and simultaneous bomb blasts in March 1993 involving multiple locations in Mumbai. Our emergency service has also responded to national disasters in other parts of the country, including a cyanide gas leak at Bhopal in 1984; and two earthquakes, one in Latur (1996) and one in Bhuj (2002). Finally, the city of Mumbai recently experienced extensive flooding, which resulted in epidemics of various diseases [Table 2].

PATTERNS OF EMERGENCY MEDICAL SERVICES (EMS) RESPONSE

Though disaster management systems are well developed in the western world with regard to airport disasters,^[3] civilian contingency,^[4] terrorist bomb blasts,^[5] fires,^[6] motor vehicle accidents,^[7] and general disaster preparedness,^[8-10] there was no organized system to deliver emergency medical care to victims of disasters in India prior to 1996. During the last decade, EMS systems have been developed to ensure a coordinated response and prevent many agencies from functioning as isolated units. Specifically, the success of efficient delivery of relief depends on a predetermined command structure.

Command structure

The established command structure for India is at the national, state, and city levels. Various levels of commands are activated depending upon the magnitude and nature of the disaster. At the national level, the high level committee, which includes the deputy prime minister, agriculture minister, finance minister, and deputy chairman, of the Planning Commission is the primary disaster response committee.^[11] This committee is under the Disaster Management Division of the Ministry of Home Affairs. A national calamity contingency fund (NCCF) was created to finance the activities of this committee. Finances for the NCCF are generated through contributions from the government, industry, international agencies, and non-government organizations (NGOs). The national committee administers these funds and makes decisions about resource allocation and utilization.

The state government has a relief and rehabilitation division to handle disasters. This division constitutes the Emergency Operation Centre (EOC) under the leadership of Secretary, Department of Relief and Rehabilitation, Government of Maharashtra, designated for that disaster. Mumbai has a Disaster Management Cell which functions from the main building of Municipal Corporation of Greater Mumbai.

PRE-HOSPITAL EMERGENCY RESPONSE

The Disaster Management Cell of the Municipal Corporation of Greater Mumbai has a Control Room^[12] and a dedicated three-digit phone number. The first to respond for any disaster in Mumbai is the fire brigade or the Police or both, activated through public calls. There are two well-equipped control rooms, one each for the fire brigade and the Police. Three control rooms function round the clock for disaster response. All three are interlinked, and the call is received at any one of the rooms. The calls are then sorted depending on the nature and location of the disaster and passed on to the appropriate authority. Mass disasters are handled by integrated response through the disaster management cell. Higher levels of disaster management, i.e., the state and central governments, are activated only if the disasters are of very large scale.

The pre-hospital care of victims is taken by the Mumbai Fire Brigade. Initially, this was restricted to transport of the victims. However, we now appreciate the improved outcomes associated with pre-hospital care. Therefore, we recently created a cadre of formally trained paramedics under Emergency Medical Services of the Mumbai Fire Brigade. They are trained for basic life-support skills and carrying out prescribed emergency resuscitation protocols. This is an improvement over their previous role as pure transporters.

Communication

The communication system is useful for rapid notification to appropriate units and expeditious implementation of relief procedures. The fire brigade and metro police units are linked through a wireless communication network. Mumbai Fire Brigade has a stateof-the-art wireless communication network. Communication is maintained with the disaster site through wireless sets installed at their headquarters and on vehicles and through a base station. Mumbai Police have their own separate wireless network for communication, carrying purely the traffic of police and is not available for other use. Ambulances and referral facilities like hospitals can use this network for effective communication. However, some of the transport vehicles do not have a wireless set; and to that extent, are deficient. Additional channels of communication are now available through personal cell phones. Use of personal cell phones is not restricted during disasters.

Currently we do not have a dedicated wireless frequency exclusively for a disaster, but proposal for the same is in process.

Extrication

Individual instances such as car accidents are handled by the police, rescue workers, or onthe-spot volunteers. In Mumbai, paramedics also extricate victims. However, extrication is the primary responsibility of the Mumbai Fire Brigade. The routine basic items carried by them are axes, shears (mechanical and hydraulic), and heavy-duty hammers. The Mumbai Fire Brigade boasts of extrication vans equipped with highly sophisticated equipment for special needs. If required, the Mumbai Municipal Corporation can be called into service by the Disaster Management Cell for large-scale earth-moving or on-site engineering expertise.

Transportation

The Mumbai Fire Brigade launched an EMS wing last year with an objective of efficient prehospital care and reduction in the morbidity and mortality during transportation. The corps was raised by inducting formally trained paramedics and 12 'Level I' ambulances as per the standard international specifications. Eventually, existing ambulances will be upgraded to Level I ambulances are first responders and perform nonmedical, noninvasive acts. They use splints (including cervical collars, long spine boards, and vacuum mattresses) and oxygen first aid and make the emergency lifting.

Many urban areas in India have fire departments which transport victims of disaster. However, there are no paramedics assigned to these departments. The lack of a better system resulted in considerable delays during the Mumbai riots of 1992. Specifically, ambulances were not available to pick up casualties; therefore, police and personal cars were used. This resulted in unnecessary delays and late initiation of therapy. In contrast, during the bomb blasts, there was an effective ambulance service, which was supplemented by the public transport systems, such as buses and taxis, which transported the casualties rapidly to the various hospitals.

On-site crowd control and information management

Disasters usually attract crowds consisting of curious bystanders, onlookers, overenthusiastic volunteers, and self-styled advisers. In general, this hampers rapid triage and transport. The primary responsibility for crowd management is with the police. When a call is received at any of the control rooms, the information is passed on to the local police. The police contingent which arrives on the scene has the primary responsibility for crowd control.

The relevant information regarding the disaster is passed on to public through popular media like TV. The information to next of kin is passed through display of victims list on TV or display boards at the hospitals, as well as contact to dedicated phone numbers.

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HOSPITAL EMERGENCY RESPONSE

The government medical college hospitals in India have Level I – Level II facilities offered free of cost. A few private hospitals of various levels are also available at a cost borne by either the victim or the medical insurance. Mumbai has four medical college hospitals having Level I facility and two suburban hospitals having Level II facility. There are also five Level I private hospitals available at a cost. There are other Level III government and private facilities available in the community. Large areas which are routinely used as lobbies and waiting areas are temporarily converted to wards by addition of extra cots to receive additional casualties.

Disaster management plans

There is an elaborate disaster management plan (DMP) for Mumbai and a state-level plan. Each of the four Level I medical college hospitals in Mumbai has its DMP. The DMP for each hospital is designed, custom made, and specific for the institution. There is periodic evaluation, and suitable changes are made depending on the changing needs or the experience emerging from past disasters.

Periodic drills (every month) are carried out to maintain the staff on alert, to check that the equipment is functioning optimally, and to ensure coordination between the participating fellow departments. The effectiveness of the DMP can be assessed during such drills, and suitable modifications could be incorporated for betterment.

Activation of DMP

There is a basic structure on which all these

through the telephone operators who are manning the hospital EPABX (electronic private analogue branch exchange) for 24 hours or by designating a person who can be reached 24 hours a day, 7 days a week, and his or her contact details are available with the control rooms. When the call is received, the information is communicated to the emergency medical officer (EMO) on call in the Emergency Department according to the duty schedule. The emergency medical officer carries out firsthand assessment of the magnitude of the disaster based on available information and decides the need for activation of DMP. If necessary, the EMO communicates the information within a few minutes to the senior consultant in charge of EMS and DMP and to the administrative chief of the hospital.

plans work. The first step involves mechanism

to receive disaster information. This is done

In the third step, either the consultant in charge of EMS and DMP or the administrative head activates the DMP. Activation of DMP is communicated to the concerned deparments by sounding a central bell and through personal telephonic communication. We still do not have the system of various alarm codes in places.

He then proceeds to take care of casualties.

Triage

Triage (French: sorting) means categorization and distribution of casualties, which establishes priorities and proper allocation of the treatment. The triage is carried out at the disaster site and in the hospital. Triage at the disaster site is virtually nonexistent, with some exceptions. In Mumbai the leaders from among paramedics belonging to the newly

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formed EMS of Mumbai Fire Brigade carry out on-site triage. In-hospital triage is conducted by a senior medical officer in the Emergency Department. Casualty categorization not only includes initial evaluation of the injuries but assigns a value to the injury relative to mass disaster. The categorization utilized varies according to the therapy needs:

1. Red tag — critical — likely to survive if simple care given within minutes; needing immediate management in emergency department

2. Blue tag - catastrophic — unlikely to survive and/or extensive or complicated care needed within minutes

3. Yellow tag — urgent — likely to survive if simple care given within hours; needing indoor admission and treatment

4. Green tag — minor — likely to survive even if care delayed by hours to days; may be walking or stretcher cases; may be treated as outpatient

5. Dead patient

Black tag — requiring indoor admission and expectant treatment

Medical supplies and equipment

The emergency supplies are stocked up in a room which is opened in case of mass casualties. The hospital administration provides for adequate quantities of intravenous airways, lines, solutions, drainage tubes, nasogastric tubes, anesthetic agents, splints, drugs, and dressing materials by opening the stores or through fresh procurement. The need for additional supplies is determined by the senior medical officers and consultants at the hospital. The supplies are replenished from the hospital medical stores. The stock situation is monitored at the medical stores during the long-drawn

disasters and stocks obtained from suppliers whenever necessary.

The routine operation rooms are opened and made available for emergency. Additional equipment like patient monitors, ventilators, and pulse oximeters are redeployed and organized from the fellow departments which are low key for that particular disaster. If need be, elective operation schedules are postponed.

Personnel

Additional staff is mobilized for all the cadres (consultants, nurses, theatre attendants, medical stores staff, ward staff, and administrative staff) by calling the staff staying on campus, asking the staff already on duty to continue beyond their regular hours, and appealing to the staff to join by telephonic instructions. The Anesthesia Department is involved, in particular; and in turn, it mobilizes extra staff from nearby hospitals in disaster situations.

Crowd management at hospital

Families commonly come to hospitals during disasters to seek information about their family members. Multiple boards displaying information of admitted patients with their locations are put up at prominent places in the hospital. Our protocol is that the families go through the victims list on display boards and contact help desks. Administrative staff at help desk provides accurate and adequate information required; special counters are opened up for the purpose at the hospital. Periodic bulletins are issued regarding the condition and progress of the patients. The job of guiding the crowd away from the operational areas is managed by the security department of the hospital.

Handling of press

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The press is handled mainly by senior medical administrators such as the dean of the medical school (who is also the chief of the attached hospital) or deputy deans. Timely, accurate, and adequate briefings are organized for the press. They are provided with the factual statistics. A senior officer is deputed to take up their questions and provide appropriate information. The periodic bulletin as needed is issued, and a copy is forwarded to the press.

POSTTRAUMATIC STRESS DISORDERS IN INDIA^[13-16]

Posttraumatic stress disorder (PTSD) consists of a complex combination of co-occurring symptoms and mental processes. PTSD is a disabling psychiatric disorder that survivors of disasters may suffer. It can manifest itself even several years after the disaster. It is estimated that 50% to 80% of the survivors of a major disaster suffer from this disorder.[14]

Considering the circumstantial evidence, a mere absence of community prevalence data from the developing world does not justify the assumption that PTSD is nonexistent or its prevalence is negligible in nonwestern countries. On the contrary, the risk of developing postdisaster/posttraumatic sequel, like posttraumatic stress-related disorders, may be considerably higher among the population in these settings. Even in India, there is high incidence of posttraumatic stress disorders, as was documented after the tsunami in December 2004.^[13] The prevalence of posttraumatic stress disorder was 12.7% (95% confidence interval [CI] = 9.4%, 17.1%), and odds of posttraumatic stress disorder were higher among individuals with no household income, women, and those injured during the tsunami. PTSD is a relevant traumatic-stress clinical construct in the Indian context, a fact which is also supported by a recent (2005) study based on in-depth interviews with 55 women traumatized by the riots in Gujarat, India, in March 2002,^[17] which revealed that symptoms described as characteristic features of PTSD in biomedical classification were clearly expressed by these women and attributed by them to trauma. The treatment in the form of meditation program has been found to be highly effective against other stress-related conditions such as hypertension, and to improve brain coherence-a measure of effective brain function.[15]

TRAINING PROGRAMMERS

Basic life support (BCLS), advanced life support (ACLS), and trauma support courses are organized for training of consultants and nursing staff through trained faculty every month. We now have certified trainers to conduct such courses; they organize such activity periodically for various levels of the staff. The Anesthesia Department at our hospital has EMS laboratory equipped with mannequins, and it organizes BCLS and ACLS certification courses. The hospital has organized training courses for Traffic Police, Highway Police, and Fire Brigade under the banner 'Ayushdan' (gift of life) to teach them extrication, pre-hospital handling, and transportation skills. EMS of Mumbai Fire Brigade now has officers who have obtained certification as Trainer. They train the paramedics that ride on the ambulances.

Experience of disaster management in Mumbai^[1,2,18]

The city of Mumbai continues to witness

variety of disasters every year, ranging from bomb blasts, fires, accidents, floods, fever epidemics, and others. Though most disasters are managed well nowadays by public hospitals who take the brunt of the sudden influx of a large number of patients, the responses were unplanned a decade ago. However, there has been a change in approach to these disasters over the last decade. KEM Hospital now has a well-developed disaster management plan that is updated every year and also has regular training programs and annual drills.

There was an epidemic immediately after the water logging in Mumbai in 2005. There was need for a well-written disaster management plan, with proper allocation of liabilities and clear instructions. This was established through a lot of coordination with, and inputs from, experts and various other agencies such as security, fire brigade, and police. The document was prepared and drills were conducted. This was of great help during the multiple-bomb disaster in Mumbai's local railway network in 2006, and it improved the disaster responses.^[18]

RECOMMENDATIONS FOR PLANNING OF MASS DISASTER MANAGEMENT

Though many public hospitals in major cities can effectively manage disasters, we recommend the following policies and procedures, based on our experiences during several disasters.

Hospital planning

All hospitals must have a designated disaster committee composed of knowledgeable representatives from medical and nonmedical departments. The committee should formulate a disaster plan that is flexible enough to meet the demands of major disasters but is practical and considerate of hospital trauma capabilities, location, personnel, and resources. A handbook outlining this plan should be widely circulated and easily accessible during times of disaster. The handbook should emphasize factors which help in organizing specific teams for a particular disaster. These factors include (i) nature of the disaster: riots, gas leaks, etc. (the nature of injuries may differ between disasters); (ii) number of disaster victims; (iii) period of disaster: bomb blasts and fires are usually 1-day problems, while riots may continue for a few days.

In situations where the disaster is likely to continue for a few days (e.g., riots), it is better to prepare a roster of the available personnel. The security and protocol for visiting dignitaries should be anticipated and organized, thereby preventing the interruption of activities of disaster relief being carried out by health care providers. The committee has the responsibility for dissemination and reappraisal of the plan in terms of the community's and hospital's changing needs. The disaster plan must be tested quarterly in the form of a drill. The director of the disaster plan should be a physician or a surgeon experienced in both administration and trauma care. The importance of the triage system and mass disaster management must be emphasized at all levels (i.e., from medical students to senior consultants).

Community planning

Disaster planning is the responsibility of all sections of the community. The police, fire brigade, civil defense, Home Guards, press, clergy, industrial groups, and community groups must participate in the pre-disaster planning. The community as a whole has the responsibility to teach first aid to groups in the community that could be utilized in disaster situations. The disaster may involve the normal communication network itself. Therefore, twoway radio systems and messenger systems must be included as backups in the event of a communication-system failure. It is vital to have communication between disaster site and hospitals, so that the patients can be distributed to various hospitals depending upon their capacity.

Training in disaster planning

There is need for introducing special curriculum for disaster planning at the undergraduate medical and paramedical levels, as well as at different higher education levels for better medical and other community-related preparedness. Drills and training programs must be conducted regularly.

CONCLUSIONS

Reduction in mortality and morbidity in mass disaster can be achieved by a well-organized, concise, but flexible, pre-disaster protocol and frequent training. Every hospital must have a disaster management committee with flexible disaster management plan. Every member of the disaster team must be exposed to this plan and to regular drills. Every hospital must coordinate with other agencies such as police, fire brigade, and paramedical agencies for better performance by disaster teams in critical situations, as well as for reduction in morbidity and mortality. Elaborate disaster management curriculum needs to be included in the undergraduate medical program of every college. A well-established plan, especially trained staff and regular drills, can make significant change in the outcome of such commonly occurring mass disasters.

REFERENCES

- 1. Supe AN. Disaster management: Are we ready? J Postgrad Med 1993;39:1-4.
- Dalvie SS, Pai PR, Shenoy SG, Bapat RD. Analytical data of January 1993 communal riot victims--the KEM Hospital experience. J Postgrad Med 1993;39:5-9.
- Dove DB, Del Guercio LR, Stahl WM, Star LD, Abelson LC. A metropolitian airport disaster plan: coordination of a multihospital response to provide onsite resuscitation and stabilisation before evacuation. J Trauma 1982;22:550-9.
- Beary JF II, Bisgard JC, Armstrong PC. Sounding boards: The civilian-military contigency hospital system (CMCHS) pro and con. N Engl J Med 1982;306:738-40.
- 5. Brismar B, Bergenwald L. The terrorist bomb explosion in Bologna, Italy, 1980: An analysis of the effects and injuries sustained. J Trauma 1982;22:216-20.
- Buerk CA, Batdorf JW, Canmack KV, Ravenholt O. The MGM Grand Hotel fire: Lessons learned from a major disaster. Arch Surg 1982;117: 641-4.
- Lowe DK, Gately HL, Gross JR. Patterns of death complication and error in the management of motor vehicle accident victims: Implications for a regional system of trauma care. J Trauma 1983;23:503-9.
- Briggs Se, Flint LM. Mass casualty managment. In: Zuidema Gd, Rutherford RB, Ballinger W. Editors. Management of trauma, 4th ed. Philadelphia: WB Saunders; 1985. p. 801-6.
- 9. Rodning CB. Disaster preparedness. South Med J 1983;76:229-32.
- 10. Weiss DB. Organisation of hospital medical care

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of mass casualities in peace time disasters. Int Surg 1982;67:400-2.

- Available from: http://www.ndmindia.nic.in/. [last accessed on 2008 Mar 16].
- Available from: http://www.mcgm.gov.in/. [last accessed on 2008 Mar 16].
- Kumar MS, Murhekar MV, Hutin Y, Subramanian T, Ramachandran V, Gupte MD. Prevalence of posttraumatic stress disorder in a coastal fishing village in Tamil Nadu, India, after the December 2004 Tsunami. Am J Public Health 2007;97: 99-101.
- 14. Available from: http://www.hinduonnet. com/thehindu/mag/2005/03/13/ stories/2005031300160601.htm. [last accessed on 2008 Mar 16].

- 15. Hankey A. CAM and Post-Traumatic Stress Disorder. eCAM 2007;4:131-2.
- Margoob MA. Post traumatic stress disorder: Culture syndrome of the west or a hidden diagnosis for the rest. JK Practitioner 2006;13:s7-9.
- Mehta K, Vankar G, Patel V. Validity of post traumatic stress disorder in a low income country. Br J Psychiatry 2005;187:585-6.
- Deshpande A, Mehta S, Kshirsagar NA. Hospital management of Mumbai train blast victims. Lancet 2007;369:639-40.

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