

WEI ZHONGHAI

# DISASTER MEDICINE



# Disaster Medicine

Wei Zhonghai



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# Preface

Disaster Medicine is a comprehensive textbook with all information that both beginners and the highly trained healthcare personnel and professional rescuers may need to know to provide basic life support and first aid in accidents and disaster emergency.

Designed for out-of-hospital and in hospital medical care and first aid in emergency medicine and disaster medicine, Disaster Medicine covers all emergency and other first aid situations that may be encountered as in earthquakes, snowstorm, landslides, volcanic eruption or accidents like mine disasters, car accidents, poisoning, gas leaking, electrocution and blasts.

Disaster management, transfer arrangements as well as first aid on the site are also included in this training textbook. Different from other first aid or emergency medicine textbooks, this book also includes all the possible folk rescuing tips and traditional Chinese medicine practice in emergency situations. This unique book stated to every single detail what to do in different emergencies with or without the help of trained first aiders.

Written and edited by experienced first aiders, surgeons from Emergency, physicians, traditional Chinese medical experts, researchers, and practitioners.

Disaster Medicine is a must-have resource for community first aiders training and practicing in this challenging specialty.

This text presents a concise, methodical approach to patient evaluation, management and problem solving especially in disastrous emergency out of hospital.

***The major chapters are:***

- On-site Management for Natural Disasters
- Rules and Procedures for the on-the-spot Treatment
- On-site Treatment for Accidents
- Surgical Management for Disasters
- Treatment for Internal Medicine Disease
- Treatment for diseases of special Departments
- Treatment for Infectious Diseases
- Post-disaster Treatment of Psychological Problems
- Emergency Operation
- Agents for First Aid

We want to acknowledge the help of all the people who have made this book really practical and professional for emergency medical students, community first aiders, healthcare providers and rescuers.

We are particularly appreciative of the wonderful jobs by chapter authors who have generously shared their experiences and knowledge.

The authors and editors have made every effort to provide updated concise information on emergency medicine. However, due to the rapid changes of medical science and possibility of errors, readers are advised to check the latest information.

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## An Insight

Throughout history, human beings lived in the nature, faced with the threat from natural disasters like earthquake, flood, drought, storm, debris flow, landslide, forest fire, etc.. When human beings participate in the process of social activities, productive labor and scientific research, there are always various unexpected accidents like traffic accidents, mine disasters, aircraft wrecks, shipwrecks, chemical accidents, etc.. Human society experiences frequent wars and disasters. Furthermore, the recent development of global economy and the destruction of environment always cause multiple disasters. Once those natural and human-made disasters, accidents happen, there will be serious life deaths and property loss, which brings fateful disasters. From 1970s to 1980s, 2,800,000 people lost their lives and up to 8,200,000,000 people were affected due to the natural disasters. Although the development of technology improves the human abilities for overcoming diverse disasters, unfortunately, most disasters are unavoidable. However, we can try to minimize their damage to the minimum level. Mastering the medical rescue techniques for disasters is one of the most important measures to reduce disaster losses.

### Definition and Classification of Disasters

#### Definition

There is no universally accepted definition of a disaster. The definition adopted by the World Health Organization (WHO) terms a disaster as "A serious disruption of the functioning of a community or a society causing widespread human, material, economic or environmental losses which exceed the ability of the affected community or society to cope using its own resources (ISDR)." The specialists from the "International Strategy for Disaster Reduction" of the United Nations defined it as: The situation or event, which overwhelms local capacity, necessitating a request to national or international level for external assistance.

Therefore, disasters are kinds of events that threaten people's lives, property and living condi-



tions. When those natural or man-made destructive events go beyond the self-rescue ability or endurance of disaster-stricken communities, a disaster happens. Since endurance of communities is comparative, these are the threats of destructive events to different communities. The same destructive event may cause damage to one community or but not to others.

## Classification of Disasters

Disasters can be classified by causes, natures, or occurrence as the demands of different researches.

### 1 By Causes of Disasters

**1.1 Natural Disasters:** Disasters caused by the variation of natural factors, then producing and showing natural disasters, called “tian zai” in Chinese. Earthquake, eruption of volcano, flood, landslide, avalanche, gale and the like which cause disasters are Natural Disasters. These disasters cannot be controlled by human beings, but the loss caused by them can be reduced to the minimum level.

**1.2 Man-made Disasters:** Disasters that are mainly caused by human influences, called “ren huo” in Chinese. War, nuclear accidents, air crash, traffic accident etc. which cause disasters are man-made disasters. These disasters can be avoided with people’s efforts, as improving working conditions, strengthening prevention senses because prevention is better than cure.

### 2 By Course, Nature and Mechanism

**2.1 Natural Disasters:** Includes drought disaster, meteorological disaster, earthquake disaster, geological disaster, oceanic disaster, biological disaster, forest fire and so on.

**2.2 Accidents:** Primarily covers kinds of safety accidents that occurs in the companies concerning industry, mining, business and trade fields, traffic and transport accidents, accidents of public establishments and equipments, environmental pollution and ecological destruction events, and so on.

**2.3 Public Health Events:** Involves the epidemic situation of infectious diseases, diseases within a group caused by unknown factors, food safety and occupational hazards, animal epidemic situation, and other events that badly influence public health and life safety.

**2.4 Social Safety Events:** Involves terrorist attacks, economic safety events and foreign emergent events, and so on.

### 3 By Occurrence

**3.1 Primary Disasters:** Disasters that are primary and original, like volcano eruption.

**3.2 Secondary Disasters:** Disasters caused by primary disasters, like fire caused by volcano eruption.

**3.3 Derived Disasters:** Disasters deriving from primary and secondary disasters, like the influence on weather trend and climate after the volcanic eruption.

## **Damage and Grading of Disasters**

### **Damage of Disasters**

The harm caused by any disaster on human beings is devastating. Small disasters, like traffic accidents may cause property loss, lifelong disability, and psychic trauma to some people. Big disasters may bring great hazards and invaluable loss to the masses and human beings from a district, a country or this world.

#### **1 Endangering People's Lives and Health, Affecting Their Life Style**

Disasters, especially fatal or emergent disasters, may cause a great deal of casualties. Serious disasters affect millions of people, which bring innumerable casualties. For example, an earthquake of magnitude 7.8 happening in Tangshan City on July 28, 1976 killed 242,000 people. In 1995, Kobe and Osaka in Japan had an earthquake of magnitude 7.0. It rendered 300,000 people homeless, caused 6,055 deaths, 26,000 injuries at different levels, and an economic loss of 900 billion francs. On May 12, 2008, Wenchuan City, Sichuan Province of our country had an earthquake of magnitude 8.0, which killed 69,226, hurt 374,643 and left 17,693 people missing according to the statistics on Aug 12. The damage caused by the secondary disasters, especially due to the spread of infectious diseases, was more serious. For instance, the Gulf War from Jan. 17, 1991 to Feb. 28, 1991 led to 145,000 deaths during the war and 70,000 deaths due to the plague and other diseases, though it only lasted for 42 days. Disasters also affect people psychologically leaving fear, fluster, woe and despair, etc., worsening people's health conditions worse and damaging the social functions. Disasters severely threaten people's existence and living.

#### **2 Devastating Public Facilities, Public and Private Property, Causing Severe Economic Loss**

Disasters hamper the basic facilities of our society like housings, roads, transport, communication, electricity, water supply and sanitary service, and cause great economic loss. Construction, traffic and energy facilities, factories and research units in the cities are complex and gigantic systematic projects. Therefore once they are damaged, they will be out of control and bring great destruction to the circulation of social economy. For example, the destruction of a mine will bring down hundreds factories. The damage of life-line projects like water supply, electric power, traffic and energy will also paralyse the production and living system of the whole city. Therefore, the indirect economic loss caused by structural and systematic damage is greater than the direct one and some of them cannot be calculated in numbers. The weather disasters like flood, drought,

hail, wind, freeze, snow and frost bring most serious loss to the Agriculture. Our country has farmland 1.6 billion mu (a unit of area). Every year there are 0.6 to 0.7 billion mu damaged, 20 billion kg grain loss, and 0.2 billion people are affected. Landslide, debris flow, land salinization, land desertification and earthquake destroy the agricultural production. According to statistics, at least 1.3 million mu farmland in our country has been ruined by geologic disasters from 1949 to 1990. In accordance with the statistics collected in 1987 by the Commission of "International Strategy for Disaster Reduction", natural disasters like earthquake, flood, hurricane, landslide, tsunami, volcano eruption and nature fire have caused 2.8 million deaths worldwide. More than 0.82 billion people have been affected and direct economic loss is about 25 billion to 100 billion dollars during the past 2 decades. It always causes turbulence in the society. There are also man-made disasters like fire, explosion, electric traffic and mining traffic in the Industrial Production. Such man-made disasters are comparatively more abrupt and accidental, and bring inconceivable loss. Therefore, disasters have been restrictive factors to hinder the economic development of human society.

### **3 Destroying Resources and Environment, Threatening the Sustainable Development of National Economy**

Flood, debris flow and sand storm lead to water and soil erosion, and land desertification. Wood fire, biological pests etc directly ruin woods and plain, damage biological resources and worsens the ecological environment. Ground sedimentation and landform change holds back the flow of surface and ground water, therefore it increases the level of water pollution. Some destruction caused by disasters can be restored, but the damage to resources and environment cannot be restored in a short period. Some needs hundreds of years or more, and some can never be restored. Though we have lots of biological resources, most of them are nongenerative. If water resource gets polluted, it takes long time to recover. Therefore, disasters not only destroy present economic development, but also endanger future's living and growing conditions.

### **4 Affecting the Peace of the Society**

The outburst of severe disasters, like earthquake, ruins people's living conditions and environment. It makes people feel terrified, restless, woeful, hopeless or even get psychopath. Those things and the breakage of disasters to economy will cause social turbulence.

The damage from disasters mainly affects the body and health leading to short-dated and long-dated damage.

**4.1 Short-dated damage:** It is the hurt to the body, bad influence and threat to health from unexpected disasters. For instance, when an earthquake occurs, buildings directly hit a part of the body which causes fracture, hemorrhage, shock, etc., and the direct hurt to the body from the fire, flood, etc. It also involves the skin burn from the fire, the burn of the respiratory tract, dehydration and so on.

**4.2 Long-dated damage:** It is the damage to the body from unexpected disasters, which includes psychic trauma, kinds of sequelae and cripplehood after the treatment, and the increase of epidemics after the disaster, etc. For example, nuclear explosion and leak, spread plague after the flood and the psychological problems after the earthquake etc.

## Grading of disasters

The level or grading of disasters is related to the enduring or self-saving abilities of the communities that meet with disasters. Hence, it is comparatively hard to grade disasters. There is no common grading of disasters internationally. The scholars classify disasters into the following five levels based on the direct death toll and economic loss.

**(1) Level A:** Huge disasters that kill more than 10000 people or cause more than 0.1 billion RMB property losses.

**(2) Level B:** Big disasters that kill 1000-10000 people or cause 10 million – 0.1 billion RMB property losses.

**(3) Level C:** Medium disasters that kill 100-1000 people or cause 1 million – 10 million RMB property losses.

**(4) Level D:** Small disasters that kill 10-100 people or cause 0.1 million – 1 million RMB property losses.

**(5) Level E:** Minor disasters that kill less than 10 people or cause less than 0.1 million RMB property losses.

## Medical Aid during Disasters and Its Characteristics

### What Is Medical Aid During Disasters

Medical Aid during Disasters is a subject that provides emergent medical treatment, disease prevention, cure and hygiene for wounded and sick patients in stricken areas while facing kinds of natural disasters and man-made calamities. It is a subject of Disaster Science and Medicine, covering every factor of disaster management like disaster warning, prevention, diagnosis, defence, on the spot treatment and sending victims to the hospitals for further treatment, healing and psychological intervention. It is an important part of Disaster Rescue. Medical Aid during Disasters has developed from a pure medical study to an interdisciplinary and multidisciplinary comprehensive subject and is going towards the tendency of cross-area and transnational communication.

Disaster threatens human beings' lives and endangers people's health. It is the responsibility of medical staff to carry out emergent treatment activities and control sanitary situations. Once there is a disaster, we should organize every rescue force, provide timely and effective medical rescue

for victims, and medical equipments. We should provide necessary medical treatment, and send patients to hospitals for having further treatment via diversified transport to save lives, reduce the number of wounded and handicapped people and recover their health. Medical Aid during Disasters is the medical science that focuses on how to protect people's lives, organizing jobs and measures of injury, illness prevention and treatment. It involves the study on the law of various disasters harming people's health, establishing reasonable sanitary guarantee schemes, calling on essential sanitary force and organizing them into strict rescue network, fully exert cooperative function of multiple subjects (including epidemiology, lemmology, nutriology, public health, emergency surgery, social medicine, community medicine, and international health, etc.) and scientific and technical abilities, providing victims on the spot emergent treatment and sending them to the hospitals and controlling the occurrence and popularity of diseases after disasters.

## **Characteristics of Medical Aid during Disasters**

### **1 Medical Aid during Disasters Is a Social System Project Including Every Factor**

Medical Aid during Disasters is not only the pure medical treatment, but also a complicated social system project. It is a disaster science, an amalgamation of clinical medicine, preventive medicine, nursing science and psychology, based on sociology, management, engineering mechanics, international law, communication, transport, and fire fighting. Only the cooperation among each department and the whole society or even countries can bring the effect of Medical Aid during Disasters into full play.

### **2 Medical Aid during Disasters Needs Powerful Organizing System**

Severe disaster has the features of suddenness, lots of people involved, and complexity, happening unexpectedly and killing numerous people. It is hard to rescue the wounded and sick under undesirable circumstances where they are buried under the ruins or caught in the damaged cars or plane debris. The execution of Medical Aid during Disasters should be under the guidance of local governments and rescue center to build powerful commanding system and scientific emergent rescue network. It also demands every available healthcare resource and the help of communication, transport, energy, architecture, insurance, weather and water supply departments, in accordance with firemen, policemen, servicemen to complete the saving task.

### **3 Medical Aid during Disasters Is Different from Emergency Treatment**

Medical Aid during Disasters develops from emergency medicine. It is different from emergency treatment and its connotation is abundant. Medical Aid during Disasters particularly on the treatment and management outside hospitals, and most of its working hours is spent at the scene of disasters, including large-scale search of wounded people, examination and classification of injuries, emergent treatment, transport of critically wounded people, building and operation of

movable hospitals, etc.. To prevent the prevalence of epidemic diseases after disasters, the job of epidemic prevention is an important part of Medical Aid during Disasters. Medical Aid during Disasters also covers sociology, psychology, management and so on.

#### **4 Strict Timeliness and Heavy Task**

Disasters are always sudden and unexpected. Earthquake can instantly raze cities and countries to the ground, and gas explosion is as sudden as lightening. At that time, time is life, and an early rescue means more recovering hope of survivals. So rescuers are required to arrive at the scene immediately. It is proved that to carry out correct cardiopulmonary resuscitation on patients within 5 minutes after the stop of their heartbeat can save them, but it's hard to save after 10 minutes. Therefore, strict timeliness is a key feature of disaster treatment.

There are always lots of wounded people and deaths after disasters. Trains in collision may hurt or kill thousands of people, and an intense earthquake may even hurt or kill millions of people. So there is an explicit need of a large number of doctors and medical things in the disastrous areas. After big disasters, disaster areas encounter severe damage, and the collapse of buildings, the stop of water, electricity and gas supply, no lightening, unassured domestic and cleaning water and no gas supply brings more difficulties. Roads and bridges collapse, the traffic is blocked and cars cannot go through. Rescue force and relief materials cannot be sent into disaster affected areas and it always needs walking and the help of helicopters, therefore, the time of arriving at disaster areas and supplies of medical materials are delayed. Meanwhile, health institutions and hygienic facilities in disaster areas meet with loss and damage. Wounded people are in the need of salvage and cure, and there are not enough treating forces. The task for treatment staff is arduous and onerous for most of the wounded people are terminally ill and their condition is complicated.

#### **5 Traumatic Conditions Are Complex**

Complex traumatic condition means disasters always cause the damage of multiple tissues and organs. Many wounded people may have more than one serious disease like massive hemorrhage, asphyxiation, and shock, etc.. The wound can be contaminated, and make the situation more complex. It not only makes first-aid more difficulty, but also requires multidisciplinary knowledge and excellent first-aid technique.

Medical Aid during Disaster is different from common first-aid jobs. Common first-aid jobs only rely on the force of health department, but the spot control, search of wounded people, transmission and communication after the disasters require the participation and cooperation of army, police station, transportation department, and telecommunication, etc.. Therefore, disaster emergency treatment is a systematic project, covering a wide range.

#### **6 Epidemic Prevention Is an Important Part of Disaster Treatment**

Victims instantly become homeless, without water and electricity, short of food and clothes, their lives shatter, and their body resistance declines from the lack of nutrition and the psychic

trauma from the loss of family members and properties. At the same time, health and epidemic prevention institutions in urban and rural areas are destroyed by disasters and cannot organize epidemic prevention tasks. All of those are likely to infectious diseases after disasters. In order to prevent the epidemic of infectious diseases, epidemic prevention becomes very important.

## **Procedures and Significance**

### **Procedures**

#### **1 On the Spot Treatment of the Wounded People:**

Covers searching on the spot, rescue survivals, checking and classifying injuries, treatments and transmission of the wounded.

#### **2 Giving Emergency Treatment:**

When disasters happen, people are having a declined living condition with limited stuff available, and are suffering from psychic trauma. It not only leads to the prevalence of epidemic diseases, but also causes explicit increase of various diseases. To provide emergency treatment for people in stricken areas is a major part of Medical Aid during Disasters.

#### **3 Carrying out Sanitary and Epidemic Prevention Jobs:**

Includes food sanitation, drinking water, environmental sanitation, immunoprophylaxis, monitoring and reporting of diseases, and prevention of the outbreak epidemics.

#### **4 Psychological Management after Disasters:**

Try to deal with crisis intervention and psychological shock of people in disaster affected areas.

#### **5 Rebuilding Health Institutions after Disasters:**

Health institutions are also affected, so one task of Medical Aid during Disasters tasks is to help the people in disaster affected areas to carry out resuming and rebuilding jobs of health institutions, including reconstructing health institutions, hygiene facilities and medical training, etc..

### **Significance**

#### **1 Saving the Lives of Wounded People and Improving Their Health**

The chief aim of Medical Aid during Disasters is to give effective emergency treatment in time and reduce the damage to lives and health. Therefore, the progress of Medical Aid during



Disasters will enhance the living probability and health level of the wounded, decrease disability and mortality rates, and reduce the incidence of epidemic diseases after disasters.

## **2 Providing Emergency Medical Aid and Improving Treatment**

Medical Aid during Disasters is based on emergency medicine, disaster medicine, clinical emergency treatment and critical illness monitoring, integrating with the science of communication, transport, architecture, fire-fighting, biomedicine and so on, using the development of high technology for reference. Thus, the connotation of emergency medicine becomes profound, and its extension covers more. The development in the external environment of hospitals, and the former rough treatment technique, equipments, experience and theory enhance the pre-hospital treatment level. Also, the standardized improvement of traditional nosocomial emergency treatment and other emergency treatment in clinical departments including surgical department is the completion and support for the experience and theory of emergency medical treatment.

## **3 Decreasing Economic Loss and Maintaining Social Stability**

Disasters always bring a heavy blow to the economy of a country or district, and its indirect economic loss is even more difficult to estimate. The large number of casualties makes social insurance lose considerable compensation, and bring economic loss. Furthermore, the wounded people and patients with epidemic diseases will increase the medical expense of a country or district. The advance of Medical Aid during Disasters also has important significance for maintaining the politics of a country and social stability, and reducing the economic loss caused by the disaster. Disasters bring misfortune to people's lives, health and material life. There is a lack of medicine, where victims are homeless, without clothes, food and in panic, and national economy faces a heavy blow. All this may lead to social turbulence and even regime change. Therefore, improving the level of Medical Aid during Disasters and giving victims physical and psychological treatment is helpful for social stability.

# **How to Manage and Organize**

On the spot medical treatment requires spontaneity, arduousness, urgency. The wounded state is complex, where people are in panic and the order is chaotic. There is no people command and co-ordination on the spot; the order of emergency treatment is confused; no medical staff operate and classify wounded people; patients are sent to the hospitals instantly without elementary treatment; people have no idea about the transmission of wounded people; the hospital don't know the number and the state of wounded people; and there is no standard working procedures. The center cannot cope up with on the spot emergency treatment, etc.. Consequently, a special organizing and managing institute should be built to scientifically allocate people and material, assure saving emphasis, allot treatment staff, dispatch buses and cars, maintain saving order, and



coordinate people to send wounded people to hospitals and so on. Thus, the whole treatment job can go on in good order and improve the efficiency of spot treatment. Therefore excellent organization and management is crucial in providing proper medical treatment.

## Organizing and Managing Principle

**1 Centralized Command and Definite Duty:** The command and co-ordination of the medical treatment at the scene should be under the guidance of local sanitary departments and each responsible official for medical institutes should take charge. The staff in each medical institute should look at the big picture, follow the command, and endure the effective working of life saving task.

**2 On the Spot Rescue and Transportation of Victims:** The emergency treatment of the unexpected disaster accidents should follow the principles of on the spot saving, sending victims to the nearby place, treating safely, and should fully use the present medical resources, organizing treatment and transmission as soon as possible with the help of the network dispatching of "120" command center, and the effective coordination of the three-level emergency network: first-aid center, sub-center, emergency station (network hospitals). We should strengthen the medical serving network of pre-hospital emergency treatment. The cooperation and joint action of the related departments including police offices, armed police departments, fire-fighting departments, medical emergency center, and road administration bureaus can explicitly reduce the pre-hospital death rate and achieve the aim of instant and effective treatment.

## Organizations

Medical and sanitary organizations cover groups for medical and sanitary treatment, expert groups, medical and sanitary treatment institutions (including medical emergency center, general hospital, special hospital, special institution for first-aid medical treatment of chemical poison and nuclear radiation, disease prevention control institution, and health monitoring institution) and headquarters for spot medical and sanitary treatment.

### 1 Leading Groups for Medical and Sanitary Treatment:

Health administration department in the State Council set up leading groups for Medical and Sanitary treatment of public emergencies to lead, organize, coordinate and deploy the medical and sanitary treatment tasks of emergent public events. Sanitary emergency office in the health administration department is responsible for the daily things. Health administration departments in the province, city (district) or county establish relative leading groups for medical and sanitary treatment of unexpected public events to guide the sanitary treatment jobs of public emergencies in the administrative region. Each leading group of medical treatment for disaster affairs should know the features, rules, medical treatment resources, geography and transport state of the local