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Rational Drug Use in Medical Response to an Earthquake

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1. Introduction

Earthquake can be defined as the shaking of earth caused by waves moving on and below the earth's surface and causing: surface faulting, tremors vibration, liquefaction, landslides, aftershocks and/or tsunamis (World Health Organization [WHO], 2011). 118 earthquakes of magnitude 7 or over occurred since 21st century all over the world, and caused millions of casualties (National Geophysical Data Centre [NGDC], 2011). In 2004，the Indian Ocean earthquake with a magnitude of 9.1 triggered a series of devastating tsunamis along the coasts, killing 230,000 people in 14 countries, which was one of the deadliest natural disasters in recorded history. In 2011, the 9.0 magnitude East Japan earthquake, which caused tsunami and nuclear crisis, killed 15,365 people.

Earthquakes cause high mortality resulting from trauma, asphyxia, dust inhalation (acute respiratory distress), or exposure to the environment (i.e. hypothermia) (WHO, 2011). Recent studies suggest that primary prevention is the most effective means of reducing earthquake casualties (Durkin & Thiel, 1992). Therefore, priority should be given to considering seismic safety in land-use planning and in building design (Coburn & Spence 1992). After an earthquake occurs, however a well-planned medical response is a key strategy for reducing mortality and disability (Schultz et al, 1996). During a medical response, drug use is an important issue in the management of the injured, especially for ones have known or suspected infections, internal injuries and crush syndrome requiring intensive drug treatment besides surgery. Therefore, the rationality of drug use in earthquake injured needs to be discussed to find whether irrationality exists and how to get improved in future medical response. In addition, there is no doubt that the pharmacists as medical professionals play an important role in promoting rational drug use in our medical service, however, what can pharmacists do to promote rational drug use in earthquake medical response? Based on these facts and questions, in this chapter we reviewed drug use and practice experience of pharmacists in management of injured in previous earthquakes, to provide evidence for better pharmacy practice in earthquake medical response in the future.

2. Death and diseases caused by earthquakes

In most earthquakes, people are injured and killed by mechanical energy as direct result of being crushed by falling building materials. Deaths caused by earthquakes can be

instantaneous, rapid or delayed (Naghii, 2005). Instantaneous death can result from sever crushing injuries to the head or chest, severe external or internal bleeding, or get drowned in the tsunamis caused by the earthquake. Rapid death occurs within minutes or hours and can result from asphyxia caused by inhalation or chest compression, hypovolemic shock, or environmental exposure. Delayed death occurs within days and can result from dehydration, electrolyte disturbance, crush syndrome, or infections (Pretto et al, 1994).

Within 1 week after an earthquake occurs, the dominated disease is traumas. In the first day after Sichuan earthquake in 2008, trauma accounted for 96.8% of all the patients (Liu et al, 2011). 1 week later, number of traumas patients decreases and more patients are admitted to internal medicine, pediatrics and dermatology department for infectious diseases, in which respiratory infection, diarrhea and skin rash are more common (Ma et al, 2011). Trauma is mostly caused by the collapse of building and leads the majority of deaths and injuries in most earthquakes (Coburn & Spence 1992). Major injury requiring hospitalization includes skull fractures with intracranial hemorrhage, spine injuries, and damage to intrathorcic, intra-abdominal, and intrapelvic organs, including pneumothorax, liver lacerations, and ruptured spleen. Most seriously injured people have combination injuries, such as pneumothorax in addition to an extremity fracture (Naghii, 2005). A study based on the Spitak-88 earthquake in 1988 found that combination injuries accounted for 39.7% of the cases. Superficial trauma such as lacerations and contusions were the injuries most frequently observed (24.9%), followed by head injuries (22%), lower extremity injuries (19%), crush syndrome (11%), and upper extremity trauma (10%) (Noji, 1992). Appropriate medical and surgical treatment of these injuries is vital to improving survival, minimizing future functional impairment and disability.

3. Drug use in earthquake injured patients

There was scarcely any study investigating drug use in the earthquake injured until several studies based on data from Sichuan Earthquake in 2008 had addressed this topic. To our knowledge, there is no data on this subject from other earthquakes, we discussed drug use in earthquake injured patients based on available data from Sichuan earthquake.

3.1 Characteristics of drug use

3.1.1 Types of drugs

The study conducted by Yuan analyzed types of drugs used in injured patients in a hospital which is the nearest large general hospital to epicenter in Sichuan earthquake. This study was based on medical record of 325 patients who were admitted within 1 week after the disaster. Most patients had trauma, including bone fractures, soft tissue trauma, brain injury and other kinds of contusion/laceration. The results showed that 21 types and 433 drugs were used. The top 10 types in number of individual drugs used were listed in table 1. Among all drugs used, anti-infective drugs had the most individual drugs, in which 84 drugs were used, accounting for 19.39% of all the 433 individual drugs. 65 drugs acting on central nervous system were used, including analgetics sedatives and antianxietics. 59 cardiovascular drugs were used, most of which were calcium channel blockers, drugs for chronic cardiac insufficiency, drugs for angina, hypotensive agents, and anti-shock drugs. 36 gastrointestinal drugs were used, and most of them were drugs for peptic ulcer, prokinetic agents, antiemetic agents, catarrhectics, anti-diarrheal agent and drugs for liver and gall

diseases. 34 drugs were used in respiratory disease, including expectorants, antitussives and antasthmatics. Drugs affecting blood included blood coagulants, anticoagulant drugs, blood plasma and its substitutes. Externally applied drugs included disinfectants, antiseptics and dermatological drugs. Hormones included adrenal cortex hormone and trypsin. Antiallergic agents are mainly anti-histamine drugs. These drugs are mainly administered by injection or external application (Yuan & Zhang, 2009).

Types of drugs	Number of individual drugs	Percentage (%)
Anti-infective drugs	84	19.39
Drugs acting on central nervous system	65	15.01
Cardiovascular drugs	59	13.63
Gastrointestinal drugs	36	8.31
Drugs acting on respiratory system	34	7.85
Drugs affecting the blood	26	6.00
Externally applied and ophthalmological preparations	18	4.16
Hormones	17	3.93
Antiallergic drugs	9	2.08
Drugs correcting water, electrolyte and acid-base disturbances	9	2.08

Table 1. The top 10 types in number of individual drugs used in Sichuan earthquake injured patients

Another study analyzed drug use in 329 women and children injured after Sichuan earthquake, and found that 26 types involving 398 individual drugs were used (Han et al, 2008). Anti-infective, involving 77drugs, had the most number of individual drugs, which was consistent with results found by Yuan in the general hospital (Yuan & Zhang, 2009).

These results suggest that many types involving hundreds of individual drugs might be used during the treatment of earthquake injured patients, and thus actions should be taken to ensure those essential drugs accessible in medical response. Decision makers in hospitals and local governments especially in areas where earthquakes occur frequently should make related polices, such as an essential drug list to ensure those essential drugs are well prepared when an earthquake breaks out.

3.1.2 Frequently used drugs

2 studies conducted in different hospitals analyzed the consumption of drugs in injured patients after Sichuan earthquake. The top 20 frequently used drugs in injured patients admitted in 2 hospitals were listed in table 2. Both results suggested that water and electrolyte supplements were most frequently used drugs, including glucose, sodium chloride, potassium chloride, sodium lactate Ringer's and sodium bicarbonate. Antibiotics were second frequently used, but different antibiotics were used in the 2 hospitals. Ciprofloxacin was the most frequently used antibiotic in Mian Yang Central Hospital. Metronidazole, cefazolin and ofloxacin were other frequently used antibiotics (Yuan & Zhang, 2009). Benzylpenicillin was most frequently used in West China Hospital, cefuroxime, ciprofloxacin, and clindamycin were other frequently used antibiotics (Li et al,

2009). Other frequently used drugs included hemostatic drugs（etamsylate and aminomethylbenzoic acid), dexamethasone, vitamin C, atropine, dopamine, tetanus antitoxin, ambroxol, inosine injection, lidocaine hydrochloride, and disinfectants (hydrogen peroxide solution and betagen solution) .

Rank	Drug name （specification）	
	Mian Yang Central Hospital	West China Hospital
1	Glucose injection （5% 500ml）	Benzylpenicillin （80 U）
2	Etamsylate injection （2ml 0.5g）	Sodium chloride injection (0.9% 500ml)
3	Glucose and sodium chloride injection（ 5% 500ml）	Sodium chloride injection (0.9% 100ml)
4	Dexamethasone sodium phosphate injection（1ml 5mg）	Vitamin C injection*
5	Potassium chloride injection （10ml 1 g）	Tetanus antitoxin (250 U)
6	Ciprofloxacin lactate injection （100ml 0.2g）	Sodium chloride injection (0.9% 250ml)
7	Vitamin C injection （2ml 0.5g）	Potassium chloride Injection (10ml)
8	Sodium chloride injection （0.9% 500ml）	Etamsylate injection*
9	Sodium lactate Ringer's injection （500ml）	Glucose injection（5% 500ml）
10	Atropine sulfate injection 2ml 1mg	Cefuroxime*
11	Metronidazole injection （100ml 0.5g）	Dexamethasone (5 ml)
12	Cefazolin injection （0.5g）	Ciprofloxacin injection*
13	Ofloxacin and glucose injection （100ml 0.2g）	Sodium lactate Ringer's injection (500ml)
14	Dopamine hydrochloride injection （2ml 20mg）	Aminomethylbenzoic acid injection*
15	Glucose injection （10% 500ml）	Glucose and sodium chloride injection（5% 500ml）
16	Hydrogen peroxide solution （3% 100ml）	Glucose injection（5% 250ml）
17	Sodium bicarbonate injection （10ml 0.5g）	Clindamycin injection*
18	Tetanus antitoxin （1500U）	Ambroxol injection*
19	Lidocaine hydrochloride injection （5ml 0.1g）	Inosine injection*
20	Betagen solution （5% 200ml）	Dopamine injection*

* Drug specifications were not given in primary studies

Table 2. Top 20 frequently used drugs in Sichuan earthquake injured patients admitted in 2 hospitals

These results provided information on drugs that frequently used and thus urgently needed by injured people, which can be important evidence for drug donation and pharmaceutical management in the earthquake disaster. Priority should be given to those drugs when purchasing and donating drugs after an earthquake, and actions should be taken in hospitals to ensure that those drugs were or can be supplied in sufficient quantity immediately.

3.1.3 Antibiotic use

Open injuries are common in trauma caused by an earthquake, and have a potential for bacterial wound infections. These in turn may lead to long term disabilities, chronic wound or bone infection, and death. As the delay between injury and treatment after an earthquake, most injury presented with infected wounds, and necessitated empirical antimicrobial treatment urgently （Miskin et al, 2010）. Appropriate management with antibiotics to prevent and control infections is criticality important to the injured.

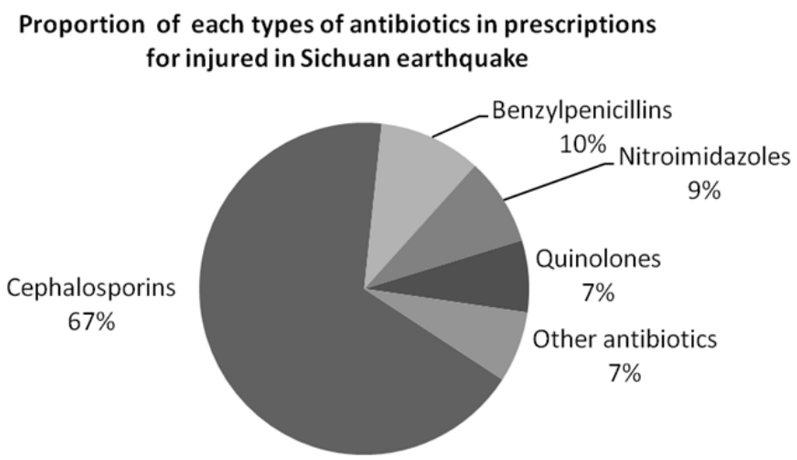


Fig. 1. Proportion of each type of antibiotics in prescriptions for injured patients in Sichuan earthquake

World Health Organization and The Centers for Disease Control and Prevention have proposed guidelines for management of wound infectious. Considering that most wound infections are due to staphylococci streptococci and anaerobe, WHO recommends penicillin G and metronidazole for empirical prophylaxis and treatment of infection (WHO, 2010). CDC recommended beta-lactam antibiotics and clindamycin for management of wound infections (Centers for Disease Control and Prevention [CDC], 2010). However, a study on Haiti earthquake injured patients found that 77% of the wound infections were poly-microbial, with 89% involving gram-negative pathogens, and these pathogens were generally resistant to the antibiotics suggested by CDC and WHO. This result exactly demonstrated the types of pathogens around injured patients in the earthquake stricken place, as the patients had not been exposed to any other health care environment since the earthquake occurred, and could not be infected by nosocomial pathogens (Miskin et al, 2010). Results of several previous studies based on data from earthquakes happened in Turkey (Keven et al, 2003), Pakistan (Kiani et al, 2009), China (Wang et al, 2008; Ran et al, 2010) and Haiti (Miskin et al, 2010) in 1999~2010 also found that most bacterial isolates that caused infection in the injured were gram-negative. The emergency-relief medical teams

and hospitals should be equipped with antimicrobial drugs for treatment of gram-negative infections as well as drugs for gram-positive currently recommended.

A study analyzed the antibiotic use based on 2953 prescriptions of injured patients in Sichuan earthquake in 2008. The results showed that 2830 prescriptions included antibiotics, accounting for 98.5% of all studied prescriptions. The frequency of each type of antibiotics presented in the 2830 prescriptions is listed in Fig 1. Cephalosporin was the most frequently used antibiotic, about 2/3 prescriptions included this types of drugs, followed by Benzylpenicillins, nitroimidazoles and quinolones (Li et al, 2008). This result may suggest that the use of antibiotics for injured patients in Sichuan earthquake was consistent with the recommendation by WHO and CDC, and large quantities of beta-lactam antibiotics, nitroimidazoles and quinolones are needed for earthquake injured patients.

3.2 Irrational drug use in earthquake injured patients

Rational use of drugs requires that patients receive medications appropriate to their clinical needs, in doses that meet their own individual requirements, for an adequate period of time, and at the lowest cost to them and their community (WHO, May 2010).

The drug utilization study in 329 injured women and children in Sichuan earthquake found that over-use and under-use of drugs were very common especially in children. In women patients, over-used drugs included vitamin C, magnesium sulfate, estradiol valerate, and dexamethasone. They were prescribed in an average daily dose 7~12 times larger than the defined daily dose (DDD) which is the assumed average maintenance daily dose for its main indication (WHO,2009). Drug over-use was more serious in earthquake injured children and mostly occurred when antibiotics and hormone were used. Benzylpenicillin and oxacillin were prescribed in an average daily dose more than 6 times larger than their DDD, and prednisolone was prescribed with over-dose 40-80 times than DDD. However, drug under-use was also found, as amoxicillin and valaciclovir were far less than recommended dose, which were 0.03-0.13 times of DDD (Han et al, 2008).

Over-use of drugs increases risk of adverse effect that can be harmful and causes trouble to the treatment of injured patients. In contrast, drug under-use caused failing to achieve the intended treatment outcome. Over-use and under-use both induce waste of drugs, which can make the lack of drug resources even worse in the earthquake-stricken area. Under these circumstances, prescription during the medical care of earthquake injured patients should be monitored and regulated to improve rational drug use.

4. The role of clinical pharmacists in medical relief

Clinical pharmacists can make a difference in drug supply and use in emergency. The job of clinical pharmacists includes ensuring adequate drug supply and promoting rational drug use.

4.1 Ensuring adequate drug supply

4.1.1 Participating in making earthquake relief drug list

According to past experience and *Hospital Formulary*, hospitals could make an *Earthquake Relief Drug List*, which would act as a guide of drug supply and use during medical relief

(Rao et al 2009). The List based on the major diseases after earthquake, includes detail information of drugs, such as indication, usage, dosage, pharmacology, the main adverse reactions and precautions and warnings. Clinical pharmacists should participate in the development of the list, because they have rich pharmaceutical knowledge, basic medical knowledge and are familiar with clinical use of drugs. Furthermore, clinical pharmacists could specify first-line agents for each type of drugs in the list, which would be helpful for doctors choosing drugs rationally (Rao et al 2009).

4.1.2 Choosing suitable drugs for medical team

Choosing suitable drugs is part of the clinical pharmacists' job. Medical team could bring only limited drugs with them. In case of that, it is necessary to choose the most suitable types and formulations of drugs for easy to use in the stricken area. Additionally, the drug packaging should be considered as well. It should be convenient to transport and not be frangible. Ciprofloxacin injection was listed on the *Earthquake Relief Drug List* in a hospital, which was packaged by glass bottle (Zhang et al 2010). Levofloxacin has similar antimicrobial spectrum and anti-bacterial effect with ciprofloxacin. It needs no allergy test before use as well. What's more, Levofloxacin injection was packaged by plastic bags. Considering about the characteristics of levofloxacin, their pharmacists replaced Ciprofloxacin injection with Levofloxacin injection.

4.1.3 Choosing alternative drugs for saving the short one

After Sichuan earthquake, so many roads were blocked. It was difficult to send materials to the stricken area. In addition, there was a huge consumption of drugs. Therefore drug supply was relatively short. In this case, clinical pharmacists play a crucial role in guaranteeing drug supply by choosing alternative drugs. It is reported that in order to save injectable antibiotics during Haiti earthquake relief, pharmacists were asked to participate in rounds with doctors, and choose appropriate alternative oral antibiotics to replace injectable ones (Ferris 2010). In our hospital, albumin was once short during earthquake relief. Our pharmacists advised doctors to use Dextran and Amino acid injection for adding colloidal solution instead of albumin, and successfully saved several lives with serious crush syndrome (Chen et al 2010).

4.2 Promoting rational drug use

4.2.1 Suggesting better treatment plans

Clinical pharmacists, who are familiar with pharmacokinetics, pharmacology and pharmacy, could choose suitable drugs, adjust drug dosage and suggest better treatment plans, especially for special patients. Crush syndrome was common after earthquake, which is a serious medical condition characterized by major shock and renal failure after a crushing injury of skeletal muscle. Individualized treatment plans should be considered for those patients who had renal insufficiency. In our hospital during Sichuan earthquake relief, there was a patient who was suspected to be infected with gram-negative bacterium (Chen et al 2010). Considering about his crush syndrome, our pharmacists advised doctor to use drugs which have little effect on kidney function or failing to excrete in urine via the kidneys (e.g. cefoperazone and ceftriaxone). Apart from renal insufficiency, patients who

have hepatic insufficiency or chronic disease that need long-term medications require special attention to their drug use. Additionally, clinical pharmacists should also pay attention to treatment of children, pregnant women and the elderly.

4.2.2 Prescription audit

Clinical pharmacists are responsible for drug safety monitoring. Apart from reporting adverse drug reaction (ADR), they could contribute to reducing the incidence of ADR (Chen et al 2010). Incidence of ADR is particularly higher in patients with multi diseases, because it is positively correlated with the number of administered drugs. It is difficult to make a rational treatment plan alone for multi diseases patients. In addition, in an emergency like earthquake, the efficacy of drugs is usually considered at first. And there is no time to think much about the adverse drug reaction. In order to reducing ADR, Clinical pharmacists could conduct prescription audit to prevent irrational drug use, such as over-dose drug use and negative drug interactions.

4.2.3 Providing information and guidance of drugs

Compliance of patients affects the outcome of therapy. However, there are too many factors that cause patients taking drugs not as drug therapies. In order to improve compliance of patients, clinical pharmacists could instruct patients to take drugs rationally (Chen et al 2010; Zhang et al 2010). They could provide information about the effects, proper dosage and usage, and potential adverse effect of drugs for patients. In addition, clinical pharmacists could provide information and guidance for local residents and relief workers.

Improving use of donated drugs could avoid wasting resources. But doctors are not familiar with donated drugs. Clinical pharmacists could introduce donated drugs to doctors, provide them with information on indication, efficacy, dosage, adverse effect, precautions and warnings of those drugs, and change their prescribing habits. In our hospital, the utilization rate of donated drugs was significantly improved in the effort of our clinical pharmacists (Zhang et al 2008).

4.3 Making therapeutic decisions alone

Clinical pharmacists have the ability to make and implement therapeutic decisions alone when a clear diagnosis is made by doctors (Chen et al 2010). Earthquake can cause a large number of injured. Facing too many patients after earthquake, it is crucial to distribute limited medical personnel reasonably. Optimizing the diagnosis and treatment procedures could greatly improve the efficiency of treating patients. Clinical pharmacists are familiar with clinical use of drugs and have the ability to make therapeutic decisions alone for the patients with common diseases such as diarrhea, upper respiratory tract infection and soft tissue or superficial infection, when a clear diagnosis is made. In addition, clinical pharmacists are responsible for making *the Detailed Rules of the Reasonable Application of Antimicrobial Agents* in many hospitals. They are vital in treating infective diseases which are common after earthquake. Therefore for part of medical disease, they also have the ability to make therapeutic decisions alone.

Clinical pharmacists can play an important role in medical response after an earthquake and thus should be included in the medical relief team. Hospitals especially those undertake medical relief should routinely employ clinical pharmacists. In addition, experienced clinical pharmacists can be sent to the earthquake-stricken place for the benefit of the injured to achieve a better treatment outcome.

5. Pharmaceutical administration in medical response to an earthquake

Multi-sectoral collaboration is vital in a relief operation. A survey in 2006 showed that 84% of pharmacy in the investigated hospitals had participated in emergency exercise (Hsu et al 2006). Pharmaceutical administration is a key link to keep the medical response work in an orderly way. As different influencing factors exist in earthquake stricken areas distributed all over the world and decision makers may face new problems in each disaster, there can hardly a guideline for the administration work. The past experience can be important evidence for making decisions.

5.1 Devising an emergency plan

Earthquake could occur in a sudden, and in a flash. It is difficult to take an emergency evacuation or fight against earthquake. It can cause a large number of life and material losses. Pharmacy should be prepared for disasters such as earthquake. It is necessary to devise a well-developed emergency plans for earthquake (Rao et al 2009; Tong & Xiao 2008). Once the disaster happened, pharmacy could supply drugs rapidly and timely. Firstly, an *Earthquake Relief Drug List* should be made, which is the directory for drug supply in emergency. Secondly, there should be an emergency team, which can make a response to earthquake quickly. Five parts comprise the emergency team, which is respectively responsible for clinical pharmaceutical care, controlled drug management, drug purchase, transportation and dispensing (Rao 2009). All members of emergency team must be on call at any time (Tong & Xiao 2008).

5.2 Management of drug supply

5.2.1 Core principle of drug supply

Drug supply should be based on the major diseases in different periods of earthquakes (Xing et al 2008; Xu et al 2008; Cui et al 2010). After Sichuan earthquake, drug supply respectively focused on emergency drugs for trauma, antimicrobial agents and antipsychotics in different periods. In 1995, Kobe Earthquake caused several fires. Drug supply included emergency drugs for burn (Tong & Xiao 2008). In addition, disinfectant and vaccine are necessary in earthquake relief.

5.2.2 Emergency drug purchase

Our hospital, a women and children specialized hospital, is about 100 kilometers away from the epicenter of Sichuan earthquake and closed to the affected area. A large number of the injured were accepted in our hospital. But the area of drug warehouse in our hospital is very small so that the stock of emergency drugs is serious low. In the night of the day earthquake happened, pharmacy made an emergency purchase plan based on drug use of the injured in

earthquake and stock of drugs, and informed the supply companies immediately. The day after earthquake, we revised the purchase plan and decided to store 3 to 10 times of the monthly average amount for emergency drugs, and 2 times for common drugs (Xu et al 2009), considering about the major diseases after earthquake, and the characteristics of our hospital and drugs. What's more, we kept in contact with each of the supply companies during earthquake relief.

5.2.3 The way to obtaining drugs in the stricken area

There are still many situations beyond our expected, although we prepared well for medical relief. Therefore, it is an important way to obtain drugs from other organizations and help each others. It is reported that in an international relief for Haiti Earthquake, there was no pediatric formulations and some special drugs in a mobile hospital, for example, oxytocin, which is necessary for a pregnant in labor and a woman with continuous vaginal bleeding after incomplete abortion (Yang et al 2006). Fortunately, they borrowed that from local Spanish Red Cross. What's more, the hospital was seriously lack of drugs after a few days of relief operation (Yang et al 2006). But with the help of local army, non-governmental organization and international counterparts, the hospital obtained drugs for 1500 patients.

5.3 Management of donated drugs

It was estimated that about 2500 tons of drugs and medical supplies had been sent directly to Armenian by the end of 1989 after the earthquake in 1988 (Autier et al 1990). But 8% of those donations had already expired on arrival, 11% was proved to be useless, 21% was not for emergency situation, and 20% had been destroyed. Only 30% could be immediately regarded as usable drugs. These proportions were striking. In Sichuan Earthquake, there were a big difference between types of donated drugs and the actual demands in our hospital (Lin et al 2010).

Although it was recognized that the management of donated medicines is important many years ago, there are still many problems need to be pay attention. According to the reviewed papers and our own experience, we provided some suggestions for management of donated drugs in order to avoid wasting resources.

- Management of the received donated drugs, including repository, records of receiving and dispensing and the statistical data, should be separated from the common drugs in a hospital (Tong & Xiao 2008).
- Providing information of clinical drug use to the organizations or individuals who are interested in donating .
- Promoting the clinical use of the donated drugs (Zhang et al 2008).
- Selling the remainder of the donated drugs in hospitals after the permission of donors has been obtained (Lin et al 2008).

Decision makers can conduct pharmaceutical administration work based on evidence from those good experiences. In case that the disaster occurs in a sudden, an emergency plan should be made by local government and hospitals; An earthquake relief drug list

can be made to ensure essential relief drugs are well prepared; The drug purchase plan can be flexible, as the types and quantity of drugs used after an earthquake may be different from routine treatment; The obtaining of drugs can vary a lot depending on different situation; The management of donated medicines should be effective to avoid waste and ensure good quality.

6. Conclusion

After an earthquake occurred, trauma is the dominated disease within the first week, during the medical response, hundreds of drugs can be involved in the treatment of injured patients, but antibiotics and drugs correcting water, electrolyte and acid-base disturbances were most frequently used. Antibiotics for gram-positive bacterium and anaerobe are recommended by WHO and CDC for prophylaxis and treatment of wound infections, but antibiotics for gram-negtive bacterium should also be equipped by medical relief teams and hospitals.

The pharmacist can play an important role in supply and rational use of drugs in an earthquake medical response, by providing drug information and participating in the decision-making. Past experience from earthquake medical relief had provided evidence for management of drug supply and donated drugs in pharmaceutical administration after an earthquake.

7. References

Autier P.; Férir MC.; Hairapetien A.; Alexanian A.; Agoudjian V.; Schmets G.; Dallemagne G.; Leva MN. & Pinel J. (1990). Drug supply in the aftermath of the 1988 Armenian earthquake. *Lancet,* Vol.9, No.335, (Jun 1990), pp. 1388-1390, ISSN 0140-6736

Centers for Disease Control and Prevention. (2010) Emergency preparedness and response: emergency wound management for healthcare professionals. Atlanta: Centers for Disease Control and Prevention. Retrieved from <http://emergency.cdc.gov/disasters/emergwoundhcp.asp#guidance or http://www.bt.cdc.gov/disasters/pdf/emergwoundhcp.pdf>

Chen L.; Guo YJ.; Lan Y. & Zhang LL. (2010). Pharmaceutical support role of clinical pharmacist in earthquake medical assistance. *China Pharmacy*, Vol.21, No.5, (2010), pp. 390-392, ISSN 1001-0408

Coburn A. & Spence R. (1992). *Earthquake protection (Second Edition)*, Wiley, ISBN 0-470-84923-1, Chichester, England

Cui J.; Zhang JH.; Wu F. & Liu AB. (2010). Drug supply during earthquake emergency rescue: experience from Haiti. *China Journal of Emergency Resuscitation and Disaster Medicine*, Vol.5, No.9, (Sep 2010), pp. 805-807, ISSN 1673-6966

Durkin ME. & Thiel CC. (1992). Improving measures to reduce earthquake casualties. *Earthquake Spectra*, Vol.8, (1992), pp. 95-113, ISSN 8755-2930

Ferris D. (2010). Pharmacist's assistance after Haiti earthquake. *American Journal of Health-System Pharmacy*, Vol.67, No.14, (Jul 2010), pp. 1138, 1141, ISSN 1079-2082

Han L, Zeng LN, Guo C, Lan Y, Wang L, Luo C, Zhang LL (2009). Utilization Analysis of Drug Efficacy of the 329 Cases of Wenchuan Earthquake Women and Children Patients. *Chinese Journal of Evidence-Based Medicine*, Vol.9, No.3, (2009), pp. 265-272, ISSN 1672-2513

Hogerzeil HV.; Couper MR. & Gray R. (1997). Guidelines for drug donations. *British Medical Journal*. Vol.314, No.8, (Mar 1997), pp. 737-740, ISSN 0959-8146

Keven K, Ates K, Sever MS, et al. (2003) Infectious complications after mass disasters: the Marmara earthquake experience. *Scandinavian Journal of Infectious Diseases*. Vol.35, No.2, (2003), pp. 110-113, ISSN 0036-5548

Kiani, QH.;Amir, M,; Ghazanfar, MA. & Iqbal, M. (2009). Microbiology of wound infections among hospitalised patients following the 2005 Pakistan earthquake. *The Journal of Hospital Infection*. Vol.73, No.1, (2009), pp. 71-78, ISSN 0195-6701

Li J.; Shang L.; Zhu P. & Tang Y. (2008). Analysis of antibiotic for the injured in the 5.12 earthquake in west china hospital. *West China Medical Journal*, Vol.23, No.5, (2008), pp. 1057, ISSN 1002-0179

Li J.; Xu T.; Liu KX. & Tang Y. (2009). Analysis of drug used in the injured within 3 weeks after Wenchuan earthquake. *China Pharmaceuticals*, Vol.18, No.15, (2009), pp. 46, ISSN 1006-4931

Lin YZ.; Xu QF.; Liu SL.; Liu YT.; Luo C. & Zhang LL. (2010). Management of donated drugs viewed from perspective of the use of the donated drugs following earthquake disaster. *China Pharmacy*, Vol.21, No.1, (2010), pp. 17-20, ISSN 1001-0408

Liu XJ.; Fan HJ.; Chen W. et al. (2011). Statistical analysis of category of earthquake related diseases. *China Journal of Emergency Resuscitation and Disaster Medicine*, Vol.6, No.2, (Feb 2011), pp. 100-101, ISSN 1673-6966

Ma MX.; Guo P.; Xiao YY. et al. (2008). Chang of patterns of diseases and medical rescuing measurement after earthquake. *Journal of Sun Yat-Sen University (Medical Sciences)*, Vol.29, No.3, (Apr 2008), pp. 372-374, ISSN 1672-3554

Miskin IN.; Ran NP.; Block C. et, al. (2010). Antimicrobial Therapy for Wound Infections after Catastrophic Earthquakes. *The New England Journal of Medicine*, Vol.363, No.26, (Dec 2010), pp. 2751-2753, ISSN 0028-4793

Naghii MR. (2005). Public health impact and medical consequences of earthquakes. *Pan American Journal of Public Health* Vol.18, No.3, (Sep 2005), pp. 216-221, ISSN 1020-4989

National Geophysical Data Center. The Significant Earthquake Database. 2011-03-13 Available from:
<http://www.ngdc.noaa.gov/nndc/struts/form?t=101650&s=1&d=1>

Noji EK. (1992) Medical and health care aspects of the Spitak-88 earthquake. *Proceedings of the International Seminar on the Spitak-88 Earthquake*. Yerevan, S.S.R. of Armenia. May, 1989

Pretto EA.; Angus DC.; Abrams JI. et al. (1994). An analysis of prehospital mortality in an earthquake. *Prehospital and Disaster Medicine*, Vol.9, No.2, (Apr-Jun 1994), pp. 107-117, ISSN 1049-023X

Ran YC, Ao XX, Liu L, Fu YL, Tuo H, Xu F. (2010) Microbiological study of pathogenic bacteria isolated from paediatric wound infections following the 2008 Wenchuan

earthquake. *Scandinavian Journal of Infectious Diseases*. Vol.42, No.5, pp. 347-350, ISSN 0036-5548

Rao YY.; Ning H. & Yu JP. (2009). Pharmaceutical care in disaster assistance in large earthquake. *China Pharmacy*, Vol.20, No.34, (2009), pp. 2646, 2648, ISSN 1001-0408

Schultz CH.; Koenig KL. & Noji EK. (1996). A Medical Disaster Response to Reduce Immediate Mortality after an Earthquake. *New England Journal of Medicine*, Vol.334, No.7, (Feb 1996), pp. 438-444, ISSN 0028-4793

Tong RS. & Xiao BR. (2008). Experience and thoughts on hospital pharmaceutical service after disaster outbreak. *Practical Journal of Clinical Medicine,* Vol.5, No.6, (Nov 2008), pp. 35-37, ISSN 1672-6170

Wang, Y.; Hao, P.; Lu, B.; Yu, H.; Huang, W.; Hou, H. & Dai, K. (2008) Causes of infection after earthquake, China. *Emerging Infection Disease.* Vol.16, No.6, (Jun 2010), pp. 974-5, ISSN: 1080-6059

World Health Organization. (2009). Definition and general considerations. In: DDD. 2011-06-03, Available from:
< http://www.whocc.no/ddd/definition_and_general_considera/>

World health organization. (2010). Prevention and Management of Wound Infection. World health organization. Retrieved from
<http://www.who.int/entity/hac/techguidance/tools/guidelines_prevention_and_management_wound_infection.pdf>

World Health Organization. (May 2010). Medicines: rational use of medicines. 2011-5-26, Available from:< http://www.who.int/mediacentre/factsheets/fs338/en/ >

World Health Organization (2011). Earthquakes - Technical Hazard Sheet - Natural Disaster Profile. In : health action crisis. 2011-05-01, Available from:
<http://www.who.int/hac/techguidance/ems/earthquakes/en/>

Xing M.; Wang Q.; Jiang M. & Zhang EJ. (2008). Drug supply during earthquake disaster: experience from Wenchuan Earthquake. *Acta Academiae Medicinae Militaris Tertiae,* Vol.30, No.16, (Aug 2008), pp. 1578-1579, ISSN 1000-5404

Xu QF.; Lin YZ.; Liu YT. & Zhang LL. (2009). Emergency drug supply mechanism in Women and Children's Special Hospital during earthquake disaster. *China Pharmacy*, Vol.20, No.34, (2009), pp. 2679-2681, ISSN 1001-0408

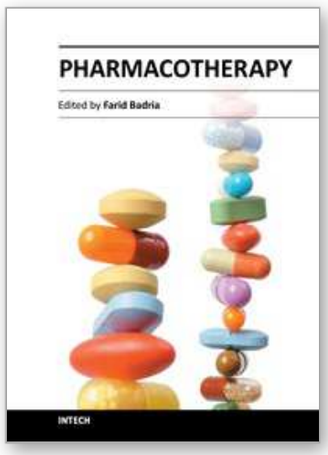
Xu Y.; Wei QZ.; Meng H. & Liu S. (2008). Drug supply of field medical team in earthquake relief. *Pharmaceutical Care and Research,* Vol. 8, No.5, (Oct 2008), pp. 385-386, ISSN 1671-2838

Yang ZC.; Peng BB.; Bai XD.; Zhang YQ. & Guan XP. (2006). Drug supply during earthquake emergency rescue in Pakistan. *Medical Journal of the Chinese People's Armed Police Forces,* Vol.17, No.2, (Feb 2006), pp. 148-149, ISSN 1004-3594

Yuan CJ. & Zhang XF. (2009). Analysis of drug application in "5.12"Wenchuan major earthquake. *China Medical Herald*, Vol.6, No.1, (2009), pp. 133-134, ISSN 1673-7210

Zhang LL.; Lin YZ.; Chen L.; Liu YT.; Liu SL.; Xu QF. & Han L. (2008). Emergency pharmaceutical administration of hospital for women and children in medical rescue after Wenchuan earthquake. *Chinese Journal of Evidence-Based Medicine*, Vol.8, No.9, (2008), pp. 692-697, ISSN 1672-2513

Zhang LP.; Zhang Y.; Tang HH.; Li J. & Yang ZW. (2010). Pharmaceutical care and drug supply in hospital during emergency disaster. *Pharmaceutical Journal of Chinese People's Liberation Army*, Vol.26, No.3, (Jun 2010), pp. 282-283, ISSN 1008-9926



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The intent of this book is to provide an overview of current conceptualizations of Pharmacotherapy. The book focuses on three major areas; diagnosis, treatment, and prevention for a wide array of diseases; Cognitive and Psychological disorders (Schizophrenia and Nicotine addiction), Inflammatory disorders (New Chemical anti-inflammatory and Immunotherapy), updated antihypertensive therapy and healing of ulcers with venous origin. A separate chapter is dedicated to the rationality of drug use in earthquake injuries. The last chapter deals with Imaging of potential therapeutic or diagnostic agents in animal models in the early stage of research. We hope this book is useful to a wide range of people, from students first learning about Pharmacotherapy, to advanced clinicians and researchers.

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