Mass Casualty Incident Primary Triage Methods in China

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Abstract

Objective: To evaluate the technical characteristics and application of mass casualty incident (MCI) primary triage (PT) methods applied in China.

Data Sources: Chinese literature was searched by Chinese Academic Journal Network Publishing Database (founded in June 2014). The English literature was searched by PubMed (MEDLINE) (1950 to June 2014). We also searched Official Websites of Chinese Central Government’s (http://www.gov.cn/), National Health and Family Planning Commission of China (http://www.nhfpc.gov.cn/), and China Earthquake Information (http://www.csi.ac.cn/).

Study Selection: We included studies associated with mass casualty events related to China, the PT applied in China, guidelines and standards, and application and development of the carding PT method in China.

Results: From 3976 potentially relevant articles, 22 met the inclusion criteria, 20 Chinese, and 2 English. These articles included 13 case reports, 3 retrospective analyses of MCI, two methods introductions, three national or sectoral criteria, and one simulated field testing and validation. There were a total of 19 kinds of MCI PT methods that have been reported in China from 1950 to 2014. In addition, there were 15 kinds of PT methods reported in the literature from the instance of the application.

Conclusions: The national and sectoral current triage criteria are developed mainly for earthquake relief. Classification is not clear. Vague criteria (especially between moderate and severe injuries) operability are not practical. There are no triage methods and research for children and special populations. There is no data and evidence supported triage method. We should revise our existing classification and criteria so it is clearer and easier to be grasped in order to build a real, practical, and efficient PT method.

Key words: Mass Casualty Incident; Prehospital; Primary Triage; Standards; Systematic Review

INTRODUCTION

Mass casualty incident (MCI) refers to earthquakes, landslides, floods, terrorist attacks, toxic chemical spills, and explosions, etc., which result in a large number of casualties.¹ Primary triage (PT) is a system of health rescue resource allocation that is used to determine the priority of treatment of injuries, evacuation, and transport to the medical treatment points. PT is often carried out by professional rescue personnel or medical personnel who enter the disaster site first. The core of PT is to allow the overwhelming majority of the wounded get the maximum benefit overall with limited health resources, and ensure sure fair and efficient allocation to each of the injured individuals.² PT is the first step in the medical rescue, and guarantees that if effective treatment is administered to injuries within the “golden time,” the injury death rate is reduced. China’s research in this field started late and development is lagging behind. Although China has suffered a series of major disasters such as 6.8-magnitude earthquake in Xingtai in 1966, a 7.8-magnitude Tangshan earthquake in 1976, a 8.0-magnitude Sichuan Wenchuan earthquake in 2008, Gansu Zhouqu landslides in 2010, and a 7.0-magnitude Lushan earthquake in 2013, PT method of MIC has not yet formed a unified understanding and standard in our country. Different departments and rescue teams are still using different methods and standards. It is
important to know what the technical characteristics and problems of these methods. How was their application? Do they need to be revised? In this study, we explored the application and development of PT methods in China and made a comparative analysis of the technical characteristics and the scope of different PT methods.

**Methods**

**Data sources**

Chinese literature was searched by Chinese Academic Journal Network Publishing Database (CAJD) (founded in June 2014). English literature was searched by PubMed (MEDLINE) (1950 to June 2014). We also searched Official Websites of Chinese Central Government’s (http://www.gov.cn/), National Health and Family Planning Commission of China (http://www.nhfpc.gov.cn/), and China Earthquake Information (http://www.csi.ac.cn/). We identified a broad set of Chinese and English search terms to encompass each facet of the inclusion criteria. The search included free text and Medical Subject Headings terms. We chose “triage” OR “triage method,” OR “triage system,” OR “PT,” OR “on-site triage,” OR “mass casualty incidence,” OR “disaster triage,” OR “medical triage,” OR “earthquake” to describe the concept of PT. We limited the range of country as AND “China” OR “Chinese.” We queried CAJD and PubMed on July 26, 2014.

**Study selection**

Two reviewers (Jun Yang and Jin-Hong Chen) independently examined the results returned by the MEDLINE and CAJD search to identify potentially relevant abstracts. Articles that clearly did not meet at least one of the review criteria according to the title and abstract were not considered. When the two reviewers disagreed, a consensus was reached through discussion. We retrieved full-articles for the potentially relevant abstracts. The same two reviewers independently examined the full-text articles to determine which article met at least one of the inclusion criteria. Disagreements were again resolved through discussion to reach a final consensus set of articles that met the review criteria.

**Literature inclusion criteria**

This review of literature inclusion criteria included: (1) Literature on Chinese MCI on-site wounded PT; (2) Literature on Chinese primary natural disaster on-site PT of the wounded; (3) Literature on Chinese accidents, disasters, and social security incidents on-site PT; (4) Literature on Chinese PT introduction; (5) Literature on Chinese PT case study; (6) Literature on Chinese PT methodology evaluation; (7) Literature on scene simulation deduction of Chinese PT methods.

**Literature exclusion criteria**

(1) Literature does not meet the above inclusion criteria; (2) Non-English and non-Chinese literature; (3) Non-PT literature.

**Data collection and processing**

We used a modified data extraction form according to the resource available online at http://www.annemergmed.com to record information about the methods and results of each relevant article including study design, sample size, primary findings, name of the triage method, scope (the disaster, the study population), priorities division, criteria for the classification, criteria of judgment, marking methods, technical characteristics, and problems and applications.

**Assessment of literature quality**

To assess the methodological quality of the studies, we applied the four levels GRADE system. Quality level A included randomized trials without serious limitations or well-performed observational studies with very large effects (or other qualifying factors). Quality level B included randomized trials with serious limitations and well-performed observational studies yielding large effects. Quality level C included randomized trials with very serious limitations or observational studies without special strengths or important limitations. Quality level D included randomized trials with very serious limitations and inconsistent results or observational studies with serious limitations and unsystematic clinical observations (e.g., case series or case reports).

**Results**

The MEDLINE and CAJD query returned 3976 abstracts including 3534 Chinese and 442 English. The reviewers identified 87 abstracts for full-text retrieval. Of which, 22 articles (20 Chinese, 2 English) satisfied the criteria for inclusion criteria.

There were 13 case reports, 3 retrospective analyses of various types of MCIs, 2 PT method introductions, 1 national standard, 2 sectoral standards, and 1 simulated field testing and validation. We found that the quality level D contained 18 articles and quality level C contained one article. Three articles were not scored because of they were national standard or methods.

**Application of different triage methods**

Nineteen kinds of triage methods have been reported in China from 1950 to 2014. Other than the American “simple triage and rapid treatment” (START), the rest are all domestic methods which included one national standard and two methods. There are 15 triage methods that have been reported in practical application to earthquakes, war, accidents, mining traffic accidents, and mass casualty events, etc.

The Ministry of Public Health PT Standard (1995), the “Five-step Method,” and the danger, reaction, airway, breath, and circulation (DRABC) have been reported as being practically applied on more than two occasions. The other methods were not reported repeatedly. Among national level methods and standards, only the Ministry of Health PT Method (1995) was applied in 2008 Wenchuan earthquake rescue site. Others have not been practically reported [Table 1].
| Author, time | PT method | Disaster | Operator | Classification levels | Classification criteria | Tools | Judgment criteria(quantitative/qualitative) | Marking color |
|-------------|-----------|----------|----------|-----------------------|-------------------------|-------|------------------------------------------|--------------|
| Zhou, 2008  | TI        | Wenchuan Earthquake | Doctors and nurses | Minor, moderate, severe and death | TI score | Classified marking cards, sphygmomanometer | Qualitative: injury location, type, severity, existence of respiratory dysfunction, consciousness; Quantitative: SBP <50 mmHg, Pulseless or pulse <55/min=6, SBP 50–70 mmHg, pulse>140/min=5, SBP 70–100mmHg, pulse 100–140/min=3 | Green, yellow, red, black |
| Zhang, 2011 | –         | Traffic accident | Doctors and nurses | Minor, moderate, severe and death | – | Classified marking cards | – | Green, yellow, red, black |
| Zhang, 2007 | Five-step Method | Traffic accident | Doctors and nurses | Minor, moderate, severe | Consciousness, respiratory, circulatory, injury severity | Sphygmomanometer | Qualitative: existence of suffocation, cyanosis/pallor, jugular ven distention, chest asymmetry, pulse abnormalities, unconscious; quantitatively: blood pressure (without specific value) | Green, yellow, red, black |
| Yang, 2009  | START     | Mine disaster | Doctors and nurses | Minor, moderate, severe and death | Consciousness, respiratory, circulation | Classified marking cards | Qualitative: existence of spontaneous breathing, pulseless, purposeful movement; Quantitative: respiratory rate >30/min, Capillary filling time >2 s as priority I | Green, yellow, red, black |
| Li, 2010    | PT of mass poisoning incident | Mass poisoning | Doctors | Minor, moderate, severe and death | Consciousness, respiratory, circulatory, burns/chemical burn severity, seizures | Classified marking cards | Qualitative: existence of consciousness, seizures, respiratory dysfunction, special burned location; Quantitative: respiratory rate >30 or <6/min, Capillary filling time >2 s, chemical total burn area >50%, or III burn area >20% as priority I | Green, yellow, red, black |
| Lin, 2010   | TC        | MCIs | Doctors and nurses | Minor, moderate, severe and death | Consciousness, respiratory, circulatory, injury type and location | Classified marking cards, sphygmomanometer | Qualitative: injury location, type, existence of consciousness, respiratory dysfunction; Quantitative: SBP <90 mmHg, pulse rate >120/min, respiratory rate >30 or <12/min, or 4.6 m above falling as priority I | Green, yellow, red, black |
| Ye, 2008    | –*       | Wenchuan Earthquake | Doctors and nurses | Minor, moderate, severe | Consciousness, blood pressure, pulse, respiration, Temperature | Classified marking cards, sphygmomanometer, thermometers | Qualitative: existence of consciousness, movement ability; quantitatively: blood pressure, pulse rate, respiratory, body temperature (without specific values) | Green, yellow, red |
| Chen, 2008  | –        | Wenchuan Earthquake | Doctors and nurses | Minor, moderate, severe and very severe | – | Classified marking cards | – | – |
| Jiang, 2009 | –         | MCIs | Doctors and nurses | Minor, moderate, severe and death | Consciousness, respiratory, circulatory | Classified marking bend | Qualitative: existence of consciousness, respiratory, circulation; quantitatively: respiratory rate >30 or <8/min as priority I | Green, yellow, red, black |
| Zhao, 2007  | –         | MCIs | Senior physicians | Minor, moderate, severe and death | Vital signs, blood pressure, pulse | Classified marker | Qualitative: existence of consciousness, respiratory, vital signs, walk ability; Quantitative: SBP <90 mmHg, pulse rate >120/min as priority I | Green, yellow, red, black |
| Feng, 2008  | Five-level classification method | Wenchuan Earthquake | Doctors and nurses | Minor, moderate, severe, serious, and death | Injury type, location, severity | – | Qualitative: existence of intracranial hypertension, respiratory dysfunction, hemorrhage, multiple injuries, tendency of organ dysfunction, dying | – |
| Author and year | Disaster | Classification criteria | Judgment criteria (quantitative/qualitative) | PT method | Operator | Classification levels | Tools |
|----------------|----------|-------------------------|---------------------------------------------|-----------|----------|-----------------------|-------|
| Sun, 1987      | Doctors  | Consiousness, injury location, severity, pressure | Qualitative: SBP <90 mmHg means shock, pulse rate | MCI       | Doctors | Minor and moderate | –     |
| Lu, 1997       | Doctors  | Consiousness, injury location, severity, pressure | Qualitative: existence of hemorrhage, shock, respiratory dysfunction | DRABC     | Doctors | Minor and moderate | –     |
| Liu, 2007      | DRABC    | Consiousness, injury location, severity, pressure | Qualitative: existence of stimulus response, respiratory dysfunction, cyanosis/pallor, Capillary filling time >2s | MCI       | Doctors | Minor and moderate | –     |
| Huang, 2004    | Traffic accident | Consiousness, injury location, severity, pressure | Qualitative: existence of stimulus response, respiratory dysfunction | Modified ABCD method | Doctors, nurses | Minor and moderate | –     |
| Yang, 2001     | Traffic accident | Consiousness, injury location, severity, pressure | Qualitative: existence of stimulus response, respiratory dysfunction | DRABC     | Doctors, nurses | Minor and moderate | –     |
| Zhao, 2007     | Earthquake | Consiousness, injury location, severity, pressure | Qualitative: existence of stimulus response, respiratory dysfunction | Modified ABCD method | Doctors, nurses | Minor and moderate | –     |
| Huang, 2004    | Earthquake | Consiousness, injury location, severity, pressure | Qualitative: existence of stimulus response, respiratory dysfunction | Modified ABCD method | Doctors, nurses | Minor and moderate | –     |
| Ministry of Public Health, 2008 | Earthquake | Consiousness, injury location, severity, pressure | Qualitative: existence of stimulus response, respiratory dysfunction | DRABC     | Doctors, nurses | Minor and moderate | –     |
| Ministry of Public Health, 1995 | Wenchuan Earthquake | Consiousness, injury location, severity, pressure | Qualitative: existence of stimulus response, respiratory dysfunction | DRABC     | Doctors, nurses | Minor and moderate | –     |
| Fan, 2011      | Wenchuan Earthquake | Consiousness, injury location, severity, pressure | Qualitative: existence of stimulus response, respiratory dysfunction | Modified ABCD method | Doctors, nurses | Minor and moderate | –     |

According to the Ministry of Public Health, the Guideline of Disaster Relief (1995); –: Without or not being indicated clearly; TIC: Trauma index; POC: Point-of-care; IVC: Inferior vena cava; SBP: Systolic blood pressure.
Triage priorities and levels

Triage priority schemes vary among the 19 kinds of triage methods in China. However, all these methods followed the same principle: “Do the greatest good for the greatest number,” and put forward clear classifications for the injured. According to medical treatment and evacuation priorities, all the wounded were classified into 2–5 levels [Table 1]. Other than Yang’s two-level classification (minor and severe),[19] and Feng’s five levels classification (minor, moderate, severe, serious, and death),[14] the others classified the on-site wounded into four levels: Minor, moderate, severe, and death, respectively. These four levels were identified with green (or blue), yellow, red, and black color codes. The Ministry of Health Triage Standard (1995) clearly defined its color code as “5 cm × 3 cm adhesive materials,” the rest were not clearly stated. Except literature,[5,11,23,25] the others all specified their classification standard and judgment criteria. Classification based on (1) physiological index and (2) injury type, location, and severity. Their judgment criteria could be divided into two types: (1) Qualitative indicators and (2) Quantitative indicators. The former included conscious state, respiratory function, circulation and perfusion, the injured area, and the type of injury, etc. The latter included blood pressure, pulse/heart rate, respiratory rate, capillary refill time, burn area, and degree.

Operator and tools of triage

All the on-site triage action was performed primarily by doctors and nurses. Only one triage method[24] was equipped with a portable ultrasound system and was carried out under the assistance of ultrasound technologists [Table 1]. Six triage methods were done with a sphygmomanometer. The rest were only with classified marking cards, thermometers, and other simple tools. Therefore, most of the triage methods used in China was unarmed.

Evaluation methodology

There were a total of 12 literature findings related to the methodology evaluation on classification. However, only one conducted a comprehensive evaluation methodology with total accuracy rate, over triage rate, under triage rate, and the average time of a PT on mass chemical poisoning accident scene.[19] The average triage time was 2.69 s per victim and the total accuracy rate reached 49%. However, the over triage rate and missed detection rate were as high as 36.8% and 11.3%, respectively. Other literature applied clinical treatment effects as evaluation methodology indicators such as prehospital treatment success rate (9 literatures), on-site treatment success rate (1 literature), and the overall survival rate of victims (1 literature).

Discussion

Triage method development history in China

The practice of Chinese triage also arose from the exigencies of war. As the Chinese army is the main disaster rescue force, the earliest Chinese triage literature, that we could collect, was a case report of the Tangshan earthquake rescue experience published in the People’s Military Magazine (1977).[26] According to the wounded rescue space sequence, the author introduced a vehicle outpatient-inpatient departments-specialist treatment four-step triage method. In fact, this literature introduced the whole triage system for the Tangshan earthquake which included PT, second triage, Emergency Department triage, and specialist triage (Surgery Department; Intensive Care Unit; Medicine Department). The break out of the 1979 China Vietnam War (February 17, 1979) promoted the development of triage key technology for mass war-field and disaster casualty. At that time, there was no consensus and uniform regulation on how to triage. All triage operations were carried out based on experience. Until the early 1980s, Li[27] summarized mass casualty triage techniques and experience on the battlefield and proposed a triage method with comprehensive judgments based on the combining injury site, injury type, and cause. The author also described the triage task focus, material support, staff, and so on for different medical rescue institutions on the battlefield, tactical rear, and rear hospitals. Unfortunately, all the above literature failed to offer their priority, marking methods, and judgment standards in detail. In 1987, Sun reported a battlefield triage method, named the three-step method,[15] which included a process of “look, check, and rescue.” The wounded were sorted into three categories (minor, moderate, and severe) according to the situation. This triage method assigned a clear priority based on the seriousness of the injury with severe injuries being addressed immediately and minor injuries delayed. The author also provided injury check order “head, chest, abdomen, and then extremities.” “Look” means the observation of complexion, facial expressions, awareness, and the distribution and size of the injured area. “Check” meant measurement of blood pressure and pulse. “Rescue” meant first medical aid and follow-up treatment. However, neither specific qualitative or quantitative criteria nor marking method was clearly offered in this article. In 1995, the Chinese Ministry of Public Health promulgated “Management Measures for Disaster Medical Rescue,”[23] which sorted the victims on-site into minor, moderate, severe, and death, according to the situation, and marked by blue, yellow, red, and black colored code, respectively. Although, the priority was clearly described as: (1) Save lives other than an injury; (2) The serious first then the minors in this document; it did not provide specific classification methods and standards. Therefore, it did not have the maneuverability. From then on to the 2008 Wenchuan earthquake, there were a total of 11 literatures[4,6,10–14,17–19,25] associated with the nine kinds of PT methods performed in MCI emergency rescue operations. Five different PT methods[4,10–12,14,25] were applied and reported in 2008 Wenchuan earthquake rescue, which means there was still no consensus or standards on PT method.

The lack of a unified and standardized triage method reduced the rescue efficiency and caused difficulties for communication between different rescue teams. Therefore,
Character and deficient of primary triage in China

Triage was introduced 200 years ago by French surgeon Baron Larry (1766–1842) during the Napoleonic Wars (circa 1812). In the early 1980s, START was proposed and widely used. Modern triage technology has developed into a key technology for disaster relief and emergency prehospital casualty rescue operation. At present, there are more than 10 kinds of triage methods reported in the world. Many developed countries (USA, Japan, and Australia, etc.) has built up national normative triage systems and begun to study evidence-based, scientific formulation, and outcome-driven new triage.

Although, compared to other countries, China started late in this field. However, there were a total of 19 kinds of triage methods reported in China from 1950 to 2014. Among which, 15 triage methods have been reported in practical application to earthquakes, war, accidents, mining traffic accidents, and mass casualty events, etc. Five methods were applied to the 2008 Wenchuan earthquake rescue site. However, only The Ministry of Public Health PT Method (1995), the “Five-step Method” and the DRABC have been being practically applied more than 2 times. Modern triage technology attaches great importance to triage classification markings which consist of four elements: (1) Marker color, (2) Marker position, and (4) Tag content. It has been found in this study that only the Ministry of Public Health PT Standard (1995) clearly defined standard maker colors: “Red, yellow, blue, black,” marker material: “5 cm × 3 cm self-adhesive material,” and the marker position: “Injury left chest.” The other 18 kinds of methods have omissions or lack clear instructions in the above-mentioned elements. China has used a variety of PT methods; however, no uniform norms or standards are really performed in rescue practice.

Physiological and pathological characteristics of children (<8 years) are different from adults. Therefore, special classification methods, more well-known as Jump START, PTT, SMART Pediatric, etc., were developed for children. Neither the Ministry of Health methods (1995), nor the national standard (2013) clearly stated whether it is suitable for children.

Classification and evaluation methodology

According to the methodology, triage methods can be divided into qualitative and quantitative methods. The former does not require scoring or calculations to be prompt and efficient. The latter is based on wound severity score and prognosis of quantitative evaluation. Therefore, quantitative methods are more accurate and professional. Nonetheless, relatively complex and time-consuming. PT methods applied to the site of MCI require its core principle to be a fast and accurate classification and treatment of the wounded, to ensure the maximum utility of limited resources and minimize the number of casualties. Consequently, most rescue teams have selected qualitative classification methods. In all the 19 kinds of PT methods applied in China, only the Trauma Index Method was a quantitative method. The others including the Ministry of Public Health method and the national standard, all applied a qualitative method. Accurate classification under the premise of improving efficiency is a hot study topic at present. Regardless of a qualitative or quantitative triage method, high triage speed means less triage time and declined accuracy, which mainly reflects the increase of over triage rate or under triage rate. However, because of chaos at the scene, the relative lack of medical resources on site, and secondary disasters, once a serious injury is missed (false positives for minor injuries), this often leads to serious consequences. Therefore, only a certain number of over triage rate is allowed. The ratio should not exceed 50%. On the other hand, the under triage rate must be controlled under 5%.

Due to the special nature of MCIs, large sample, randomized, controlled study methods cannot be applied in this field. The main evaluation tools of PT methods are retrospective analysis, perspective study, computer simulation tests, simulated site deduction tests, and systematic review. Retrospective analysis is based on trauma center or rescue record database. Different triage methods were...
retrieved and analyzed to comprise the correct rate, over triage rate, and under triage rate of different methods. However, due to the lack of a simulated site environment, the ability of the operator and triage time cannot be evaluated. Perspective studies, computer simulation tests and simulated site deduction tests can give a comprehensive evaluation of correct rate, triage time, over triage rate, under triage rate, and operator ability of different triage methods. In our study, only 1 literature reported a comprehensive evaluation methodology with total accuracy rate, over triage rate, under triage rate, and the average time of a PT on a mass chemical poisoning accident scene.[8] The others were nonrandomized, uncontrolled, descriptive retrospective analyses or case reports, and applied clinical treatment effects as evaluation methodology indicators. Therefore, these literatures were primarily on-site evaluations of the overall medical rescue technology. These literatures contained some reference value but lacked specificity. Coupled with missing data and varying quality, the evaluation methodology of these methods has been limited. Therefore, all of these PT methods including national-level standards, lack of evidence, or supporting data.

**National standard application status and problems**

There were three national-level PT method standards in China. Only the Ministry of Public Health PT Standard (1995) was reported to be applied more than 2 times.[10,25] However, as the first national level PT method (1995) was too simple and fuzzy, without operability, the 2008 method[23] and 2013 standard[21] were designed for earthquake site rescue. These methods need further verification and revision before being applied to all MCIs. According to the national standard (2013),[21] all injuries were prioritized into four levels: “Serious life-threatening trauma,” “heavier trauma,” “mild trauma,” and “dead.” However, there are no specific and clear criteria to judgment. The subjective judgment of the operators made it easy to increase the risk of over triage or under triage.

**Limitation**

First, we may not have captured every article associated with PT method having being applied in China. Chinese and English are the most popular written languages; therefore, we limited the search to the English and Chinese language. However, it is hard to be certain that there are no any relevant articles published in other languages. In the English or Chinese, we primarily searched a single database. Consequently, it is possible that our search terms did not capture all aspects of the topic. Therefore, we attempted to minimize the likelihood of missed articles by applying a broad search strategy. In order to avoid national or sectoral standards in PT for MCIs, we expanded the search range to include government and professional rescue association websites.

Second, some articles were written by military researchers between 1950’s and 1960’s. Due to historical reasons, some of the background, data, and even the name of the author were incomplete and fuzzy. All articles were case reports, method introductions, or a small sample, noncomparative retrospective studies. Therefore, we did not conduct any kind of statistical analysis, which limited the interpretation of the results.

**Conclusions**

Classification and criteria need to be clearer and easier to grasp. Triage methods should clearly indicate whether they apply to children. More attention should be given to children triage methodologies. Referring to the trauma pattern databases, triage databases should be established to provide data and evidence support for further study. Based on the improvement and revision of existing quantitative methods, more attention should be paid on qualitative PT methods. Based on the evidence, mathematical formulas, computer and information technology, and scientifically validated PT technology will be the development direction of this field.

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**Conflicts of interest**

There are no conflicts of interest.

**References**

1. Slater MS, Trunkey DD. Terrorism in America. An evolving threat. Arch Surg 1997;132:1059-66.
2. Pesik N, Keim ME, Iserson KV. Terrorism and the ethics of emergency medical care. Ann Emerg Med 2001;37:642-6.
3. Brozek JL, Akel EA, Alonso-Coello P, Lang D, Jaeschke R, Williams JW, et al. Grading quality of evidence and strength of recommendations in clinical practice guidelines. Part 1 of 3. An overview of the GRADE approach and grading quality of evidence about interventions. Allergy 2009;64:669-77.
4. Zhou YB, Zeng J. First aid on the spot of Beichuan middle school in “5.12” Wenchuan Earthquake (in Chinese). PJCM 2009;5:74-76.
5. Zhang AJ. Rescue experience of mass casualties in traffic accidents (in Chinese). Qinghai Med J 2012;41:54-5.
6. Zhang L. Pre-hospital emergency treatment of mass casualties in traffic accidents (in Chinese). J Qianman Med Coll Natl 2008;21:38.
7. Yang XY. Prehospital first-aid and nursing on massive casualties in a down hole accident (in Chinese). Nuns Res Pract 2010;7:58-60.
8. Li M, Han M, Liu Q, Liang XF, Chu RP, Wang WJ, et al. Simulation test research on sudden chemical poisoning site triage criteria (in Chinese). Hebei Med J 2010;32:3511-2.
9. Lin ZK. Analysis of severe multiple trauma classification and first aid pre-hospital (in Chinese). Mod Med 2010;16:2451-2.
10. Ye C, Li DQ, Li Y. Transportation of mass earthquake casualties (in Chinese). West China Med J 2009;21:124-5.
11. Chen N, Gu Q, Mao SF. Medical earthquake rescue experience in Qingchuan County Myu middle school site (in Chinese). Qiqihar Univ Med J 2009;30:365-6.
12. Jiang L, Tang ZG. Analysis of pre-hospital care in large number of wounded (in Chinese). Public Med Forum Mag 2010;14:194-6.
13. Zhao XJ. Pre-hospital first aid in disaster rescue (in Chinese). J Chin Emerg Med 2008;16:1125-7.
14. Feng L, Wang LM, Chen L, Jiang HW, Wang JX. Method of triage and remedy for earthquake casualties (in Chinese). Med Mod 2009;25:323-5.
15. Sun X. A coordination experience of mass casualties triage (in Chinese). Med J Natl Defend Forces Northwest China 1987;8:80-1.
16. Lu GX. Pre-hospital treatment of mass casualties in disaster (in Chinese). Med J Trauma Disabil 1997;5:33-5.
17. Liu CG. Prehospital first aid and nursing of mass casualty incidents (in Chinese). J Chengde Med Coll 2007;24:285-6.
18. Huang MZ, Wang F. Experience of pre-hospital first aid in traffic accidents (in Chinese). Mod Med 2004;20:1547.
19. Yang QF. First aid and nursing of mass casualties in traffic accidents (in Chinese). J Nanhua Univ 2001;29:105-6.
20. Zhao W. Comments on qualitative and quantitative triage methods on disaster site (in Chinese). Chin J Emerg Resusc Disaster Med 2007;2:291-4.
21. Standardization Administration of the People’s Republic of China (SAC). Operation for Earthquake Search and Rescue Team – Part 2: Procedures and Methods (draft). Available from: http://www.cea.gov.cn/publish/dizhenj/465/539/20130821114718818945567/1376986451786.pdf. [Last accessed on 2013 Sep 01].
22. China Ministry of Public Health. The notice on relative standards for “5.12” Sichuan Wenchuan earthquake emergency medical rescue and treatment (in Chinese). Chin Med Mod Distance Educ China 2008;6:505-8.
23. China Ministry of Public Health. Management Measures in Disaster and Accident Medical Rescue (Health Department Order No. 39). Available from: http://www.moh.gov.cn/zhuzhan/wsbmgzl/200804/4de56996d92f484a0a8b051717eefea.shtml. [Last accessed on 2013 Sep 01].
24. Zhang S, Zhu D, Wan Z, Cao Y. Utility of point-of-care ultrasound in acute management triage of earthquake injury. Am J Emerg Med 2014;32:92-5.
25. Haojun F, Jianqi S, Shike H. Retrospective, analytical study of field first aid following the Wenchuan Earthquake in China (in Chinese). Prehosp Disaster Med 2011;26:130-4.
26. 269 Hospital, 59171 Army. First surgical aid of mass earthquake casualties (in Chinese). Peoples Mil Surg 1977;1:71-4.
27. Li FR. Views on strengthening the mass casualty triage (in Chinese). Peoples Mil Surg 1982;12:6.
28. Rignault D, Wherry D. Lessons from the past worth remembering: Larrey and triage. Trauma 1999;1:85-9.
29. Super G. START: A triage training module. Newport Beach, CA: Hoag Memorial Hospital Presbyterian; 1984.
30. Jenkins JL, McCarthy ML, Sauer LM, Green GB, Stuart S, Thomas TL, et al. Mass-casualty triage: Time for an evidence-based approach. Prehosp Disaster Med 2008;23:3-8.
31. Sacco WJ, Navin DM, Fiedler KE, Waddell RK 2nd, Long WB, Buckman RF Jr. Precise formulation and evidence-based application of resource-constrained triage. Acad Emerg Med 2005;12:759-70.
32. Romig LE. Pediatric triage. A system to JumpSTART your triage of young patients at MCIs. JEMS 2002;27:52-8, 60-3.
33. Lerner EB, Schwartz RB, Coule PL, Weinstein ES, Cone DC, Hunt RC, et al. Mass casualty triage: An evaluation of the data and development of a proposed national guideline. Disaster Med Public Health Prep 2008;2 Suppl 1:S25-34.
34. Garner A, Lee A, Harrison K, Schultz CH. Comparative analysis of multiple-casualty incident triage algorithms. Ann Emerg Med 2001;38:541-8.
35. Kennedy K, Aghababian RV, Gans L, Lewis CP. Triage: Techniques and applications in decision-making. Ann Emerg Med 1996;28:136-44.
36. Wesson DE, Scorpio R. Field triage – Help or hindrance? Can J Surg 1992;35:19-21.