Appraisal of Field Triage in Mass Casualty Incidents in Taipei

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Abstract

To evaluate the performance of field triage, we retrospectively reviewed the data from 76 victims from mass casualty incidents (MCIs) from January 2003 to December 2004. The golden guides included 4 color-coded triage system, Simplified Triage And Rapid Transportation (START), Revised Trauma Score (RTS) and Pediatric Trauma Score (PTS). Ten items were provide to evaluate the performance. Of the victims, 41 (54%) of them were rescued from fire accidents, 29 (38%) from traffic accidents and 6 (8%) from landslides. The average age were 52±24 years and 40 (52%) were women. In addition, 10 (13%) of them were children (<15 years). The presence of color-coded badges was significantly lower than in exercises (8% vs. 100%, $P<0.001$). It is similar in specified triage personnel (12% vs. 100%, $P<0.001$), the rate of over-disposition rate (40% vs. 5%, $P<0.001$), usage of pediatric triage (0% vs. 100%, $P<0.001$), and usage of PTS (0% vs. 100%, $P<0.001$). In conclusion, the field triage is not actually performed according to the standard operations procedure in Taiwan. The most inadequate responses are the absence of specially-designated triage personnel, lack of pediatric triage and trauma scoring. The only way to improve the situation may be to implement the triage and trauma scoring into the daily activities of the EMTs. *(Ann Disaster Med. 2005;3:69-75)*

Key words: Triage; Start; Trauma; Mass Casualty Incident

Introduction

A mass casualty incident (MCI) means any event that causes a large number or individuals to become ill or injured. A basic concept is that MCI is defined by the amount of available medical resources in relation to the needs of individuals requiring care at a specific place and time. Emergency medical services are always the first responders to arrive at the scene of such incidents. The mission of these prehospital providers is thus critical in managing the whole event. The most consistent theme is to perform extrication, triage and transport victims from a scene to a definite care facility. However, the reality of prehospital activities often differs from the plan.[1-3] The same situation is found in Taiwan. The so-called paper plan syndrome may be present in the real casualty circumstances. The most essential step "field triage" may be missed or inadequate at the

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scene. It causes the supply-demand mismatch more severe and the incidents more chaos.

The three major phases of initial mass casualty are as follow, that is, triage, evacuation, and definitive medical care.[4] The performance of accurate triage provides the first responders with the best opportunity to do the greatest good for the greatest number of casualties. Many different triage systems have emerged over the years. Although various nomenclatures and systems are in common use throughout the world, commonalities do exist. Most systems of triage sort patients into four major categories designated by colors. The so-called reverse triage is used in most of the MCIs because of the considerations in saving the most number of victims as possible and in the miserable survival in those with traumatic cardiac arrest. Although the concept has been introduced in Taiwan for many years, there is still no definite report concerning the reality of field triage in the circumstances. Because field experience is probably the only true teacher of triage training, we thus designated such a retrospective study to investigate the performance of filed triage in MCIs in Taipei metropolitan area in recent two years.

Methods

Field triage algorithm

A set of triage criteria for use by emergency medical service staffing the various venues was developed already. The triage system is generally that of four major categories designated by colors. A priority one or immediate (red) patient is classified as one whose injury is critical but who can be cared for with only minimal time or resources and who would have a good prognosis for survival after treatment. Priority two or delayed (yellow) patients include patients whose injuries are significant but who are able to tolerate a delay care without the risk of substantial morbidity. Priority three or nonurgent (green) patients are those whose injuries are minor enough that they can wait for treatment. Expectant patients (black) include those whose injuries are so severe that they have only a minimal chance of survival even if significant resources are expended.

The prehospital triage training is also emphasized on a system titled Simple Triage and Rapid Treatment (START) that has emerged in recent years had gained popularity. This system takes into account the respiratory status, the perfusion, and the mental status of the patient. In general, the patients who can walk are asked to move away from the incident area to a specific location. These patients are classified as priority three or minimal (green), and they will be reassessed after the more immediately critical patients are evaluated. The patients who remain are then assessed. After the patient's respiratory rate, pulse, and ability to follow commands are evaluated, they are classified as one of the three remaining categories—priority one (red), priority two (yellow), and expectant (black).

Further triage has been focused on the triage depending upon the severity of trauma. This triage system has been modified from the guidelines from Advanced Trauma Life Support (ATLS) programs.[6] It included 4-step stepwise approach to these with injuries. In detail, the first step is to evaluate if the patient has any signs of instability such as Glasgow coma scale <13, respiratory rate < 9 bpm or > 30 bpm, systolic blood pressure < 90 mmHg, revised trauma score <11, or pediatric trauma score

<9. If the victims had no unstable signs, the second step was to assess if they had any external injuries that were associated with life-threatening problems such as flail chest, two or more proximal long-bone fractures, amputation above wrist or ankle, penetrating injury over torso, head or neck, pelvic fracture, or combination with burn. If the victims also had no significant external injury, the third step was to evaluate the mechanisms of trauma to find if there would be any possibilities of internal injury. Significant mechanisms include extrication time over 20 min, fall from height above 6m, high speed collision (>64 Kmph), extrusion from the vehicles, and so on. The last step was those with poor physical tolerance such as those younger than 5 years or older than 55 years, the pregnant women, immunocompromised patients, diabetics, and so on.

The Revised Trauma Score (RTS) is one of the more common physiologic scores.[7] It uses 3 specific physiologic parameters, (1) the Glasgow Coma Scale (GCS), (2) systemic blood pressure (SBP), and (3) the respiratory rate (RR).

Practitioners code parameters from 0-4 based on the magnitude of the physiologic derangement. The RTS has 2 forms depending

Table. Pediatric trauma score (PTS) (Adapted from reference 8)

Components	+2	+1	-1	Score
Weight	> 20 kg (44 lbs.)	10-20 kg (22-44 lbs.)	< 10 kg (22 lbs.)	
Airway	Patent[1]	Maintainable[2]	Unmaintainable[3]	
Systolic B/P	> 90 mm Hg	50-90 mm Hg	< 50 mm Hg	
Pulses	Radial	Carotid	Nonpalpable	
CNS	Awake	+ LOC¤	Unresponsive	
Fractures	None	Closed or suspected	Multiple closed or open	
Wounds	None	Minor*	Major, penetrating or burns[a]	
Total Score				-6 to 12, decreases with severity of condition

9-12 - Minor trauma
6-8 - Potentially life threatening
0-5 - Life threatening
< 0 - Usually fatal
[1] No assistance required.
[2] Protected by patient, but requires continuous monitoring for changes, may require positioning.
[3] Requires airway adjuncts NPA, OPA and ET or suctioning.
¤ Responds to voice, pain, or temporary loss of consciousness noted.
* Abrasions, minor lacerations, burns < 10% and not involving hands, face, feet, or genitalia.
[a] Penetrating, major avulsions, lacerations, burns > 10% or involving hands, face, feet of genitalia.

on its use. When used for field triage, the RTS is determined by adding each of the coded values together. Thus, the RTS ranges from 0-12 and is calculated very easily. An RTS of less than 11 is used to indicate the need for transport to a designated trauma center. The coded form of the RTS is used more frequently for quality assurance and outcome prediction. The coded RTS is calculated as follows, in which SBPc, RRc, and GCSc represent the coded values of each variable, that is, RTSc = 0.7326 SBPc + 0.2908 RRc + 0.9368 GCSc.

Pediatric trauma scoring (PTS) was used to evaluate the victims less than 15 years old. In summary, the PTS consists of six parameters which are common determinants of the clinical condition in the injured child.[8] During the initial assessment of the injured child, each parameter is assessed and given a numeric score based on its three associated variables: +2 for no injury or non-life threatening; +1 for minor injury or potentially life-threatening; and -1 for life-threatening. Totals can range from a +12 to a -6 with the range of <8-9 being the critical break point for transport to a comprehensive trauma care facility. The scoring of each category has been presented in Table.[8]

Evaluation of triage performance

We retrospectively reviewed the pre-hospital data of the victims of MCIs who were transported to our institute from January 2003 to December 2004. The emphasis has been placed on the triage information recorded by the emergency medical technicians. The evaluation included as follows:

1. The presence of color-coded badge;
2. The arrangement of a specified triage personnel;
3. The accuracy of triages;
4. The presence of triage categories;
5. Adequate disposition of the victims according to their triage categories;
6. Medical recordings of the victims with different triage categories;
7. Validity of triage information and medical recordings;
8. The adequacy of RTS if needed;
9. The usage of pediatric-specific triage if needed;
10. The usage of PTS if needed.

For each item, zero to 100 points would be given by two independent reviewers. If the differences between the above two scorings are more than 10 points, a third reviewer would participate the work of qualification and the final scoring became the average of the two most close values.

Statistics

The values were presented as mean $\pm$ SD. We made comparisons between the performances in real MCIs and those in exercises (a MCI scenario with 40 victims) which were held in summer 2004. For categorical variables, the percentage of fulfillment has been converted to the scores and the comparison between groups has been analyzed by Chi-square tests. In contrast, the scores of non-categorical variables were evaluated by the reviewers and the comparisons between the groups were made by students' *t* test or ANOVA as indicated. A *P* value less than 0.05 was considered as statistically significant.

Results

We collected the pre-hospital data from 76 victims of mass casualty incidents from January

2003 to December 2004. Forty-one (54%) of them were rescued from fire accidents, 29 (38%) from traffic accidents and the remaining 6 (8%) from landslides. The average age of the victims were 52±24 years and 40 (52%) of them were women. In addition, 10 (13%) of them were children.

All of the investigation items have been completed for all of the information from the victims except that the last two (usage of pediatric triage and PTS) were only applied for the ten children. The results of evaluation were summarized as follows.

The presence of color-coded badge

We surprisingly found that most of the victims had no color-coded badges along them. The presence of such badges was only 8% (6/76). We consulted the related EMS personnel and bureaus and found that the limited reaction time and lack of routine application of color-coded badges in ambulance were major explanations for such results. However, it is completely different from the performance in exercises (8% vs. 100%, $P<0.001$).

The arrangement of specified triage personnel

The overall presence of a specified triage personnel was also low (12%, 9/76) that was significantly different from what was observed in the exercise (12% vs. 100%, $P<0.001$). The truth was that most of the EMTs sorted the patients themselves. They did triage, emergency care and transportation for the same victim. The phenomenon was far away from what they have learned in the exercise.

The presence of triage categories

Although there was very low percentage of color-coded badge along the victims, the overall triage rate was 86% (65/76). Most of the triage was documented in medical recordings of the transport sheets. However, it was still significantly lower than the rate in the exercise (86% vs. 100%, $P<0.05$).

Accuracy of triage

From the details of records, we determined the original condition and the triage category for each victim. The correct triage rate was 91% (69/76) that was comparable with the rate accomplished in the exercise (91% vs. 95% (38/40), P=NS). The over-triage rate was 9% whereas the under-triage rate was none. Among the victims with over-triage, all of them were expectant (black) instead of urgent (red).

Adequate disposition

We defined so-called over-disposition as the situation that the victims of lower triage priority have been transported to the trauma center whereas under-disposition vice versa. The rate of over-disposition rate was 40% (30/76) that was significantly higher than that in the exercise (40% vs. 5% (2/40), $P<0.001$). In contrast, the rate of under-disposition was 3% (2/76) that was similar to the performance in the exercise (3% vs. 3% (1/40), P=NS).

Medical recordings

The overall accuracies of medical recordings of real MCIs and of the exercise were similar (90% vs. 95%, P=NS).

Validity of triage information and medical recordings

The validity of triage information and medical

recording was analyzed by comparison with the chart recordings. The overall valid rate was 75% and also lower than that in the exercise (90%, $P<0.05$). The most frequent missing items to fulfill include trauma score (25%), vital signs (14%) and transportation/arrival time (10%).

Adequacy of RTS

Because failed RTS documentation was found in 25% of the recordings, the remaining 57 records were analyzed. The accuracy rate was about 67% (38/57) which was significantly lower than in the exercise (67% vs. 90%, $P<0.05$). The over-scoring rate and under-scoring rates were both 16%.

Usage of pediatric-specific triage

As mentioned above, there were 19 records that failed to document trauma scores. Among them, there were 10 pediatric trauma victims. In other words, all of the pediatrics patients did not have comparable PTS documentation (0%, 0/10). The finding was definitely different from that present in the drill (0% vs. 100%, $P<0.001$).

Usage of PTS

The situation was similar to pediatric triage. There was none of the ten pediatric victims evaluated by PTS (0% vs. 100%, $P<0.001$).

Discussion

This study demonstrated that the inadequacies of field triage in MCIs from Taipei metropolitan region. The absence of color-coded badge, inadequate triage and mismatch of triage and transportation were main problems among all. It is also a kind of so-called paper plan syndrome which we have been always deeply concerned in the field of disaster medicine.

Field medical triage should prioritize and categorize casualties to enable timely rescue, treatment, and evacuation in an orderly fashion. It also optimize the use of available medical nursing, and emergency personnel at the disaster site and the use of logistical support and equipment.[4,5] The factors that will worsen the medical supply-demand imbalance include lack of an appropriate number and type of medical, nursing, or emergency personnel, lack of access by rescuers and emergency personnel to the disaster site, lack of access by rescuers and emergency personnel to the casualties because of extrication issues or exposure to hazards, shortages of medical equipment and supplies, limited availability of evaluation assets such as ambulances or helicopters, and inadequate physical and functional integrity of medical facilities.

It is disappointing to find the actual performance of EMTs in the field triage in Taipei area. The target problem should be the gap between standard operations procedure and the actual processing. Because EMS agencies are crucial resources in MCI preparedness and response, they could be called on before a MCI to assist with evaluations of hospitals, nursing homes, and other skilled care facilities and provide medical staffing for shelters. Planning and preparation are the keys to the successful functioning of EMS provides. And the most effective plans are often those that most closely match an agency's daily activities. Unfortunately, because children and MCIs are infrequent parts of most EMT's daily encounters, they and their needs are often mentioned in the standard operations procedures. In Taiwan, there are still

no specially-designed EMTs and ambulances, let alone the usage of pediatric triage[9,10] and pediatric trauma scores. However, it deserves us to look up to such a crisis.

We therein have the following suggestions. First, medical consultants and EMT experts should urge to implement the pediatric triage system and pediatric trauma scores into the standard operations procedures. JumpSTART and PTS are two good examples. Second, the triage and trauma scoring should be actually performed in EMT's daily activities to avoid the EMS providers may only consider triage and scoring in the MCI or disaster exercise. When a real disaster or MCI occur, the chaos of the circumstances would always make the staff forget to do what they should do. Third, a detailed and long-term follow-up as this investigation should be continued in each corner of EMS agencies.

This study has the following limitations. First, it is a retrospective study rather than a prospective one. Although this kind of investigation should be free from the effects of early warning, the possible confounding factors that would be met in retrospective studies still cannot be definitely avoided. Second, the study population is small and the study region involved is also limited. A large-scale national wide study may be indicated to confirm the real situations of field triage in Taiwan.

In conclusion, the field triage is not actually performed according to the standard operations procedure in Taiwan. The most inadequate responses are the absence of specially-designated triage personnel, lack of pediatric triage and trauma scoring. Implement of triage and trauma scoring into the daily activities of the EMTs may be the only way to improve the situation.

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