Precision of In-Hospital Triage in Mass-Casualty Incidents after Terror Attacks

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Abstract

Introduction: Proper management of mass-casualty incidents (MCIs) relies on triage as a critical component of the disaster plan.

Objective: The objective of this study was to assess the precision of triage in mass-casualty incidents.

Methods: The precision of decisions made by two experienced triage officers was examined in two large MCIs. These decisions were compared to the real severity of injury as defined by the Israeli Defence Forces (IDF) classification of severity of injuries and the Injury Severity Score (ISS).

Results: Two experienced trauma physicians triaged a total of 94 casualties into 77 mild, seven moderate, and 10 severe casualties. Based on the IDF criteria, there were 74 mild, five moderate, and 15 severe casualties. Based on ISS scoring, there were 78 mild (ISS <9), five moderate (9 ≤ISS<16), and 11 severe (ISS < 16) casualties. Of 15 severely injured victims defined by the IDF classification of injury severity, the triage officers identified only seven (47%).

Conclusion: Primary triage, even when carried out by experienced trauma physicians, can be unreliable in a MCI.


Introduction

Management of a mass-casualty incident (MCI) relies heavily on triage as one of the critical determinants of the success of a disaster plan. The triage officer is the first to assess the victims when they arrive at the medical facility. The triage officer sorts the casualties into management groups according to their severity of injury. Incorrect assessment of injury severity can send victims with serious injuries to a management site for the less severely injured, and can send those with less severe injuries to the management site with the most severely injured. This could lead to wasted efforts on inappropriately triaged patients in a situation in which the efficient use of maximal effort is essential. Therefore, many contingency plans incorporate the placement of one of the most experienced trauma physicians in the position of triage officer. The objective of this study was to examine the precision of decisions made by triage officers in the two largest MCIs experienced by the Hillel Yaffe Medical Center (HYMC) staff during the last four years.

Methods

This retrospective study was performed in 2003. It was based on a cohort study of patient records of the Israeli National Trauma Registry, which is maintained by the Israeli Ministry of Health. Besides demographic information on the patients, data collected by the registry includes details of the injury such as diagnoses, severity indicators, mechanism of injury, treatments, hospital resource utilization, and patient outcome.

The HYMC is a Level-II trauma center with extensive trauma experience. It is located in the coastal city of Hadera, 30 miles from the nearest Level-I...
Table 1—Classification of severity of injury (IDF = Israeli Defence Forces; ISS = Injury Severity Score)

<table>
<thead>
<tr>
<th>Classification</th>
<th>IDF’s definition of severity of injury</th>
<th>ISS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mild</td>
<td>Injury not endangering life and will not lead to permanent disability</td>
<td>ISS &lt;9</td>
</tr>
<tr>
<td>Moderate</td>
<td>Injury not endangering life immediately, but may do so if not handled appropriately; or injury leading to permanent disability</td>
<td>9 ≤ ISS &lt; 16</td>
</tr>
<tr>
<td>Severe</td>
<td>Injury endangering life</td>
<td>ISS ≥ 16</td>
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Table 2—Distribution of severity of injuries, as defined by the IDF classification of severity of injury, compared to the decisions made by the triage officer

*As assessed retrospectively using the IDF’s classification of severity of injury.

(42 and 62, respectively) were admitted to the emergency room. Terrorists added metallic fragments to their bombs, so blast lung and multiple penetrating injuries were common.

These two incidents were chosen because of their potential to strain the healthcare system. In both incidents, the large number of victims was greater than the emergency department’s bed capacity. Furthermore, both incidents involved a large percentage of severely and moderately injured. For the purpose of analysis, results from these two MCIs have been combined.

Results

The data were relatively complete for the patients from the two incidents. The initial decisions made by the triage officers could be retrieved from the medical records for 94 out of 104 (90%) of the patients. In 10 patients (10%), either the appropriate medical records were lost, or the classification made by the triage officer was not clear.

Of the 94 victims included in this study, the triage officers assessed 77 casualties (82%) as mildly injured, seven casualties (7%) as moderately injured, and 10 casualties (11%) as severely injured. When using the IDF criteria to assess the actual severity of injury, there were 74 (79%) mildly injured, five (5%) moderately injured, and 15 (16%) severely injured. Using the ISS, the resulting numbers were 78 (83%), five (5%), and 11 (12%) respectively. Tables 2 and 3 list the respective decisions of the triage officers and the severity of injury.

In Table 2, “real” severity of injury is defined according to the IDF classification of severity of injury. In Table 3, the severity of injury is defined according to the ISS. Compared to the IDF classification of severity of injury, out of 94 victims studied, 10 (11%) victims were underestimated and seven (7%) were overestimated. Compared to the ISS, out of 94 victims studied, six (6%) victims were underestimated and seven (7%) were overestimated.

Of the 15 severely injured victims, the triage officers identified only seven (47%). Of the other eight, six were classified incorrectly as mildly injured and sent to the corresponding site for mildly injured victims.
understage patients injured in bombing incidents. The reliability of the use of the ISS in this set of victims is the topic of an ongoing, multi-institutional study.

Based on the triage assessment carried out by the experienced trauma experts, an undertriage rate of eight (53%) severely injured out of 15 such patients is cause for concern, especially if six of the eight were classified by the triage officers as mild and not moderate. The time allotted for making triage decisions usually is very short. Most victims are transferred from the site of injury to the different medical facilities within one hour. Ambulances usually transfer several victims simultaneously. Thus, if three ambulances arrive at the medical facility at the same time, the triage officers may be confronted with as many as 12 victims simultaneously. This allows only a few seconds to triage each patient. This time span is not long enough to allow for careful decision-making, which relies on physiological parameters. Furthermore, identifying life-threatening injuries in stable explosion victims who potentially harbor multiple penetrating injuries from metallic fragments is not feasible without a full physical examination of the trunk. Triage usually is carried out close to the entrance of the emergency department, a place exposed to onlookers, including curious by passers, journalists, and police officers, among others. This makes serious evaluation of the victims in the triage site difficult, even by experienced triage officers. Triage in these circumstances is a process dependent on the acumen of the triage officer.

The triage officers in both of the reported MCIs were experienced physicians with previous experience in MCIs and other trauma scenarios. Several authors have emphasized the need to allocate the most experienced trauma surgeon to the role of triage officer. Currently, there is no proof that such an approach actually will improve triage reliability. Even if positioning the most experienced trauma physician in the role of triage officer would have improved triage precision, this policy would have undermined the ability of this physician to be involved directly with the delivery of trauma care to those severely injured.9

The approach used in this study, intended for avoiding the under-triage of severely injured victims, incorporated both the decisions made by the triage officers and the primary evaluations performed in the emergency department, according to advanced trauma life support (ATLS) guidelines. The term "continuous triage" describes this method.

The emergency department is divided into three sites according to the severity of injury: (1) mild; (2) moderate; and (3) severe. The decisions made by the triage officer help distribute the victims between the various sites. Once the casualty arrives at his/her respective site, medical personnel are instructed to perform primary and secondary surveys as quickly as possible, aiming to identify the severely injured victims. Once a victim is identified as suffering from a life-threatening injury, a trauma physician and an anesthesiologist take over the treatment of this victim, who is transferred immediately to a secondary site of treatment. At this stage, immediate, primary resuscitation is done only for those with life-threatening injuries. The medical team is instructed to refrain from performing ancillary examina-

<table>
<thead>
<tr>
<th>Triage decisions</th>
<th>Severity of injuries*</th>
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<tbody>
<tr>
<td>Mild (total 77)</td>
<td>Mild (total 78)</td>
</tr>
<tr>
<td></td>
<td>Moderate (total 5)</td>
</tr>
<tr>
<td></td>
<td>Severe (total 11)</td>
</tr>
<tr>
<td>72 (92.3)</td>
<td>3 (60)</td>
</tr>
<tr>
<td>6 (4.4)</td>
<td>1 (20)</td>
</tr>
<tr>
<td>1 (1.3)</td>
<td>1 (20)</td>
</tr>
<tr>
<td>8 (73)</td>
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</tbody>
</table>

Table 3—Distribution of severity of injuries, as defined by ISS, compared to the decisions made by the triage officer

*As assessed retrospectively using ISS

Relying on the ISS classification of injury severity, there were 11 severely injured victims. Of these, the triage officer identified eight. Two were classified incorrectly as mildly injured and were sent to the corresponding site for mildly injured victims.

Discussion

During the last 10 years, the HYMC experienced 20 MCIs following terror attacks. Most of these attacks were caused by bombings. Sixteen of these MCIs occurred from November 2000–October 2002, averaging one MCI every six weeks. The two incidents discussed in this study occurred in March 2002 and October 2002. By the time these MCIs occurred, the emergency department staff had accumulated extensive experience in the medical management of these incidents. In both of the MCIs studied, the triage officers were board-certified physicians with >10 years of experience in the treatment of trauma victims. Both of these physicians had previous experience in MCIs caused by terrorist attacks.

The magnitude of most MCIs caused by terrorist acts is smaller than that of other catastrophic events. However, MCIs caused by terrorist attacks may serve as a model to evaluate different components of the hospital response to disasters. Execution of triage is considered a critical component of any disaster plan, whether the plan addresses MCIs caused by terrorist attacks or other causes. In this study, the precision of the decisions made by the triage officers was evaluated.

Relying on the IDF’s classification of severity of injury, there were 15 injured victims (Table 2). Of the 15 severely injured casualties, the triage officer identified only seven. Of the other eight, six were classified wrongly as mildly injured and were sent to the corresponding site for mildly injured victims. In this system, mildly injured victims are situated automatically at a site geographically distant from the area in which the trauma experts are concentrated. This situation may lead to intolerable outcomes.

The results indicate that severity of injury was classified differently according to the different classification systems used. It has been observed that the use of the ISS tends to
tions such as blood tests and x-rays in the initial stages of response for patients whose physical examination suggests they are mildly injured. To date, >600 victims from 20 different MCIs have been treated. From 78 patients suffering from life-threatening injuries, only three (3.8%) were not identified following primary and secondary survey performed in the emergency department. All three suffered from distracting injuries.

Although triage is a crucial component in all contingency plans, little data exist regarding the precision of the triage officers’ assessments during real events. This study provides data concerning triage decisions in just two events, which limits the authenticity of the results. In their description of the suicide bombing attack in the Sbarro pizza restaurant, Almogy et al. offer insight into the experience of another institution, the only Level-I trauma center in Jerusalem.10 Of the 146 casualties in that incident, the emergency department at their medical center admitted 18 patients. According to their protocol, the most experienced trauma surgeon available received incoming emergency medical services and triaged the casualties into either the trauma room or the emergency department, according to the presence or absence of immediate life-threatening injuries. Four casualties were directed to the trauma room, and 14 others were directed to the emergency department. Of the four patients admitted to the trauma room, one victim had an ISS score of 5. On the other hand, one of the patients, who was not allocated to the trauma room, suffered severe injuries, including blast lung injury, a penetrating rectal wound, an open fracture of the left tibia, and second degree burns covering 15% of her body surface area. Thus, in this incident, the most experienced trauma surgeon under-triaged one out of four (25%) severely injured victims in a MCI in which only 18 injured victims were admitted to that hospital.

In retrospect, the collection of data concerning precision of triage decisions should have been an integral part of the evaluation of the response for each of the MCIs experienced by the HYMC staff. Data were available from only two incidents, though theoretically, data could have been available from as many as 18 other MCIs experienced in the HYMC, and 50 other major MCIs experienced in Israel. Inclusion of other incidents would have eliminated the possibility that poor results of triage found in this study resulted from inexperience of the triage officers. If the rate of undertriage of severely injured victims is universal, possible strategies on how to compensate for this gap in the recognition of life-threatening injuries should be studied. Other medical institutions should collect and report their data and incorporate an assessment of triage accuracy in their evaluation of future incidents.

Conclusions
In summary, the triage officers in two large MCIs were unable to identify as many as 50% of the victims who suffered from life-threatening injuries. To make an impact on survival, rapid recognition of these victims is necessary. Until more information is available on precision of triage, primary triage should be combined with rapid evaluation based on primary and secondary surveys, as described in the ATLS training programs.

References