



Original Research

The role of trauma team activation by emergency physicians on outcomes in severe trauma patients

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Received 13 September 2013; accepted 31 October 2013

Available online 2 January 2014

Abstract

Background: In our region, trauma team activation (TTA) is initiated by emergency physicians once an injured patient meets any of the criteria of TTA after the injured patient arrives at the emergency department (ED).

Purpose: To evaluate the role of TTA on outcomes in patients with severe trauma.

Methods: All trauma patients who had injury severity score (ISS) >15 and were admitted from ED between January 2010 to December 2010 were included in the study. Mann–Whitney *U* test (non-normal distribution) or Student's *t* test (normal distribution) for continuous variables and Fisher exact test or Chi-square test for categorical variables were used to compare the statistically significant differences between TTA and non-TTA groups. Logistic regression was applied to determine any significant differences found in the statistical analysis for 30-day mortality.

Results: A total of 231 patients were signed up in the study. The TTA group had shorter time from ED to operation room (170 minutes vs. 534 minutes, $p = 0.02$) and tended to have more emergent operations (42.7% vs. 23.2%, $p = 0.002$). Emergent operation [odds ratio (OR), 0.34; 95% confidence interval (CI), 0.12–0.92, $p = 0.035$] was associated with lower mortality while ISS > 25 (OR, 7.48; 95% CI, 2.48–22.57, $p < 0.0001$), Glasgow coma scale score <13 (OR, 32.1; 95% CI, 4.30–94.6, $p < 0.0001$), hypotension (OR, 3.0; 95% CI, 1.1–7.9, $p = 0.03$), and coagulopathy (OR, 9.3; 95% CI, 1.2–71.4, $p = 0.033$) were associated with higher mortality.

Conclusion: This study shows that TTA may shorten the time from ED to operation room in trauma patients with an ISS > 15.

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Keywords: Injury severity score; Trauma; Trauma team activation

1. Introduction

Improved patient assessment and management systems can reduce morbidity and mortality from serious injury or trauma. The chains of life contain injury prevention, prehospital care, services provided by trauma centers and other acute-disease care facilities, and posthospital care. Outcome improvements in the patient population have been achieved through the regionalization of trauma care and the designation of level I trauma centers.^{1–4} The cornerstone of trauma care has been

the early involvement of surgeons in the management of injured patients.⁵ In Taiwan, the emergency medical system (EMS) provides only basic and noninvasive prehospital care. The EMS in Taiwan does not perform field triage. Most trauma patients are transported to the nearest hospitals or to the hospitals based on a patient's or their family's request instead of the level of trauma care provided by the hospital. After arrival at the hospital, severely injured patients are first evaluated by emergency physicians, not trauma physicians. Trauma team activation (TTA) at our hospital is at the discretion of the initial emergency attending physician according to consensus triage guidelines. The emergency physicians lead the initial resuscitation, assessment, and invasive

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procedures before the trauma team arrives. Injured patients receive trauma service only if a trauma team is activated. In this situation, a proportion of moderately to severely injured trauma patients do not receive trauma service but individual service since the trauma team is not activated after their initial assessment and resuscitation.

To date, only a limited number of studies related to trauma patients in our region have been reported. The aim of this study was to evaluate the role of TTA on outcomes in trauma patients with an injury severity score (ISS) >15 at a level I trauma center.

2. Methods

2.1. Study design and population

All trauma patients with ISS > 15 admitted from the emergency department (ED) from January 2010 to December 2010 were included in our analysis. Four groups of patients were excluded: (1) patients pronounced dead at the scene or initial hospital but still transported to our hospital; (2) patients who stayed at the initial hospital for more than 6 hours; (3) patients who were admitted to a ward or intensive care unit (ICU) at the initial hospital; and (4) patient was transported to the initial hospital or to our hospital by any mode of transportation other than EMS. The reason for the exclusion of those patients pronounced dead at the scene or initial hospital was that they might have received resuscitation only, which would be a confounding factor in the TTA group with increase of mortality. In addition, patients not transported by EMS were excluded because they might not receive enough standard and qualified prehospital care, resulting in variable outcomes.

This study was conducted at a university-affiliated teaching hospital located in south-central Taiwan. The hospital has an annual ED volume of 60,000 patients, approximately 20% (12,000) of whom are trauma patients, and has approximately 1000 beds in the general ward and 120 beds in the ICU. This is also the only hospital in our region rated as a *severe-grade emergency care ability hospital*, a rating similar to a level I trauma center, and can receive patients transferred for definitive care. It provides a trauma team composed of in-house attending surgeons, has an operating room service on a 24-hour basis and admits referred patients with severe major trauma within the region. The ED is staffed 24 hours a day by board-certified and ATLS-certified attending emergency physicians. An emergency attending physician or resident evaluates all trauma patients presenting at the ED. The activation of a trauma team for the major trauma patients is initiated by attending emergency physicians once the injured patient meets any one of the following criteria: (1) Glasgow coma scale (GCS) score <13; (2) respiratory distress, systolic pressure <90 mmHg, or hemodynamic instability; (3) fall from a very high height (>6 m or 2 floors); (4) head, neck or torso penetration wound (gunshot wound or knife wound); (5) severe pelvic fractures; (6) multiple traumas; (7) severe burn; and (8) children aged <10 years or elderly aged >65 years with suspicious multiple traumas. The in-house attending

trauma surgeon presents at ED within 10 minutes after the initiation of TTA. The trauma surgeons lead the treatment of injured patients with TTA, whereas the emergency physicians and specialized surgeons cooperated in the treatment of those injured patients without TTA.

This study was approved by our hospital's Institute Reviewing Board with serial number 98-2032B and is exempted from informed consents.

2.2. Survey content and administration

We evaluated all trauma patients presenting at ED and calculated the ISS scores of all the patients once the diagnoses were confirmed. We followed their clinical courses and recorded their demographic data, injury mechanisms, laboratory data, radiographic reports, trauma team activation or not, management, discharge diagnosis, and 30-day mortality or survival on discharge. Only patients with ISS > 15 and who did not meet any exclusion criteria were included in the analysis. Initial GCS scores were recorded as the first data assessed by physicians. The number of invasive procedures (including endotracheal intubation, cricothyrotomy, tracheostomy, needle thoracostomy, tube thoracostomy, central venous catheter insertion, large-bore catheter insertion, and venous cut-down) of each enrolled patient was documented. Prothrombin time test and hemoglobin and platelet count were assessed by first laboratory analyses. Hypotension was defined as the lowest systolic pressure checked during ED stay, that is, <90 mmHg. Bradycardia was defined as the lowest heart rate checked during ED stay, that is, <60 beats/minute. A body temperature of <36.0 °C was defined as hypothermia and a body temperature of >38.0 °C was defined as hyperthermia. The presence of coagulopathy was defined as international ratio (INR) of prothrombin time >1.5 checked at ED and acidosis was defined as pH < 7.35 in first arterial blood gas checked at ED. Hyperglycemia was defined as blood glucose >200 mg/dL. Emergent operation was defined as a case when a patient was sent to the operation room directly from ED. The decision of ICU admission was made by treatment providers.

2.3. Data analysis

The demographic characteristics, trauma mechanism, performance of emergent operation, and time elapsed from ED to operation room were analyzed. Statistical analysis was carried out using the software SPSS 17.0 (SPSS Inc, Chicago, IL, USA). Mann–Whitney *U* test (non-normal distribution) or Student's *t* test (normal distribution) for continuous variables and Fisher exact test or Chi-square test for categorical variables, were used to compare the statistically significant differences between the TTA and non-TTA groups. The difference was considered significant if the *p*-value was <0.05. A stepwise backward logistic regression model was developed. All variables with a *p* < 0.05 in the univariate analysis were selected for the stepwise backward elimination model. Continuous cycles of repeated operations were performed until all covariates with a multivariate *p* > 0.1 were eliminated from

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