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Rapid ground transport of trauma patients: a moderate distance from trauma center improves survival

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ABSTRACT

Background: There is debate within the emergency medical services (EMS) community over the value of calling a helicopter for trauma patients within a moderate distance/<45 min, of a trauma center. Helicopter EMS (HEMS) generally have a wider scope and more advanced training than the ground EMS (GEMS). GEMS, on the other hand, have the benefit of being able to immediately initiate rapid transport to the trauma center without the delay involved with HEMS flying to the scene, landing, and assuming patient care.

Methods: We retrospectively analyzed patients brought to a level I trauma center who were admitted with blunt traumatic injuries between 2010 and 2015 in the Trauma Quality Improvement Program database. Two analyses were performed, one in which the patient's reported initial scene vitals met criteria for step one of the Centers for Disease Control's 2011 National Field Triage Guidelines (NFTG) and the other in which the patient's initial scene vitals met those same guidelines and/or had a pulse greater than 110 beats per minute. Patients were categorized on scene to emergency department (ED) transport mode, either HEMS or GEMS. Inclusion criteria were a HEMS response time to the scene that was between 15 and 45 min with a transport time from the scene to the ED that was between 10 and 35 min or a GEMS transport time from the scene to the ED that was between 15 and 45 min. Statistical significance ($P < 0.05$) was established through logit regression. Mortality rates were then calculated within each transport mode–based population.

Results: Four hundred subjects were included in the analysis of patients meeting the first step of the NFTG, with 212 HEMS patients and 188 in the GEMS group. HEMS had a higher mortality rate at 0.184 and GEMS at 0.101, which was statistically significant ($P = 0.019$). When 606 subjects meeting the first step of the NFTG or with a pulse greater than 110 beats per minute were analyzed, the results were statistically significant ($P < 0.001$), with the HEMS category having a higher mortality rate at 0.154 and the GEMS category having a lower mortality at 0.056.

Conclusions: Our data demonstrate that scene-to-ED time is paramount, and rapid ground transport should be used in blunt trauma patients when the scene is up to a moderate ground distance away from the trauma center and there would be a moderate-to-prolonged HEMS

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response time. In both analyses, hemodynamically unstable trauma patients had lower rates of mortality following ground transport. We recognize that there may be a subset of patients at these distances who could benefit from HEMS response, particularly if the flight crew can offer more advanced and specialized techniques; however, every effort should be made to minimize the scene-to-ED time, and HEMS response, scene, and transport time must be considered. This study only analyzed the patients within a moderate distance of the trauma center and at longer distances or in different environments; HEMS transport may indeed minimize the scene to ED time.

Introduction

Rapid access to a trauma center is a significant mitigating factor against mortality in severely injured trauma patients.[1] Suburban and rural localities use helicopter emergency medical services (HEMS) most frequently, as those in urban areas often have a relatively immediate access to a trauma center.[2] There are well vetted guidelines to determine which injured patient needs a trauma center, but guidelines for helicopter transport are not as robust and often parochial.[3] While there is no doubt that getting an injured patient to the right facility as quickly as possible is paramount to better outcomes, no clear criteria exist for when it is appropriate to dispatch HEMS if the ground EMS (GEMS) crew is within a moderate distance (≤45 min of ground transport) of the trauma center. Mobilizing a HEMS crew can add a significant amount of time to a patient's scene to emergency department (ED) interval and that addition of time may exceed GEMS rapid ground transport. It can be argued that with the advanced scope that HEMS generally has over GEMS, the benefit of having HEMS render care may outweigh the extra time. Many large studies show improved survival in higher traumatized patients when HEMS is used; however, the distances of the populations studied in relation to a trauma center were not applied.[4,5]

No scene to ED outcome comparisons between HEMS and GEMS are published. Only when a stratification of patients by their distance is created and applied, can the benefit of HEMS be further explored. In this study, we aimed to analyze the outcomes of blunt trauma patients transported by either HEMS or GEMS from within a moderate distance, or a 45-min ground transport time, to the ED.

Materials and methods

Study population

All data were obtained through the National Trauma Data Bank (NTDB).[6] Patients aged 16 to 65 years brought from the scene and admitted to a level I trauma center for blunt trauma injuries between 2010 and 2015 were included in this study. To be included in the GEMS category, the subject must have had a transport time from the scene to the ED between 15 and 45 min. To be included in the HEMS category, the HEMS response to the scene must have taken between 15 and 45 min with a subsequent transport time between 10 and 35 min. The flight time limits were chosen by approximations using the average speed of a helicopter, which is 120 MPH.[7] In addition, the distance from the hospital for all subjects included was chosen based on several factors. In 2013, a multidisciplinary committee met and released guidelines on appropriate utilization of HEMS. One of their guidelines addressed the time sensitivity involved in dispatching HEMS, suggesting HEMS be used if there would be a significant time reduction over GEMS.[3] While the committee did not define a GEMS travel distance threshold at which HEMS utilization would significantly reduce the time from scene to the ED, many local protocols have since adopted a threshold of a ground travel time of 30 min.[8] Based on this commonly used threshold, we also included in our interval 15 min greater and 15 minutes less. Demographics, scene vitals, injury type, injury severity score (ISS), abbreviated injury scores, comorbidities, and outcomes were collected. Subjects were excluded if they had an incomplete data set, history of chronic anticoagulation or a coagulation disorder, burns, pregnancy, abbreviated injury scores of 6 in any system, or they were transferred out or left against medical advice.

The aeromedical system responds to a 21-county, approximately 70,685 square mile, service area of the trauma center. The system has four bases staffed 24/7 centered with the trauma center at the extreme distance of the range to help reduce travel times. A fifth base is operated primarily on weekends, serving another isolated region, and HEMS transport is used not only for trauma, but cardiac and neurologic emergencies as well. Facility-to-facility transfers are not included in this analysis.

Statistical analysis

Two populations were analyzed, one which applied the first step of the Centers for Disease Control's 2011 National Field Triage Guidelines (NFTG) and one which applied a modified NFTG, which was positive if one of the first steps of the 2011 guidelines were met with or without a pulse of 110 beats per minute.[9] The 2011 NFTG criteria were chosen for application to our initial inclusion criteria due to the robust evidence supporting the capability of the guidelines in identifying patients that would benefit from a specialized trauma center and its adoption as a guide to call HEMS by several state emergency medical services (EMS) agencies.[10] We then added the pulse modification to the NFTG based on our population being traumatized immediately before EMS intervention, with tachycardia being one of the earliest physiologic compensations to shock.[11] We also considered that the pulse rate is a metric that can be easily evaluated in the field and applied to the decision between choosing to transport by HEMS or GEMS.