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Clinical Study

Comparison of helicopter versus ground transport for the interfacility transport of isolated spinal injury

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Abstract

BACKGROUND CONTEXT: The use and need of helicopter aeromedical transport systems (HEMSs) in health care today is based on the basic belief that early definitive care improves outcomes. Helicopter aeromedical transport system is perceived to be safer than ground transport (GT) for the interfacility transfer of patients who have sustained spinal injury because of the concern for deterioration of neurologic function if there is a delay in reaching a higher level of care. However, the use of HEMS is facing increasing public scrutiny because of its significantly greater cost and unique risk profile.

PURPOSE: The aim of the study was to determine whether GT for interfacility transfer of patients with spinal injury resulted in less favorable clinical outcomes compared with HEMS.

STUDY DESIGN/SETTING: Retrospective review of all patients transferred to a Level 1 trauma center.

PATIENT SAMPLE: Patients identified from the State Trauma Registry who were initially seen at another hospital with an isolated diagnosis of injury to the spine and then transferred to a Level 1 trauma center over a 2-year period.

OUTCOME MEASURES: Neurologic deterioration, disposition from the emergency department, in-hospital mortality, interfacility transfer time, hospital length of stay, nonroutine discharge, and radiographic evidence of worsening spinal injury.

METHODS: Patients with International Classification of Diseases, Ninth Revision (ICD-9) codes for injury to the spine were selected and records were reviewed for demographics and injury details. All available spine radiographs were reviewed by an orthopedic surgeon blinded to clinical data and transport type. Chi-square and *t* tests and multivariate linear and logistic regression models were done using STATA version 10.

RESULTS: A total of 274 spine injury patients were included in our analysis, 84 (31%) of whom were transported by HEMS and 190 (69%) by GT. None of the GT patients had any deterioration in neurologic examination nor any detectable alteration in the radiographic appearance of their spine injury attributable to the transportation process. Helicopter aeromedical transport system resulted in significantly less transfer time with an average time of 80 minutes compared with 112 minutes with GT ($p<.001$). Ultimate disposition included 175 (64%) patients discharged to home, 15 (5%) expired patients, and 84 (31%) discharged to extended care facilities. After adjusting for patient age and Injury Severity Score, the use of GT was not a significant predictor of in-hospital mortality

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(odds ratio, 1.4; 95% confidence interval, 0.3–5), hospital length of stay (11.2+1.3 vs. 9.5+0.8 days, p=.3), or nonroutine discharge (odds ratio, 1.1; 95% confidence interval, 0.5–2.2).
CONCLUSIONS: Ground transport for interfacility transfer of patients with spinal injury appears to be safe and suitable for patients who lack other compelling reasons for HEMS. A prospective analysis of transportation mode in a larger cohort of patients is needed to verify our findings.

Keywords: Interfacility transport; Spinal injury; Helicopter aeromedical transport system

Introduction

With approximately 25 to 40 new cases of spinal cord injury per million people annually, there are a significant number of trauma patients with spine injuries who require transport to a center that can provide a more acute level of care [1]. Designation as a Level 1 trauma center necessitates prompt and continuous care availability for patients with spine injuries [2]. Since the enactment of the Emergency Medical Treatment and Active Labor Act in 1986, Level 1 trauma centers have been effectively required to accept all transfers for a higher level of care unless facility capacity precludes transfer [3]. The Centers for Disease Control and the American College of Surgeons have established well-accepted guidelines for the triage of trauma patients with suspected spinal injuries or mechanisms of injury that can result in spinal injury while in the field [4]. The criteria for interfacility transfer or recommendation for subsequent method of transfer of trauma patients, however, are less well defined.

Interfacility transport of trauma patients via ground transport (GT) versus helicopter aeromedical transport system (HEMS) is a decision most often left to the discretion of the involved health care providers. The use and need of HEMS in health care today is based on the basic belief that early definitive care improves outcomes [5]. The use of helicopters for routine medical evacuation began during the Korean War in the 1950s. It was believed that this contributed to the decreased mortality rate of soldiers compared with prior wars [6]. The first civilian hospital-based medical helicopter service then followed in 1972 at St. Anthony's Hospital, Denver, CO. Now, an integral part of the modern health care system, air medical services are estimated to be required in the care of one in every 1,000 people in the United States yearly. Despite its increasing prevalence, when to use this revolutionary method of transportation remains controversial for multiple reasons.

Whether HEMS confers a reduction in transfer time and an improved clinical outcome remains debatable. A study of 145 patients transferred via GT or helicopter transport from 20 hospitals within a large University referral system demonstrated faster helicopter transport times; however, they commented that under optimal dispatch and transport conditions, this time difference was minimal [7]. Furthermore, no improvement in outcomes including disability, health status, or health care utilization was found in patients undergoing interfacility transport via helicopter compared with GT in a prospective study of 1,234 critical patients [8]. Conversely, Brown et al. [9] reviewed 74,779 patients who underwent interfacility transfer and found that for patients with an Injury Severity Score (ISS) of >15, helicopter transport was a predictor of survival. However, these benefits may not be able to be extrapolated to a spinal injury patient population.

The principal concern with respect to transport for patients with suspected spinal injury is deterioration of neurologic function. Major neurologic deterioration from the time of injury to the time of admission to a Spinal Injuries Unit has been documented to be as high as 26% [10]. Although in this study only 6% of those with major neurologic deterioration occurred during GT from a local hospital to the Spinal Unit, the question arises whether helicopter transport could have resulted in improved patient outcomes.

In looking at interfacility transport of acute spinal cord injuries, Burney et al. [11] in 1989 reviewed 61 patients and found that no patient suffered an ascending level of injury as a result of transfer nor did the choice of transport vehicle adversely impact neurologic function. Flabouris looked at both scene of injury and interfacility transport of patients with suspected spinal injury. He found no clinical advantage to helicopter transport as there was no documented neurologic deterioration. He recommended that the decision of mode of transportation be based on ambient geography, operational factors, and time to receiving facility and not the presence of a suspected spinal injury [12]. The most recent spine trauma recommendations regarding transportation of patients with acute traumatic cervical spine injuries simply state that neither land nor air transport has been reported to negatively affect the outcome of spinal injury patients if properly executed [13]. Their Level 3 recommendations include expeditious and careful transport of patients via the most appropriate method of transportation to the nearest capable medical facility.

Yet, even with the aforementioned studies, when faced with the decision of GT versus HEMS for the interfacility transport of a spinal injury patient, many health care professionals find little evidence on which to base their decision. This may partially be because of the literature on the subject which reflects more antiquated helicopter systems, does not stratify interfacility and scene of injury transport, includes multisystem trauma patients, isolates the spine injury to a particular level, or defines a negative outcome based solely on the clinical examination and does not