Factors Associated With Mode of Transport Decision Making for Pediatric-Neonatal Interfacility Transport

Janis M. Quinn, MSN, CPNP-AC, Mary Clyde Pierce, MD, and Mark Adler, MD

Abstract

Objective: Transport professionals must routinely engage in complex decision making. One challenging decision is the determination of mode of transport. This study explores the decisional factors involved in the determination of mobilizing ground ambulance versus helicopter for pediatric-neonatal interfacility transport. The aim was to gather initial qualitative data to aid in the development of an objective scoring tool that would be used to guide the mode of transport decision for pediatric and neonatal interfacility transport. The focus of the study was to elicit the factors that influence the mode of transport decision among professionals who are involved in this decision.

Methods: This study was conducted in an urban, freestanding children's hospital with a dedicated pediatric/neonatal transport team. Subjects were given written scenarios that represented a phone call requesting transport from a referring hospital. Subjects were asked to choose between 2 modes of transport: ambulance or helicopter. Weather was assumed to be clear. Decision-making factors were gathered and tallied. For group comparison, the Fisher exact, Pearson chi-square, Student *t*, or Wilcoxon rank sum tests for scale data was used. A multivariate logistic regression was performed to assess factors associated with the mode of transport decision.

Results: Responses were received from a total of 19 subjects. Nurses represented 58% (11) of the respondents, and physicians represented 42% (8). The nurses were all either currently employed on the transport team or had left the team within the past 2 years. The physicians were all critical care or emergency medicine fellows and attending physicians who serve in the medical control role for the transport team. All subjects reported a minimum of five years in their respective professions. The decision to mobilize a helicopter for interfacility transport was significantly associated with the provider's level of clinical concern in conjunction with the perceived distance and if neurovascular or respiratory status was in question in both univariate tests and the multivariate logistic regression. The decision to mobilize a helicopter did not differ significantly between professional roles (nurse vs. physician) or concerns about hemodynamic status such as blood pressure and heart rate. Physicians were significantly more likely to overestimate perceived ground travel time to the outside facility.

Conclusions: Health care providers responsible for directing and conducting the interfacility transport of critically ill children are more likely to mobilize a helicopter for transport in the face of neurovascular or respiratory clinical concerns in conjunction with a prolonged transport distance. When the provider's level of concern is lower, then a ground ambulance is consistently chosen even if out of hospital time is prolonged.

Critically ill or injured children often present to hospitals that may not be equipped to manage their complex medical needs. As a result, they must be emergently transported to a pediatric tertiary care facility to receive advanced care. Transport teams and specialty teams are faced with a constant series of complex decisions that must be made from the time of the initial referral call and throughout the clinical care and transport of the patient. One complex decision is the determination of the appropriate mode of transportation for each patient. This decision often requires the mobilization of either a ground ambulance or a helicopter. A decisional challenge arises when the patient is at distances in excess of 30 miles or more from the receiving hospital and is critically ill. Travel is possible by ambulance, but time can become an issue for a patient with the potential for deterioration. Transport professionals must then determine which mode of transport will be of greatest benefit. These decisions are multifactorial and are often based on incomplete information obtained only by phone. Referring facilities may not be comfortable with the care of critically ill children. This may lead to an overestimate or underestimate of the severity of the child's condition, rendering the mode of transport decision even more challenging. For this reason, transport professionals must not only consider the child's current reported condition, but they must also consider what is the most serious event or potential complication that may occur during the transport back to the receiving facility.[1]

Ground ambulance is the baseline method of transporting patients, but for some patients the decision is made to escalate the mode of transport to helicopter. How is this subset of patients identified, and is this mode of transport really advantageous? The adult literature has demonstrated that helicopter transport is very valuable and has been shown to save lives. Holtvedt et al[2] reported a series of 370 helicopter transports consisting mostly of adult patients in which 11% were deemed by a

Ann & Robert H. Lurie Children's Hospital of Chicago, Chicago, IL

Address for correspondence:
Janis M. Quinn MSN, CPNP-AC, Ann & Robert H. Lurie Children's Hospital of Chicago, Transport Team, Box #98, 225 East Chicago Avenue, Chicago, IL 60611, jquinn@luriechildrens.org

1067-991X/$36.00

http://dx.doi.org/10.1016/j.amj.2014.08.009

panel of experts to have specifically benefited from the use of a helicopter rather than an ambulance for their transport. These authors concluded that helicopter transport may be beneficial to a small select group of patients including trauma patients and pediatric patients. Ringburg et al[3] conducted a thorough overview of the published literature on the value of helicopter transport. They reviewed 16 publications between 1985 and 2007 and concluded that for every 100 helicopter transports, an additional 1.1 to 12.1 lives were saved because of this mode of transport. The overall mortality reduction attributed to helicopter transport was 2.7 additional lives saved per 100 helicopter transports. More recently, Galvagno et al[4] reported a sample of 223,475 trauma patients over 15 years old transported by either ambulance or helicopter. They found that, of the 159,511 adult trauma patients transported by helicopter to a level 1 trauma center, approximately 2,393 of these patients had an absolute rate of improved survival attributed specifically to helicopter versus ground transport. The challenge is the accurate identification of the select group of patients who would most benefit from helicopter transport.

The limitation of much of the literature is that most studies focus on the adult population and are specifically looking at scene response as opposed to interfacility transport. Research on mode of transport decisions in the pediatric population is void. Another key limitation is that helicopters are staffed with higher-level providers than emergency medical service ambulance responders at the scene of an accident. Helicopter teams have the ability to provide higher-level interventions than a standard emergency medical service ambulance, so the comparison is not necessarily equal. More research needs to be conducted in the area of pediatric interfacility critical care transport.

It is the goal of this research to gather initial, qualitative data to be used in the development of a scoring tool that will serve as a decision aid to identify high-risk pediatric-neonatal patients who may benefit from interfacility helicopter transport and to support the mode of transport decision. There is a distinct lack of objective decision aids to support transport professionals in making this very complex decision. Although the professionals involved are highly qualified, the lack of an objective tool may lead to inconsistencies between decision makers. Wisdom often passed down from experienced transport professionals to the less experienced includes the adage, "if the patient is very sick and very far, you should fly." The obvious question, of course, is how sick and how far?

The first step in developing a useful decision tool is to examine the factors involved in the decision-making process as it stands. We hypothesized that decision makers would mobilize a helicopter for referral centers that were greater than an hour away by ground in combination with a hemodynamically or neurologically unstable patient status.

Methods

This study was designed to gather initial qualitative data to establish current decision-making patterns among transport professionals involving pediatric-neonatal interfacility transport, with the larger goal of developing a tool to serve as an aid in guiding this complex decision. The study was conducted in an urban, freestanding children's hospital with a dedicated pediatric-neonatal transport team. Approval was obtained from our institutional review board. A survey of 14 scenarios (Appendix 1) was given via an online survey tool to a convenience sample of 50 transport registered nurses and physicians who serve in the medical control role for the transport team. The scenarios were constructed to include information that is typically gathered in the initial referral phone call. This information includes the referring hospital, the patient's chief complaint, a brief history of the presenting problem, the patient's current condition including vital signs, physical examination findings, laboratory values, imaging, and treatments rendered. The subjects were also given the time of day and number of miles away of the referring hospital. They were asked to choose ambulance or helicopter as the mode of transport for the patient in each scenario. Once the choice was made, subjects were then asked, via free text response, to list the primary reasons they chose that mode of transport. These free text responses were then divided by the principal investigator into 4 clinical decision categories based on the descriptive words used by the subject. The 4 categories were neurologic/neurovascular status, heart rate/perfusion status, systolic blood pressure, and respiratory status. Respiratory status included both airway and breathing concerns. For example, if a subject mentioned mental status, level of consciousness, intracranial pressure, pupils responsiveness, and so on, then that mode of transport decision was considered influenced by neurologic/neurovascular assessment (Appendix 2).

The distance reported in the scenarios ranged from 25 to 63 miles. Some scenarios also were missing some data, such as laboratory values and imaging results, because this is often the case in reality, and decisions needed to be made without the full and complete picture. The weather was assumed to be adequate for rotor wing operations for all scenarios. The principal investigator was blinded to subject identity. Consent was obtained at the beginning of the survey. Subjects were asked to read the scenarios and then, based on all of the information provided, make a decision to transport the child by ambulance or helicopter. Subjects were then asked a series of questions including 1) the level of concern for the patient using a Likert-type scale ranging from no concern to immediate life threat; 2) the rationale for the mode of transport decision given in the subjects own words via free text response; and 3) subjects' perceived estimation of time, in minutes, that it would take to drive, with lights and sirens employed, to the referring facility based on the distance and time of day.

For comparison between groups, either the Fisher exact test for categorical data or a Student *t*-test or Wilcoxon rank sum test for scale data (depending on normality of data) were used. A multivariate logistic regression was performed to