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Original Research

Retrospective Review of Pediatric Transport: Where Do Our Patients Go After Transport?

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A B S T R A C T

Objective: This review describes disposition of transported children and identifies contributing factors affecting optimal patient placement. The study describes timing and patient placement indicators in transport patients to identify areas of improvement, re-education, and training.

Methods: A retrospective chart review for transports via our pediatric specialty transport team from January 1, 2012, to December 31, 2014, was performed. Patients were identified by the transport quality assurance performance improvement database, hospital electronic medical records, and transport medical records.

Results: Three thousand two hundred fifty-six pediatric patient transports were reviewed. One hundred forty-three records were excluded. Of the remaining 3,113 patients, admission disposition was: 1,487 (47%) pediatric intensive care unit, 120 (4%) pediatric cardiovascular intensive care unit, 835 (27%) step-down critical care unit, 438 (14%) emergency department, 194 (6%) general floor, 29 (1%) neonatal intensive care unit, and 10 (< 1%) operating room. Of the 22% transported to a lower-acuity unit, several subsequently required critical care. Children transported for traumatic injuries had a shorter emergency department length of stay than medical patients.

Conclusion: Our study validates the efficient use of pediatric specialty transport team resources. Many transported patients are critically ill, require specialized pediatric services, or require definitive pediatric emergency department care.

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At the inception of the field of transport medicine, the goal was to move the child to receive specialty care; now the focus has shifted toward bringing a mobile pediatric intensive care unit (ICU) to the community.¹ Each year, there are more than 200,000 children (ranging from neonates to adolescents) who require interfacility transport for specialized care.² Evidence shows that children transported by specialized pediatric transport teams have improved outcomes when compared with nonspecialized teams.³ A lack of familiarity with the pediatric patient, relative scarcity of pediatric inpatient care resources, and improved outcomes with regionalization⁴⁻⁶ have contributed to many smaller facilities routinely requesting transport of pediatric patients. In our large metropolitan city, the city-based

emergency responders handle 25,000 annual pediatric calls, which make up 9.5% of their total call volume (D. Ostermayer, Written, December 2016). In contrast, our hospital-based, specialized transport team handles approximately 1,500 calls per year (6%). Specialized pediatric transport teams are a limited resource that requires intensive training, specific equipment, and the ability to provide expert care in a mobile dynamic environment. The act of transport has inherent costs and risks⁷ that must be balanced with the need to transfer and the availability of such teams.

Despite efforts to establish tools in order to aid transport triage decisions, it is still not always clear which patients require specialized pediatric transport.^{8,9} Disposition on arrival after transport by a pediatric specialty team is difficult to predict, and studies have investigated if patient illness severity scores could be used to accurately determine patient placement before arrival.^{8,9} The field of pediatric transport is relatively new,¹⁰ and much remains unknown regarding optimal practices within the discipline. In addition, transport teams must consider their local geography, weather, patient

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demographics, referral patterns, and available high-acuity specialty services when making decisions about the allocation of transport team resources.¹ This topic is especially relevant in today's era of quality health care because the appropriate use of specialized pediatric transport teams directly relates to the goal of delivering health care that is efficient, safe, effective, patient centered, timely, and equitable.¹¹ Accurate patient disposition on arrival to a tertiary care facility also optimizes overall hospital resource use and patient length of stay.

No previous study has looked at the pediatric transport patient population to determine if the limited resource of specialized pediatric transport teams is appropriately used. One surrogate marker for proper use of the specialized pediatric transport team is admission to a critical care unit. If a patient requires ICU admission, it can be inferred that transport by a mobile ICU team allowed that patient to begin receiving specialized care at an earlier time point, a factor that has been associated with improved outcomes.³ Admission disposition does not tell the whole story of pediatric transport. Some patients require advanced pediatric care to correct or reverse an immediate issue, such as a foreign body in the airway, and do not subsequently require ICU disposition. The use of pediatric-specific subspecialty services at accepting institutions can also be a stand-alone indication for transport to a pediatric center and has not been investigated. This single-center retrospective study aims to describe if 1 transport team is being used properly by acutely and critically ill children or if it is unduly strained by nonurgent or low-acuity patients. To capture all patients who potentially benefited, we describe the overall disposition by unit of transported patients and take an in-depth look at those who may have required specialized pediatric care without being admitted to a critical care unit. Thus, the subset of patients admitted to the emergency department (ED) was further analyzed to determine if they required pediatric-specific intervention or subspecialty expertise.

Methods

Study Design

This study reviewed pediatric specialty transports to a quaternary, multidisciplinary, university-affiliated pediatric 572-bed hospital in a large urban center with a single satellite campus 24 miles from the hub. Our institution is a level 1 pediatric trauma center, and by protocol all trauma admissions, including those transported by our specialized pediatric transport team, must receive a trauma evaluation in the ED. Our center's dedicated pediatric transport team works under the guidance of the medical control physician to assess the patient and determine initial patient disposition. Final disposition is determined by the medical control physician. The pediatric specialty team consists of a nurse and respiratory therapist with critical care experience and transport training as well as an emergency medical technician. A physician or neonatal nurse practitioner is added as determined by clinical indication. Our institution has general admission unit guidelines for specific conditions, and these are followed at all times (eg, neonates with single ventricle physiology and ductal-dependent systemic blood flow are always admitted to the cardiovascular intensive care unit [CVICU]). Additionally, certain diagnoses have protocols in place to objectively determine patient disposition based on severity of illness, and these protocols are used by our transport team. An example of this is diabetic ketoacidosis; the admission unit is predetermined based on the patient's initial pH as well as the presence or absence of specific inclusion criteria that automatically triage a patient to the pediatric intensive care unit (PICU). When a patient does not fit 1 of our general or diagnosis-specific guidelines, the disposition of that patient is determined by online medical control based on input and observation from the transport team. Initial and final patient disposition may differ in a case in which a patient's condition changes

during transport. In these scenarios, our team conveys the new data to the medical control physician who then has the ability to change the accepting unit en route. At that time, the medical control physician will obtain patient acceptance from the new admitting unit. Our pediatric specialty transport team uses both ground ambulance and fixed wing for transport.

A retrospective chart review of patients transported via our institutional pediatric specialty transport team to either of 2 affiliated hospital campuses over a 36-month period from January 1, 2012, to December 31, 2014, was performed. All patient transports were identified via an internal institutional transport quality assurance database. Patients were excluded if they were outbound transports from our facility, if transport was performed by another transport team or private conveyance, if the transport was not completed, or if substantial data were missing. Neonatal transports were excluded because they are exclusively transported to the newborn center, and, thus, their disposition was predetermined. The hospital electronic medical record as well as the transport medical records were reviewed and compared with validated information. The primary outcome measure was to identify the initial disposition of transported patients by unit. Secondary measures tracked included the transport diagnosis, referring institution, and use of ground or air transport. Additionally, for the subgroup of patients initially directed to the ED, supplementary data were collected including disposition from the ED, trauma status, length of stay (hours) in the ED, significant interventions performed within 1 hour of transport, hospital length of stay (days), and the use of pediatric subspecialty services. This study was approved by our institution's institutional review board.

Patient Selection

The transport quality assurance database included a total of 3,256 patients for the 36-month period from January 1, 2012, through December 31, 2014. All transports were initially collected, and upon review, 143 patients were excluded because of being outbound transports, incomplete transports, or missing information. The remaining 3,113 patients were analyzed according to the admitting unit, referring diagnosis, and referring facility. The 460 patients initially admitted to the ED were then analyzed further as described previously (Fig. 1).

Study Definitions

Terms were defined a priori to standardize data review. Time spent in the ED was rounded up or down to the nearest half hour. The total hospital length of stay (LOS) was rounded to the nearest whole day according to the midnight rule defined as follows: if a patient is admitted to the hospital on midnight of any given day, then that day counts as a full day of hospital stay, regardless of the time of discharge. Thus, the day of admission counted as day 0, and the day of discharge counted as 1 full day. Significant interventions performed in the ED were identified a priori and counted only if they performed at the receiving institution and they were either crucial to patient survival or reasonably considered to be something a community hospital could not perform (Table 1). The collection of routine laboratory work or the administration of common medications such as acetaminophen or ondansetron were excluded from the definition of significant interventions because these are readily available at most referring hospitals and do not require specialized pediatric care to perform. Significant interventions were only evaluated for the subset of patients triaged to the ED, and no intervention performed during transport by the pediatric specialty transport team was included. The need for significant interventions en route overwhelmingly resulted in triage to an ICU. The use of pediatric emergency medicine or pediatric-specific support services such as nursing, respiratory therapy, and child life

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