Brief Communication

Benefits of and Untoward Events during Intrahospital Transport of Pediatric Intensive Care Unit Patients

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Abstract

Background and Aims: The transport of critically ill patients for procedures or imaging outside the Intensive Care Unit (ICU) is potentially hazardous; hence, the transport process must be organized and efficient. The literature about benefits of and untoward events (UEs) during intrahospital transport of pediatric critically ill patient is scarce. We, therefore, audited the UEs during and benefits of intrahospital transport of critically ill pediatric patients in our ICU. **Subjects and Methods:** Eighty critically ill pediatric (<18 years) cancer patients, transported from the ICU for either diagnostic or therapeutic procedure over a period of 6 months, were included in the study. The data collected included the destination (computed tomography scan, intervention radiology, magnetic resonance imaging scan, and operation theater), accompanying medical personnel, UEs, and benefits obtained during transport. **Results:** Among eighty pediatric patients, the median age was 8 years (range 2–17 years). During the transport, four (5%) patients required endotracheal intubation, three (3.75%) patients required intercostal drain placement, and six (7.5%) patients required cardiopulmonary resuscitation. Accidental removal of central venous catheter was reported in three (3.75%) patients, drain came out in four (5%) patients, and three (3.75%) patients had accidental extubation. Transport indirectly led to a change in antibiotic therapy in 24 (30%) patients and directly helped in change of therapy in the form of interventions in 20 (25%) patients. **Conclusion:** Critically ill children can be transported safely with adequate pretransport preparations, which may help in avoiding major UEs and benefit the patient by change in the therapy.

Key words: Cancer patients, critically ill, intrahospital transport, pediatric transport

Introduction

Intrahospital transport of a critically ill patient from Intensive Care Unit (ICU) to various destinations for diagnostic and therapeutic purposes is common.[1] Despite its benefits, there is an inherent risk involved due to transition from controlled ICU environment to complex environment out of ICU and hence maintaining patient's condition becomes difficult, and there is a potential for untoward events (UEs). To prevent UEs, the accompanying physician should be well acquainted with the patient's condition, equipment being used for transport, and environment of destination where patient is being transported to. Pediatric patients are at higher risk of UEs due to narrow margin of safety.[2] Acquiring the skill of transporting critically ill pediatric patient is hence imperative for intensivists dealing with pediatric ICU patients. The literature about benefits of and UEs during intrahospital transport of critically ill pediatric patients is scarce. Therefore, we conducted this study to identify the benefits and quantify the major UEs during transport of critically ill pediatric patients.

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Materials and Methods

After obtaining approval and waiver of informed consent from the Institutional Review Board, data on intrahospital transport of eighty critically ill pediatric patients were collected prospectively between June 2014 and November 2014 in a tertiary care referral cancer center. All patients <18 years of age who were transported from the ICU for either diagnostic

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or therapeutic procedure within the above-mentioned period were included in the study.

Data collection included the destination of the patient (computed tomography [CT] scan, intervention radiology, magnetic resonance imaging, and operation theater), the accompanying person (junior or senior residents), and any major UEs such as accidental device removal or any significant physiological decompensation. We also noted down the development of complications such as pneumothorax, need for cardiopulmonary resuscitation (CPR), and increase in the rate of vasopressor administration. Vitals parameters (heart rate, blood pressure, respiratory rate, and SpO_2), mode and type of ventilation, dose of vasoactive agents, and volume status were recorded before initiating transport and on return to ICU. Need for any procedures during the transport such as endotracheal intubation, tracheostomy, Intercostal drain insertion, and new venous access were documented. Glasgow Coma Scale and focal neurological deficits before and after transport were also noted. UEs due to and benefits obtained from transport were recorded. We also documented whether transport led to any change in therapy such as escalation or de-escalation of antibiotics, insertion of drains, pigtail catheters, or surgical exploration. ICU outcomes of patients were recorded. The data were filled after completion of transport by accompanying doctor.

Demographic, categorical variables are presented as frequency (%), mean (standard deviation), and median as appropriate. Categorical variables were analyzed using Chi-square test or Fisher's exact test. $P < 0.05$ was considered statistically significant.

Results

Eighty critically ill pediatric cancer patients needed intrahospital transport. Table 1 shows the destination of the patients, whereas Tables 2 and 3 show the patient characteristics and the number and type of UEs, respectively. During the transport, four (5%) patients required endotracheal intubation, whereas three (3.75%) patients required intercostal drain placement due to the development of pneumothorax. Fourteen (17.5%) patients required new intravenous line placement due to accidental removal of intravenous cannula and 6 (7.5%) patients required CPR.

Significant hemodynamic instability in the form of bradycardia was noted in 4 (5%) patients and hypotension (mean arterial pressure <50 mm Hg) was observed in 21 (26.25%) patients. Severe hypoxia (SpO_2 <80%) occurred in four (5%) patients. Accidental removal of devices such as central venous catheter, drain, and endotracheal tube occurred in three (3.75%), four (5%), and three (3.75%) patients, respectively.

The unfavorable changes in vital parameters and UEs were more in patients who were accompanied by 1st-year senior resident than the patients who were accompanied by other residents.

Transport indirectly led to a change in antibiotic therapy in 24 (30%) patients. Imaging directly helped in change of therapy in the form of interventions such as pigtail insertion for collections, surgical re-exploration, and angioembolization in twenty (25%) patients. Twenty-eight percent patients died in the ICU, but none of the deaths were directly related to transport.

Table 1: Destination of patients

Destination	Number of patients (%)
CT scan	53 (66.3)
Operation theater	3 (3.8)
MRI	6 (7.5)
Intervention radiology	18 (22.5)
Total	80 (100)

MRI: Magnetic resonance imaging; CT: Computed tomography

Table 2: Patient characteristics

Patient characteristics	Number of patients (%)
Age	Median 8 years (range 2-17 years)
Sex (male: female)	53:27
Invasive arterial pressure monitoring	39 (48.8)
On vasopressors	24 (30)
On invasive mechanical ventilation	54 (67.5)
With central venous line	25 (31.25)

Table 3: Accompanying person and incidence and types of untoward events

Escorting person	JR 2	JR 3	SR 1	SR2
Physiological decompensation				
Bradycardia	0	0	4	0
Desaturation (SpO_2 <80%)	0	0	4	0
Hypotension (MAP <50 mmHg)	0	5	16	0
CPR	1	0	5	0
Intubation needed	4	0	0	0
Pneumothorax detection	0	3	0	0
Accidental device removal				
Endotracheal tube	3	0	0	0
Central venous catheter	0	1	2	0
IV line accidental removal	4	0	10	0
Accidental removal of drain	0	0	4	0
Untoward events (total)	12	9	45	0
Number of transports	20	25	26	9

JR: Junior resident; SR: Senior resident; IV: Intravenous; CPR: Cardiopulmonary resuscitation; MAP: Mean arterial pressure

Discussion

Patient safety during intrahospital transfers has not been well acknowledged in the literature as interhospital transfers. Safely and efficiently transporting patients in need of specialized care is the goal for transport teams. The majority of the available literature concerning intrahospital transport involves adult patients; literature on pediatric intrahospital transport that too in critically ill cancer patients is lacking. Unlike other studies, which observed both minor and major UEs, we focused only on major UEs which required immediate intervention,

in the absence of which patient may have come to harm including death.[3-5] In our study, we categorized major UEs into physiological decompensation and accidental device removal. Head-to-head comparison of studies cannot be done as methodology and definition of UEs vary significantly among studies. In a study by Parmentier-Decrucq *et al*., serious UEs were found to be 16.8%; however, in the current study, this proportion is much higher.[6] More recently, in another study by Jia *et al*., in adult patients, the reported critical UE rate was 33%, which is lower as compared to our study.[7] In that study, it was observed that vasopressor support was related to UEs. In our study, there was a high number of patients on vasopressor (catecholamines) support (30%) as compared to their study (14.1%). That may be the reason of high incidence severe UEs recorded in our study. Compared to study by Wallen *et al*., we found that UEs related to physiological decompensation were lower (52.5%) in our study as compared to theirs (71.7%).[4] However, no patient in their study needed CPR, but a number of patients who needed CPR in our cohort was high (7.5%). The number of patients transported with artificial airway and those on vasopressors were similar in both the studies; however, in their study, more than 50% of patients were accompanied by two physicians who provide a greater degree of vigilance and a helping hand. In our study, all the patients were escorted by one resident physician.

In our study, the UE rates were inversely related to physician seniority which is similar to that of study done by Papson *et al*. in adult critically ill ICU patients; however, we observed that in our study, UEs were more in 1st year senior resident which could be related to their unfamiliarity with our ICU protocols.[3]

An important finding highlighted in our study is that transport led to a change in antibiotic therapy in 30% of the patients, and interventional radiology procedure or exploration was needed in 25% of patients. Similarly, Hurst *et al*. reported that diagnostic testing produced a change in therapy in 39% of patients transported, while in abdominal CT and angiography led to a change in treatment in more than 50% patients.[8] Our study shows that intrahospital transport and imaging led to change in therapy though the transport may lead to hazardous changes in vital parameters.

To summarize, we should not transport patients unless absolutely needed, carry out minor interventions at bedside if possible, stabilize patients before transport, prepare adequately with appropriate drugs/equipment/monitoring, have trained personnel accompany the patient, and ensure proper documentation and handover. Appropriate planning and communication may improve patient safety by avoiding unnecessary delays. Extrapolating data from interhospital transport of pediatric critically ill patients, a dedicated team for pediatric critically ill patients may be helpful in reducing the incidence of major UEs during intrahospital transport.[9-11] The transport of critically ill pediatric patients more often led to UEs as compared to when adults were transported in our unit.[12]

Our study is unique in the sense that not only it has identified and quantified the major UEs but also acknowledged that how transport has benefited the patient and contributed to change in therapy. The limitations of the study are that apart from being a single-center study, the study has been done in patients with underlying cancer which may hinder the extrapolation of data to other critically ill population. Other limitation is that we have not recorded the minor UEs and also the disease severity scores have not been calculated.

Conclusion

Intrahospital transport and imaging led to change in therapy, hence weighing risk and benefit is of utmost importance. A dedicated pediatric transport team may provide safe transport and reduce the incidence of major UEs.

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Conflicts of interest

There are no conflicts of interest.

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