

Intrahospital transport practices of pediatric intensive care units and adverse events experienced during transport process in Türkiye

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ABSTRACT

Objective: The purpose of this study was to identify the intrahospital transport practices of pediatric intensive care units and the adverse events that occurred during intrahospital transport in Türkiye.

Method: In this descriptive study, a questionnaire with 22 questions was used, which was created by the researchers based on the relevant literature. The questionnaire was filled out electronically.

Results: The study included 26 centers from 13 different provinces. In terms of intrahospital transport practices, 53.8% of the units lacked a written protocol for patient transport, and 92.3% did not utilize a transport preparation checklist. It was determined that in 65.4% of the units, a nurse accompanied a physician during transport. Examining the adverse events during intrahospital transport, findings reveal that 96.2% of the units reported a decrease in oxygen saturation, 80.8% hypotension, 73.1% hypothermia, 61.5% unplanned extubation, and 61.5% cardiac arrest. It was found that 7.7% of the units had an accident with mortality during transportation.

Conclusion: As a result of our study, it has been determined that many of the measures recommended in the literature to ensure the safe transport of intensive care patients are implemented at varying rates, and adverse events occur during intrahospital transport. In pediatric intensive care units, it is crucial to utilize a written in-hospital transport protocol when transporting pediatric patients and to enhance monitoring procedures during transportation.

Keywords: Pediatric intensive care, intrahospital transport, patient safety, nursing

INTRODUCTION

Pediatric patients of all ages are treated in pediatric intensive care units (PICUs), typically with one or more organ failures and a broad diagnostic spectrum. Also, intensive care hospitalizations may necessitate the use of diagnostic and therapeutic techniques for critically ill patients.¹⁻⁴ Depending

on the capabilities of the hospital where they are treated, critically ill patients require a range of procedures. These procedures are sometimes performed at the patient's bedside (echocardiography, abdominal ultrasound, etc.) in the unit they are in, and sometimes in the service where the procedure is performed [abdominal computed tomography (CT) in the radiology service, laparotomy in the operating room, etc.].



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Patients should be transported from the intensive care unit to the appropriate service in this instance. Additionally, transport within the hospital is required for transferring patients from the Pediatric Emergency Care Unit to the PICU.^{1,2,4}

Transporting gravely ill children into or out of the hospital has the potential to have severe negative effects and even be life-threatening.⁵⁻⁷ According to studies, transporting critically ill children carries a greater risk of morbidity and mortality.^{2,8,9} The mortality rate for patients who are transported is 17% higher than that of those who are not transported in the same condition, even when the transport conditions are optimal.⁹ Among the risks associated with transport are respiratory decompensation, equipment failures, and ineffective team communication. The majority of critically ill children may experience a change in vital signs during transport, and more serious adverse events, such as death and severe injury, have also occurred.²⁻⁴ The most clinically applicable definition of an adverse event is an incident that necessitates a change in therapy while being transported. It is essential to remember that accidents can occur directly or indirectly. Numerous observational studies have focused on the incidence or types of adverse events associated with intrahospital transport. In studies examining the effects of intensive care unit (ICU) transport on patients, the incidence of adverse events related to in-hospital transport ranges from 0.11 percent to 75 percent.^{2-4,10-15}

Due to the limited resources available that may be used for patient monitoring and necessary interventions, the patient is perceived by healthcare professionals as more vulnerable during the patient's transfer from the ICU. Transporting a critically ill patient outside the intensive care unit is therefore a very challenging and stressful situation, even for the most experienced intensive care nurses.⁷⁻¹² To avoid any negative outcomes for the patient or a healthcare provider during the transport of an intensive care patient, effective management of all procedures before and during intrahospital transport is crucial.¹¹ To ensure the safe mobility of intensive care patients inside the hospital, it is recommended that procedures be established that include requirements for transport planning, staffing, organization, and equipment. The use of checklists, stabilizing the patient before transport, securing patient devices, checking the necessary equipment, and having qualified nurses and doctors present are all advised in order to ensure patient safety during all transport processes.^{3,10,14,16-20}

However, little is known about the transport practices used in PICUs across Türkiye, the adverse events that can happen during transport, and how the PICU healthcare team members respond to serious events that occur. Intrahospital transport of critically

ill children is a high-risk procedure. The purpose of this study was to identify the intrahospital transport procedures used by pediatric intensive care units and the adverse events that have occurred during intrahospital transport in Türkiye.

MATERIALS AND METHODS

Institutions (university, research and training, and private hospitals) that offer specialized intensive care for children and were willing to take part in the study were included. Hospitals that provided intensive care interventions to children in other intensive care units (such as internal medicine, coronary, and anesthesiology intensive care units) were excluded from the study. This descriptive study employed a questionnaire comprising 22 questions to assess intrahospital transport practices and the occurrence of adverse events during the intrahospital transport process. This questionnaire was distributed to the participating institutions in 2021. The questionnaire was developed by the researchers based on the relevant literature and provided to the attending nurses and physicians of the units that agreed to take part in the study. The questionnaire asks about the characteristics of the participating units, intrahospital transport preparations, applications made during the transport process, and whether the participants have encountered unexpected events that took place during the transportation process in their previous experiences. The data were collected online using the Redcap (Research Electronic Data Capture) software, which can be accessed online at "redcap.deu.edu.tr". The data was analyzed using the IBM SPSS Statistics 21.0 (Chicago, IL) software package. Numbers, percentages, the mean, standard deviation, and median (minimum-maximum) values were used to present descriptive characteristics.

Approval from the Non-Interventional Research Ethics Committee was obtained before the study began. In addition, the necessary institutional approvals were obtained to conduct the research. Since our study was descriptive and we received no information about the patients, we did not request informed consent from the children and parents.

RESULTS

The questionnaire was sent to 28 centers; 26 centers in 13 provinces participated in the study. The units that participated in our study had an average of 10.6 ± 4.6 beds (minimum = 6, maximum = 24, median = 10). Among the PICUs, 69.2% were training and research hospitals, 23.1% were university hospitals, and 7.7% were private hospitals. It was determined that 34.6% of these units had 6–10 intrahospital transports in the previous week, while 26.9% had 11–15 intrahospital transports.

Table 1. Reasons and frequency for intrahospital transport of patients in PICU (n=26)

Reasons*	n	%
Computed tomography (CT)	24	92.3
Magnetic resonance imaging (MRI)	24	92.3
Surgical procedure	23	88.5
Angiography	9	34.6
Transport to another intensive care unit	6	23.1
Electroencephalography	5	19.2
Ultrasonography	1	3.8
Bronchoscopy	1	3.8
Frequency (In a Week)		
5 and less	7	26.9
6-10 times	9	34.6
11-15 times	8	30.7
16-20 times	2	7.7
* Multiple choices were selected		

Table 2. Equipment and monitoring methods used in the transport of intubated patients in Pediatric Intensive Care Units (n=26)

Equipment Used in The Transport of Intubated Patients*	n	%
Oxygen cylinder	26	100
Manual resuscitator	26	100
Emergency medicine and supplies	26	100
Pulse oximeter device	26	100
Laryngoscope Set	25	96.2
Transport bag	19	73.1
Monitor	17	65.3
Transport ventilator	12	46.2
Portable aspirator	8	30.1
Monitoring Methods Used in Transporting The Intubated Patient*		
Electrocardiography	24	92.3
Oxygen saturation	24	100
End-tidal carbon dioxide	8	30.1
Invasive blood pressure	9	34.6
Noninvasive blood pressure	9	34.6
Central venous pressure	1	3.8
Body temperature	4	15.3
* Multiple choices were selected		

Table 3. The findings of the intrahospital transport procedures in Pediatric Intensive Care Units (n=26)

Availability of Written Intra-Hospital Transport Protocol	n	%
The protocol exists	12	46.1
No protocol	14	53.8
Use of Transport Preparations Checklist		
Using checklist	2	7.7
No checklist	24	92.3
Medical Record Keeping Status During Transport		
Medical record is kept	7	26.9
No record	19	73.1
Medical Team Members Accompanying the Transport*		
Pediatric intensive care specialist	6	23.1
Assistant physician	24	92.3
Pediatric intensive care nurse	17	65.3
Paramedic	20	76.9
Support staff	3	11.5
* Multiple choices were selected		

The most common reasons for intrahospital transport of patients were computed tomography (CT) and magnetic resonance imaging (MRI) scans (Table 1). During intrahospital transport, the majority of units were found to utilize only a single monitoring method (ECG or oxygen saturation). At least 50% of PICUs monitored SpO2 and ECG during the transport of intubated patients; 30% of PICUs used portable aspirators, and 46% of PICUs used transport ventilators (Table 2). According to the findings, a significant proportion of Pediatric Intensive Care Units (PICUs), specifically 53.8%, did not possess a documented protocol for patient transport. Furthermore, a substantial majority of PICUs, approximately 92%, did not adhere to the practice of utilizing a checklist for intrahospital transport preparation. Additionally, a considerable percentage of PICUs, specifically 73.1%, failed to maintain records during the patient transport process. It was determined that 34.7% of PICU patients were transported without a pediatric intensive care nurse (Table 3). It was determined that units participating in the study frequently experienced device- and equipment-related adverse events. All twelve units using a transport ventilator for intrahospital transport reported experiencing adverse events related to the transport ventilator during previous transports. At least 15 out of 17 PICUs that utilized monitors during transport reported at least one monitor or battery failure in the past. Shortage of health care professionals and communication issues were the most common system-related issues encountered by

pediatric intensive care units, while more than half of the units reported unfavorable outcomes due to inadequate preparation prior to transport. In these circumstances, more than half of the PICUs reported experiencing life-threatening adverse events, while two units experienced an event resulting in mortality during transport (Table 4).

Table 4. Adverse Events Experienced in Previous Transport Experiences in Pediatric Intensive Care Units (n=26) *		
Patient-Related Adverse Events	n	%
Oxygen desaturation	25	96.2
Hypotension	21	80.8
Hypothermia	19	73.1
Unplanned extubation	16	61.5
Cardiopulmonary arrest	16	61.5
Dislocation/occlusion of the vascular access or central venous catheter	9	34.6
Falling of the patient	2	7.7
Death	2	7.7
Device and Equipment-Related Adverse Events		
End of the oxygen cylinder	18	69.2
Monitor malfunction/out of battery	15	57.7
Transport ventilator failure / out of battery	12	46.2
Infuser failure / out of battery	12	46.2
Manual resuscitator failure	10	38.5
System-Related Adverse Events		
Shortage of health care professionals	21	80.8
Lack of communication with the unit where the patient is transported	19	73.1
Problems in accessing the elevator	18	69.2
Starting the transport without making adequate preparations	15	56.7
* Multiple choices were selected		

DISCUSSION

Intrahospital transport poses a substantial risk to patient safety and is associated with a high incidence of complications and adverse events that have a significant impact on clinical outcomes. The intrahospital transport of critically ill children requires extensive labor, care, and logistical support, but even the most critical patients can be transported safely in the hands of trained professionals.

This study represents the first investigation of the intrahospital transport protocols employed by pediatric intensive care units in Türkiye. The findings of our study indicate that the implementation rates of measures outlined in the existing literature to ensure the safe transport of pediatric intensive care patients vary significantly. Furthermore, adverse events occur during intrahospital transport in Türkiye. Even though patient transport is often needed in pediatric intensive care units in Türkiye, it has been found that major improvements are required in terms of equipment, training, guidelines, and preparing checklists to keep patients safe and avoid complications during transport.

It is strongly recommended to use checklists for pretransport and intrahospital transport preparation, to carefully plan and organize the timing of intrahospital transport, to provide adequate equipment for transport, and to train PICU team members to standardize transport practices.¹⁶⁻²² In Türkiye, there are deficiencies in maintaining patients' medical records during intrahospital transport, reviewing the preparation procedures with a checklist for safe transport, beginning transport only when preparations are completed, and using a written protocol to standardize these processes. Studies examining adverse events during intrahospital transport have identified, inadequate protocols, inadequate equipment, shortage of trained health workers, inadequate patient preparation, and communication problems as situations posing a threat to transportation safety.^{5,6,11,12,14} In this study, deficiencies of this sort were found to be prevalent during the transportation process in many intensive care units, indicating the need for significant improvements in this area in Türkiye.

The transport team must have the necessary technical skills and knowledge to transport patients.²³ Our research shows that there is a severe shortage of qualified transportation professionals and support staff in Türkiye. Therefore, the duration of transport can be prolonged, and patients can spend more time outside the intensive care units as a result of the insufficient availability of qualified support staff. The physical demands involved in tasks such as lifting and pulling patients, particularly when relocating them for diagnostic examinations, can pose a potential threat to the health of medical professionals, including doctors and nurses.

Diagnostic tests are often performed outside of the ICU, which increases the risk of complications without the proper support. Adverse events during intrahospital transport are caused by logistical issues and the relative instability of patients.²⁴ These complications prolong the extremely dangerous transport time of the critically ill child. Institutions are required to provide a

supportive and sustainable transport environment with fewer transport-related risks, develop a streamlined process, and make all the necessary arrangements to minimize the time a patient spends outside the intensive care unit.^{23,25}

The adverse events experienced during in-hospital transports in pediatric intensive care units in Türkiye are comparable to those described in the literature. Numerous studies examining adverse events that occurred during intrahospital transport of critically ill patients have found that equipment-related adverse events and significant changes in at least one physiologic variable are the most prevalent.^{2,13,15,16,26-28} However, the results of our study showed that most pediatric intensive care units in Türkiye were not able to utilize the monitoring technologies that are necessary for patient transport. The fact that more than half of the pediatric intensive care units in Türkiye do not monitor end-tidal carbon dioxide during transport and that these centers have experienced cardiopulmonary arrest during transport in the past demonstrates the critical importance of advanced monitoring techniques during transport.

The study had some limitations. First, the study did not examine the relationship between potential complications and adherence to transport guidelines in the ICUs, the presence of health care workers during transport, or the monitoring techniques used during transport. Second, the study design required the participation of a single physician or nurse from each institution. This implies that the collected data may have been influenced by the subjective experiences of the respondent. It is essential to recognize that the findings may not be representative of the overall practices observed in each PICU. It is crucial to consider these limitations when interpreting the data, and it is recommended that further studies should aim to objectively evaluate the standard practices of the participating healthcare facilities and the challenges encountered during transport.

CONCLUSION

Our study revealed that approximately 50% of the units did not adhere to the established written protocol for patient transfer. Furthermore, the majority of these units neglected to utilize the prescribed checklist to prepare for intrahospital transport. In these instances, it was observed that nurses were primarily accompanied by physicians during the transport process, yet there was a notable deficiency in the utilization of advanced monitoring techniques. To increase the safety of critically ill children during intrahospital transport, it is essential to develop intrahospital transport procedures, guidelines, and checklists for transport readiness based on the most recent evidence. To ensure full adherence to national recommendations in PICUs, it is essential to ensure the provision of proper equipment and

the maintenance of an adequate number of skilled medical experts. To prevent any potential problems that may arise during transportation, it is imperative to enhance the utilization of modern monitoring tools.

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Ethical approval

This study has been approved by the Dokuz Eylül University Non-interventional Clinical Research Ethics Committee (approval date 08/09/2016, number 2016/24-38). Written informed consent was obtained from the participants.

Author contribution

Surgical and Medical Practices: GA, AK, EMB; Concept: GA, AK, EMB; Design: GA, AK, EMB; Data Collection or Processing: GA, AK, EMB; Analysis or Interpretation: GA, AK, EMB; Literature Search: GA, AK, EMB; Writing: GA, EMB. All authors reviewed the results and approved the final version of the article.

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Conflict of interest

The authors declare that there is no conflict of interest.

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