



Intrahospital Transport Practice in Pediatric Intensive Care Units

Çocuk Yoğun Bakım Ünitelerinde Hastane İçi Transport Uygulamaları

© Mehmet Ünal¹, © Perihan Aydın¹, © Nazan Ülgen Tekerek², © Oğuz Dursun², © Erdem Çebişi², © Alper Köker²

¹Akdeniz University Faculty of Medicine, Nurse in Department of Pediatric Intensive Care, Antalya, Turkey

²Akdeniz University Faculty of Medicine, Department of Pediatrics, Division of Pediatric Intensive Care, Antalya, Turkey

Abstract

Introduction: Critically ill children often require transport during diagnosis and treatment procedures during intensive care hospitalization. With this study, it was aimed to evaluate the practice of transport and the problems encountered during transport in pediatric intensive care units in Turkey.

Methods: A questionnaire consisting of 18 questions was filled in with internet access by the head nurses of the pediatric intensive care unit, who agreed to participate in the study. Responses to questions about the characteristics of the participating centers, transport practices, problems encountered during transport, interventions and the registration system were evaluated.

Results: A total of 29 tertiary pediatric intensive care units from 8 provinces in Turkey were included in the study. The mean number of beds was 14. In most pediatric intensive care units, 5 to 10 patients (51.7%) were transferred within 1 week. It was observed that the most patients were transported to the inpatient service (89.7%), followed by the operating room (69%). There was a protocol for patient transport in 69% of the units. The transport decision was made by the responsible specialist physician at a rate of 96.6%. 65% of the participants stated that the transport was recorded on a form. Transports were accompanied by 93% nurses, 86% allied health personnel, and 79% doctors. In 20 centers (69%), transport was possible with an invasive mechanical ventilator and 11 (37.9%) with a non-invasive mechanical ventilator. The most common problem encountered during transportation was the inadequacy of the physical conditions of the hospital (48.3%). There were 4 (13.8%) participants who encountered problems during patient transport in the last week. It was stated that the oxygen tube was depleted in one of them, and respiratory arrest developed in another patient.

Conclusion: In this study, it was shown that; In our country, there are significant differences in intrahospital transport conditions, transport teams, equipment used during transport between centers. Transport standards should be established and these should take into account the conditions of our country. For these, compliance and monitoring mechanisms should be established.

Keywords: Intrahospital transport, child, intensive care

Öz

Giriş: Kritik hasta çocuklar, gerek yoğun bakım yatışı öncesinde ve gerekse yatıştan sonraki süreçte, tanı ve tedavi işlemleri sırasında sıklıkla transport gereksinimi göstermektedir. Bu çalışma ile Türkiye’de çocuk yoğun bakım ünitelerinde yapılan transport işlemlerinin ve transport sırasında karşılaşılan sorunların değerlendirilmesi amaçlanmıştır.

Yöntemler: Türkiye’de çalışmaya katılmayı kabul eden merkezlerin çocuk yoğun bakım sorumlu hemşireleri tarafından 18 sorudan oluşan anket internet erişimli olarak dolduruldu. Katılan merkezlere ait özellikler, transport ile ilgili özellikler, transport sırasında karşılaşılan sorunlar, müdahaleler ve kayıt sistemi ile ilgili sorulara verilen yanıtlar değerlendirildi.

Bulgular: Çalışmaya Türkiye’de 8 ilden toplam 29 üçüncü basamak çocuk yoğun bakım ünitesi dahil olmayı kabul etti. Ortalama yatak sayısı 14 idi. Çalışmaya katılan çocuk yoğun bakım ünitelerinin çoğunda 1 hafta içerisinde 5 ila 10 hasta transferi (%51,7) yapıldığı, en çok yataklı servise (%89,7), ikinci sırada ameliyathaneye (%69) hasta transportu yapıldığı saptandı. Ünitelerin %69’u hasta transportu ile ilgili bir protokole sahipti, %96,6’sında transport kararını sorumlu uzman hekim vermekte, %65 oranında transport kaydı tutulmaktaydı. Hasta transportlarına hemşire katılımı %93 oranında, yardımcı personel %86 oranında, doktor %79 oranında eşlik etmekteydi. Merkezlerden 20’si (%69) invaziv mekanik ventilasyon ile 11’i (%37,9) non-invaziv mekanik ventilasyonla transport olanağına sahipti. Transport sırasında en sık karşılaşılan sorun hastane fiziki koşullarının eksikliği (%48,3) idi. Dört kişi (%13,8) son bir hafta içinde gerçekleşen hasta transferleri sırasında sorun ile karşılaştığını yanıtladı ve bunlardan birinde oksijen tüpü bittiği, bir diğer hastada solunum arresti geliştiği belirtildi.

Sonuç: Bu çalışmada ülkemizde hastane içi transport koşullarının, oluşturulan transport ekiplerinin, transport sırasında kullanılan ekipmanın merkezler arasında önemli farklılıklar gösterdiği saptanmıştır. Ülkemiz koşullarını gözeterek transport standartları oluşturulmalı, uyum denetleme mekanizmaları kurulmalıdır.

Anahtar Kelimeler: Hastane içi transport, çocuk, yoğun bakım

Address for Correspondence/Yazışma Adresi: Nazan Ülgen Tekerek, Akdeniz University Faculty of Medicine, Department of Pediatrics, Division of Pediatric Intensive Care, Antalya, Turkey

E-mail: nazanulgen@hotmail.com **ORCID ID:** orcid.org/0000-0002-4577-1488

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Introduction

Pediatric intensive care units are the places where critically ill children are followed up and treated, their care is maintained, and the most complex biomedical devices of hospitals are available. And, advanced technology and knowledge and performance to use this technology are required in these units. In pediatric intensive care units, a well-equipped team for emergency intervention, invasive or non-invasive mechanical ventilators for advanced respiratory support treatments, infusion pumps for appropriate treatment, and advanced monitoring devices are needed. From this point of view, the most reliable place for critically ill children is the pediatric intensive care unit. However, critically ill children often require transport during diagnosis and treatment, both before and after admission to the intensive care unit. During transport, morbidity and mortality may develop due to problems that may arise from the patient, equipment and team. Complications can be encountered at a rate of 6-71% during in-hospital transport.¹ Various studies are carried out and pre-transport checklists are created in order to ensure patient safety and to prevent medical errors in transport all over the world.² In this study, it was aimed to evaluate the transport procedures performed in pediatric intensive care units in Turkey and the problems encountered during transport.

Material and Methods

A questionnaire consisting of 18 questions was filled in with internet access by the nurses responsible for the pediatric intensive care units of 29 centers in Turkey, who agreed to participate in the study. Features of the participating centers (number of beds, number of transports in a week, transport units), transport-related features (determinants of transport decision, presence of transport protocol, members of the transport team, emergency bag and its contents, monitorization used during transport, oxygenation, drug infusion systems), problems encountered during transport, interventions and answers to questions about the registration system were evaluated.

Statistical Analysis

Study data were evaluated using SPSS 23 software. Categorical data were expressed as numbers and percentages. The study was conducted with the approval of the Clinical Research Ethics Committee of Akdeniz University (24.08.2022, no: KA EK-500).

Results

A total of 29 tertiary pediatric intensive care units from 8 provinces in Turkey agreed to be included in the study. While

14 health centers were university hospitals, the others were training and research hospitals. The average number of beds was 14. It was observed that 5-10 patients (51.7%) were transferred within a week in most of the pediatric intensive care units participating in the study. It was determined that most of the transfers were made to the inpatient service (89.7%), and the second place was to the operating room (69%) (Table 1). 69% of the units had a protocol for patient transport, the transport decision was made by the responsible specialist physician in 96.6%, and transport records were kept in 65%. Postoperative patient transport was performed by the intensive care team and the relevant surgical department team at a rate of 37.9% (Table 2). Each unit had an emergency bag, in which there were drugs such as adrenaline, saline and sedo-analgesics (Table 3). The participation rate of nurses in patient transports was 93%, auxiliary staff accompanied at

Table 1. Distribution of units where patients are transported from pediatric intensive care unit

Units	n (%)
Inpatient ward	26 (89.7)
Operating room	20 (69)
Radiology	19 (65.5)
Nuclear medicine	2 (6.9)
Other	5 (17.2)

Table 2. Distribution of units that transport patients from the operating room to the pediatric intensive care unit

Unit that transports patients	n (%)
Intensive care unit + related surgical unit	11 (37.9)
Related surgical unit	7 (24.1)
Intensive care unit	4 (13.8)
Intensive care unit + anesthesiology	3 (10.3)
Anesthesiology	2 (6.9)
Anesthesiology + related surgical unit	2 (6.9)

Table 3. Distribution of drugs in the transport bag

Drug	n (%)
Adrenalin	29 (100)
0.9% NaCl	28 (96.6)
Midazolam	22 (75.9)
Fentanyl/morphine	15 (51.7)
Methylprednisolone/dexamethasone	15 (51.7)
Atropine	13 (44.8)
Glucose	12 (41.4)
Calcium	10 (34.5)
Diazepam	7 (24.1)
Muscle relaxants	4 (13.8)
Bicarbonate	3 (10.4)
Propofol	1 (3.4)

the rate of 86%, and the doctors at the rate of 79%. The most common problem encountered during transport was the inadequacy of hospital's physical conditions (48.3%) (Figure 1). Twenty (69%) centers had the opportunity to transport with invasive mechanical ventilation and 11 (37.9%) centers with non-invasive mechanical ventilation. The rate of using infusion pumps was 3.4%. For monitoring purposes, transport monitor was used with a rate of 82.8%. Four (13.8%) of the 29 nurses who answered the questionnaire stated that they had encountered problems during the patient transfers in the last week, and these were depletion of oxygen tube in one patient, development of respiratory arrest in one patient, and adverse events related to the physical conditions of the hospital in two patients. For the case of a possible cardiac or pulmonary arrest during the transfer, 51.7% of the participants stated that they would start the intervention at the place where patients were and take them back to the intensive care unit.

Discussion

In this study, the situation regarding in-hospital critical patient transport in tertiary pediatric intensive care units in our country was presented cross-sectionally. In the presented study, 30.1% of the units included in the study did not have a transport protocol. It was stated that all centers participating in the study had an emergency bag, and this bag contained the necessary materials for airway management and the necessary drugs for resuscitation. It was stated that the patient transfer was accompanied by 93% nurses, 86% auxiliary staff, and 79% doctors. It has been stated in the guidelines published for patient transfer that intensive care units should have written protocols.³ When emergency or unexpected situations occur during in-hospital transport, it is vital to have team coordination, communication, trained personnel, properly working equipment, adequate documentation and relevant checklists. The transport team should be familiar with

the equipment used, and should be experienced in emergency airway, ventilation and resuscitation management.^{4,5} In addition to the necessary equipment and oxygen supply for emergency airway management, monitoring systems that can measure blood pressure and cardiac functions should be available without exception. Essential resuscitation drugs for cardiac arrest or arrhythmia should be available in sufficient quantities in the emergency bag.³

In our study, it was determined that patients were most frequently transported to clinics and operating rooms, and the most common problems were related to the physical conditions of the hospital. The physical conditions of the pediatric intensive care unit and its location close to the operating room are important for the rapid and convenient transportation of patients who require emergency intervention. Patient transport becomes more risky in clinics located in different places, distant or requiring ambulance transport.

In our study, 20 centers (69%) had the opportunity to transport with invasive mechanical ventilation and 11 (37.9%) centers with non-invasive mechanical ventilation during transport. A large proportion of patients followed in intensive care units, trauma patients, and perioperative patients require mechanical ventilation, and this may result in airway and pulmonary complications during in-hospital transport. Although symptomatic pneumothorax and atelectasis are seen more frequently, the risk of pneumothorax may increase 2 times and the occurrence of atelectasis may increase approximately 3 times.^{6,9} Malposition of the intubation tube is also an important condition that is often not noticed but can cause serious problems. In a study conducted on newborns in the literature, it was found that the intubation tube was positioned incorrectly at a rate of 50% after transport.¹⁰ In the study of Parmentier-Decrucq et al.⁹ on the group of 262 mechanically ventilated patients, 0.4% of all adverse events during in-hospital transport were accidental extubation, 8.8% were related to low oxygen saturation (it was stated that patients who needed positive end-expiratory pressure over 6 cm H₂O constituted an important risk group) and 17.6% were related to airway equipment events (including inappropriate alarm settings, probe disengagement, and battery problems). Similar to this study, many studies have shown that the most common adverse events are equipment-related.^{11,12} In addition, although it is not very common, accidental extubation is an adverse event that should be considered because it may result in the death of the patient. Another important issue is that when the transport of the mechanically ventilated patient with a balloon mask or a transport ventilator was evaluated, changes in some parameters (more than 10 mmHg in pCO₂, more than 0.05 units in pH) were found in arterial blood gas analysis with balloon mask.² Therefore, we think that choosing a ventilator would be safer.

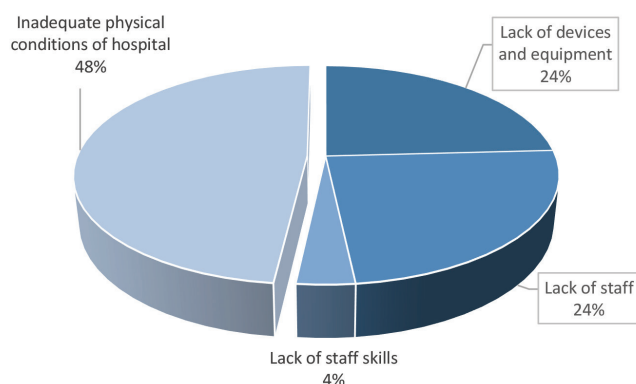


Figure 1. The most frequently observed deficiencies during transport

In our study, it was observed that there was a very low rate of the use of infusion pumps during transport. In addition to the possibility of medication errors during patient transport, interruption of vital infusions or administration of wrong doses (fluid therapy, sedation, analgesia, vasopressor, inotropic, antiarrhythmic, etc.) bring great risks. Hypotension, hypertension, hypoglycemia, hyperglycemia, and blood gas changes may be encountered. Changes in intravenous fluid infusions, interruptions in vasoactive drug administration, as well as altered circulatory dynamics and end-organ perfusion can cause disruptions in systemic acid-base balance.¹² Acidotic conditions may alter vasopressor activity and predispose patients to arrhythmias, resulting in cardiac arrest. For this reason, to reduce or even eliminate these risks, it will be useful to ensure the continuity of the infusion during transport, if possible, with infusion pumps at the appropriate dose, and to get their calibrations made and ensure them to be fully charged if the infusion pumps are used.

Study Limitations

This study has some limitations. Due to the fact that it is a cross-sectional survey study and the number of participating centers is limited, we think that it does not accurately reflect the emergency transport management of critically ill children, but it is informative. For this reason, we suggest that further prospective studies involving more centers will be beneficial.

Conclusion

Critically ill children are at risk for significant adverse events such as airway or pulmonary complications, hemodynamic deteriorations (including cardiac arrest), nosocomial infections, acid-base imbalances, and glucose abnormalities during in-hospital transport. In this study, it was determined that in-hospital transport conditions, the transport teams, and the equipment used during transport in our country differed significantly among health centers. Transport standards should be created by taking the conditions of our country into account, and compliance inspection mechanisms should be established.

Information: This study was presented as an oral presentation at the 16th Pediatric Emergency Medicine and Intensive Care Congress, 12th Pediatric Emergency Medicine and Intensive Care Nursing Congress and won the third prize.

Ethics

Ethics Committee Approval: The study was conducted with the approval of the Clinical Research Ethics Committee of Akdeniz University (24.08.2022, no: KAEK-500).

Informed Consent: It was a survey work.

Peer-review: Internally and externally peer-reviewed.

Authorship Contributions

Surgical and Medical Practices: P.A., N.Ü.T., A.K., Concept: N.Ü.T., O.D., E.Ç., Design: P.A., N.Ü.T., O.D., E.Ç., A.K., Data Collection or Processing: M.Ü., P.A., N.Ü.T., Analysis or Interpretation: M.Ü., N.Ü.T., O.D., A.K., Literature Search: M.Ü., P.A., N.Ü.T., O.D., Writing: M.Ü., P.A., N.Ü.T., O.D.

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