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Retrospective Evaluation of Cases Accepted by Inter-hospital Transfer to the Pediatric Emergency Clinic

Çocuk Acil Kliniğine Hastaneler-arası Transferle Kabul Edilen Olguların Retrospektif Değerlendirilmesi

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Abstract

Introduction: Inter-hospital transport is an important process of pediatric emergency and pediatric intensive care; the patient is transferred to another center with the emergency medical services. Inter-hospital transport can be life-saving for pediatric patients, but the process can logistically be difficult and risky. The actions required to prevent unwanted events during transport depend mostly on the accurate and reliable data obtained. We think that research on the transport of pediatric patients is limited in our country. Our study investigated the characteristics of pediatric patients transferred to our unit by ambulance and the problems during transport.

Methods: One hundred and eighty-three patients under the age of 18 who were referred to the pediatric emergency service between June 2017 and June 2019, whose data were regularly recorded, were included in our study. Data of patients who were sent to the external center for consultation via 112 were excluded. The list of the transferred patients was obtained from 112 command centers in our city and the patient records were analyzed retrospectively with the hospital information management system.

Results: Fifty-nine percent of the 183 patients included in our study were male. The mean age of the patients was 62.2±39.1 months. Fourty-two percent of the patients were between 1 month and 3 years old. We found that the most frequent transports are in the spring with 42.6% and 50.9% of the transports took place between 16.00-00.00 hours. We found that the most common transported patients were pneumonia with 28.4% and respiratory distress was the most common adverse event during transport with 7.1%.

Conclusion: In the transfer of pediatric patients between hospitals, every step, from the training of staff to the equipment in the ambulance, should be planned in detail. We believe that more studies are needed to examine transport protocols for children's emergency medical services, the level of education required by the transport team, the state of the medical device used in the transport process, the patient's pre and posttransport stability, and the safety of the patient during the transport period.

Keywords: Child, ambulance, patient transfer, emergency medical services

Öz

Giriş: Hastaneler arası nakil çocuk acil ve çocuk yoğun bakımın önemli bir süreci olup; acil tıp hizmetleri ile hasta gerektiğinde başka bir merkeze nakledilir. Hastaneler arası nakil çocuk hastalar için hayat kurtarıcı olabilir ancak bu süreç lojistik açıdan zor ve risklidir. Nakil sırasında istenmeyen olayları engellemeye yönelik eylemlerimiz çoğunlukla elde edilen doğru ve güvenilir verilere bağlıdır. Literatürde çocuk hastaların hastaneler arası nakli ile ilgili yapılan çalışmaların kısıtlı olduğunu düşünüyoruz. Çalışmamızda ünitemize ambulansla nakledilen çocuk hastaların özelliklerini ve nakil sırasında yaşadığı sorunları araştırmayı amaçladık.

Yöntemler: Haziran 2017-Haziran 2019 tarihleri arasında, 3. basamak sağlık merkezi olan hastanemiz çocuk sağlığı ve hastalıkları acil servise nakil olması kabul edilmiş 18 yaşından küçük 183 hasta alındı.

Bulgular: Çalışmamıza katılan 183 hastanın %59'u erkekti. Hastaların yaş ortalamasının 62,2±39,1 ay idi. Nakledilen hastaların %42,1'i 1 ay-3 yaş arasında idi. En sık naklin %42,6 ile ilkbahar mevsiminde olduğunu ve %50,9'unun 16.00-00.00 arasında naklediğini saptadık. Transport tanıları açıdan değerlendirildiğinde %28,4 ile en sık pnömoni hastalarının nakil edildiğini ve nakil sırasında istenmeyen olay olarak %7,1 ile solunum sıkıntısı olduğunu bulduk.

Sonuç: Hastaneler arası çocuk hastaların naklinde; çalışanların eğitiminden ambulansta bulunan ekipmanlara kadar her basamak ayrıntılı bir şekilde planlanmalıdır. Çocuklar için acil tıp hizmetlerinin nakil protokollerini, nakil ekibinin gereksinim duyacağı eğitim düzeyini, nakil işleminde kullanılan tıbbi cihaz durumunu, hastanın nakil öncesinde ve sonrasındaki stabilizasyonunu ve nakil süresinde hasta güvenliğini araştıran daha geniş ve kapsamlı çalışmalara ihtiyaç olduğunu düşünüyoruz.

Anahtar Kelimeler: Çocuk, ambulans, hasta transferi, acil tıp hizmetleri

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Introduction

Emergency medical services are the provision of appropriate health care outside of hospital, during transport, or at a hospital when a person requires immediate medical attention if suddenly becoming ill or injured.[1] Children's emergency services are the components of emergency medical services which address children's medical needs. These pediatric emergency services consist of protection from injuries, pre-hospital medical care, hospital medical treatment, rehabilitation, and transport between hospitals.[2] Within emergency medical services, inter-hospital transport is an important process that pediatric emergency and intensive care units rely on transfering a patient to another center when necessary. Inter-hospital transport can be life-saving for pediatric patients, but the process can logistically be difficult and risky, especially if it causes the patient's physiology to deteriorate and triggers unwanted events.[3] The frequency of undesirable events is proportional to the duration of the transfer, the severity of the pre-transfer disease, and the experience of the emergency medical personnel.[4,5] Identifying the main problems that may occur during pediatric patient transport will reinforce our knowledge for addressing children's needs during emergency situations, and the actions required to prevent unwanted events during transport depend mostly on the accurate and reliable data obtained.[6] We think that research on the transport of pediatric patients is limited in our country. Our study investigated the characteristics of pediatric patients transferred to our unit by ambulance and the problems that are experienced during transport.

Materials and Methods

One hundred and eighty-three patients under the age of 18 who were referred to the Çanakkale Onsekiz Mart University Pediatric Emergency Service between June 2017 and June 2019, whose data were regularly recorded, were included in our study. Data of patients who were sent to the external center for consultation via 112 were excluded. The list of the transferred patients was obtained from 112 command centers in our city and the patient records were analyzed retrospectively with the "hospital information management system". Our study was approved by the Çanakkale Onsekiz Mart University Ethics Committee on 20.08.2020 with the decision number 2020-11. A form was created that included age, gender, referral diagnosis, distance between centers, time of transport, duration of transport and problems encountered during transport. After the patient was admitted to the 112 command center; the time between the patient's departure from the first center and his arrival at our hospital was accepted as the golden hour. Ambulances with 12-channel ECG, a monitor with pulse peak, minute respiratory rate, transport ventilator and aspirator device were used by 112 command centers for patient transport.

Statistical Analysis

IBM Statistics 23.0 (SPSS) statistical package program was used to evaluate the statistical data in our study. Number, percentage, mean and standard deviation were calculated in the presentation of descriptive data.

Results

Fifty-nine percent of the 183 patients included in our study were male. The mean age of the patients was 62.2±39.1 months. Within the patient sample, 11.5% were newborns, 42.1% were 1 month to 3 years old, 7.1% were 3-5 years old, 34.9% were 5-15 years old, and 4.4% were older than 15 years (Table 1). Considering the seasonal variations in transport between hospitals; transports most commonly occurred in the spring. It was observed that the transfer frequency was 42.6% in the spring, 38.7% in the winter, 17.3% in the summer, and 1.4% in the autumn. In 2018, the frequency of transport was 20.7% in the spring, 19.6% in winter, and 9.2% in summer. In 2019, it was found to be 21.9% in spring, 19.1% in winter,

Table 1. Epidemiological characteristics of transport patients

	Mean ± SD (min-max)		
Age (month)	**62.2±39.1 (1-192)**		
	n (%)		
Gender			
Female	75 (41)		
Male	108 (59)		
Age			
0-1 month	21 (11.5)		
1 month-3 years	77 (42.1)		
3-5 years	13 (7.1)		
5-15 years	64 (34.9)		
>15 years	8 (4.4)		
	n (%)	**2018 (n) (%)**	**2019 (n) (%)**
Season			
Spring	78 (42.6)	38 (20.7)	40 (21.9)
Winter	71 (38.7)	36 (19.6)	35 (19.1)
Summer	32 (17.3)	17 (9.2)	15 (8.1)
Autumn	2 (1.4)	1 (0.7)	1 (0.7)
Transport time			
08.00-16.00	65 (35.5)		
16.00-00.00	93 (50.9)		
00.00-08.00	25 (13.6)		
Transport reason			
Further examination and treatment	158 (86.3)		
Need for intensive care	25 (13.7)		
Referring center			
Second level state	174 (95.1%)		
Third level state	2 (1.1%)		
Private hospital	7 (3.8%)		
Total	183 (100)		

SD: Standard deviation, n: Number of cases

and 8.1% in summer (Figure 1). Considering the distribution of patient transfers throughout the day; it was seen that transports most frequently took place outside of official working hours with 50.9% of the patient transports occurring between 16:00-00:00 hours, 35.5% between 08:00-16:00 hours, and 13.6% between 00:00-08:00 hours (Table 1). While 86.3% of the patients were referred for further examination and treatment, 13.7% were referred because of the need for intensive care. Ninety-five percent of the transferred patients were referred from the second level hospital, 1.1% from the third level state hospital, and 3.8% from the private hospital (Table 1). When the patients transferred by ambulance were evaluated, the diagnosis frequencies were as follows: 28.4% pneumonia, 24.6% bacteremia, 20.8% central nervous system pathologies, 7.1% intoxication, 7.1% gastrointestinal system pathologies, 5.5% trauma, 2.8% hematological diseases, and rarer diseases was neuromuscular pathologies, cardiac pathologies, malignancy, epiglottitis, and soft tissue diseases (Table 2, 3) (Figure 2). Twelve of the patients (6.5%) transported by ambulance were intubated. While 7.1% of the patients had dyspnea, 5.5% were unconscious, two patients had arrhythmia, and two patients had hypotension (Table 4). During the transfer of the patients, there were no complications related to the equipment, such as misplacement or lack of endotracheal tubes or vascular access, monitoring, and ventilator devices. The average transport distance was determined to be 51.4±30.0 kilometers. The time elapsed between the admission of patients from 112 command centers and arrival at our hospital was 55.7±39.1 minutes. The mean transfer time of patients who were less than 50 kilometers away from our center was 41.1±3.8 minutes, while it was 63.6±3.3 minutes for those between 50-150 kilometers, and 128.3±16.3 minutes for distances further than 150 kilometers (Table 5). An ambulance helicopter was used for one patient being transferred from a distance further than 150 kilometers. It was observed that the duration of the transport using an ambulance helicopter was reduced to 30 minutes and no complications occurred during the transport.

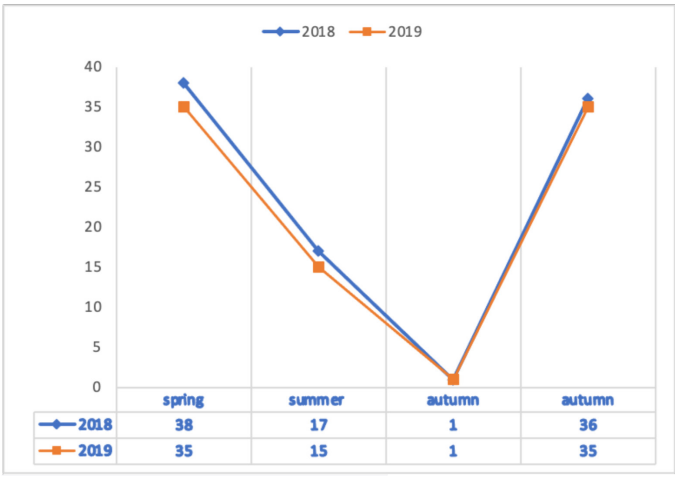

Figure 1. Transport patients according to the seasons

Discussion

In our study, in which we investigated the problems and characteristics of pediatric patients during transport, we found that 42.1% of the patients transferred to our unit were between the ages of 1 month and 3 years, and 11.5% were newborns. Chaichotjinda et al.[7] in a study conducted on 122 pediatric patients in 2020, 30% of the patients were younger than 1 year old. Gupta and Rettiganti[8] they also reported that 59.6% of the 401 patients they evaluated the transport process in 2020 were younger than 1 year old, and 20.9% were newborns. Qui et al.[9] they reported that 22.9% of them were in the neonatal group in their study on 9.231 children. In our study, the reasons for the lower neonatal transfer rate compared to other studies in the literature are; In studies, we evaluated the high rate of transport of children with malformations, transfers of mothers requiring neonatal hospitalization before birth and low fertility rate in our location (1.47 children in our city and the province with the tenth lowest rate in our country).[10]

In our study, patients referred with a diagnosis of pneumonia were observed more frequently in winter months, while more patients were referred for bacteremia and central nervous system diseases in spring and summer months. Qui et al.[9] reported that 29.9% of the transports were made in winter and 29.5% in spring. We think that the reason for the seasonal change in the number of cases is the seasonal changes of childhood pneumonia and viral infections. In our study, 28.9% of transport patients were diagnosed with pneumonia and 21.9% were neurological system diseases. In the study conducted by Chaichotjinda et al.[7], 17% of the

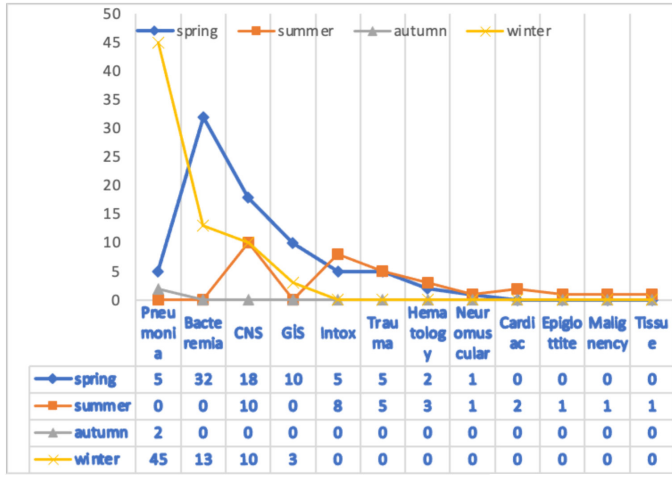

Figure 2. Transported patient diagnoses according to the seasons
CNS: Central nervous system, GIS: Gastrointestinal system

Table 2. Evaluation of transport time and diagnosis of transport patients

	n (%)	08.00-16.00 (n) (%)	16.00-00.00 (n) (%)	00-08.00 (n) (%)	
	Transport time (mean ± SD) (minutes)				
Pneumonia	52 (28.4)	23 (12.5)	25 (13.6)	4 (2.3)	47±25
Bacteremia	45 (24.6)	9 (4.2)	30 (16.2)	6 (3.2)	52±31
CNS pathology	38 (20.8)	10 (5.4)	21 (11.6)	7 (3.8)	56±38
GIS pathology	13 (7.1)	7 (3.7)	3 (1.7)	3 (1.7)	77±50
Intoxication	13 (7.1)	6 (3.4)	4 (2.0)	3 (1.7)	54±16
Trauma	10 (5.5)	5 (2.8)	3 (1.7)	2 (1.0)	80±68
Hematological diseases	5 (2.8)	2 (1.0)	3 (1.8)	0 (0.0)	65±17
Neuromuscular pathology	2 (1.1)	1 (0.5)	1 (0.5)	0 (0.0)	37±3
Cardiac pathology	2 (1.1)	1 (0.5)	1 (0.5)	0 (0.0)	57±45
Epiglottite	1 (0.5)	1 (0.5)	0 (0.0)	0 (0.0)	80
Malignancy	1 (0.5)	0 (0.0)	1 (0.5)	0 (0.0)	60
Tissue diseases	1 (0.5)	0 (0.0)	1 (0.5)	0 (0.0)	75
Total	183 (100)	65 (35.5)	93 (50.9)	25 (13.6)	55.7±39.1

SD: Standard deviation, n: Number of cases, CNS: Central nervous system, GIS: Gastrointestinal system

Table 3. Evaluation of season and diagnosis of transport patients

	n (%)	Spring	Winter	Summer	Autumn
Pneumonia	52 (28.4)	5 (2.7)	45 (24.3)	0 (0.00)	2 (1.4)
Bacteremia	45 (24.6)	32 (17.4)	13 (7.2)	0 (0.00)	0 (0.00)
CNS pathology	38 (20.8)	18 (10.0)	10 (5.4)	10 (5.4)	0 (0.00)
GIS pathology	13 (7.1)	10 (6.2)	3 (1.9)	0 (0.00)	0 (0.00)
Intoxication	13 (7.1)	5 (2.7)	0 (0.00)	8 (4.3)	0 (0.00)
Trauma	10 (5.5)	5 (2.7)	0 (0.00)	5 (2.7)	0 (0.00)
Hematological diseases	5 (2.8)	2 (1.1)	0 (0.00)	3 (1.7)	0 (0.00)
Neuromuscular pathology	2 (1.1)	1 (0.5)	0 (0.00)	1 (0.5)	0 (0.00)
Cardiac pathology	2 (1.1)	0 (0.00)	0 (0.00)	2 (1.1)	0 (0.00)
Epiglottite	1 (0.5)	0 (0.00)	0 (0.00)	1 (0.5)	0 (0.00)
Malignancy	1 (0.5)	0 (0.00)	0 (0.00)	1 (0.5)	0 (0.00)
Tissue diseases	1 (0.5)	0 (0.00)	0 (0.00)	1 (0.5)	0 (0.00)
Total	183 (100)	78 (42.6)	71 (38.8)	32 (17.5)	2 (1.1)

n: Number of cases, CNS: Central nervous system, GIS: Gastrointestinal system

patients were transported for respiratory system diseases and 22% for neurological system diseases. Hamrin et al.[11] they reported transportation due to respiratory system diseases with a rate of 45.9%. In the study conducted by Qui et al.[9] the rate of respiratory system diseases was 30%, and the rate of neurological system diseases was 18.8%. Walls et al.[12] In the study they evaluated 3.288 in 2015, 23% of respiratory system-borne diseases and 8% were neurological pathologies. Similar to the literature, in our study, it was observed that respiratory and neurological pathologies were more common in patients referred to our unit. Soysal et al.[13] in the study in which 1.666 patients evaluated the transportation process in 2004, 18.7% were respiratory system-related diseases and 21.7% were neurological diseases.

In our study, we found that patients were most frequently referred to our unit between 16:00 and 00:00. The most likely reason for the transfer of patients during these hours may be as a result of the insufficient number of specialist physicians in referring institutions outside of official working hours. We found that pneumonia (13.6%) and bacteremia (16.2%) cases were referred to our unit between 16:00 and 00:00. Qui et al.[9] the found that the transfer hours were concentrated between 08:00 and 16:00. The study by Chaichotjinda et al.[7] reported that transports occurred more frequently between 16:00-00:00 hours. It would be useful to plan more studies to explore other reasons for the timing of transfers.

In our study, adverse events were encountered in 21.3% of the patients during transport, with respiratory distress being

Table 4. Problems encountered during transport	
	n (%)
Respiratory distress	13 (7.1)
Intubation	12 (6.5)
Impaired consciousness	10 (5.5)
Arrhythmia	2 (1.1)
Hypotension	2 (1.1)
Total	39 (21.3)
n: Number of cases	

Table 5. Distance of transport patients and transport time		
Kilometer	**n (%)**	**Transport TIME (mean ± SD) (minutes)**
<50	96 (52.5)	41.1±3.8
50-150	78 (42.6)	63.6±3.3
>150	9 (4.9)	128.3±16.3
Total	183 (100)	55.7±39.1
SD: Standard deviation, n: Number of cases		

the most frequent complication in 7.1% of the patients. In the study conducted by Hatherill et al.[14], it was reported that 18% of 71 pediatric patients who were transported had undesirable events, with respiratory distress occurring in 6% of the patients. In the study performed by Ligtenberg et al.[15], in which transport patients were evaluated, they reported 10% of patients having respiratory distress. In their study, Chaichotjinda et al.[7] reported that the majority of hardware malfunctions were related to endotracheal tube slippage, loss of vascular access, oxygen depletion, and insufficient battery reserves for medical equipment. We believe the results from our study coincide with the results in the literature, but our study differed from the literature in that there were no hardware malfunctions, such as oxygen deficiency and lack of batteries, in the records. In our study, we could not determine whether the patients were exposed to hypo/hyperglycemia during the transfer because their blood sugar could not be checked. In order to prevent undesirable events, we believe it is vital to verify the hardware that may be required during transportation before the transfer begins.

There are studies in the literature that have investigated the time between the decision to transport and the time of leaving the center.[16,17] In the study conducted by Qui et al.[9], the mean transport time of the patient from the primary center was found to be 30 minutes. We investigated the golden hour application described by Stroud et al.[18] and found this time to be 55.7±39.1 minutes. While the average transport distance was 51.4±30.0 kilometers, we saw that the longer the transport distance, the longer the transport time. In a study of 100 patients performed by Ligtenberg et al.[15], the mean transport time for a distance of 57±43 kilometers was found to be 47±30 minutes. Hamrin et al.[11] they reported the mean transport distance as 115 kilometers. In our study, the mean transfer time of patients referred with a diagnosis of pneumonia was found to be 47±25 minutes, those referred with a diagnosis of bacteremia was 52±31 minutes, and those referred with a diagnosis of gastrointestinal system pathologies was 56±38 minutes. There were, however, limited studies in the literature for comparing data for this subject.

Study Limitations

The limitations of our study is that our study was single-centered, end-tidal carbon dioxide could not be measured during transport, blood glucose was not monitored for illness, and the number and education level of the personnel who performed the transport were unknown. The strength of our study is that it is one of the first studies to describe the socio-demographic data and adverse events during the transport of pediatric patients transferred to our hospital in the South Marmara.

Conclusion

The results of this study will be useful information to develop a referral guide to improve the quality of the pediatric patient transport system in the future.

Ethics

Ethics Committee Approval: Our study was approved by the Çanakkale Onsekiz Mart University Ethics Committee on 20.08.2020 with the decision number 2020-11.

Informed Consent: Retrospective study.

Peer-review: Externally peer-reviewed.

Authorship Contributions

Surgical and Medical Practices: T.Ç., S.G., F.B., Concept: T.Ç., S.G., F.B., Design: T.Ç., S.G., F.B., Data Collection or Processing: T.Ç., S.G., F.B., Analysis or Interpretation: T.Ç., S.G., F.B., Literature Search: T.Ç., S.G., F.B., Writing: T.Ç., S.G., F.B.

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