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If the "Animal" item was used in the study, the authors stated that in the Material and Method section of the article, they protect the animal rights in their studies in accordance with the principles of Guide for the Care and Use of Laboratory Animals (www.nap.edu/catalog/5140.html) and that they have received approval from the ethics committees of their institutions. must specify.

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Case Reports should not exceed 1000 words and 10 references, and should be arranged as follows: Abstract, Introduction, Case Report, Discussion and References. It may be accompanied by only one figure or table.

Letter to the Editor should not exceed 500 words. Short relevant comments on medical and scientific issues, particularly controversies, having no more than five references and one table or figure are encouraged. Where letters refer to an earlier published paper, authors will be offered right of reply.

Reviews are not accepted unless written on the invitation of the Editorial Board.

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- b) All pages should be numbered consecutively in the top right-hand corner, beginning with the title page.
- c) The title page should not include the names and institutions of the authors.
- d) The manuscript should be presented in the following order: Title page, Abstract (English, Turkish), Keywords (English, Turkish), Introduction, Materials and Methods, Results, Discussion, Conclusion, Acknowledgements (if present),

References, Figure Legends, Tables (each table, complete with title and foot-notes, on a separate page) and Appendices (if present) presented each on a separate page.

Title

The title should be short, easy to understand and must define the contents of the article.

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Abstract should be in both English and Turkish and should consist "Aim, Materials and Methods, Results and Conclusion". The purpose of the study, the setting for the study, the subjects, the treatment or intervention, principal outcomes measured, the type of statistical analysis and the outcome of the study should be stated in this section (up to 300 words). Abstract should not include reference. No abstract is required for the letters to the Editor.

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Cancer-pain.org [homepage on the Internet]. New York: Association of Cancer Online Resources [updated 16 May 2002; cited 9 Jul 2002]. Available from: www.cancer-pain.org

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- Makale, şu bölümleri içermelidir: Her biri ayrı sayfada yazılmak üzere; Türkçe ve İngilizce Başlık Sayfası, Öz, Abstract, Anahtar Sözcükler, Keywords, Giriş, Gereç ve Yöntem, Bulgular, Tartışma, Sonuç, Açıklamalar (varsa), Kaynaklar, Şekil Alt Yazıları, Tablolar (başlıkları ve açıklamalarıyla beraber), Ekler (varsa).

Yazının Başlığı

Kısa, kolay anlaşılır ve yazının içeriğini tanımlar özellikte olmalıdır.

Özetler

Türkçe (Öz) ve İngilizce (Abstract) olarak yazılmalı, Amaç, Gereç ve Yöntem, Bulgular ve Sonuç (Aim, Materials and Methods, Results, Conclusion) olmak üzere dört bölümden oluşmalı, en fazla 300 sözcük içermelidir. Araştırmanın amacı, yapılan işlemler, gözlemsel ve analitik yöntemler, temel bulgular ve ana sonuçlar belirtilmelidir. Özetle kaynak kullanılmamalıdır. Editöre mektup için özet gerekmemektedir.

Anahtar Sözcükler

Türkçe Öz ve İngilizce Abstract bölümünün sonunda, Anahtar Sözcükler ve Keywords başlığı altında, bilimsel yazının ana başlıklarını yakalayan, Index Medicus Medical Subject Headings (MeSH)'e uygun olarak yazılmış en fazla beş anahtar sözcük olmalıdır. Anahtar sözcüklerin, Türkiye Bilim Terimleri'nden (www.bilimterimleri.com) seçilmesine özen gösterilmelidir.

Metin

Yazı metni, yazının türüne göre yukarıda tanımlanan bölümlerden oluşmalıdır. Uygulanan istatistiksel yöntem, Gereç ve Yöntem bölümünde belirtilmelidir.

Kaynaklar

Pediatric Practice and Research Dergisi, Türkçe kaynaklardan yararlanmaya özel önem verdiğini belirtir ve yazarların bu konuda duyarlı olmasını bekler.

Kaynaklar metinde yer aldıkları sırayla, cümle içinde atıfta bulunulan ad veya özelliği belirten kelimenin hemen bittiği yerde ya da cümle bitiminde noktadan önce parantez içinde Arabik rakamlarla numaralandırılmalıdır. Metinde, tablolarda ve şekil alt yazılarında kaynaklar, parantez içinde Arabik numaralarla nitelendirilir. Sadece tablo veya şekil alt yazılarında kullanılan kaynaklar, tablo ya da şeklin metindeki ilk yer aldığı sıraya uygun olarak numaralandırılmalıdır. Dergi başlıkları, Index Medicus'ta kullanılan tarza uygun olarak kısaltılmalıdır. Kısaltılmış yazar ve dergi adlarından sonra nokta olmamalıdır. Yazar sayısı altı veya daha az olan kaynaklarda tüm yazarların adı yazılmalı, yedi veya daha fazla olan kaynaklarda ise üç yazar adından sonra et al. veya ve ark. yazılmalıdır. Kaynak gösterilen derginin sayı ve cilt numarası mutlaka yazılmalıdır.

Kaynaklar, yazının alındığı dilde ve aşağıdaki örneklerde görüldüğü şekilde düzenlenmelidir.

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Açıklamalar

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Tablolar

Tablolar metni tamamlayıcı olmalı, metin içerisinde tekrarlanan bilgiler içermemelidir. Metinde yer alma sıralarına göre Arabik sayılarla numaralandırılıp tablonun üstüne kısa ve açıklayıcı bir başlık yazılmalıdır. Tabloda yer alan kısaltmalar, tablonun hemen altında açıklanmalıdır. Dipnotlarda sırasıyla şu semboller kullanılabilir: *, †, ‡, §, ¶.

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Ölçümler ve Kısaltmalar

Tüm ölçümler metrik sisteme (Uluslararası Birimler Sistemi, SI) göre yazılmalıdır. Örnek: mg/kg, µg/kg, mL, mL/kg, mL/kg/h, mL/kg/min, L/min, mmHg, vb. Ölçümler ve istatistiksel veriler, cümle başında olmadıkları sürece rakamla belirtilmelidir. Herhangi bir birimi ifade etmeyen ve dokuzdan küçük sayılar yazı ile yazılmalıdır.

Metin içindeki kısaltmalar, ilk kullanıldıkları yerde parantez içinde açıklanmalıdır. Bazı sık kullanılan kısaltmalar; iv, im, po ve sc şeklinde yazılabilir.

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- Kurallara uygun yazılmış kaynaklar
- İmzalı "Yayın Hakkı Devir Formu" (makale yayın için kabul edildikten sonra istenmektedir)



CONTENTS

VOLUME 12 ISSUE 3 YEAR 2024

ORIGINAL ARTICLES

- Care Burden and Psychological Resilience of Mothers Accompanying Their Children with Chronic Illnesses Hospitalized in Pediatric Wards**
Pediatri Servislerinde Kronik Hastalık Tanısı ile Yatan Çocuklarına Refakat Eden Annelerin Bakım Yüğü ve Psikolojik Dayanıklılıkları
Karakaya E, Kamışlı S..... 65-72
- Retrospective Evaluation of Clinical Characteristics of Children with Cat Sensitivity**
Kedi Tüyü Alerjisi Olan Çocukların Klinik Özelliklerinin Retrospektif Değerlendirilmesi
Çevik S, Altas U, Özkars MY..... 73-76
- Üniversite Hastanesi Çocuk Yoğun Bakım Ünitesinde Eritrosit Süspansiyonu Transfüzyonu: Mevcut Yönergelere Uyulmakta mıdır?**
Red Blood Cell Transfusions in the Pediatric Intensive Care Unit of the University Hospital: Are they in accordance with the Current Guidelines?
Yılmaz R, Işık Bedir Ş..... 77-82
-
- CASE REPORT**
- Infantile Intraparenchymal Brain Abscess due to *Streptococcus pyogenes***
Streptococcus pyogenes'e Bağlı İnfantil İntraparankimal Beyin Apsesi
Kıymaz M, Alkan G, Özyalvaç B, Yücel AG, Öztürk M, Sündüs Uygun S, Konak M, Karaoğlu Gündoğdu D, Emiroğlu M..... 83-87



Care Burden and Psychological Resilience of Mothers Accompanying Their Children with Chronic Illnesses Hospitalized in Pediatric Wards

Pediatric Servislerinde Kronik Hastalık Tanısı ile Yatan Çocuklarına Refakat Eden Annelerin Bakım Yükü ve Psikolojik Dayanıklılıkları

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ABSTRACT

Aim: Psychological resilience plays a pivotal role in managing the caregiving burden experienced by mothers of hospitalized young children with chronic illnesses. The resilience of these mothers is not only critical for their own mental health but also for the well-being and development of their child. This study aimed to determine the caregiving burden and psychological resilience of mothers accompanying their children aged 0-2 years who are hospitalized due to chronic illness.

Material and Method: The participants included 134 mothers of hospitalized children. Data were gathered utilizing a personal information form, the Zarit Burden Interview, and the Brief Resilience Scale.

Results: Working mothers with a bachelor's degree had higher Zarit Burden Interview scores than non-working mothers. Mothers of children with epilepsy and neurological diseases had higher Zarit Burden Interview scores than those with other chronic diseases. Mothers receiving instrumental and spiritual support had significantly higher Brief Resilience Scale scores. Among mothers who accompany their children with a chronic illness diagnosis in the hospital, those who are university graduates, employed, or have children diagnosed with epilepsy and neurological diseases are particularly at risk in terms of the burden of care and psychological resilience.

Conclusion: Physicians and especially pediatric nurses can enhance the psychological resilience of these mothers identified as a risk group in this study and alleviate their care burden by providing instrumental and moral support in the clinical setting. The support given to these accompanying mothers can contribute more significantly to the quality of life and care of the child.

Keywords: Care burden, chronic diseases, resilience, pediatrics, mothers

ÖZ

Amaç: Psikolojik dayanıklılık, kronik hastalığı olan hastanede yatan küçük çocukların annelerinin yaşadığı bakım yükünü yönetmede çok önemli bir rol oynar. Bu annelerin dayanıklılığı sadece kendi ruh sağlıkları için değil, aynı zamanda çocuğun iyilik hali ve gelişimi için de kritiktir. Bu çalışmanın amacı, hastanede kronik hastalık nedeniyle yatan 0-2 yaş arasındaki çocuklarına refakat eden annelerin bakım yükü ve psikolojik dayanıklılık durumlarını belirlemektir.

Gereç ve Yöntem: Katılımcılar, hastanede yatmakta olan çocukların annesini (134 kişi) içermektedir. Veriler, kişisel bilgi formu, Zarit Bakım Yükü ve Kısa Dayanıklılık Ölçeği kullanılarak toplanmıştır.

Bulgular: Çalışan ve lisans mezunu olan annelerin bakım yükü puan ortalamaları çalışmayan annelerden daha yüksek bulunmuştur. Epilepsi veya nörolojik hastalık tanısı ile izlenen çocukların annelerinin bakım yükü puan ortalamaları, çocukları diğer kronik hastalıklara sahip olan annelerden daha yüksek çıkmıştır. Araçsal ve manevi destek alan annelerin psikolojik dayanıklılıkları, bu desteği almayanlardan anlamlı olarak daha yüksek bulunmuştur. Kronik hastalık tanısı ile izlenen çocuklarına hastanede refakat eden anneler arasında özellikle; lisans mezunu, çalışan, epilepsi ve nörolojik hastalık tanısı ile izlenen çocuğa sahip anneler bakım yükü ve psikolojik dayanıklılık bakımından risk grubundadır.

Sonuç: Hekimler ve özellikle de pediatri hemşireleri, bu çalışmanın sonucunda risk grubu olarak belirlenmiş annelere klinik ortamda araçsal ve manevi destek sağlayarak, annelerin psikolojik dayanıklılıklarını artırabilir ve bakım yükünü hafifletebilirler. Refakatçi annelere verilen bu destekle çocuğun yaşam kalitesi ve bakımına daha fazla katkı sağlayabilirler.

Anahtar Kelimeler: Bakım yükü, kronik hastalık, dayanıklılık, pediatri, anneler

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INTRODUCTION

Chronic illnesses, often known as noncommunicable diseases, last for a long time and progress slowly. Pediatric chronic diseases are caused by genetic, physiological, environmental, and behavioral factors. These diseases impact people of all ages, locations and countries (1). Caring for a child with chronic illness poses substantial challenges for families, with mothers often bearing a significant emotional, physical, and psychological burden (2,3). Parents of children with chronic diseases experience denial, depression, loneliness, difficulty making decisions, and uncertainty, which negatively affect their quality of life (4-5). Mothers want to give birth to healthy children, however, they experience psychological problems, especially in the first years following birth, when caring for children with chronic diseases (6). The constant demands of maintaining the child's health, combined with significant financial constraints and upheavals in family dynamics, increase the impact.

The way in which caregivers provide care is affected by numerous factors, including level of education, uncertainties, a child's pain, adverse effects of the treatment, disease characteristics, the necessity for long periods of hospitalization, financial difficulties (7-9). This adverse situation affect mothers of children with chronic diseases. These mothers are supposed to be psychological resilience strong to cope with and adapt this situation. In the context of caring, resilience is not simply a desirable trait, but also a requirement, allowing caregivers to traverse the emotional, physical, and financial complexity of their duties (10). The substantial demands of caring frequently put mothers' resilience to the test, making it an important topic of study to understand how they manage, adjust, and protect their well-being in the face of such challenges.

Psychological resilience allows caregivers to deal with disease-related problems positively (11). Psychosocial support services help such parents experience fewer problems, adapt to their child's illness, and build psychological resilience (12).

The present study aimed to contribute to and understanding of the effect of sociodemographic factors and psychological resilience on the burden of care in mothers of 0-2-year-old children with chronic diseases. Many factors affect the burden of care. But we wanted to understand the care burden and psychological resilience experienced by mothers who are taking care of their children hospitalized due to chronic illness. The current research focused on the association between psychological resilience and burden of care, hypothesizing that the findings will help healthcare professionals formulate and implement interventions

to help mothers of babies/infants with chronic diseases increase their psychological resilience and develop effective coping strategies to minimize the burden of care.

MATERIAL AND METHOD

The study was carried out at the pediatrics inpatient clinic of an university hospital between April and August 2021. This pediatric hospital has important population including families from urban and rural districts. The children with chronic diseases are treated and followed up in this inpatient clinic. We invited to participate the mothers of children who are receiving treatment aged 0-2 years with chronic diseases at the inpatient clinic. The sample size of 128 mothers was determined to have 0.80 power to detect an effect size of 0.20 according to Cohen's *d*. The final target sample of 134 mothers was selected to allow for an estimated for possible losses. The inclusion criteria were (1) mother of a child receiving treatment with a chronic disease aged 0-2 years in the inpatient clinic, (2) literate in Turkish, (3) absence of any problems that prevent communication. The mothers were selected with the convenience sampling approach. The mothers completed the personal information form, the Zarit Burden Interview, and the Brief Resilience Scale at the inpatient clinic. The mothers were provided with information related to the study. Ethical approval for the research was obtained from the ethics committee of the university (Approval date: 1 March 2021; no: 496). In addition, the hospital where the study was conducted received institutional permission, and the participants gave written and verbal consent.

Personal Information Form

The personal information form was developed based on previous survey, conducted by the researchers (13-16). The form included 23 items on mother sociodemographic characteristics (age, gender, marital status, level of education, employment status, health insurance, migration status, place of residence, number of children, the child's chronic diseases, other children and relatives, habits, and social isolation), children's sociodemographic characteristics (gender, diagnosis of chronic disease, and time of diagnosis), and identifying information about caregiving (area of care, duration of caregiving, presence of the other caregiver, material/financial, emotional and spiritual support during caregiving).

Zarit Burden Interview (ZBI)

ZBI was developed by Zarit et al (17). and adapted to Turkish by Inci and Erdem (18) The instrument assesses caregiver burden of care. The 22-item scale does not

have a cut-off score or subscales. The 5-point Likert-type response scale ranges from never (0) to nearly always (4). The total score ranges from 0 to 88, with higher scores indicating higher burden of care (0-21: little or no burden; 21-40: mild to moderate burden; 41-60: moderate to severe burden; 61-88: severe burden). In this study, the scale demonstrated a Cronbach's alpha of 0.874.

Brief Resilience Scale (BRS)

BRS was developed by Smith et al. (19). and adapted to Turkish by Doğan (20). The scale's six items are scored on a 5-point Likert scale, from strongly disagree (1) to strongly agree (5). Items 2, 4, and 6 are scored in reverse. The scale has no cut-off score or subscales. The total score varies between 6 and 30, with higher levels suggesting greater resilience. The scale had a Cronbach's alpha of 0.95, indicating that it was an appropriate instrument for this investigation.

Data Analysis

The data were analyzed with IBM SPSS Statistics for Windows v.26.0 (IBM Corp., Armonk, NY), using a significance level of $p=0.05$. Descriptive analysis including median, range percentages was used to define the sample's characteristics. Nonparametric tests were employed because the data obtained from the study did not follow a normal distribution.

Spearman's Rho coefficient was used to determine the relationship between the ZBI and BRS. Mann-Whitney U test was used to determine the significance of the mothers' health insurance, employment, presence of another caregiver, spiritual and material support on the mother's resilience and caregiver burden. The Kruskal-Wallis H Test was used to compare the significance of the mother's age, education, number of children on the mother's resilience and caregiver burden.

RESULTS

85.1% of the children of were first diagnosed 6 months ago. The rate of the mothers who had been giving care to their child during this period was 85.1% (**Table 1**). Majority of the children (32.8%) had a diagnosis of respiratory system diseases

Table 2 shows the distribution of ZBI and BRS scores according to the mothers' sociodemographic characteristics. Mothers with a bachelor's degree had a significantly higher mean ZBI score than those with lower levels of educational ($p=0.013$). Working mothers had a significantly higher mean ZBI score than their non-working counterparts ($p=0.001$). Participants that received material and spiritual support had a significantly higher mean BRS score than those that did not ($p=0.019$ and $p=0.021$, respectively).

Table 1. Characteristics about the mothers and their children

Mothers	n (134)	%
Age (years) median (19-44)		
≤29	64	47.8
30-34	33	24.6
≥35	37	27.6
Marital Status		
Married	130	97.0
Single	4	3.0
Level of Education		
Primary school	52	38.8
High School	35	26.1
Bachelor's Degree	47	35.1
Number of children		
1	55	41.0
2	45	33.5
≥3	34	25.5
Employment Status		
Unemployed	93	69.5
Employed	41	30.5
Job		
Housewife	93	69.4
Employee	10	7.5
Official	31	23.1
Health insurance		
Yes	108	80.6
No	26	19.4
Presence of another caregiver		
Yes	72	53.7
No	62	46.3
Spiritual (emotional etc.) support for care		
Yes	68	50.7
No	66	49.3
Material (financial etc.) support for care		
Yes	59	44.0
No	75	56.0
Children		
Sex		
Girl	52	38.8
Boy	82	61.2
Diagnosis of the children		
Cardiovascular diseases	34	24.6
Chronic respiratory diseases	44	32.8
Epilepsy and neurological disease	34	25.4
Metabolic disease	23	17.2
Kidney disease	17	12.7
Immunologic and hematologic disease	34	25.4
Time of diagnosis (month)		
6	114	85.1
6>	20	14.9
Period of the mother caregiving duration (month)		
<6 months	114	85.1
≥6 months	20	14.9

**Table 2. Distribution of ZBI and BRS scores according to the mothers' sociodemographic characteristics and presumed social support**

The mother's sociodemographic characteristics and details of the presumed social support	n(134)	ZBI Median	Statistical Analysis-ZBI	BRS Median	Statistical Analysis-BRS
Age (years)			0.941 ^a		0.822 ^a
≤29	64	45.00		12.00	
30-34	33	43.00		13.00	
≥35	37	49.00		13.00	
Level education			0.013 ^a		0.562 ^a
Primary school	52	42.50		12.50	
High school	35	44.00		12.00	
Bachelor's Degree	45	51.00		13.00	
Employment status			0.001 ^b		0.281 ^b
Unemployed	93	42.00		13.00	
Employed	41	51.00		12.00	
Health insurance			0.960 ^b		0.082 ^b
Yes	108	45.00		13.00	
No	26	44.50		12.00	
Number of children			0.773 ^a		0.966 ^a
1	55	46.00		13.00	
2	45	45.00		13.00	
≥3	34	43.00		13.00	
Presence of another caregiver			0.286 ^c		0.363 ^b
Yes	72	47.00		13.00	
No	62	43.50		12.00	
Spiritual (emotional etc.) support for care			0.801 ^d		0.019 ^b
Yes	68	46.00		13.50	
No	66	44.50		12.00	
Material support for care			0.898 ^d		0.021 ^b
Yes	59	46.00		14.00	
No	75	45.00		12.00	

^aKruskal-Wallis H test. ^bMann-Whitney U test. ^cIndependent 2-group t-test (Levene's test [$p=0.646$]). ^dMann-Whitney U test ($p<0.05$).

Table 3 shows the distribution of ZBI scores according to the children's chronic characteristics. Mothers caring for children with epilepsy and neurological diseases had a significantly higher mean ZBI score than those caring for children with other chronic diseases ($p<0.001$).

Table 3. Distribution of mother's ZBI scores according to their children's chronic diseases characteristics.

Chronic Diseases	n	ZBI Mean±SD	Median	Statistics p ^a
Heart disease	Yes	33 44.39±11.09	45.00	0.967
	No	101 43.57±14.40	45.00	
Respiratory system disease	Yes	44 42.41±13.62	42.00	0.353
	No	90 44.44±13.65	46.00	
Epilepsy and neurological disease	Yes	34 50.82±11.84	55.00	<0.001
	No	100 41.38±13.41	43.00	
Metabolic disease	Yes	23 47.13±11.18	49.00	0.233
	No	111 43.08±14.02	45.00	
Immunologic and hematologic disease	Yes	34 43.38±14.19	47.50	0.931
	No	100 43.91±13.50	45.00	

^aMann-Whitney U test.

Table 4 shows the distribution of BRS scores according to ZBI scores of the mothers. The mothers with mild to moderate burden of care had a significantly higher mean BRS score than those with moderate to severe burden of care ($p<0.001$).

Table 4. Distribution of BRS scores according to ZBI scores.

BI Score levels	n	BRS Scores Mean±SD	Median	p ^a
Mild to Moderate burden of care	49	19.71±6.14	23.00	<0.001
Moderate to severe burden of care	85	12.14±2.31	12.00	<0.001

^aMann-Whitney U test.

Spearman's correlations are presented in **Table 5**. Spearman correlations revealed negative links between the BRS and ZBI. There was an inverse correlation between the ZBI and BRS scores ($r=-0.650$; $p=0.001$).

Table 5. Spearman's Rho Correlations

Scales and correlations	BRS	ZBI
Spearman's Rho coefficient		
BRS correlation coefficient	-	-0.650**
Sig	-	.000
N	134	
ZBI correlation coefficient	-0.0650**	-
Sig	.000	-
N	134	

** $p<0.01$

DISCUSSION

The present study examined the effect of sociodemographic factors and psychological resilience on burden of care in mothers of children with chronic diseases. The findings show that the mothers had moderate to severe burden of care. The mothers with a bachelor's degrees had a significantly higher mean ZBI score than those with lower levels of education. Working mothers had a significantly higher mean ZBI score than their non-working counterparts. The mothers caring for children with epilepsy and neurological diseases had a significantly higher mean ZBI score than those caring for children with other chronic diseases. Moreover, the findings show that the level of psychological resilience is lower in mothers who report greater burden of care. Other research shows that mothers that care for children with chronic diseases have moderate and severe burden of care (21-24).

In the present study level of education, employment status, type of chronic disease, and level of psychological resilience were associated with the level of burden of care. Burden of care rankings in the current study were higher than those previously reported (5,8,16,25-26) which might be because the presented sample consisted of mothers of hospitalized infants aged 0-2 years. Even healthy babies require a great amount of care; therefore, caring for infants with chronic diseases increases the burden of care. Mothers of hospitalized infants are faced with extra high burden of care because those infants are in the active period of disease. In accordance with our observations, the reasons for the increase in mothers' caregiving burden can include factors such as polypharmacy, complications, frequent changes in basic self-care needs (nutrition and excretion), physical dependence, finances problems, emotion and feeling of inadequate in responding to the needs of their children. Some Turkish studies report low mean burden of care scores, which is probably because Turkish people do not consider care to be a burden (18,27). Although Turkish people perceive caregiving as a form of help, physical and psychological factors increase their burden of care, because balancing work and home life becomes difficult when a child is chronically ill. More highly educated women are participating in the workforce in Turkey than ever before, and due to the dual responsibilities of work and home women caring for children with a chronic illness are expected to have an increased burden of care (25).

Researchers focusing on the relationship between level of education and burden of care have reported inconsistent findings. Turan and Yayan reported that university graduates had a high burden of care (23). On the other hand, Alahan et al. reported that parents with a primary school degree had higher mean burden of care

scores than others (27). Çalışır et al. reported that there isn't a relationship between burden of care and level of educational (22). The researchers that reported parents with a bachelor's degree have a lower burden of care attributed this finding to the assumption that the burden of care may decrease as the level of knowledge increases. Mothers in the present study with a bachelor's degree had a higher mean ZBI score than those with primary and high school degrees, which might have been due to 3 things. First reason; mothers with a bachelor's degree may be more aware that their children with chronic diseases have specific needs that need to be met, and therefore, they can feel the burden of care more intensely than those with lower levels of education. Second reason; On one hand, the responsibilities brought by working life, and on the other hand, accompanying a child hospitalized and taking care of responsibilities at home, when experienced together, can increase the mother's caregiving burden. Third reason; educated mothers can gather information about the complications of their illnesses from a variety of information sources, therefore they may feel the responsibilities that come with knowing more intensely.

In the present study working mothers had a significantly higher mean ZBI score than their non-working counterparts, which is consistent with the literature (15,28). On the other hand, some studies observed that non-working mothers had a significantly higher mean ZBI score than their working counterparts (25,29). Caring for a child with a chronic disease requires constant attention, emotional support, and medical management, which can significantly strain the mother's psychological well-being. Balancing these responsibilities with work demands can exacerbate burden care of the mothers. The mother's responsibilities at the workplace and increased roles can increase the burden of care. Also the type of work, duration and intensity of work, work-related physical and mental fatigue, stress, and the distance between the workplace and home are among the factors that affect work and burden of care (29).

Mothers in the present study whose children had epilepsy and neurological diseases had a significantly higher mean ZBI score than those whose children had other chronic diseases. Earlier research also shows that caregivers of children with epilepsy and neurological diseases have more burden of care than those whose children has other chronic diseases (22,30). It was further suggested that a child with epilepsy's seizure frequency, response to treatment, and need for prolonged and frequent hospitalization, and the fact that the child's mental functions are negatively affected increase burden of care.

In the present study there was a negative correlation between the ZBI and BRS scores; as the ZBI score increased the BRS score decreased, as previously reported (31-33). High-level psychological resilience



has a significant positive effect on the perception of burden of care, as compared to low-level resilience. Psychological resilience plays a role in mobilizing functionality used to solve problems. Mothers with chronically ill children need support to overcome illness-associated adversity; therefore, it is necessary to develop intervention strategies for strengthening psychological resilience (14). Positive results are expected when resilience development strategies are used with mothers that have low-moderate-level psychological resilience. In addition to improving psychological resilience, it can also decrease the burden of care. The mothers in the present study that received material and spiritual support had a significantly higher mean BRS score than those that did not. Earlier research shows that parents that receive social support have higher levels of psychological resilience and lower burden of care than those that do not (34-37). Positive social relationships are critical to psychological resilience and social support positively affects parents' maintenance of positive relationships and psychological resilience (38).

The present findings show there is a significant relationship between burden of care and psychological resilience. Mothers reporting, mild to moderate burden of care had higher levels of psychological resilience than mothers reporting moderate to severe burden of care. Mothers reporting, mild to moderate burden of care had higher BRS scores than those reporting moderate to severe burden of care. These findings are similar to previous studies that interventions to improve psychological resilience might also decrease burden of care (30,39-40). They also indicate that chronic diseases in children, especially those requiring continuous care in hospital, can negatively affect parents' psychological resilience because they require medication and multiple forms of treatment, and a high level of care. A study conducted on caregivers of children with chronic illness reported that the level of psychological resilience varied according to being a parent or not and that the level of psychological resilience in non-parents was higher than that in parents (37). The first years of parenthood (in the case of a child with a chronic disease) might negatively affect psychological resilience due to the challenges of the required high level of caregiving. Up to a certain point, mothers may employ coping mechanisms and resilience strategies effectively to manage the stress and demands of caregiving. However, as the burden intensifies, these mechanisms may become overwhelmed, leading to a decrease in resilience. Several factors might account for the relationship between the burden of care and resilience ratings. Firstly, individuals with a light to moderate caregiving load might have better access to support networks like family, community resources, and healthcare services, which can help them maintain their resilience. Secondly, the intensity and length of the caregiving situation can greatly affect resilience; those

with moderate to severe caregiving duties might face longer-term, more demanding responsibilities, which can hinder their ability to recover from stress. Lastly, personal traits such as optimism, coping skills, and past experiences with adversity can also play a role in determining resilience levels.

Limitations

The present study was initially designed to be conducted in outpatient and inpatient clinics but was conducted only in inpatient wards due to the ongoing COVID-19 pandemic and the closure of outpatient clinics. The results are obtained from a small size of companion mothers from the inpatient pediatric clinics and, therefore whether these results can be replicated in general in large sample remains to be clarified. In this study, only the caregiving burden and resilience of mothers who provide care was examined.

CONCLUSION

In this study, which examines the care burden and resilience of mothers accompanying children aged 0-2 who are receiving treatment in hospitals, it has been found that the mothers' care burden is high. In addition, the burden of care was higher in the mothers that had a bachelor's degree, were employed, and had children with epilepsy and neurological diseases. Based on these findings, we think it is essential to initiate interventions to increase psychological resilience in these mothers, so as to decrease their burden of care.

Working mothers had a higher level of burden of care than non-working mothers. Identification of the factors associated with work-related stress in mothers of children with chronic diseases and interventions directed towards those factors are recommended. The burden of care in the present study's mothers of children with epilepsy and neurologic diseases was higher than in the mothers of children with other diseases. These mothers face an immense burden that extends beyond physical care and into deep emotional, spiritual, and existential dimensions. Recognizing this load is the first step toward providing the comprehensive support that these families deserve. As society tries to better understand and address these difficulties, it is critical to recognize and encourage the resilience of these mothers. It is recommended that information and counseling services be provided not only to mothers, but also to other family members to facilitate their contribution to the care and support of mothers and expansion of mothers' social support networks. Fathers were not included in the study because they could not be interviewed even though they did not stay in the hospital. In the future, similar studies including fathers could be conducted to investigate the caregiving burden and resilience more in-depth.

The burden of care was higher in the present study's mothers with low levels of psychological resilience, as compared to those with high levels of resilience. It is recommended to provide information and counseling services not only to mothers but also to other family members to enhance the psychological resilience of mothers. This aims to involve other family members in caregiving and to support the expansion of mothers' social support networks.

ETHICAL DECLARATIONS

Ethics Committee Approval: Ethical approval for the research was obtained from the Ethics Committee of the university (Date: 01.03.2021, Decision No: 496).

Informed Consent: The hospital where the study was conducted received institutional permission, and the participants gave written and verbal consent.

Referee Evaluation Process: Externally peer-reviewed.

Conflict of Interest Statement: The authors have no conflicts of interest to declare.

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Retrospective Evaluation of Clinical Characteristics of Children with Cat Sensitivity

Kedi Tüyü Alerjisi Olan Çocukların Klinik Özelliklerinin Retrospektif Değerlendirilmesi

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ABSTRACT

Aim: Cat sensitivity holds a significant place among allergic diseases, and it is known that environmental factors as well as genetic factors affect sensitisation. It has been reported that having a cat at home increases the risk of sensitisation, especially in susceptible individuals. The aim of this study was to retrospectively evaluate the clinical features of cat sensitisation in children.

Material and Method: In this descriptive retrospective study, children aged 0-18 years with cat sensitisation who were admitted to the clinic between June 2023 and December 2023 were examined. Clinical characteristics, total IgE, eosinophil count, specific IgE values and skin prick test results were retrospectively evaluated using data obtained from the hospital database.

Results: The study included 76 children with cat sensitisation. The mean age was 7 years and 56.6% were male. The most common diagnoses were asthma (63.2%) and allergic rhinitis (31.6%). Cat sensitisation was positive in 100% of the patients, house dust mite sensitisation was found in 78.9% and pollen sensitisation in 14.5%. Total IgE levels of patients with multiple allergies were significantly higher than those without multiple allergies.

Conclusion: The study showed that additional allergen sensitisation was common in children with cat sensitisation and the most common diagnoses were allergic rhinitis and asthma. The findings are consistent with the existing literature and emphasise the importance of total IgE in the clinical management of allergic diseases.

Keywords: Cat allergy, house dust mite, pollen, allergic rhinitis

ÖZ

Amaç: Kedi alerjisi, alerjik hastalıklar arasında önemli bir yer tutmaktadır ve genetik faktörlerin yanı sıra çevresel etkenlerin de bu duyarlılığı etkilediği bilinmektedir. Evde kedi bulundurmanın, özellikle duyarlı bireylerde sensitizasyon riskini artırdığı bildirilmektedir. Bu çalışmanın amacı, çocuklarda kedi duyarlılığı olanların klinik özelliklerini retrospektif olarak değerlendirmektir.

Gereç ve Yöntem: Bu tanımlayıcı retrospektif çalışmada, Haziran 2023 - Aralık 2023 tarihleri arasında kliniğe başvuran 0-18 yaş arası kedi duyarlılığı tanısı konmuş çocuklar incelenmiştir. Hastane veritabanından elde edilen veriler kullanılarak, klinik özellikler, total IgE, eozinofil sayısı, spesifik IgE değerleri ve deri prick test sonuçları retrospektif olarak değerlendirilmiştir.

Bulgular: Çalışmaya 76 kedi duyarlılığı olan çocuk dahil edilmiştir. Ortalama yaşları 7'dir ve %56.6'sı erkektir. En sık tanılar astım (%63.2) ve alerjik rinit (%31.6) olarak belirlenmiştir. Hastaların %100'ünde kedi duyarlılığı pozitif bulunurken, %78.9'unda ev tozu akarı, %14.5'inde polen duyarlılığı saptanmıştır. Çoklu alerji olan hastaların total IgE düzeyleri, olmayanlardan anlamlı derecede yüksek bulunmuştur.

Sonuç: Çalışma, kedi duyarlılığı olan çocuklarda ek alerjen duyarlılığının sık görüldüğünü ve en yaygın tanıların alerjik rinit ve astım olduğunu göstermiştir. Bulgular, mevcut literatürle tutarlıdır ve alerjik hastalıkların klinik yönetiminde total IgE'nin önemini vurgulamaktadır.

Anahtar Kelimeler: Kedi alerjisi, ev tozu akarı, polen, alerjik rinit

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INTRODUCTION

Besides genetic factors, environmental factors are also considered influential in the onset of allergic diseases (1). Environmental pollutants, microorganisms, tobacco smoke, and chemicals form a specific external environment that individuals may be exposed to throughout their lives (1,2). Aeroallergens are the most commonly detected allergens in patients diagnosed with allergy (3). Studies have shown an increasing prevalence of cat sensitivity, a type of aeroallergen sensitivity, over recent years. Symptoms of cat allergy can vary from mild rhinoconjunctivitis to severe asthma attacks and anaphylaxis (4-6). Individuals who keep cats indoors are more prone to developing sensitization. Moreover, research indicates that cat allergens adhere to individuals' clothing and can be carried into various shared environments, potentially increasing sensitization rates in these individuals (7,8). Furthermore, patients sensitized to cats have been reported to have an elevated likelihood of sensitization to other animal allergens, particularly dogs (9,10). The most recommended strategies to alleviate symptoms in patients with cat sensitivity include removing the pet from the household, minimizing contact, and administering allergen-specific immunotherapy to suitable candidates (11).

The objective of our study was to retrospectively assess the clinical characteristics of children who are sensitive to cats.

MATERIAL AND METHOD

This study is a descriptive retrospective study. It included all patients aged 0-18 years diagnosed with cat sensitivity at our clinic over a six-month period. We retrospectively evaluated clinical characteristics such as age, gender, allergic conditions (urticaria, asthma, allergic rhinitis, etc.), total IgE levels, eosinophil counts, specific IgE antibody values, and results of skin prick tests. Data were collected from the hospital database of patients who visited our pediatric allergy and immunology outpatient clinic between June 2023 and December 2023. ImmunoCAP (Thermo Fisher Scientific, Uppsala, Sweden) was used for allergen specific IgE measurements. Specific IgE levels were measured for inhaled allergens including house dust mite, cat epithelium and pollen. Specific IgE values of 0.35 kU/L or higher were considered positive. Epidermal SPT (skin prick test) was performed using allergen extracts (ALK-Abello, Madrid, Spain) with positive control (10 mg/dl histamine phosphate) and negative control (0.9% sterile saline). Horizontal and vertical measurements were made for indurations. Indurations with a mean diameter at least 3 mm larger than the negative control were considered positive. Patients undergoing SPT were tested for inhaled allergens such as house dust mite, cat epithelium, wood mixture, cockroach, alternaria and cladosporium. Patients

with negative allergen-specific IgE results underwent SPT. Allergen positivity was defined as a positive result on allergen-specific IgE testing or SPT.

Statistical Analysis

Statistical analyses and data recording were performed using SPSS (Statistical Package for Social Sciences) 29.0. Descriptive statistics such as median, minimum, maximum values, number (n), and percentages (%) were used to summarize the data. The normal distribution of continuous variables was assessed both visually (histogram and probability plots) and analytically (Kolmogorov-Smirnov/Shapiro-Wilk tests). For categorical variables, Fisher's exact test was employed for statistical comparisons. The Mann-Whitney U test was used to compare two groups concerning numerical data that did not follow a normal distribution. The significance level for all statistical tests was set at $p < 0.05$.

Ethics

Ethical approval was obtained from Ümraniye Training and Research Hospital Clinical Research Ethics Committee (Date: 08/02/2024, Decision No: 33).

RESULTS

A total of 76 children with cat sensitivity were included in the study. The median age was 7 years (1-16). 56.6% (n=43) of the patients were male. A family history of atopy was present in 26.3% (n=20) of the children. The proportions of cat owners and smokers at home were 10.5% (n=8) and 11.8% (n=9), respectively. Asthma and allergic rhinitis (AR) were diagnosed in 63.2% (n=48) of the patients (**Table 1**). The median duration of cat ownership was 2 years (1-3) in the eight people who kept cats at home.

Table 1. Sociodemographic and clinical characteristics

Age (years), median (min-max)	7 (1-16)	
	n	%
Gender		
Female	33	43.4
Male	43	56.6
Family history of atopy		
No	56	73.7
Yes	20	26.3
Presence of cats at home		
No	68	89.5
Yes	8	10.5
Smoking exposure at home		
No	67	88.2
Yes	9	11.8
Clinical		
Asthma	1	1.3
AR	24	31.6
Asthma+AR	48	63.2
Urticaria+AR	3	3.9

AR: Allergic rhinitis, min: minimum, max: maximum

The laboratory data of the patients included in the study are given in **Table 2**. The median absolute number of eosinophils was 320 (min 0-max 520), the median percentage of eosinophils was 3.8% (min 0-max 21.1%) and the median total IgE was 267.0 IU/mL (min 3.0-max 5585.0). In terms of specific IgE positivity, cat sensitivity was found to be positive in 100% of the patients, house dust mite allergy in 78.9%, and pollen allergy in 14.5%.

Laboratory values	Median (min-max)	
Eosinophil absolute count	320 (0-520) (103/uL)	
Eosinophil percentage	3.8 (0-21.1)	
Total IgE (IU/ml)	267.0 (3.0-5585.0)	
Allergen sensitisation	n	%
Cat	76	100.0
House dust	60	78.9
Pollen	11	14.5

Min: minimum, max: maximum

The presence of multiple allergies was found in 27.3% of patients with a family history of atopy, whereas this rate was 20.0% in patients without a family history of atopy (P=1.000). There was no statistically significant difference observed between patients who had a cat at home and those who did not (P=1.000) and between patients with and without smoking exposure at home (P=1.000) in terms of the presence of multiple allergies (**Table 3**).

	Presence of multiple allergies				P value
	Yes		No		
	n	%	n	%	
Family history of atopy					
No	48	72.7%	8	80.0%	1.000
Yes	18	27.3%	2	20.0%	
Cat at home					
No	59	89.4%	9	90.0%	1.000
Yes	7	10.6%	1	10.0%	
Smoking exposure at home					
No	58	87.9%	9	90.0%	1.000
Yes	8	12.1%	1	10.0%	

No statistically significant differences were found between patients with and without multiple allergy in terms of age, absolute eosinophil count and eosinophil percentage (P values 0.078, 0.208, 0.344, respectively). A statistically significant difference was found between patients with and without multiple allergy in terms of total IgE level (P=0.015) (**Table 4**).

DISCUSSION

Allergic diseases are known to be influenced by genetic and environmental factors. In our study, we investigated the prevalence of multiple allergy conditions in children with cat sensitivity and the clinical features of the patients.

In our study, 10.5% of patients with cat sensitivity kept a cat at home. According to another one-year study conducted in our clinic, 38.1% of children with cat sensitivity were found to have a cat at home (12). According to another study in the literature, it was reported that 35.0% of children sensitized to cats had a cat present in their home (13). Compared to the literature, the proportion of patients with cat sensitivity who had a cat at home was found to be lower in our study. This suggests that exposure to cat allergens may also be possible outside the home.

In our study, house dust mite allergy was found in 78.9% and pollen allergy in 14.5% of patients with cat sensitivity. Kaya et al. found additional aeroallergen sensitisation, mostly pollen allergens, in 85% of their patients in addition to cat sensitisation (14). In another study in the literature, it was found that 93.3% of children with cat sensitivity were also allergic to house dust mites (15). This finding points to an allergic picture in which cat allergy is usually accompanied by sensitisation to other allergens, not alone. In this context, it is important to evaluate the sensitisation profile against other allergens in children with cat sensitivity in detail.

In our study, the most common clinical diagnoses in patients with cat sensitivity were allergic rhinitis and asthma, which were similar to the literature (16). Severcan et al. found that the most common symptoms in cat contact were AR (29.4%) symptoms such as runny nose, itching and sneezing (17). In our study, 31.6% had AR complaints, while 61.3% patients had

	Presence of multiple allergies						P value
	Yes			No			
	Median	Minimum	Maximum	Median	Minimum	Maximum	
Age	7.00	2.00	16.00	5.50	1.00	14.00	0.078
Eosinophil absolute count (10 ³ /uL)	360	0.00	520	20	0.00	270	0.208
Eosinophil percentage	3.80	0.00	16.30	2.05	0.10	21.10	0.344
Total IgE (IU/ml)	353.50	6.00	5585.00	72.00	3.00	1355.00	0.015



coexistence of asthma and AR. In the study of Severcan et al. (17), when allergen sensitisation accompanying cat allergy was analysed, 6 grass species were found in 59.8% and house dust mite in 20.3%. This may explain the coexistence of AR symptoms in the group in which pollen allergy accompanied AR symptoms most frequently, whereas in our study, asthma and AR symptoms were associated with house dust mite sensitivity most frequently.

In our study, a significant difference was found between the total IgE values of patients with multiple allergies and those without multiple allergies. This finding emphasises the importance of total IgE in allergic response in allergic diseases.

Limitations and Strengths of the Study

The findings of this study may be limited in their applicability due to its single-centre nature. Additionally, the inability to assess the clinical severity of the patients represents another significant limitation of our study. However, this study provides a detailed description of the clinical features and laboratory findings of cat sensitivity and contributes to the literature.

CONCLUSION

Our study aimed to assess the prevalence and clinical characteristics of coexisting allergies in children with cat sensitivity. Our findings indicated that many patients allergic to cats also showed sensitivities to other allergens, such as house dust mites and pollen. Allergic rhinitis and asthma were the most frequent clinical diagnoses, aligning well with existing literature.

ETHICAL DECLARATIONS

Ethics Committee Approval: Ethical approval was obtained from Ümraniye Training and Research Hospital Clinical Research Ethics Committee (Date: 08/02/2024, Decision No: 33).

Informed Consent: Because the study was designed retrospectively, no written informed consent form was obtained from patients.

Referee Evaluation Process: Externally peer-reviewed.

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Üniversite Hastanesi Çocuk Yoğun Bakım Ünitesinde Eritrosit Süspansiyonu Transfüzyonu: Mevcut Yönergelere Uyulmakta mıdır?

Red Blood Cell Transfusions in the Pediatric Intensive Care Unit of the University Hospital: Are they in accordance with the Current Guidelines?

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ÖZ

Amaç: Kan bileşeni transfüzyonu hastane yatışları sırasında uygulanan yaygın bir prosedürdür; ancak risksiz de değildir. Kan ürünlerinin doğru kullanımının değerlendirilmesi, kullanımlarında belirtilen riskler ve maliyetler göz önünde bulundurulduğunda büyük önem taşır. Amacımız, üçüncü seviye bir üniversite hastanesinde çocuk yoğun bakım ünitesindeki hastalarda eritrosit süspansiyonu (ES) transfüzyonu için uluslararası yönergelere uyumu değerlendirmektir.

Gereç ve Yöntem: Çocuk hastalarda (1 aydan 18 yaşına kadar) ES transfüzyonunun uygun kullanım sıklığını belirlemek için retrospektif tanımlayıcı analitik bir çalışma yürütüldü. 1 yıllık bir zaman diliminde, 155 tıbbi kayıt analiz edildi ve toplam 53 ES transfüzyonu uygulanmış hasta verileri çalışma örneği olarak seçildi. İncelenen değişkenler transfüzyon için Hemoglobin (Hb) eşik değeri, ES hacmi ve transfüzyon sonrası hedef Hb değerleriydi. Uluslararası yönergelere göre hastanın tıbbi kayıtların değerlendirildi.

Bulgular: Analiz edilen transfüzyonların %67,9'u, esas olarak transfüzyon kriterlerinin karşılanmaması nedeniyle uygun değil olarak sınıflandırıldı. Çocuk yoğun bakım hastalarında ES transfüzyon endikasyonları uluslararası kılavuzlara yeterince uymamaktadır.

Sonuç: Mevcut kılavuzlara uyumu artırmak için ES transfüzyonlarının kullanımı hakkında eğitim ve bilgi için etkili programların uygulanması gerekmektedir.

Anahtar Kelimeler: Eritrosit süspansiyonu, transfüzyon, çocuk yoğun bakım, rehber, uygunluk

ABSTRACT

Aim: Blood component transfusion is a common procedure performed during hospitalization; however, it is not without risks. The assessment of the appropriate use of blood products is of great importance considering the risks and costs associated with their use. Our aim was to assess compliance with international guidelines for red blood cell suspension (RBC) transfusion in patients in a pediatric intensive care unit at a tertiary university hospital.

Material and Method: A retrospective, descriptive, analytical study was conducted to determine the appropriate frequency of RBC transfusion in pediatric patients (aged 1 month to 18 years). Over a 1-year period, 155 medical records were analyzed and a total of 53 RBC transfused patients were selected as the study sample. The variables examined were the hemoglobin (Hb) threshold for transfusion, packed RBC volume, and post-transfusion target Hb values. Patient medical records were evaluated according to international guidelines.

Results: 67.9% of the analyzed transfusions were classified as inappropriate, mainly due to failure to meet transfusion criteria. Indications for RBC transfusion in pediatric intensive care patients do not adequately comply with international guidelines.

Conclusion: Effective programs for education and information on the use of RBC transfusions need to be implemented to increase compliance with current guidelines.

Keywords: Red blood cell suspension, transfusion, pediatric intensive care, guideline, compliance

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GİRİŞ

Kan ürünleri transfüzyonu, tıbbi uygulamada gerçekleştirilen en yaygın prosedürlerden biridir (1,2). Anemi, trombositopeni, pıhtılaşma bozuklukları veya travma veya cerrahiye bağlı kanama gibi hastane içi bakım sırasında, birçok tıbbi durumda yaygın olarak kullanılır (2). Ancak kan transfüzyonlarının yanlış kullanımı, akut transfüzyon reaksiyonları veya majör alerjik reaksiyonlar gibi komplikasyonlara neden olabilir (3). Komplikeasyonları ve olumsuz etkileri azaltmak için doğru prosedürün seçilmesi önemlidir. Güvenlik önlemlerindeki gelişmelere rağmen, kan transfüzyonu ilişkili riskler devam etmektedir (4); bu nedenle, transfüzyonlar yalnızca faydaların potansiyel olarak ilişkili yan etkilerden daha fazla olduğu durumlarda yapılmalıdır (5). Bu ilke, kan nakli endikasyonlarını standartlaştırmaya ve bu tür bir prosedür için kimin aday olduğuna ve kimin olmadığına karar vermeye yardımcı olmuştur. Bu sürecin bir sonraki adımı, klinik uygulama kılavuzlarının geliştirilmesi yoluyla bilgileri yaygın olarak benimsenen ve tutarlı bir uygulamaya dönüştürmektir (6,7).

Kan nakli için kılavuzlar oluşturmak ve kanın bağışçıdan uygun şekilde toplanması, değerlendirilmesi, kan ürününün korunması ve alıcıya uygulanması amacıyla onlarca yıldır araştırmalar yürütülmektedir (6-8).

Kan ürünlerinin güvenli ve doğru kullanımı için protokol ve yönergeler oluşturulmuştur. Kan ürününü kullanan personelin, kan transfüzyonuyla ilgili olumsuz etkilerin sayısını azaltmak ve optimum klinik iyileşmeye izin veren eylemleri uygulamak için, dünya çapında normlara uymaları önemlidir (6,7,9). Ülkemizde, Türkiye Cumhuriyeti Sağlık Bakanlığı'nın 2016 yılında "Türkiye'de Kan Tedarik Sisteminin Güçlendirilmesi Teknik Destek Projesi" kapsamında "ULUSAL KAN VE KAN BİLEŞENLERİ HAZIRLAMA, KULLANIM VE KALİTE GÜVENCESİ REHBERİ" yayınlanmış ve 2020 yılında güncellenmiştir (10). Hem yetişkin hem de pediatrik hastalarda kan ürünleri transfüzyonlarına ilişkin spesifikasyonları belirtir (10). Ancak, yenidoğan ve pediatrik popülasyonla ilgili çok sayıda klinik senaryoda spesifikasyon eksikliği olabilir. Bu durumu çözmek için ulusal dernekler de kan ürünleri uygulama rehberleri hazırlamaktadır (11).

Pediatrik kan transfüzyonu bağlamında, eritrosit süspansiyonu (ES) en çok nakledilen kan bileşenidir. ES aferez veya tam kanın santrifüjlenmesi veya her ikisi yoluyla elde edilebilir (12); klinikte kullanılan diğer ana kan bileşenleri ise taze dondurulmuş plazma (FFP), kriyopresipitat (Cryo) ve trombositlerdir (PLT) (12). Mevcut araştırma, esas olarak ES kullanımını çocuk yoğun bakım ünitesi uygulamalarına odaklanarak İç Anadolu'da bir Üniversite Hastanesinde yürütülmüştür. Günlük uygulamada uluslararası yönergelere uyum, bilgi ve anlayış düzeyleri analizi yapılmıştır.

GEREÇ VE YÖNTEM

Bu araştırma, kritik pediatrik hastalarda ES transfüzyonunun doğru ve yanlış kullanımının yaygınlığını belirlemek için retrospektif, tanımlayıcı ve analitik bir çalışmadır. Selçuk Üniversitesi Tıp Fakültesi Yerel Etik Kurulu'nun 14/02/2023 tarih ve 2023/98 sayılı onam kararı sonrası 1 Ocak 2022 ve 31 Aralık 2022 tarihleri arasında Selçuk Üniversitesi Tıp Fakültesi Hastanesi Çocuk Sağlığı ve Hastalıkları Anabilim Dalı 3. Basamak Çocuk Yoğun Bakım Ünitesinden alınan transfüzyon kayıtları, 1 yıllık bir süre boyunca 30 günlükten 18 yaşına kadar olan hastalar için ES transfüzyon endikasyonlarını değerlendirmek için analiz edildi. Belirlenen süreçte Toplam 155 hasta içinde 53 olguda uygulanan ES transfüzyonları incelendi. Çocuk Yoğun Bakım hastaları için Uluslararası transfüzyon rehberine göre ES transfüzyonu için Hb eşik değeri 7 g/dL, ES dozu 10 ml/kg ve transfüzyon sonu hedef Hb değeri 7-9,5 g/dL olarak belirlendi (6).

Transfüzyon için eşik Hb değeri, kullanılan ES hacmi, transfüzyon sonrası hedef Hb değeri, endikasyonlar ve gerekçeler, Uluslararası Kılavuzlara uygunluklarına göre uygun veya değil olarak değerlendirildi. İstatistiksel analiz SPSS yazılım sürümü 21.0 kullanılarak yapıldı; frekans ve yüzdeler hesaplandı, değişkenler Kolmogorov-Smirnov testi ile değerlendirildi ve nitel değişkenler için ki-kare kullanıldı. Yetersiz veri içeren kayıtları olan hastalar hariç tutuldu.

BULGULAR

Çalışmaya toplam 53 ES transfüzyonu uygulanan 53 hasta dahil edildi. Hastaların 37'si (%69,8) erkek, 16'sı (%30,2) kız idi. Yaş ortalaması 37,43±48,06 ay (min: 1-211) idi. ES Transfüzyonlarının hemoglobinin (Hb) eşik değerine göre 36'sının (%67,9) ES dozuna göre 25'inin (%47,2), transfüzyon sonrası hedef Hb değerine göre ise 38 (%71,7) rehberlere uygun değil olarak uygulandığı belirlendi. Çocuk yoğun bakıma başvuru Hb ortalaması ve PRISM II skorları ortanca değeri ise sırasıyla 9,86±1,93 g/gL ve 8 [min: 0 max: 33] bulunmuştur. Kız ve erkekler arasında yaş, PRISM II skoru ve başvuru Hb düzeyi arasında istatistiksel olarak fark bulunmamaktadır (Tablo 1).

Tablo 1. Demografik verilerin cinsiyetlere göre dağılımı

Değişken	Kız	Erkek	Toplam	p
Cinsiyet	16(%30,2)	37 (%69,8)	53 (%100)	0,59
Yaş (ay)	27,75±24,18	41,62±55,07	37,43±48,06	0,32
PRISM II skoru	5,5 [0-32]	10 [0-33]	8 [0-33]	0,35
Mortalite				
Var	6 (%37,5)	9 (%24,3)	17 (%28,3)	0,77
Yok	10 (%62,5)	28 (%75,7)	38(%71,7)	
Başvurudaki Hb Değeri (g/dL)	10,10±1,96	9,76±1,98	9,86±1,93	0,56

Hb: Hemoglobin

ES transfüzyonunun Hb değerine göre ve ES transfüzyon dozu uygun yapılanlar ve yapılmayanlar arasında sırasıyla mortalite açısından fark saptanmamıştır. (X2: 2,044 p=0,197) (X2: 1,382 p=0,360)

ES transfüzyonunun Hb değerine göre ve ES transfüzyon dozu uygun yapılanlar ve yapılmayanlar arasında sırasıyla PRISM II skoru açısından fark saptanmamıştır. (Her ikisi için de p>0,05) (Tablo 2)

Tablo 2. ES uygulanan Hb değeri ve ES dozunun PRISM II skoru ile ilişkisi				
	PRISM II SKORU			P
	N	Ortalama	Standart Sapma	
Hb eşik değeri uygun mu?				0,72
Uygun	17	9,76	6,694	
Değil	36	10,61	8,764	
ES dozu uygun mu?				0,249
Uygun	28	9,11	7,564	
Değil	25	11,72	8,61	

ES: eritrosit süspansiyonu, Hb: Hemoglobin

ES transfüzyonunun eşik Hb değeri (Tablo 3), ES transfüzyon dozu (Tablo 4) ve hedef Hb değerine (Tablo 5) göre uygun yapılanlar ve yapılmayanlar arasında hastalık grubu açısından fark saptanmamıştır.

Tablo 3. Hb değerine göre uygun transfüzyon ve hastalık grubu ile ilişkisi				
	Hb değerine göre uygun transfüzyon			P
	Uygun (n=17) N (%)	Değil (n=36) N (%)	Total (n=53) N (%)	
Enfeksiyon hastalıkları				0,43
Var	14 (82,4)	30 (83,3)	44 (83)	
Yok	3 (17,6)	6 (16,7)	9 (17)	
Solunum hastalıkları				0,38
Var	8 (47,1)	23 (63,9)	31 (58,5)	
Yok	9 (52,9)	13 (36,1)	22 (41,5)	
Nörolojik hastalıkları				0,72
Var	3 (17,6)	5 (13,9)	8 (15,1)	
Yok	14 (82,4)	31 (86,1)	45 (84,9)	
Gastrointestinal hastalıkları				0,73
Var	4 (23,5)	7 (19,4)	11 (20,8)	
Yok	13 (76,5)	29 (80,6)	42 (79,2)	
Genitoüriner hastalıkları				0,09
Var	5 (29,4)	3 (8,3)	8 (15,1)	
Yok	12 (70,6)	33 (91,7)	45 (84,9)	

Hb: Hemoglobin

Tablo 4. ES dozunun uygunluğunun hastalık grubu ile ilişkisi

	ES dozu uygun mu?			P
	Uygun (n=28) N (%)	Değil (n=25) N (%)	Total (n=53) N (%)	
Enfeksiyon hastalıkları				0,15
Var	21 (75)	23 (92)	44 (83)	
Yok	7 (25)	2 (8)	9 (17)	
Solunum hastalıkları				0,18
Var	14 (50)	17 (68)	31 (58,5)	
Yok	14 (50)	8 (32)	22 (41,5)	
Nörolojik hastalıkları				0,86
Var	4 (14,3)	4 (16)	8 (15,1)	
Yok	24 (85,7)	21 (84)	45 (84,9)	
Gastrointestinal hastalıkları				0,37
Var	4 (14,3)	7 (28)	11 (20,8)	
Yok	24 (85,7)	18 (72)	42 (79,2)	
Genitoüriner hastalıkları				0,43
Var	3 (10,7)	5 (20)	8 (15,1)	
Yok	25 (89,3)	20 (80)	45 (84,9)	

ES: eritrosit süspansiyonu

Tablo 5. Hedef Hb değerine göre uygun transfüzyon ve hastalık grubu ile ilişkisi

	ES Transfüzyonu sonrası hedef Hb uygun mu?			P
	Uygun (n=15) N (%)	Değil (n=38) N (%)	Total (n=53) N (%)	
Enfeksiyon hastalıkları				0,65
Var	13 (86,7)	31 (81,6)	44 (83)	
Yok	2 (13,3)	7 (18,4)	9 (17)	
Solunum hastalıkları				0,15
Var	6 (40)	25 (65,8)	31 (58,5)	
Yok	9 (60)	13 (34,2)	22 (41,5)	
Nörolojik hastalıkları				0,25
Var	1 (6,7)	7 (18,4)	8 (15,1)	
Yok	14 (93,3)	31 (81,6)	45 (84,9)	
Gastrointestinal hastalıkları				0,51
Var	4 (26,7)	7 (18,4)	11 (20,8)	
Yok	11 (73,3)	31 (81,6)	42 (79,2)	
Genitoüriner hastalıkları				0,67
Var	3 (20)	5 (13,2)	8 (15,1)	
Yok	12 (80)	33 (86,8)	45 (84,9)	

ES: eritrosit süspansiyonu, Hb: Hemoglobin

TARTIŞMA

Kan ürünleri hasta çocukların tedavisinde yaygın olarak kullanılır. Doğru kullanımları için endikasyonlar, belirli davranışları belirlemek, yüksek bir fayda/risk oranı garantilemek ve olumsuz etkilerden kaçınmak için hazırlanmış, yaygın olarak bulunan klinik kılavuzlar bulunur (1,6,7,10-12). Daha önceki çalışmalarda kan ürünlerinin belirtilen %15 ila %54'ü arasında yüksek bir uygunsuz kullanım oranı bildirilmiştir (9,13-15). Ancak, bu geçmiş araştırmalarda araştırma periyodunun kısa olması veya daha düşük sayıda örnek sayıları ile analiz yapıldığından oranlar farklı bulunmuş olabilir. Araştırmamızda uygun

olmayan kullanımının önceki araştırmalara göre 4,5 kata kadar yüksek olduğu bulundu. Kan ürünleri transfüzyonu için parametreler ve endikasyonlar, çalışmanın yapıldığı akademik kurumda mevcut kan transfüzyonu uygulamalarını önemli ölçüde iyileştirmek için en sık yapılan hataları ortaya çıkarmayı amaçlayan kapsamlı bir inceleme gerektirir. Kan ürünleri ile tedavi, kritik durumlarda hayat kurtarmak, hastanın semptomlarını ve genel durumunu iyileştirmek için tartışılmaz potansiyele sahip bir araçtır. Etkili bir tedavi olarak kabul edilir, ancak diğer birçok terapötik müdahale gibi bu uygulama da zararsız değildir (15-18). Bazı gelişmekte olan ülkelerde kan ürünleri transfüzyon pratiği rehberlere uygun olarak yapılmazken (13,19,20), bazılarında ise kan ürünlerin nasıl ve ne zaman doğru şekilde uygulanacağına ilişkin uygun kurallar mevcuttur ve bunlar düzenli olarak gözden geçirilmekte ve bilimsel kanıtlara dayanarak değiştirilmektedir (16,21). Ancak daha önce de belirtildiği gibi, bu kılavuzlarda hem yetişkin hem de pediatrik hastalar için farklı klinik senaryolar ve endikasyonlar bulunmamaktadır. Bu araştırmadaki bulgular, mevcut kılavuzlara yeterince uyulmadığını ve kıdemli personel denetimi ve sürekli eğitime güçlü bir vurgu ile akademik ortamda kan ürünleri kullanım eğitiminin önemli ölçüde iyileştirilmesi gerektiğini göstermektedir.

Çocuklarda, üçüncü seviye akademik hastanelerde kan ürünleri kullanımını değerlendirmek için yapılan çalışmalarda sonuçlar büyük ölçüde farklılık göstermektedir. Kan ürünlerinin %5 ila %60'ı yanlış endike olarak uygulandığı bildirilmiştir (13-15,20). Merkezimizde uygun olmayan endikasyonların daha yüksek bir insidansını (%67,9) bulduk, bu düşük ve yüksek gelirli ülkelerde kılavuzlara uyumun %5 ila %60 arasında olduğunu gösteren uluslararası araştırmalardan daha yüksektir (13-15,20,22,23), kısmen bu çalışmada değerlendirilen daha büyük örneklem büyüklüğü ve uzun zaman dilimiyle ilgili olabilir.

Kritik hastada uluslararası transfüzyon rehberlerine uyulmayabileceği, daha yüksek Hb değerlerinde transfüzyon yapılabileceği düşünülebilir. Bu hastaların mekanik ventilasyon ihtiyacı olması, dokulara O₂ sunumunu artırma ihtiyacı nedeniyle olabilir. Arslanköylü ve arkadaşlarının çocuk yoğun bakım ünitesinde yatan hastalarda yaptıkları bir çalışmada kritik çocuk hastalarda başvuru sırasında anemi varlığı ve/veya takip sırasında transfüzyon gereksinimi artmış mortalite riski ile ilişkilendirilmiştir. Transfüze edilen hastaların PRISM skorları edilmeyenlere göre anlamlı yüksek bulunmuştur (24). Bizim çalışmamızda ise rehberlere uyumlu olsun ya da olmasın transfüzyon yapılanlarda PRISM II skorlarında fark saptanmamıştır.

Mevcut araştırmanın yürütüldüğü aynı merkezde 2018-2021 yılları arasında ES transfüzyonun oksidatif stres üzerine etkisinin araştırıldığı prospektif bir diğer araştırmada ES transfüzyonlarının %34,8'inin hastanın Hb değerinin 7-10 g/dL arasında uygulandığı bildirilmiştir (25).

Bir retrospektif kohort çalışmasında, büyük bir üçüncü basamak hastanede yatan çocuklardaki transfüzyon uygulamaları karşılaştırılmıştır (26). Değerlendirilen 12 pediatrik yan dal uzmanlık kliniğinin 8'inde hastanede yatan çocuklarda Eritrosit Süspansiyonu transfüzyon uygulamasının önemli ölçüde farklılık gösterdiği vurgulanmış ve hastanede yatan pediatrik hastalarda transfüzyonların aşırı kullanılabilirdiği sonucuna varılmıştır(26).

İtalya'da bir pediatri kliniğinde 6 yıllık süreçte yapılan kan transfüzyonlarının uygunluğu araştırılmış ve 63 hastada uygulanan 147 transfüzyonun 39'unun (%26,5) klinik açıklama bulunmaması veya immünolojik veya hematolojik endikasyon gibi uzman bir endikasyonun bulunmaması nedeniyle yanlış olarak değerlendirileceği belirlenmiştir. NHS kılavuzları ile çeşitli transfüzyon gereksinimleri arasında bir uyum olmaması nedeniyle, transfüzyon için belirli eşiklere ve klinik belirtiler ile bir iç prosedürü ortaya çıkarmak için bir hematolog ve çocuk hekiminin birlikte çalışmasının gerekliliği önerilmiştir (27).

Uygun olmayan ve gereksiz transfüzyonları önlemek için geliştirilen transfüzyon paketi öncesi-sonrası araştırmasında uygun olmayan transfüzyonların %25'den %15'e gerilediği saptanmıştır (28). Araştırma bitiminde ise %12'ye düştüğü görülmüştür. Yine bu çalışmanın ana bulgusu olarak, bir transfüzyon paketinin uygulamaya konmasının, uygunsuz transfüzyon yüzdesinde önemli bir azalmaya yol açtığıdır. Ek olarak transfüzyon paketinin etkili bir şekilde kullanılmasının, günlük uygulamada transfüzyon kılavuzlarına uyumu artırmaya yardımcı olduğunu belirtmiştir (28).

İngiltere'de bir kalite kontrol çalışmasında araştırma öncesi temel ölçümlerde yalnızca 2/10 ES transfüzyonunun kılavuzlara uygun şekilde reçete edildiği gösterildi (29). Planla, Uygula, Kontrol Et, Önlem Al (PUKÖ) döngüsü ile klinik tablo ve eşlik eden hastalıklara dayalı gerçek zamanlı karar almaya yardımcı olmak için bir akış şeması tarzında transfüzyon rehberi posterisi oluşturuldu. Birçok kopya, tüm doktorların (ve üniteye çalışan diğer personelin) görüş alanına yerleştirildi. Bu işlem sonrası uygun transfüzyon oranının 4/10'a yükseldiği bulundu (29). Daha sonra A5 boyutunda bir rehber transfüzyon ürünleri ile birlikte gönderildiğinde uyumun 7/10' çıkmış olduğu bulundu. Sonuç olarak bu proje, ulusal düzeyde yazılmış kanıtla dayalı kılavuzların ES transfüzyonu reçeteleme uygulamalarında iyi sonuçlar verecek şekilde yerel olarak uyarlanabileceğini başarıyla göstermiştir (29).

Uygun olmayan transfüzyonların yüksek oranını açıklayabileceğini düşündüğümüz birkaç faktör vardır. Temelde, sorun çocuk hastalar için yeterli bir ulusal kılavuzun olmamasından kaynaklanıyor olabilir. Ek olarak, bazı tıp uygulayıcılarının transfüzyon gerektiren belirli patolojilerde çok az deneyimi vardır ve birçoğu ulusal veya uluslararası transfüzyon kılavuzlarından haberdar değildir.

Kurumumuz, tıp fakültesi öğrencileri ve tıpta uzmanlık eğitimlerinden sorumludur. Diğer kurumlardan gelen önerilere ve deneyimlere dayanarak, dünya çapında yönergelerle uyumu sağlamak için sıkı bir eğitim ve denetimin oluşturulması gerektiği belirlenmiştir. Bu araştırma bulguları sonucunda hastane transfüzyon komitesi, hem hekimleri kan ürünlerinin doğru kullanımını konusunda eğitmek hem de kan transfüzyonu gerektiren hastalara sağlanan tıbbi bakımın en yüksek kalitede ve güvenli olmasını sağlamak amacıyla, ulusal yönergelerle dayalı olarak uzmanlık öğrencileri tarafından yapılan kan ürünü taleplerini incelemek, onaylamak veya reddetmek için mevcutta yaptığı uygulamaları daha etkili hale getirme için kararlar almıştır.

Araştırmamızda bazı kısıtlılıklar bulunur; bunlardan biri retrospektif bir çalışma olmasıdır, bu nedenle hastaların o zamanki tam klinik senaryosunu analiz etmek zordur. Çocuk yoğun bakım ünitemizin yönetiminden 1 öğretim üyesi sorumludur ve transfüzyon kararı çoğunlukla bu öğretim üyesine aittir. Nöbetlerde ise kıdemli araştırma görevlisi karar verir. Dolayısı ile yanlış ya da doğru transfüzyon uygulama kararlarını genellemek doğru olmayacaktır. ES transfüzyonlarının bir kısmı preoperatif anestezi konsültasyonu sonucu olarak hastanın Hb düzeyinin 10 g/dL üzerinde tutulması talebidir. Bu durumda pediatrist olarak doğru transfüzyon kararı verilse bile zorunlu olarak anestezi hekiminin önerisine uyulmak durumunda kalındığından Hb eşik değerine göre uygunsuz ES transfüzyonu yapılmış olmaktadır. Ayrıca, olgu sayısı nispeten azdır, bu nedenle kurumumuzdaki yanlış transfüzyonların gerçek etkisini değerlendirmek için çok merkezli, transfüzyon uygulama kararı verenlerin ve transfüzyon uygulanan hasta sayısının daha yüksek olduğu araştırmalara gerek vardır.

SONUÇ

Çalışmanın yapıldığı merkezde çocuk hastalarda transfüzyon kılavuzlarına sıkı sıkıya bağlılık zayıf olarak bulunmuştur ve mevcut ES transfüzyonu uygulamalarında önemli iyileştirmelerin gerektiği ortaya çıkmıştır. Uygunsuz ES transfüzyonlarını azaltmak ve olumsuz olayları önlemek için tıp eğitimindeki doktor adaylarına ve uzmanlık eğitimi alan doktorlara çağdaş kan transfüzyon stratejileri konusunda eğitim verilmelidir. Aynı şekilde, yalnızca çocuk hastalara odaklanan ulusal transfüzyon kılavuzlarının geliştirilmesi gelecekteki hataların önlenmesine yardımcı olacaktır. Ek olarak, kan bankası ile kan ürünü talep eden her klinik bölüm arasındaki koordinasyon önemlidir. Düzenlenen ve saklanan kayıtlar, daha önce belirtilen transfüzyonların analiz edilmesine ve hataların belirlenmesine yardımcı olacaktır. Doktorlar ve eğitilmiş kan bankası personeli arasındaki iletişim, transfüzyonlardan önce hataları önleyebilir.

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Infantile Intraparenchymal Brain Abscess due to *Streptococcus pyogenes*

Streptococcus pyogenes'e Bağlı İnfantil İntraparankimal Beyin Apseyi

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ABSTRACT

Group A β -hemolytic streptococcus (GABHS) are the most common bacterial cause of tonsillitis, and can cause noninvasive diseases such as pharyngitis and impetigo, as well as more severe invasive diseases. The incidence of invasive disease is 1-3/100,000 per year, and the morbidity and mortality rate is high. GABHS is rarely lead to brain abscesses. Acute phase reactants were found to be high in a 40-day-old patient who presented with fever, irritability and focal seizures. Acute phase reactants were high. Transfontanel ultrasonography showed increased thickness, echo and blood supply in the meninges. Brain magnetic resonance imaging (MRI) and diffusion MRI revealed a thick-walled abscess in the right cerebral hemisphere and parietooccipital parenchyma with diffusion restriction on diffusion-weighted images. Cerebrospinal fluid (CSF) polymerase chain reaction (PCR) test revealed *S. pyogenes*, and *S. pyogenes* grown in CSF culture. Initially, meropenem, vancomycin, metronidazole antibiotherapy was applied. Treatment was revised to cefotaxime and vancomycin after culture antibiogram and was completed for 8 weeks. Seizures regressed. Control brain imaging showed improvement. Restriction in left lower extremity movements remained. Physical therapy and rehabilitation was recommended and he was discharged. GABHS, which is the causative agent of acute tonsillitis, rarely causes invasive disease which has high mortality and morbidity.

Keywords: *Streptococcus pyogenes*, brain abscess, infant, meningitis, encephalitis

ÖZ

A grubu beta hemolitik streptokoklar (AGBHS) tonsillofarenjitin en sık bakteriyel etkenidir, farenjit ve impetigo gibi noninvaziv hastalıklardan, daha ağır seyirli invaziv enfeksiyonlara neden olabilmektedir. İnvaziv hastalık insidansı yılda 1-3/100.000'tür, morbidite ve mortalite oranı yüksektir. AGBHS'lar nadiren beyin apselerine yol açabilir. Ateş, irritabilite ve fokal nöbet ile başvuran 40 günlük hastanın akut faz reaktanları yüksek bulundu. Transfontanel ultrasonografisinde meninkslerde kalınlık, eko ve kanlanma artışı izlendi. Beyin manyetik rezonans görüntüleme (MRG) ve difüzyon MRG'de sağ serebral hemisferde, parietookspital parankimde kalın duvarlı, difüzyon ağırlıklı görüntülerde difüzyon kısıtlılığı bulunan, apse saptandı. Beyin omurilik sıvısı (BOS) polimeraz zincir reaksiyonu testinde *S. pyogenes* saptanırken, BOS kültüründe *S. pyogenes* üredi. Ampirik başlanan meropenem, vankomisin, metronidazol kültür antibiyogram sonrası sefotaksim ve vankomisin olarak 8 haftaya tamamlandı. Nöbetleri geriledi, kontrol beyin görüntülemesinde iyileşme izlendi. Sol alt ekstremitte hareketlerinde kısıtlılık kalan hasta fizik tedavi ve rehabilitasyon önerileri ile taburcu edildi. Akut tonsillofarenjit etkeni olan AGBHS'lar nadiren mortalitesi ve morbiditesi yüksek olan invaziv hastalığa yol açabilmektedir.

Anahtar Kelimeler: *Streptococcus pyogenes*, beyin absesi, infant, menenjit, ensefalit

INTRODUCTION

Group A beta-hemolytic streptococci (GABHS) typically cause tonsillopharyngitis in children aged 5-15 years, presenting with fever, exudate, lymphadenopathy (LAP), crypts, and pharyngeal hyperemia, sometimes accompanied by a scarlatiniform rash. However, in children under three years old, streptococcosis with fever, nasopharyngeal hyperemia, nasal discharge, and anterior cervical LAP is less common (1,2). GABHS tonsillopharyngitis in infants is less frequent due to the

presence of specific transplacental antibodies from the mother and the absence of streptococcal receptors in the pharynx (3,4). The incidence of brain abscesses is quite low, reported as 0.3-1.8/100,000 (5). Generally, about 25% of brain abscesses occur in children (6). It has been reported to be more common in the male population (6).

In this article, with family consent, we will discuss a brain abscess due to GABHS in a 40-day-old infant.

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CASE REPORT

A 40-day-old male patient with no known diseases and no significant features in his prenatal, natal, and postnatal history other than being consistent with 33 weeks gestation, was admitted to the hospital with fever and nasal discharge that had started one day earlier. The patient, who had a bulging fontanelle, was referred to our hospital after receiving a single intravenous dose of ceftriaxone. There was no history of trauma or drug exposure. On initial examination, irritability, "setting sun" eye sign, bulging and tension in the anterior fontanelle were present. Cutis marmoratus and prolonged capillary refill time were observed. Focal seizures in the left arm were noted during follow-up.

The patient's laboratory tests revealed a white blood cell count of 22,960/ μ L (4800-14600/ μ L), absolute lymphocyte count of 5520/ μ L (2500-9000/ μ L), absolute neutrophil count of 16210/ μ L (800-5400/ μ L), C-reactive protein 190 mg/L (0-5 mg/L), erythrocyte sedimentation rate 33 mm/hour (0-18 mm/hour), and procalcitonin 34.4 μ g/L (0-0.5 μ g/L).

Transfontanelle ultrasonography reported normal cerebral, cerebellar, and ventricular systems and midline structures, with no hydrocephalus, hemorrhage, cystic or solid lesions, but increased thickness, echogenicity, and vascularity in the meninges. Due to continuing focal seizures, brain MRI and diffusion MRI were performed. In the supratentorial sections, an intra-axial space-occupying lesion measuring 24×25×55 mm was observed in the right cerebral hemisphere, in the parietooccipital parenchyma, with intense peripheral edema, thick-walled, peripheral contrast enhancement, diffusion restriction in the wall and central part on diffusion-weighted images, opening into the right lateral ventricle (**Figure 1**).

The patient was admitted to the neonatal intensive care unit with a preliminary diagnosis of abscess, and abscess drainage was performed. The cerebrospinal fluid (CSF) taken during surgery was cloudy, with an uncountable number of neutrophils observed. CSF glucose was <2 mg/dL, and CSF microprotein (as this parameter could be studied in our hospital) was 562 mg/dL. The patient was empirically started on meropenem, vancomycin, and metronidazole to cover possible polymicrobial agents in brain abscesses. *S. pyogenes* was detected positive in the viral bacterial meningitis multiplex PCR panel and CSF culture. Although penicillin-sensitive in the culture antibiogram, the treatment was revised to vancomycin and cefotaxime as resistant seizures continued.

Due to residual abscess observed in the brain MRI taken in the 1st month of treatment, intravenous (IV) antibiotherapy was completed to 8 weeks. Despite surgery and IV antibiotherapy, focal seizures were initially resistant, and four antiepileptics were gradually increased in consultation with pediatric neurology.

Until discharge, antiepileptic drugs were gradually reduced following a decrease in seizures. Additionally, persistent lymphocytosis was observed that could not be explained by other causes. The patient was consulted with pediatric immunology. Anti-HIV was negative, immune globulin (Ig) G 695 mg/dL (376-685 mg/dL), IgA 111 mg/dL (9-30 mg/dL), IgM 79 mg/dL (36-77 mg/dL), and peripheral lymphocyte subgroups were normal. Whole exon analysis was sent for natural immune system defects, which has not yet been resulted. Immunoglobulin replacement therapy was given every 21 days for 6 months and then stopped. The patient was discharged with recommendations for physical therapy and rehabilitation due to remaining limitations in left lower extremity movements.

DISCUSSION

GABHS are gram-positive bacteria that can cause noninvasive diseases such as pharyngitis and impetigo, as well as invasive infections and complications such as necrotizing fasciitis, abscess, bacteremia, and toxic shock syndrome (7).

GABHS are the most common bacterial cause of tonsillopharyngitis. It is common in children between 5-15 years old. It can lead to primary suppurative infections in the skin and soft tissue, and late complications such as acute rheumatic fever and acute poststreptococcal glomerulonephritis. Less frequently, it can cause necrotizing fasciitis, bacteremia, streptococcal toxic shock syndrome, puerperal sepsis, pneumonia, and meningitis (2). The incidence of invasive disease is 1-3/100,000 per year (7). In a study including 10 patients with invasive GABHS infection, 40% had bacteremia, 30% had complicated pneumonia, 10% had deep neck abscess, 10% had complicated sinusitis with frontal abscess, and 10% had streptococcal toxic shock syndrome. The pathogen was isolated from blood culture in 50% of patients, throat culture in 30%, abscess culture in 30%, and pleural fluid culture in 20% (7). In our patient, GABHS growth was detected in both CSF and abscess cultures.

Invasive GABHS infections are associated with high morbidity and mortality. Central nervous system involvement is rare, accounting for only 0.2-1% of all childhood bacterial meningitis cases (8). They found the rate of GAS meningitis in the pediatric age group to be 0.06/100,000 (9). Group A streptococcal meningitis is extremely rare in the neonatal period. In one study, GABHS was isolated from both blood and cerebrospinal fluid cultures of a 24-day-old baby presenting with fever, poor feeding, and focal seizures. The patient, treated with penicillin G for 14 days, developed tetraventricular hydrocephalus and hearing loss (10). In our patient, brain abscess accompanied meningitis.

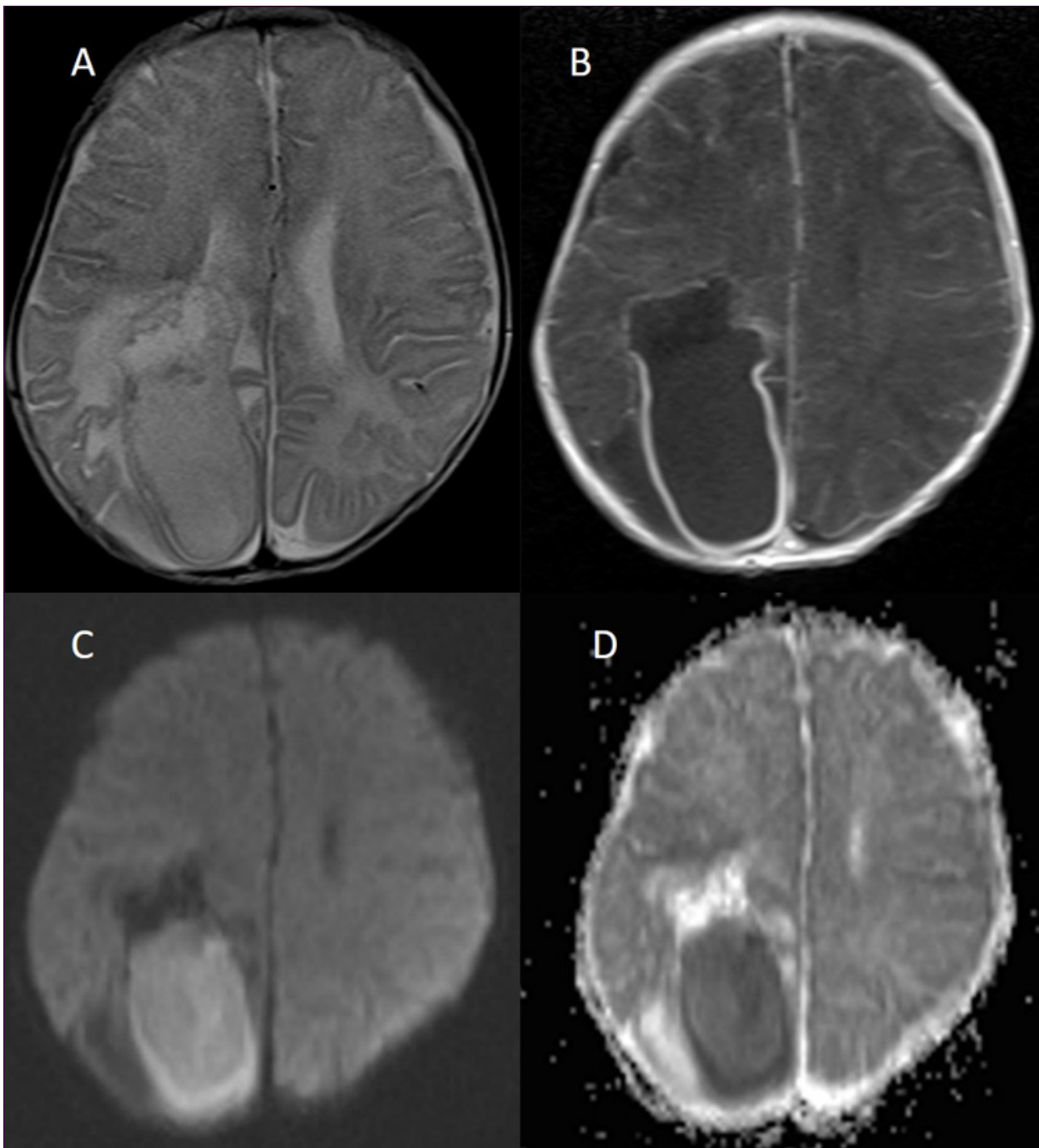


Figure 1. A-D: In the parieto-occipital parenchyma in the right cerebral hemisphere, a thick-walled lesion compatible with an abscess is observed, accompanied by intense peripheral edema located intra-axially, T2W hyperintense (A), showing peripheral contrast enhancement (B), and diffusion restriction on diffusion-weighted images (C, D).

Brain abscesses describe abscesses and empyemas in the brain parenchyma or subdural and epidural spaces (13). They are rare but have high mortality if diagnosis and treatment are delayed (11). The incidence of brain abscesses has been reported as 0.3-1.8/100,000 (5). One study reported a mortality rate of 10.7% (12). Generally, about 25% of brain abscesses occur in children. It has been reported to be more common in the male

population (6). The pathogen reaches the brain through hematogenous spread, direct invasion from adjacent tissues, penetration, or inoculation of the pathogen during surgical procedures (13). Otitis media, mastoiditis, trauma, meningitis due to ventriculoperitoneal shunt are predisposing factors for brain abscesses (11). One study reported previous pneumonia, tetralogy of Fallot, infective endocarditis on the basis of tetralogy of Fallot,



acute lymphoblastic leukemia, orbital cellulitis, and brucellosis as predisposing factors. Primary or secondary immunodeficiency is another risk factor for brain abscess development (14). No predisposing factor was detected in our patient.

Initially, clinical findings may be subtle. Different findings can be detected depending on the location of the abscess. Headache, fever, neurological findings, and vomiting are common (19). The classic triad is headache, fever, and focal neurological findings. These findings can be seen in 9-28% of children (6). Our patient was not old enough to express headache, but had fever, irritability, focal seizures, "setting sun" eye sign, and bulging and tension in the anterior fontanelle.

In our case, *S. pyogenes* was detected positive in CSF-PCR and grew in CSF culture. In a series reporting 107 cases with brain abscesses, 64.7% streptococci (11.8% GABHS), 38.1% *Proteus* spp., 30% *Staphylococcus aureus*, and 4.8% *Citrobacter freundii* were reported as causative agents (12). In another study of 75 cases with brain abscesses, *S. aureus* and *Streptococcus viridans* were isolated from 5 patients each (6.7%), polymicrobial pathogens from 3 patients (4%), *Proteus mirabilis*, *Streptococcus constellatus*, *Streptococcus pneumoniae*, *Peptostreptococci*, and *Peptococcus niger* from 3 patients each (4%), coagulase-negative staphylococci, *Streptococcus anginosus*, *Klebsiella* spp., *Ekinella* spp., *Fusobacterium* spp., *Bacteroides* spp., and *Aspergillus* spp. from 2 patients each (2.7%), and from 1 patient each (1.3%) (20). In a study of 89 children presenting with brain abscess, 14.6% *S. aureus*, 13.5% *S. pneumoniae*, 9% coagulase-negative staphylococci, 6.7% each of *S. viridans* and *Bacteroides* spp., 5.6% each of *Klebsiella pneumoniae* and *P. niger*, 4.5% *Fusobacterium* spp., 3.4% each of *P. mirabilis* and *Peptostreptococcus*, 1.1% MRSA were detected (21). In a study including 41 children with brain abscesses, GABHS was not isolated from either CSF or abscess cultures in any of the patients (22).

GABHS is extremely sensitive to bactericidal beta-lactam antibiotics. However, clinical failures have been reported with penicillin treatment alone in patients with invasive GABHS infections (23,24). Data from observational studies have found treatment with a beta-lactam + clindamycin to be more effective than beta-lactam alone (25,26). However, clindamycin has poor CSF penetration, so a combination of linezolid (CSF/blood ratio approximately 60-70%), which has better CSF penetration, with beta-lactam antibiotics (penicillin or 3rd generation cephalosporins) is recommended (27). There are no clinical studies reporting the optimal duration of antibiotic treatment, and the duration of antibiotic treatment should be determined according to the patient (25). In addition to IV antibiotherapy, surgical intervention also plays an important role in treatment (26). In our patient, who underwent early-stage surgery,

meropenem, vancomycin, and metronidazole treatment were given until the causative agent was identified, and then treatment was completed with cefotaxime and vancomycin. In a case report of a sixteen-year-old patient with a brain abscess, the abscess did not shrink in the second week of cefotaxime, vancomycin and metronidazole treatment, so the treatment was revised to meropenem, vancomycin and metronidazole treatment, and it was reported that the abscess shrank after a total of 9 weeks of treatment (28)

Delays in diagnosis, IV treatment, or surgical intervention cause morbidity and mortality. One study reported reasons for delayed treatment initiation as misinterpretation of images, failure to perform imaging in a timely manner, the need for imaging as an indication for surgical intervention, or clinician preference (29). While only meningeal thickening was noted in our patient's cranial USG, an abscess was detected by MRI.

CONCLUSION

GABHS, which is the causative agent of acute tonsillopharyngitis, can rarely lead to invasive disease with high mortality and morbidity. GABHS should be kept in mind as a causative agent in brain abscesses. Brain MRI and CSF culture play an important role in diagnosis. The total duration of treatment should be determined according to the patient's response to treatment.

ETHICAL DECLARATIONS

Informed Consent: Written informed consent was obtained from all participants who participated in this study.

Referee Evaluation Process: Externally peer-reviewed.

Conflict of Interest Statement: The authors have no conflicts of interest to declare.

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