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Research Article / Araştırma Makalesi

The effect of secondhand smoke exposure on treatment outcomes in children hospitalized for community-acquired pneumonia

Toplum kökenli pnömoni nedeniyle hastanede yatırılarak tedavi edilen çocuklarda pasif sigara içiciliğinin tedavi sonuçları üzerine etkisi

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ABSTRACT

Background: Secondhand smoke exposure remains a major yet preventable contributor to pediatric respiratory illness, especially in low- and middle-income countries. Despite public regulations limiting tobacco use, secondhand smoke exposure within homes remains a persistent threat to children's health. This study aimed to assess the impact of secondhand smoke exposure on clinical outcomes among children hospitalized for community-acquired pneumonia.

Methods: A cross-sectional observational study was conducted at Adana City Training and Research Hospital, enrolling 563 pediatric patients aged 1 month to 18 years hospitalized with community-acquired pneumonia between July 2019 and June 2020. Secondhand smoke exposure was defined as the presence of at least one smoker in the child's household. The primary outcome was length of hospital stay. Secondary outcomes included admission to the pediatric intensive care unit, use of invasive or non-invasive mechanical ventilation, PICU length of stay, and history of hospitalization due to lower respiratory tract infection.

Results: Among the patients, 70.3% were exposed to secondhand smoke at home, and 41.4% lived with two or more smokers. Secondhand smoke exposed children had significantly longer hospital stays (p=0.023), increased rates of pediatric intensive care unit admission (12.1% vs. 6.6%, p=0.032), and a higher frequency of past hospitalizations for lower respiratory tract infection (p<0.001) compared to unexposed peers. However, no statistically significant differences were found in pediatric intensive care unit length of stay or need for mechanical ventilation between the two groups. Exposure to secondhand smoke during pregnancy was also associated with a higher risk of severe respiratory outcomes.

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Conclusions: Secondhand smoke exposure in household settings is associated with worse clinical outcomes in pediatric patients hospitalized with CAP. These findings underscore the urgent need for targeted public health interventions, including parental education and stricter enforcement of smoke-free home environments. Efforts to reduce household secondhand smoke exposure may substantially decrease pediatric morbidity associated with pneumonia.

Keywords: children, community-acquired pneumonia, secondhand smoke exposure

ÖZ

Arka Plan: İkinci el sigara dumanına maruz kalma, özellikle düşük ve orta gelirli ülkelerde çocuklarda görülen solunum yolu hastalıklarının önemli ancak önlenebilir bir nedenidir. Tütün kullanımını sınırlayan kamusal düzenlemelere rağmen, ev içi ikinci el sigara dumanına maruz kalma çocuk sağlığı açısından hâlâ ciddi bir tehdit oluşturmaktadır. Bu çalışmanın amacı, ev ortamında ikinci el sigara dumanına maruz kalmanın, toplum kökenli pnömoni nedeniyle hastaneye yatırılan çocuklardaki klinik sonuçlara etkisini değerlendirmektir.

Yöntem: Bu prospektif gözlemsel çalışma, Temmuz 2019 ile Haziran 2020 tarihleri arasında, Adana Şehir Eğitim ve Araştırma Hastanesi'nde toplum kökenli pnömoni tanısıyla hastaneye yatırılan 1 ay ile 18 yaş arasındaki 563 pediatrik hastayı kapsamaktadır. İkinci el sigara dumanına maruz kalma, çocuğun yaşadığı evde en az bir sigara içicisinin bulunması olarak tanımlanmıştır. Birincil sonuç ölçütü hastanede yatış süresidir. İkincil sonuçlar arasında çocuk yoğun bakım ünitesine kabul, invaziv veya non-invaziv mekanik ventilasyon kullanımı, çocuk yoğun bakım ünitesinde kalış süresi ve alt solunum yolu enfeksiyonu nedeniyle geçmişte hastaneye yatış öyküsü yer almaktadır.

Bulgular: Hastaların %70,3'ü evde ikinci el sigara dumanına maruz kalmaktaydı ve %41,4'ü evde iki veya daha fazla sigara içicisiyle yaşamaktaydı. İkinci el sigara dumanına maruz kalan çocukların hastanede kalış süresi anlamlı düzeyde daha uzundu (p=0,023); ayrıca çocuk yoğun bakım ünitesine kabul oranı daha yüksekti (%12,1'e karşı %6,6; p=0,032) ve alt solunum yolu enfeksiyonu nedeniyle önceki hastane yatış öyküsü daha sık görülmekteydi (p < 0,001). Ancak, iki grup arasında çocuk yoğun bakım ünitesinde kalış süresi veya mekanik ventilasyon gereksinimi açısından anlamlı bir fark saptanmadı. Gebelik sırasında ikinci el sigara dumanına maruz kalma da daha ağır solunum yolu sonuçlarıyla ilişkilendirildi.

Sonuç: Ev ortamında ikinci el sigara dumanına maruz kalma, toplum kökenli pnömoni nedeniyle hastaneye yatırılan pediatrik hastalarda daha kötü klinik sonuçlarla ilişkilidir. Bu bulgular, hedeflenmiş halk sağlığı müdahalelerinin, özellikle ebeveyn eğitimi ve sigarasız ev ortamlarının daha sıkı şekilde denetlenmesinin önemini vurgulamaktadır. Ev içi ikinci el sigara dumanı maruziyetinin azaltılması, pnömoni ile ilişkili çocukluk çağı hastalık yükünü önemli ölçüde azaltabilir.

Anahtar kelimeler: çocuk, toplum kökenli pnömoni, pasif sigara dumanı maruziyeti

Introduction

Community-acquired pneumonia (CAP) in children continues to be an important cause of morbidity and mortality, especially in developing countries.[1,2] Secondhand smoke (SHS) exposure in children is a preventable cause of morbidity that starts before birth and continues in childhood. It is an important risk factor both for upper respiratory tract and lower respiratory tract infections in children and has a negative effect on the length of stay in children hospitalized and treated for pneumonia.[3,4] Secondhand smoke exposure has been reduced in public spaces outside the home with regulations against tobacco in the world and in our country. However, the outreach of these regulations in living areas is limited.

Both tobacco use and pneumonia continue to threaten public health, especially children.[3,5] According to the World Health Organization (WHO), 155 million children aged 5 and below are

diagnosed with pneumonia every year. Nearly 20 million of them are hospitalized and more than 2 million children die due to pneumonia.[2,6] It is necessary to take precautions against pneumonia, which causes such serious mortality, or to reduce its severity. Studies on tobacco use and its effects on lower respiratory tract infections in children are not sufficient.

In this study, we aimed to evaluate the effects of SHS exposure at home on treatment outcomes in children hospitalized for CAP in Adana City Training and Research Hospital Pediatrics Clinic.

Material and Methods

The study was designed as a cross-sectional study. The study included 563 patients aged between 1 month-18 year who were hospitalized for CAP in Adana City Training and Research Hospital Pediatrics Clinic between 01.07.2019 and 30.06.2020. Exposure to SHS was determined using a structured questionnaire completed by the parents or guardians. The questionnaire included items regarding both current household exposure and maternal exposure to SHS during pregnancy. The study compared two groups of patients: those who were exposed to SHS and those who were not, in order to evaluate the potential effects of SHS exposure on the clinical course and outcomes of CAP.

Diagnosis of pneumonia was made based on the presence of radiological infiltration, and/or clinical/laboratory findings of pneumonia. Secondhand smoke exposure was defined as the pre-sence of at least one smoker in the child's home. The primary outcome was the length of hospital stay, and the secondary outcomes were admission to the intensive care unit, use of invasive mechanical ventilation or non-invasive mechanical ventilation, length of stay in the intensive care unit, and history of hospitalization with a diagnosis of lower respiratory tract infection (LRTI).

Parents were asked to fill out a questionnaire about exposure to SHS exposure at home. Med-ical data were collected from hospital files.

Inclusion and exclusion criteria

Upon consent, patients aged between 1 month-18 years and hospitalized in pediatric clinics due to CAP were included in the study.

Children with malignancy, immunodeficiency, chronic respiratory diseases, as well as those who smoke, tuberculosis patients, cystic fibrosis patients, children with a birth history below 36 weeks, healthcare-associated infections, recent hospitalization (30 days), and patients whose parents could not provide sufficient information, were excluded from the study. Patients treated for COVID-19 pneumonia were also excluded.

Ethical Approval

The study was approved by the Adana City Training and Research Hospital Clinical Research Ethics Committee (22.05.2019, Meeting number: 35, Decision no: 453).

Informed consent

Informed consent was obtained from the parents of the patients aged 0-13 years and from both the parents and the patients aged between 13-18 years before the study. Patients whose parents did not consent to work were excluded from the study.

Statistical Analysis

Statistical analyses were conducted using the SPSS statistical software version 20 (IBM Corp., Armonk,NY). The normal distribution of the numerical measurements in the study group was examined with the Kolmogorov–Smirnov test. Descriptive statistics of the numerical parametric data were calculated as mean ± standard deviation; non-parametric data were calculated as median and interquartile range (IQR), categorical variables were expressed as a percentage (%), a

χ2 test was used for the comparison of categorical variables, independent samples t-test and Mann-Whitney U test was used to compare the numerical variables between groups. Significant differences are indicated as p-value of <0.05.

Results

Of the 563 patients, 237 (42.1%) were female and 326 (57.9%) were male (57.9%). The mean age of the patients was 25.2±38.2 months (median 11, IQR 19). The mean body weight of the patients was 12.6±10.89 kg (median 9, IQR 7).

While 396 (70.3%) of the patients were exposed to SHS, 233 (41.4%) of them had ≥ 2 smokers at home (Table 1). When the patients were evaluated in terms of exposure to secondhand smoke during pregnancy, it was observed that 67% of the patients (self-smoking of mother or secondhand exposure) were exposed to secondhand smoke (Table 1). Fathers were more likely to smoke than mothers (Table 1). The mean hospital length of stay was 5.45±1.69 days (median 5, IQR 3). Children exposed to SHS had longer hospital length of stay (p=0.023) (Table 2). The mean hospital length of stay of patients who had 1 smoker at home was 5.54±1.63 days and 5.6±1.61 days in those who had ≥ 2 smokers at home (p=0.717). There was no statistically significant difference between smoking during pregnancy, maternal or paternal smoking, gender, and length of hospital stay (Table 2).

Fifty-nine (10.5%) of the patients were admitted to the pediatric intensive care unit (PICU). While the rate of PICU admission was 12.1% (48/396) in patients exposed to SHS, this rate was 6.6% (11/167) in patients who were not exposed (p=0.032). The mean length of stay in the PICU of patients who were exposed to SHS was 3.09±1.44 days and 2.33±1.31 days in patients who were not exposed

Table 1. Exposure to secondhand smoke

	(n)	(%)
Household smoker/s?		
Yes	396	70.3
No	167	29.7
Number of household smokers		
1 smoker	233	59
≥ 2 smokers	163	41
Mother smoking?		
Yes	87	15.5
No	476	84.5
Father smoking?		
Yes	335	59.5
No	228	40.5
Guests smoking?		
Yes	114	20.2
No	449	79.8
Smoking in pregnancy?*		
Yes	377	67
No	186	33

* Self-smoking or secondhand exposure

Table 2. Relationship between hospital length of stay and exposure to secondhand smoke

	Length of hospital stay (day)*	P
Household smoker/s?		
Yes	5.56±1.62	**0.023**
No	5.19±1.82	
Number of household smokers		
1 smoker	5.54±1.63	0.717
≥ 2 smokers	5.6±1.61	
Father smoking?		
Yes	5.57±1.59	0.056
No	5.28±1.82	
Mother smoking?		
Yes	5.41±1.66	0.807
No	5.46±1.70	
Smoking in pregnancy?**		
Yes	5.53±1.62	0.095
No	5.28±1.82	
Gender		
Girl	5.88±2.81	0.757
Boy	5.81±2.73	

* Mean ± standard deviation
** Self-smoking or secondhand exposure

(p=0.095). Of the patients, 243 (43.2%) had a history of hospitalization with a diagnosis of LRTI (Table 3). This rate was 48.2% (191/396) in patients who were exposed to SHS and 31.1% (52/167) in patients who were not (p<0.001). A statistically significant difference was found between smoking during pregnancy, maternal or paternal smoking, and history of LRTI, but no difference was observed with regard to gender (Table 3). Additionally, no significant relationship was found between age and history of hospitalization due to LRTI (p=0.101).

There was no mortality in the study group. Invasive mechanical ventilation was required in 1 patient (0.2%). Non-invasive mechanical ventilation was required in 23 patients (4.1%) while 18 (78.3%) of these patients were exposed to SHS at home while 5 (21.7%) of them were not (p=0.276).

Table 3. The relationship between secondhand smoke exposure and patients with a history of hospitalization due to lower respiratory tract infection

	Patients with a history of hospitalization due to LRTI*		**P**
Household smoker/s?	(n)	(%)	
Yes	191	78.6	**<0.001**
No	52	21.4	
Father smoking?	(n)	(%)	
Yes	164	67.5	**0.001**
No	79	32.5	
Mother smoking?	(n)	(%)	
Yes	50	20.6	**0.005**
No	193	79.4	
Smoking in pregnancy?**	(n)	(%)	
Yes	188	77.4	**<0.001**
No	55	22.6	
Gender	(n)	(%)	
Girl	98	41.4	0.212
Boy	144	44.2	

* Lower respiratory tract infection
** Self-smoking or secondhand exposure

Discussion

The American Academy of Pediatrics has reported that SHS exposure is 43% in children aged 2-11years in the United States.[7] In studies conducted with children hospitalized for CAP, SHS exposure was found at rates ranging from 28-58%.[4,8,9] In our study, SHS exposure was found to be 69.3%.

Secondhand smoke exposure, which has many negative effects on children's health, is usually caused by parents. According to the WHO data, there are 1.4 billion tobacco users worldwide and the prevalence of tobacco use is 34% in men and 6% in women.[10,11] A decline in tobacco use rate has been observed for both sexes in high-income countries. In low and middle-income countries, smoking prevalence in men is substantially higher than in women.[10] In studies investigating the smoking behavior of parents, the rate of smoking varies between 31-59% for the father and 3-31% for the mother.[12-14] In our study, the frequency of smoking was 15.5% for the mother and 59.5% for the father.

The encounter of the child with SHS exposure starts during the pregnancy period. Studies have shown that respiratory functions are impaired in the postnatal and advanced childhood periods in children who were exposed to SHS in the prenatal period. It has been shown that it triggers respiratory tract infections in infancy due to the immune system being affected.[15] Gilliland et al. found that the reason for the high incidence of LRTI in school-age children was exposure to SHS in the prenatal period.[16] Lux et al. showed that the mother's smoking during pregnancy was effective in the development of LRTI in children.[17] In our study, there was a significant relationship between exposure to SHS during pregnancy and admission to PICU. However, in our study, no significant difference was found in the length of hospital and PICU stay in children who were exposed to SHS during pregnancy.

Exposure to chronic SHS leads to acute and chronic lung diseases by causing inflammatory and functional changes in the lungs.[3] It causes an increase in upper and LRTIs especially in children. The disease is more severe in children who are hospitalized for CAP and have been exposed to SHS. Ahn et al. showed that the hospital length of stay was longer in children hospitalized for CAP who had been exposed to SHS. No difference was found in the PICU length of stay in those who were exposed to SHS compared to those who were not, while the length of stay in the PICU was found to be longer in children who have ≥ 2 smokers at home.[4] Wilson et al. found that the duration of hospitalization was longer in those who were exposed to SHS compared to those who did not. Concurrently, the need for PICU increased.[13] Lower respiratory tract infection and smoking of the parents were compared in the study of Cook et al. It was found that hospitalization for LRTI was 3 times higher.[18] In our study, similar to the literature, the hospitalization period was found to be longer in children who were exposed to SHS at home, compared to children who were not exposed to SHS.

It has been reported that starting in early infancy, there is a significant increase in recurrent LRTI, wheezing, and chronic cough, especially in children exposed to SHS.[19] Cook et al. compared LRTI and maternal and paternal smoking of pediatric patients and showed that maternal smoking had a greater negative effect on LRTI.[18] In our study, similar to the studies in the literature, the history of past hospitalizations due to LRTI in children who were exposed to SHS at home was found to be statistically significantly higher than in children who were not exposed.

The limitations of the study were as follows: the study was observational, the reliability of results bound to the answers given by the families to the questionnaire, although patients with chronic diseases were not included in the study, all other variables that could affect the pneumonia treatment results could not be eliminated.

Conclusions

Secondhand smoke exposure paves the way for diseases that adversely affect child health; such as respiratory system infections, malignancy, cognitive disorders, sudden infant death syndrome, coronary artery disease, chronic kidney diseases, endocrine disorders, metabolic syndrome, and obesity. Although tobacco use policies reduce children's exposure to SHS outside the home, parents need to be educated about smoking at home to minimize the negative effects of secondhand smoke on children.

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Ethical approval

This study has been approved by the Adana City Training and Research Hospital Clinical Research Ethics Committee (approval date: 22.05.2019, number: 35-453). Written informed consent was obtained from the participants.

Author contribution

Study conception and design: OT, AÜ, ARU; data collection: ARU, SK, ESG; analysis and interpretation of results: OT, AÜ, ARU, SK, ESG; draft manuscript preparation: OT, AÜ, ARU, SK, ESG. All authors reviewed the results and approved the final version of the article.

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Conflict of interest

The authors declare that there is no conflict of interest.

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