

# The Prevalence of Attention Deficit Hyperactivity Disorder in Children Admitted to The Pediatric Emergency Room with Burns

## *Pediatric Acil Servise Yanık ile Başvuran Çocuklarda Dikkat Eksikliği ve Hiperaktivite Bozukluğu Prevalansı*

Cengizhan Kilicaslan<sup>1</sup>, Huseyin Mutlu<sup>2</sup>, Ekrem Taha Sert<sup>2</sup>, Kamil Kokulu<sup>2</sup>

### Öz

**Amaç:** Yanık, özellikle çocukluk döneminde sık görülen bir durumdur. Yanık oluşan çocuklarda, dikkat eksikliği hiperaktivite bozukluğu (DEHB) semptomlarının görülme sıklığını belirlemek ve sağlıklı çocuklarla karşılaştırmayı amaçladık.

**Hastalar ve Yöntem:** Bu prospektif çalışma Ağustos 2019- Nisan 2021 tarihleri arasında yürütülmüştür. Çalışma grubu, çocuk acil servise yanık nedeni ile başvuran 3-16 yaş arası çocuk hastalardan seçildi. Kontrol grubu, travma dışı sebeplerle çocuk acil servise başvuran 3-16 yaş arası çocuklardan seçildi. Her iki grubun da kültürel ve demografik özellikleri benzerdi. Her iki gruba da ilk müdahale ve stabilizasyondan sonra revize edilmiş Conners Ebeveyn Derecelendirme Ölçekleri (CPRS-R) uygulandı.

**Bulgular:** Çalışma grubu 143 kişiden oluşturuldu yaş ortalaması 6,93 ± 2,96 yıl (dağılım: 3-16) ve 69'u (%48,3) kızdı. Kontrol grubu yaş ortalaması 6,72 ± 2,48 yıl (dağılım: 3-16) olan 140 çocukta oluşmaktaydı ve olguların %49,3'ü kızdı. İki grup arasında yaş ve cinsiyet açısından istatistiksel olarak anlamlı fark yoktu (sırasıyla p = 0,36, 0,84). Yanıkların en sık nedeni (%69,2) sıcak su veya yağdan oluşmaktaydı. Yanıkların büyük bir kısmı (%89,5) ayaktan müdahale sonrası acil servisten taburcu edildi. CPRS-R'nin hesaplanan tüm alt ölçek puanları; -bilişsel problemler/dikkatsizlik alt ölçek puanları dışında- çalışma grubunda, kontrol grubuna göre anlamlı olarak daha yüksekti. Çalışma grubundaki ebeveynlerin eğitim durumu kontrol grubundakilere göre daha yüksekti.

**Sonuç:** Bizim bulgularımız acil servise yanık yaralanmaları nedeniyle başvuran çocuklarda DEHB belirtilerinin görülme sıklığının yüksek olabileceğini göstermektedir.

**Anahtar Kelimeler:** Yanık, Çocuklar, Dikkat eksikliği hiperaktivite bozukluğu

### Abstract

**Aim:** Burns are common, especially in children. Here, we aimed to determine incidence of attention deficit hyperactivity disorder (ADHD) symptoms in children with burns and compare them with healthy children.

**Patients and Methods:** This prospective study was conducted between August 2019 and April 2021. The study group consisted of pediatric patients aged between 3-16 years admitted to the pediatric emergency with burns. Children aged between 3-16 years admitted for non-traumatic reasons also constituted the controls. Cultural and demographic characteristics of both groups were similar. After initial intervention and stabilization, the revised Conners' Parental Rating Scale (CPRS-R) was applied to both groups.

**Results:** The study group consisted of 143 individuals with a mean age of 6.93±2.96 years, and 69 (48.3%) were girls. The control group consisted of 140 children (mean age: 6.72±2.48 ranging between 3-16 years), and 49.3% were girls. There was no statistically significant difference between both groups regarding age and gender (p=0.36, 0.84, respectively). The most common cause of burns (69.2%) was exposure to hot water or oil spill. Most of the victims due to burns (89.5%) were discharged from emergency after outpatient intervention. All subscale scores calculated through CPRS-R, except for cognitive problems/inattention subscale scores, were significantly higher in the study group than the controls. The educational status of the parents in the study group was higher than those of the controls.

**Conclusion:** Our findings indicated that the incidence of ADHD symptoms may be higher in children admitted to the emergency department due to burn injuries.

**Key words:** Burns, children, attention deficit hyperactivity disorder

<sup>1</sup>Aksaray University, Medical School, Department of Pediatrics, Aksaray, Turkey

<sup>2</sup>Aksaray University, Medical School, Department of Emergency Medicine, Aksaray, Turkey

**Address correspondence to:** Cengizhan Kilicaslan, Aksaray University, Medical School, Department of Pediatrics, Aksaray, Turkey  
**e-mail:** dr\_cengizhan@hotmail.com

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## INTRODUCTION

Burns developing during the pediatric period are within the major causes of injuries and lead to high mortality in children (1). Individuals at the highest risk of burn injuries are the pediatric population between 1-15 years of age. In a study performed in the United States in 2018, burn injuries were stated as the third most common cause of injuries and deaths in children aged between 5-9 years and the leading cause of deaths in children between 1-14 years of age (2-4). The most common burns are the contact burns due to contact in toddlers, leading to severe burn injuries due to prolonged transfer of heat from an object to the skin and developing in using the household appliances during routine activities of daily life. However, thermal burns are seen due to fire in young children, and in school-age children, most of the burns are caused by reckless use of fireworks or flammable materials. Most of these burns are minor and can be treated on an outpatient basis. Even so, nearly 5% of the burns are considered moderate or severe and require hospitalization (5-7).

Attention deficit hyperactivity disorder (ADHD) is a neurodevelopmental disorder, and the lifetime prevalence of the condition is estimated to be around 5-7.2% (8.9) in children and 2.5% in adults (9,10). ADHD is characterized by such symptoms as inattention, hyperactivity, and impulsivity initiating in the early developmental period; however, these symptoms in ADHD are observed not to be appropriate for the individual's age and developmental stage. Most of the time, children with ADHD usually are open to the dangers around when they are not under parental supervision. Therefore, children with ADHD are more likely to experience accidents (11-13). In several studies, ADHD was demonstrated to be related to the propensity to injuries, and children with ADHD suffer more frequent and serious injuries than those without ADHD and also require more frequent hospitalization after injuries (12-16). In children with ADHD, impulsivity and inattention are accompanied by a significant risk of burns and other accidents associated with high levels of motor activity and impulsive behavior (6,13). Therefore, our study targeted to determine the rate of ADHD in children with burns and to compare the findings between the children admitted to the emergency due to burns and the controls.

## PATIENTS AND METHODS

### *Study description and design*

The present study was conducted in the pediatric

emergency department of a tertiary hospital where an average of 15.000 pediatric patients is admitted monthly. Our study was prospectively carried out between August 2019 and April 2021. Approval was obtained from the ethics committee for clinical researches at a local university hospital (Registration number: 2019/08-20). Two hundred and seventeen children aged between 3-16 years were admitted to the pediatric emergency room due to burns and included in the study group by evaluating between August 2019-May 2021. Since the revised Conners' Parental Rating Scale (CPRS-R) test was not fully completed, and the participants wanted to leave the study, 74 of 217 children were excluded from the study, and so the remaining 143 children constituted the burn group. However, the controls consisted of 140 children aged between 3-16 years and admitted to the pediatric emergency room due to non-traumatic reasons. The patients in the control group were randomly selected among those with a similar socio-cultural and cognitive level and without any mental disorders.

The initial examination and necessary medical interventions were performed for all patients. After the patients' general conditions were stabilized, the family members were informed in detail about the study design to be performed. The revised Conners' Parent Rating Scale (CPRS-R) was carried out for the parents volunteering to participate in the study. Additionally, such demographic features as age, gender, parents' educational status, and the criteria such as factors causing burns, burn area, and classification of the burns were evaluated, and the information obtained was recorded. The children previously diagnosed with ADHD or those diagnosed with behavioral disorders were not included in the study.

### ***Conners' Parent Rating Scales***

CPRS-R is a parental scale frequently utilized to assess ADHD. The min-max values of the CPRS-R scale are 0 and 81, respectively. The scale is composed of 80 items under 14 subscales. On the scale, parents are requested to respond to the items by taking into account their characteristics within the last month. The questions are responded to by the parents on a four-point Likert scale. The options or responses, such as "never", "rarely", "often" and "always", are scored as "0", "1", "2" and "3", respectively. The fact that the score obtained from a subscale is becoming more increased indicates that the individual's level of having the problem defined by the subscale is high. Total scores of every subscale are calculated through

this score, and the test is finally ended.

The following were assessed as subscales in the present study: CG/I: Cognitive problems/inattention, H: Hyperactivity; ADHD-I: Attention deficit hyperactivity disorder index, CGI-DI: Conners' Global Index-discomfort-impulsivity, DSM-IV-SS-I: DSM-IV-symptom subscale-inattention, DSM-IV-SS-HI: DSM-IV-symptom subscale-hyperactivity-impulsivity, DSM-IV-SS-T: DSM-IV-symptom subscale-total score, anxiety-shyness, social problems, perfectionism, and psychosomatic (17,18).

### Statistical Analysis

The statistical analyses of the study findings were evaluated with the Statistical Package for the Social Sciences software version 15.0 (SPSS Inc., Chicago, IL, USA). In the analyses of descriptive statistics, continuous variables showing normal distribution were expressed as mean±standard deviation (SD), and continuous variables not showing normal distribution were expressed as median values [interquartile ranges (IQR) 25th and 75th percentiles]. Categorical variables were also expressed as numbers (n) and percentages (%). The Kolmogorov-Smirnov test was performed to determine whether the continuous variables were normally distributed. For comparisons between groups, however, the chi-square, the student's t-test, and the Mann-Whitney U test were utilized. The statistical significance level was also accepted as  $p < 0.05$ .

**Table 1.** Demographic features of the patient population with burn injuries

Variables	n (%)
Age (years)	
≤5	37 (25.9)
5>/≤10	79 (55.2)
>10	27 (18.9)
Gender, (%)	
Male	74 (51.7)
Burn Percentage	
≤10	132(92.3)
10>/≤20	8 (5.6)
>20	3 (2.1)
Burn Mechanism	
Flame	27 (18.9)
Hot water or liquid	99 (69.2)
Hot object	10 (6.9)
Steam	4 (2.8)
Electric	2 (1.4)
Chemical	1 (0.7)
Outcomes	
Admitted	15 (10.5)
Discharged	128 (89.5)

## RESULTS

One hundred and forty-three of 217 cases admitted to the pediatric emergency with complaints of burns between August 2019 and May 2021 constituted the study group. The mean age of those in the study group was  $6.93 \pm 2.96$  years (ranging between 3-16 yrs), and 69 (48.3%) were girls. However, the controls were composed of 140 children having an average of

**Table 2.** Comparisons between the study and control groups by demographics and CPRS-R subscale scores

Variables	Study group	Control group	P-value	95% CI
Male, n (%)	74/143 (51.7)	71/140 (50.7)	0.84	-13.57 to 16.17
Age (years), mean±SD	6.93±2.96	6.72±2.48	0.36	-0.21 to 1.4
The subscale of symptoms (%)				
Hyperactivity	8.71	4.46	<0.001	-5.21 to -2.46
CP/I	5.95	4.52	0.14	-3.26 to 0.18
ADHD-I	8.74	5.03	<0.001	-5.12 to -1.40
CGI-DI	6.64	3.29	<0.001	-4.13 to -1.26
DSM-IV SS-I	5.98	3.24	<0.001	-5.17 to -1.28
DSM-IV SS-HI	8.96	6.13	<0.001	-7.42 to -3.58
DSM-IV SS-T	13.36	7.85	<0.001	-9.86 to -3.71
CPRS-R SS-TS	64.65	31.65	<0.001	-41.11 to -14.75
Psychosomatic	5.32	3.64	<0.001	-2.23 to -1.03
Anxiety-Shyness	24.6	18.9	<0.001	-9.65 to -6.24
Perfectionism	9.24	5.68	<0.001	-3.24 to -1.58
Social Problems	8.31	5.97	<0.001	-2.89 to -1.06

ADHD-I: Attention deficit hyperactivity disorder index, CGI-DI: Conners' global index-discomfort-impulsivity, CI: Confidence Interval, CP/I: Cognitive problems/inattention, CPRS-R: Conners' parent rating scales-revised, DSM-IV: Diagnostic and statistical manual of mental disorders (fourth edition), DSM-IV SS-HI: DSM-IV symptom subscales/hyperactivity-impulsivity, DSM-IV SS-I: DSM-IV symptom subscales/inattention, DSM-IV SS-T: DSM-IV symptom subscales-total, CPRS-R SS-TS: Conners' parent rating scales-revised Subscales total score.

6.72±2.48 years of age (range: 3-16 yrs), and 49.3% of the subjects in the control group were girls. There was no statistically significant difference between the study and control groups in terms of age and gender ( $p=0.36$ ,  $0.84$ , respectively). The burn rate was below 10% in 92.3% ( $n=132$ ) of the cases. Of the burns, 69.2% were caused by hot water or oil spills. A great majority of the burn cases (89.5%) were discharged following the outpatient intervention, and the rest were treated with full recovery after the hospitalization. The data related to the patients' demographic features are presented in Table 1.

Out of the cognitive problems/inattention subscale scores, statistically significant differences were detected between the study and the control groups concerning the mean values for all of the subscale scores of CPRS-R found in the study. The scores over the comparisons between the study and control groups are also given in Table 2.

## DISCUSSION

Our study demonstrated that the subscale scores and total scores of CPRS-R filled by the parents of the children admitted to the pediatric emergency due to burns were significantly higher than those found in the control group. Our study findings also showed that children suffering from burns are more likely to have ADHD. To the best of our knowledge, our study is the first to investigate ADHD prospectively in the pediatric population hospitalized in the emergency department owing to burns. Affecting approximately 5% of school-aged children, ADHD is a neurobehavioral challenge difficult to diagnose, and the frequency of ADHD tends to decrease with age. Even so, if ADHD is ignored by healthcare professionals, and the treatment is neglected, it is likely that ADHD turns into a lifelong challenge; in other words, such individuals will be adversely affected by ADHD throughout their lives (11-17). Nigg et al. (18) showed that chronic diseases such as hypertension, diabetes mellitus, and obesity, as well as drug use, and addiction to cigarette and alcohol, are witnessed at high rates in those diagnosed with ADHD in childhood period; accordingly, the mortality and morbidity rates are increased.

CPRS-R is a frequently used scale consisting of questions for parents to respond to the evaluation of children revealing behaviors that indicate ADHD (17,19,20). Pediatric populations having ADHD and oppositional manners are more likely to be injured accidentally, compared to those presenting with optimal growth values (16,17). While some studies

have reported controversial findings in the literature, others have shown that patients with ADHD have a higher risk of burn injuries than those without ADHD (6,7,21). In a retrospective study in which Mangus et al. (22) evaluated 278 children with burn injuries, it was revealed that 13% of the patients were diagnosed with ADHD, and this rate was higher than that of those with ADHD in the population (5%). The study demonstrated that such children were more likely to experience thermal burns rather than flame burns (83% vs. 58%). In a case-control study including 123 patients with ADHD and 100 control patients, the incidence of burn injuries was reported to be significantly higher among those with ADHD (10.6% vs. 2%) (23). We consider that our results are consistent with and support the results of the previous studies. Even so, in another database study conducted in Germany where ADHD patients aged 3-17 years were compared with those without ADHD, it was reported that there was no significant increase in terms of burn risks (15). So, it can be suggested based on the literature that the information over the association between the development of burns and traumas in children with ADHD, and age and gender is controversial.

Regarding the incidence of injuries among children having ADHD, it has been reported that male gender and advanced age constitute a higher risk of burns and traumas (12-15). In the study by Thomas et al. (9), the proportion of boys to girls presenting with burns to the emergency was reported as 10:3. On the other hand, in the retrospective study performed by Yeh et al. (24) in 52,705 children, it was revealed that there was a higher correlation between ADHD and burn injuries, especially in children under the age of 6 while there was no difference between both genders. Those high rates of burns encountered in the early childhood period may be linked to the curious behaviors of children lacking enough experience about the dangers and children's complete dependence on the parents.

This study also has several limitations. First, the control group was randomly selected from nontraumatic patients admitted to the pediatric emergency room with similar socio-cultural and cognitive characteristics to the patients with burns. Another limitation is that due to the nature of our study, no detailed information about the diagnosis and treatment protocols of the controls performed in the emergency room was included. Finally, the study was designed as a single-centered study, and the number of samples is relatively low. Nevertheless,

we consider that our study may be an inspiration for clinicians to diagnose ADHD in children presenting with burn traumas.

## CONCLUSION

Our study detected that ADHD symptoms could be more prevalent in children applied to the pediatric emergency department due to burns. Since the delay in the diagnosis process may have negative long-life effects on individuals with ADHD, pediatric emergency physicians should consider such a possibility and should refer the suspected cases at once to the child psychiatry units for the initiation of treatment. We consider that novel multi-centric studies with larger sampling may yield more general results to be a reference for all clinicians.

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**Address correspondence to:** Cengizhan Kilicaslan, Aksaray University, Medical School, Department of Pediatrics, Aksaray, Turkey

**Phone:** +90 5052719417

**e-mail:** dr\_cengizhan@hotmail.com

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