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Prevalence of Attention Deficit Hyperactivity Disorder and Sluggish Cognitive Tempo Symptoms in Children Presenting with Foreign Body Ingestion: A Case-Control Study

Yabancı Cisim Yutulmasıyla Başvuran Çocuklarda Dikkat Eksikliği Hiperaktivite Bozukluğu ve Ağır Bilişsel Tempo Belirtilerinin Yaygınlığı: Bir Vaka Kontrol Çalışması

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Abstract

Foreign body ingestion (FBI) is one of the common causes of emergency admissions in infancy and childhood. Although the large majority of children who present with the FBI have no psychiatric diagnosis, present studies demonstrate that attention deficit hyperactivity disorder (ADHD) and related psychiatric problems might be a risk factor for FBI. This study aimed to compare the demographic variables and attention deficit hyperactivity disorder levels and sluggish cognitive tempo symptoms (ADHD-SCT) in children who ingested foreign bodies with healthy children. Also, we aimed to address the relationship between ADHD-SCT symptoms and the age of FBI. The FBI group comprised 44 children (age 2-8, median age: 5, 68.2% boys) admitted to the emergency, pediatric surgery, and pediatric gastroenterology department after FBI, and the healthy control group comprised 30 children (age 3-8, median age: 6, 56.7% boys). We administered the sociodemographic information form, SNAP-IV ADHD rating scale, and Barkley's child SCT ratings scale to both groups of parents. Our results demonstrated that maternal education level was significantly lower in the FBI group, although other demographic characteristics of the samples were similar ($p=0.023$). In addition, ADHD-hyperactivity/impulsivity scores were significantly higher in the FBI group ($p=0.01$). Still, there were no significant differences in ADHD-inattention, SCT-daydreaming, and SCT-sluggishness scores (for all, $p>0.05$). We found positive-moderate relationships between SCT-daydreaming and sluggishness symptoms and FBI age ($r=0.314$, $r=0.348$, respectively). This means that higher SCT scores are related to an older FBI age. In conclusion, for the first time, we evaluated the ADHD and SCT symptoms in young children against FBI and found that ADHD-hyperactivity, but not ADHD-inattention symptoms, were significantly higher in the FBI

group, and SCT symptoms increase the risk of FBI at an older age. In addition, we found that a lower maternal education level could be an additional risk factor for FBI. Despite the high hyperactivity in the FBI group, the low rate of child psychiatry evaluation should be considered when evaluating a child.

Keywords: ADHD, Foreign bodies, Gastrointestinal tract.

Özet

Yabancı cisim (YC) yutulması, bebeklik ve çocukluk döneminde acil başvuruların yaygın nedenlerinden biridir. YC yutma ile başvuran çocukların büyük çoğunluğunda psikiyatrik tanı olmamasına rağmen, mevcut çalışmalar gösteriyor ki, dikkat eksikliği hiperaktivite bozukluğu (DEHB) ve ilişkili psikiyatrik problemler YC yutma için bir risk faktörü olabilir. Bu çalışmada yabancı cisim yutan çocuklarda demografik değişkenler ile dikkat eksikliği hiperaktivite bozukluğu düzeyleri ve ağır bilişsel tempo semptomlarının (DEHB-SCT) sağlıklı çocuklarla karşılaştırılması amaçlandı. Aynı zamanda DEHB-SCT belirtileri ile YC yutma yaşı arasındaki ilişkiyi belirlemeyi amaçladık. YC yutma grubu, yabancı cisim yutma sonrası acil, çocuk cerrahisi ve pediatrik gastroenteroloji bölümüne başvuran 44 çocuktan (yaş 2-8, ortanca yaş: 5, %68.2 erkek) ve sağlıklı kontrol grubu 30 çocuktan (yaş 3-8, medyan yaş: 6, %56.7 erkek) oluşmaktadır. Her iki ebeveyn grubuna da sosyodemografik bilgi formu, SNAP-IV DEHB derecelendirme ölçeği ve Barkley's Child SCT derecelendirme ölçeğini uyguladık. Bulgularımız, örneklemelerin diğer demografik özellikleri benzer olmasına rağmen, anne eğitim düzeyinin YC yutma grubunda anlamlı olarak düşük ($p=0.023$) olduğunu gösterdi. Ayrıca YC yutma grubunda DEHB-hiperaktivite/dürtüsellik puanları anlamlı olarak yüksekti ($p=0.01$). Yine de, DEHB-dikkatsizlik, SCT-hayal kurma ve SCT-tembellik puanlarında anlamlı bir fark yoktu (tümü için, $p>0.05$). SCT-hayal kurma ve halsizlik semptomları ile YC yutma yaşı arasında pozitif-orta derecede ilişkiler bulduk (sırasıyla $r=0.314$, $r=0.348$). Bu, daha yüksek SCT puanlarının daha ileri YC yutma yaşıyla ilişkili olduğu anlamına gelir. Küçük çocuklarda ilk kez DEHB ve SCT belirtilerini YC yutan hastalarda değerlendirdik ve DEHB-dikkatsizlik belirtilerinin (DEHB-hiperaktivite belirtilerinin değil) YC yutma grubunda anlamlı olarak daha yüksek olduğunu ve daha büyük yaşlarda SCT belirtilerinin, YC yutma riskini artırdığını bulduk. Ayrıca anne eğitim seviyesinin düşük olmasının YC yutma için ek bir risk faktörü olabileceğini bulduk. YC yutma grubunda hiperaktivitenin yüksek olmasına rağmen, çocuk değerlendirilirken çocuk psikiyatrisi konsültasyon oranının düşük olması göz önünde bulundurulmalıdır.

Anahtar Kelimeler: DEHB, Gastrointestinal sistem, Yabancı cisim.

Introduction

Foreign body ingestion (FBI) is one of the common causes of emergency admissions in infancy and childhood [1]. According to the data of the American Association of Poison Control Centers, it was determined that 75% of the cases who applied due to FBI were younger than five years old [2]. The objects swallowed are very diverse, and it can be an object that looks like food or something in the food (fish bones, chicken bones, nutshells, etc.). It might also be an object put into their mouth during play and exploration, such as coins, small toys, magnets, buttons, pencil tips, pins, hairpins. Most of the time, swallowed objects leave the human body physiologically [3,4]. Studies show that complication rates such as perforation and obstruction are low, and only 1% require surgery secondary to complications [3,4]. On the other

hand, if the foreign object is a radioactive material such as a battery or a cusped object such as a pin that carries the risk of penetrating internal organs, a life-threatening risk may occur [5].

The large majority of children that present with FBI have no psychiatric diagnosis, and the reason was usually developmental curiosity, desire to explore, attention-seeking or boredom. However, present studies showed that attention deficit hyperactivity disorder (ADHD) and other psychiatric problems might be risk factors [6-8]. ADHD/hyperkinetic disorder is a common neuropsychiatric disorder with an incidence of 5.29% among children [9]. Symptoms usually begin in the early developmental period and include attention deficit, hyperactivity, and impulsivity. Studies show that the risk of unintentional injury, accident, and accident-related death rates in individuals with ADHD is

higher than the average population [7,10,11]. Another phenomenon associated with ADHD is sluggish cognitive tempo (SCT), characterized by sluggishness, excessive daydreaming, lethargy/apathy, slowed behavior/thinking, and mental confusion [12-14]. For a long time, these symptoms were thought to be part of ADHD [15-17]. However, some studies revealed high SCT symptoms were also found in non-ADHD populations of different age groups, and only 40-50% of the participants with high SCT symptoms also have high ADHD symptoms [18,19]. Supporting these results, many recent studies and meta-analyses demonstrated SCT has internal and external validity and is a related but different phenomenon from ADHD in children, adolescents, and adults from different cultures [20-25].

This study aimed to compare the demographic variables and levels of ADHD-SCT symptoms in children who ingested foreign bodies with healthy children. Also, we aimed to address the relationship between ADHD-SCT symptoms and the age of FBI.

Material and Method

This case-control study was conducted in pediatric surgery and pediatric gastroenterology services of a tertiary hospital in Ankara. Children's parents were further contacted by telephone through the Gülhane Training and Research Hospital Pediatric Surgery and Pediatric Gastroenterology services, and all were under eight years old during 2018-2021. The control group was selected from children who applied to pediatric outpatient clinics with no chronic physical or mental problems and no FBI history. Parents who agreed to participate in the study were asked to fill out an online informed consent form and the necessary scales for the study samples. This study was approved by the Ethics Committee of University of Health Sciences (decision number; E-50687469-799 and date; 04.03.2021).

The study group comprised 44 children (age 2-8, median age: 5) and the control group of 30 healthy children (age 3-8, median age: 6). The results of demographic variables are presented in [Table 1](#). There were no statistically significant differences between age and gender of the

children, paternal education level, number of family members, and children in the family. Maternal education level and school success rate were significantly lower in the study group when compared to the control group ($p=0.022$ and $p=0.023$, respectively).

Measures

SNAP-IV (Swanson, Nolan, and Pelham) 18 item teacher and parent rating scale

This Likert-type scale with responses ranking between 0-3 was developed to screen for ADHD-hyperactivity/impulsivity symptoms and ADHD-attention deficit. It includes nine items for attention deficit and nine for hyperactivity-impulsivity. High scores on the subscales indicate more severe ADHD symptoms. It has previously been used in both clinical trials and population-based screening studies [26,27]. We used the previously determined cut-off scores in this study (parent-rated cut-off points for IA (*inattention*): 1.78 and HI (*hyperactivity-impulsivity*): 1.44) [28]. The Cronbach α values of the SNAP-IV in the present study were 0.89 for the inattention subscale and 0.91 for the hyperactivity-impulsivity subscale.

The Barkley's child SCT rating scale

Barkley created this rating scale in 2013 [19]. The scale consisted of 12 items, and the validity-reliability study in Turkey has been completed, and it has been determined the scale has a two-factor structure called 'daydreaming' and 'sluggishness' [29]. In our study, Cronbach's α values for daydreaming are 0.80 and for sluggishness 0.84.

Statistical analyses

Statistical analyses were performed using IBM Statistical Software for Social Sciences (SPSS) 22.0 (SPSS Inc. Chicago, IL, USA). We used the Kolmogorov-Smirnov test to find out if the data is normally distributed. Demographic information was analyzed through descriptive statistics, and differences of scale scores between groups were analyzed with Mann-Whitney U test. Then we used a Spearman correlation test to examine the relationships between foreign body ingestion age (FBIA), ADHD, and SCT symptoms in the study group. A p-value of $p<0.05$ was accepted as statistically significant

Results

When comparing the ADHD and SCT scale scores, we found ADHD-hyperactivity/impulsivity scores were significantly higher in the FBI group (p=0.01). On the other hand, there were no statistically significant differences among groups for ADHD-inattention, SCT-daydreaming, and SCT-sluggishness scores (for all p>0.05). We used parent-rated cut-off points to determine the high inattention and hyperactivity-impulsivity rates among groups. There was no statistically significant difference between groups. The ratios

of IA were 4.5% (2 out of 44) and HI25% (11 out of 44) in the FBI group, but only two children had previously applied to child and adolescent psychiatric clinics (Table 2).

Finally, we used correlation analysis to find the possible relationship between FBIA and ADHD and SCT symptoms. We found positive-moderate relationships between SCT-daydreaming and sluggishness symptoms and FBIA (r=0.314 for daydreaming, r=0.348 for sluggishness). This means that higher SCT scores are related to older FBIA (Table 3).

Table 1. Characteristics of the study subjects.

| | FBI Group | | | Control Group | | | Statistics |
|----------------------------------|------------------------|--------|-----------|----------------------|--------|-----------|-----------------------------------|
| | min-max | median | mean rank | min-max | median | mean rank | |
| Gender | 14 girls (31.8%) | | | 13 girls (43.3%) | | | p=1.021* |
| | 30 boys (68.2%) | | | 17 boys (56.7%) | | | |
| Primary caregiver | School: 3 (6.8%) | | | School: 11 (36.7%) | | | |
| | Mother: 35 (79.5%) | | | Mother: 13 (43.3%) | | | |
| | Grandmother: 6 (13.6%) | | | Grandmother: 6 (20%) | | | |
| | min-max | median | mean rank | min-max | median | mean rank | |
| Age | 2-8 | 5 | 34.6 | 3-8 | 6 | 41.6 | z=-1.404 p=0.160 |
| School Success Rate | 0-4 | 0 | 29.5 | 0-4 | 3 | 40.2 | z=-2.290 p=0.022 |
| Maternal Education (year) | 5-15 | 11 | 33.0 | 8-15 | 15 | 44.3 | z=-2.269 p=0.023 |
| Paternal Education (year) | 5-15 | 11 | 33.9 | 8-15 | 15 | 42.7 | z=-1.855 p=0.064 |
| Number of Children in the Family | 0-4 | 2 | 37.0 | 1-3 | 2 | 38.2 | z=-0.265 p=0.791 |
| Number of family members | 0-7 | 4 | 38.2 | 3-5 | 4 | 36.4 | z=-0.396 p=0.962 |

*Chi-square 2x2.

Table 2. Group differences in ADHD and SCT scores.

| | Control Group | | FBI Group | | Statistics |
|---|------------------|-----------|------------------|-----------|----------------------------------|
| | min-max (median) | mean rank | min-max (median) | mean rank | |
| ADHD-inattention | 0-10 (2) | 32.07 | 0-24 (4) | 41.20 | z=-1.814 p=0.07 |
| ADHD-hyperactivity/impulsivity | 0-22 (4) | 29.92 | 0-26 (8) | 42.67 | z=-2.518 p=0.01 |
| SCT-daydreaming | 7-14 (8) | 34.83 | 7-25 (8) | 39.32 | z=-0.913 p=0.36 |
| SCT-sluggishness | 5-14 (5) | 36.88 | 5-15 (5) | 37.92 | z=-0.806 p=0.42 |
| | n | % | n | % | |
| ADHD-inattention rate due to parent-rated cut-off | 0 | 0 | 2 | 4.5 | p>0.05 |
| ADHD-hyperactivity/impulsivity rate due to parent-rated cut-off | 3 | 10 | 11 | 25 | p>0.05 |

Table 3. Correlations between foreign body swallowing age and ADHD-SCT scores in the study group.

| | FBI (r) |
|--------------------------------|--------------|
| ADHD-inattention | .137 |
| ADHD-hyperactivity/impulsivity | -.070 |
| SCT-daydreaming | .314* |
| SCT-sluggishness | .348* |

r: Spearman correlation rho *: p<0.05

Discussion

This study examined demographic variables, ADHD, and SCT symptoms among children with FBI and compared them to a control group. We can summarize our results:

1. Although paternal education level was similar, we found that the maternal education level was significantly lower in the FBI group.

2. ADHD-hyperactivity/impulsivity scores were significantly higher in the FBI group, but there was no statistically significant difference in the inattention scores.

3. SCT-daydreaming and sluggishness scores were associated with older FBI age.

Low maternal education level seems to be a risk factor for FBI in infants and young children. Maternal ability to assess FBI risk could be related to educational level. Many studies investigating the relationship between child mortality under five and maternal education levels demonstrated that child mortality decreases significantly with maternal education, especially in low-middle-income countries [30-33]. A study that examined the mothers' knowledge about foreign body aspiration (FBA) in young children demonstrated that 20.2% of mothers did not know that peanuts or other nuts can cause FBA and 48.1% did not know that they should not give peanuts to a child younger than 3 years old [34]. Also, 27.7% and 41.8% of mothers did not know that sudden choking and sudden coughing were the most common FBA signs respectively. The authors stated that being a mother of a first child and having an infant younger than 12 months are independent risk factors for lack of maternal knowledge about FBA [34]. In the light of these studies and our results, we can say it is essential for preventive health services to educate mothers

about FBI and its signs, especially for first-time mothers.

The diagnosis of ADHD is usually made during the school years when academic failure and problems with social relationships are revealed. However, attention deficit and hyperactivity-impulsivity symptoms are present from early childhood, so ADHD children have a high risk of accidents, especially in late infancy and preschool (especially 3-6 years) [7,35,36]. Studies investigating the ADHD-trauma relationship focus primarily on falls, poisoning, injuries, and burns, but research on the relationship between ADHD and the FBI is still limited. Turgut et al. examined the prevalence of ADHD in children aged 3-17 and adolescents with FBI [8]. They found that ADHD and oppositional defiant disorder symptoms were significantly higher in the FBI group when compared to the controls. Studies evaluating the children that placed foreign bodies into their mouth, ears, or nose reported high ADHD incidence [37-40]. Our results reveal the main problem associated with ADHD in the 3-8 years old FBI group is hyperactivity. So, even if the symptoms of attention-deficit are mild or at a level that does not impair functionality, treating hyperactivity in the preschool period is still important to decrease the risk of FBI. In our study, high levels of hyperactivity were detected in 11 children, but only two had had a child or adolescent psychiatric evaluation. Psychiatric evaluation of children who applied to pediatric emergency or pediatric surgery due to FBI should not be neglected.

Finally, we found higher SCT-daydreaming and sluggishness symptoms are related to an older age FBI. A recent study demonstrated that children who seem to have SCT require extra time to re-arrange the active contents of working

memory, and so they usually delay responding. They also have an overactive inhibition system that terminates thoughts too quickly, so prevents intended behaviors from starting or completing [41]. When the results of our study are examined from this point of view, it can be proposed that SCT symptoms delay the age of realizing the possible FBI risks for young children. The relationship between children's age for risk recognition and SCT symptoms should be reconsidered in future studies.

Conflict of interest: The authors declare that there is no conflict of interest. The authors alone are responsible for the content and writing of the paper. **Financial disclosure:** There is no financial support for this study.

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