

Social, Emotional and Behavioral Problems in Children With Foreign Body Ingestion: A Case Control Study

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ABSTRACT

Objectives: To compare the social, emotional, and behavioral status between the patients aged 1 to 4 years with foreign body ingestion and healthy individuals.

Methods: A case control study was conducted in a tertiary level hospital over 32 months. Children, aged 1-4 years, admitted to the pediatric emergency department with foreign body ingestion were included as cases. Patients with known autism spectrum disorders, cerebral palsy and incomplete evaluation were excluded. A matched control group constituted healthy individuals. Both groups were evaluated with Aberrant Behavior Checklist (ABC) and Brief Infant-Toddler Social Emotional Assessment (BITSEA) scales. Logistic regression was performed to determine the predictors of foreign body ingestion.

Results: Cases and controls included 150 children each. All ABC subscale scores (mean irritability, hyperactivity/dissonance, lethargy/social withdrawal, stereotypical behavior, and inappropriate speech) and problem area scores of BITSEA were significantly higher in the cases ($P < 0.001$). Hyperactivity was significantly predictive of foreign body ingestion [OR (95% CI) 1.37 (1.21-1.55), $P < 0.001$]

Conclusion: Younger children with foreign body ingestion screened significantly higher for behavioral and emotional problems compared to controls. Hyperactivity was an important predictor factor for foreign body aspiration.

Keywords: Aberrant behavior checklist, Attention-deficit/hyperactivity disorder, Brief infant-toddler social emotional assessment

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INTRODUCTION

Accidental drug or foreign body ingestion is mostly seen in early childhood and is a common cause of emergency admissions in children. Up to 75% of the total ingestions occur in children 5 years of age or younger, with higher risks of complications like perforation or obstruction, and mortality [1]. This is especially so in children between 6 months to 3 years as they are predisposed to exploring things with their mouths and fingers. Foreign body ingestion in older children occurs due to many factors,

such as triggering situations, the physical and social environment, and the psychological, behavioral, and emotional state of the child [2,3].

There is an increasing recognition of the importance of early detection and the role of intervention for infants and toddlers with significant social-emotional and behavioral problems [4]. Many authors have reported an association between foreign body ingestion and attention-deficit hyperactivity disorder (ADHD) in children [5-7], however, we were unable to find any data on children aged one to four years. The probable reason for this is that it is often difficult to make a diagnosis of ADHD in this age group. Behavioral and emotional difficulties are reported to be precursor symptoms of ADHD in younger children [8]. The objective of this study was to compare the social, emotional, and behavioral status of children aged 1 to 4 years presenting with foreign body ingestion with apparently healthy controls.

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METHODS

This prospective case-control study was conducted in a tertiary level hospital situated in Turkey over 32 months between January, 2019 and August, 2022. The study was approved by the institutional ethics committee (E2018-171). The cases included consecutive patients aged one to four years admitted to the pediatric emergency department (PED) with foreign body ingestion or accidental poisoning. After the cases were stabilized and given appropriate treatment. All eligible children were enrolled in the study after obtaining written informed consent from the parents/ legal guardians. Patients with known autism spectrum disorder, cerebral palsy, or for whom the evaluation was incomplete, were excluded.

Based on a previous study [5] and considering the prevalence of ADHD in children with FB, the calculated sample size for a similar sample proportion with a 5% margin of error and 95% confidence level was 149. The control group composed of healthy children, matched for age, gender, and socio-economic status, without a history of foreign body ingestion who had presented to the hospital for post-discharge follow-up visits for other health conditions.

The parents were asked to fill out clinical and socio-demographic details regarding their children's age, gender, gestational age, birth weight, type of birth, neonatal intensive care unit (NICU) stay, and any past history of foreign body ingestion. Details of parents (age, health status, and working status, and consanguinity) and siblings, (number history of ingestion and the ingested materials) were also collected.

The Aberrant Behavior Checklist (ABC) and the Brief Infant-Toddler Social Emotional Assessment (BITSEA) scales were used to screen the children for their social, emotional, and behavioral status. These scales were administered to the parents of each case by the pediatrician and took around 40-60 minutes to complete. The ABC assesses the severity of problem behaviors and psychiatric symptoms in children and adolescents. It is a 58-item rating scale in which each item is rated on a 4-point Likert scale, with higher scores indicating more severe problems. ABC is scored on five subdomains: Irritability (15 items); Hyperactivity/Noncompliance (16 items); Lethargy/Social Withdrawal (16 items); Stereotypic Behavior (7 items); and Inappropriate Speech (4 items) [9]. The BITSEA is a reliable and valid screening tool for behavioral and developmental problems in toddlers. The scale comprises two subscales and consists of 42 items in total; the BITSEA Problem subscale (BITSEA/P) that is comprised of 31 items and the BITSEA Competence subscale (BITSEA/C) which is comprised of 11 items. The

response format for each item has three responses: "not true/rarely" (score 0), "sometimes true/sometimes" (score 1), and "very true/often" (score 2). Higher total scores on BITSEA/P indicate a higher level of behavioral and emotional problems [10]. Turkish translations have been validated earlier in children aged 12- to 42-months for BITSEA and 14- to 43-months for ABC [11,12].

Statistical analysis: SPSS for Windows Version 20.0 package program was used. The distribution of variables was assessed with histograms, *Shapiro-Wilk test*, and non-parametric tests (as applicable). The differences between groups were tested by independent-sample t-test or Chi-square test (for normal distribution). Mann-Whitney U-test was used for comparing variables in which non-parametric testing was indicated; five subscale scores of ABC and the two domains of BITSEA (problem and competence). Binary logistic regression analysis was performed to identify predictors of foreign body ingestion.

RESULTS

Three hundred participants (150 patients and 150 controls) were enrolled (**Fig. 1**). The median (IQR) age of cases was 30 (20-37) months and of the controls was 33 (26-37) months. The percentage of males was 56% in the cases and 55% in the controls. There were no significant differences between both groups with respect to the variables under study (**Table I**). The ingested foreign substances included 40 (27%) pills, 23 (15%) dishwash rinse aid, 20 (13%) coins, 13 (9%) oral suspensions of medicine, 10 (7%) batteries, 9 (6%) beads, 8 (5%) hair clips, 6 (4%) multipurpose cleaning solution and 21 (14%) others. Most cases (89.4%) were discharged from the emergency department after intervention, and the remaining needed longer duration of hospitalization till they made full recovery.

The scale-wise mean (SD) scores of ABC in cases versus *vs* controls were as follows: irritability [21.5 (7.5)

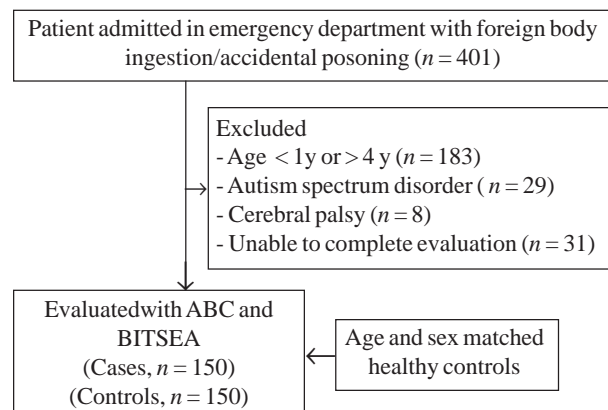


Fig. 1 Flow diagram of the study population

Table I Demographic Characteristics of the Study Participants

	Patients (n = 150)	Control (n = 150)	P values
Age (mo)	30 (20-37)	33 (26-37)	0.285
Male gender ^a	85 (56)	82 (54.6)	0.727
Cesarean delivery ^a	86 (57)	78 (52)	0.571
Gestational age (wk) ^b	38.6 (1.35)	38.15 (2.38)	0.165
Birth weight (g) ^b	3317 (497)	3343 (675)	0.416
History of NICU stay ^a	34 (22.7)	33 (22)	0.946
Sibling number ^a			0.299
None	54 (36)	74 (50)	
1	66 (44)	50 (33)	
2	30 (20)	26 (17)	
Mother age (y) ^b	31.05 (5.93)	31.39 (5.06)	0.737
Father age (y) ^b	34.29 (5.98)	34.79 (4.65)	0.590
Consanguinity ^a	28 (18.7)	26 (17.3)	0.919
Working mother ^a	53 (35.3)	72 (48)	0.225
Working father ^a	145 (96.6)	144 (96)	0.865

Values expressed as median (IQR), ^an (%), or ^bmean (SD). NICU: Neonatal intensive care unit.

vs 4.4 (5.1)]; hyperactivity/non-compliance [32.7 (8.8) vs 4.7 (5.2)]; lethargy/social withdrawal (4.41 (3.4) vs 1.39 (2.60)]; stereotypic behavior [4.24 (4.59) vs 0.24 (0.68)] and inappropriate speech [7.1 (2.6) vs 1.3 (1.9)]. These scores were significantly higher in the cases as compared to the controls across all domains ($P < 0.001$).

The mean (SD) score of BITSEA problem domain was significantly higher in the cases [27.3 (6.8)] compared to the controls [12.7 (7.5)] ($P < 0.001$). There was no significant difference between the groups in the competence domain; 17.3 (3.0) vs 17.7 (3.5) respectively ($P = 0.08$). The logistic regression analysis revealed that hyperactivity was the only variable that was significantly predictive of foreign body ingestion [OR (95% CI) 1.37 (1.21-1.55), $P < 0.001$] (**Table II**).

DISCUSSION

Attention-deficit hyperactivity disorder is one of the most common neuropsychiatric disorders in school-aged children, and the estimated worldwide prevalence in children and adolescents is 3.4% and 5% [13]. Previous studies have shown an association between ADHD and foreign body ingestion in older children [5]. In most studies, Conners' Parent Rating Scales (CPRS) have been used to evaluate ADHD in symptomatic individuals between 3 and 17 years [6]. However, it is not suitable for younger children. Previous studies have shown that children and adolescents diagnosed with ADHD also have

Table II Predictors of Foreign Body Ingestion (n = 150)

	Odds Ratio (95% CI)	P Value
Irritability	0.60 (0.81-1.13)	0.60
Lethargy/Social withdrawal	1.15 (0.90-1.48)	0.25
Stereotypic behavior	1.76 (0.97-3.19)	0.06
Hyperactivity/Non-compliance	1.37 (1.21-1.55)	<0.001
Inappropriate speech	1.42 (0.93-2.16)	0.10
Problem domain	0.97 (0.66-15.66)	0.69
Competence domain	0.70 (0.58-1.06)	0.11

behavioral problems at a young age [14-16]. That is the reason we used the ABC and BITSEA scales in this study as a surrogate indicator of possible ADHD based on the hypothesis that children identified with behavioral problems during early childhood may be predictive of ADHD in the future. We found that the scores in the problem domain of BITSEA were significantly higher in patients with foreign body ingestion compared to healthy controls. In addition, hyperactivity was the most important predictor factor. Our finding suggests the possibility that patients presenting with foreign body ingestion may be indicative of ADHD later on. Buaermeister et al reported that the rate of ADHD in boys between the ages of 4 and 17 years was 2.3 times higher than in girls [17]. Hagos et al reported foreign bodies in the esophagus, ears, and nose in 72 children aged 11 months to 14 years out of which and two thirds of them were boys [7]. The ingestion of foreign bodies in this study was most commonly seen in boys.

Our study has certain limitations. Firstly, the children were assessed using a screening tool rather than a diagnostic instrument. However, as mentioned earlier it is difficult to diagnose ADHD in younger children who are more predisposed to foreign body ingestion. Secondly, the data was generated from a single center. Thirdly, we did not screen for Autism Spectrum Disorder (ASD), which can also manifest as hyperactivity in younger children and is associated with pica. The fact that all scales were performed by a single pediatrician strengthened the consistency.

There are many other studies that have demonstrated the association between self-inserted foreign bodies and ADHD [5,17-19]. However, all these studies were performed in patients aged over 3 years. Turgut et al investigated ADHD in children aged 3-17 years with foreign body ingestion using Conners' Parent Rating Scales-Revised (CPRS-R) in a case-control study [5]. In addition to the total CPRS-R score (17 vs 6), they reported a significantly higher prevalence of cognitive problems, oppositional behavior, hyperactivity, anxiety, perfectionism, psychosomatic, social problems, and ADHD in

WHAT THIS STUDY ADDS?

- The domain-wise mean score of the Aberrant Behavior Checklist and the hyperactivity domains of BITSEA-P was significantly higher in children with foreign body ingestion and accidental poisoning compared to those without.
- Hyperactivity is associated with increased risk for foreign body ingestion in children aged 1 to 4 years.
- Patients with foreign body ingestion and accidental poisoning should be referred to trained professionals for behavioral and developmental screening, and in-depth evaluation by developmental pediatricians if warranted.

the study group. Özcan et al also reported higher CPRS revised subscale scores in children aged 3 to 9 years with self-inserted foreign bodies compared to controls in a prospective case-control study [18]. Perera et al investigated the major features of ADHD in 34 children aged 3 to 10 years with self-inserted nasal and aural foreign bodies using CPRS and questionnaire (SDQ)–Parent Version [19]. They reported 14.3% ADHD in the study group. Although it was not possible to use a diagnostic tool for ADHD due to the younger age of our study group, we found higher ABC scores of hyperactivity and BITSEA-P domains suggesting of behavioral problems in the study group. In light of the results of this study, an adequately powered multi-centric cohort study of children with foreign body insertion should be planned with initial screening using appropriate tools for assessing development, behavioral problems, and ASD. These children should be followed up and evaluated for ADHD using appropriate diagnostic tools once they become old enough.

Our study demonstrated that hyperactivity-behavioral symptoms may be more common in children under the age of four who swallow foreign bodies. On the basis of this we recommend that patients with foreign body ingestion and accidental poisoning should be referred to trained professionals for behavioral and developmental screening initially and an in-depth evaluation by a developmental pediatrician, if warranted.

Ethics clearance: IEC, Ankara Etlik City Hospital. No. 2018-171, dated Dec 10, 2018.

Contributors: BÖ: Data analysis; SBA, TÇY, NT: Conception/design of the work, data acquisition, analysis and interpretation; RMY, MMG, ÝB: Drafting the work, revising it critically for important intellectual content; CDK, AG: Final approval of the version to be published; BÖ, NT: Ensuring accuracy of the questions/ study protocol, overall supervision; guarantor for the study. All authors contributed to the execution of the study and approved the final version.

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