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Relationship between traumatic orthopedic injuries and attention deficit hyperactivity disorder symptoms in children

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Abstract

Traumatic injury is an important cause of department of orthopedics and traumatology in children. Attention deficit hyperactivity disorder (ADHD) has been identified as a potential risk factor that may contribute to the incidence of traumatic injuries. The aim of this study was to evaluate the relationship between traumatic orthopedic injuries and ADHD symptoms in children. A prospective-study approach was used to conduct the study. Ninety-two pediatric patients admitted to the department of orthopedics and traumatology of a university hospital aged between 4 and 18 years were included. The control group consisted of 60 age- and gender-matched children. Conner's parent Rating Scale (CPRS) were used to evaluate the ADHD symptoms. CPRS impulsivity/hyperactivity subscale score was significantly higher in the study group than in the control group ($p < 0.05$). Furthermore, analysis of the study group showed that the subscale scores of both scales in the subgroup with a history of repetitive injuries were significantly higher than those of the subgroup without a history of repetitive injuries ($p < 0.05$). Patients admitted to the orthopedics outpatient clinic for traumatic injuries had a higher number of ADHD symptoms than those who did not have traumatic injuries. These findings suggest that children who had traumatic injuries have more hyperactivity symptoms than without traumatic injuries. Psychiatric consultation for ADHD should be considered for patients admitted to clinics with similar injuries, especially those who have a history of repetitive injuries.

Keywords: Trauma, orthopedic injuries, attention deficit hyperactivity disorder, children

Introduction

Injuries are one of the leading causes of childhood morbidity and mortality [1]. Mental disorders in childhood are among the risk factors for childhood injuries. Attention deficit hyperactivity disorder (ADHD) is one of the most common chronic neurobehavioral disorders in children and is characterized by inattention, hyperactivity and impulsivity [2]. Based on its major symptoms, ADHD is the mental disorder most closely related to injuries [3]. Previous research has shown that children with

ADHD are at a higher risk of traumatic injuries compared to the normal population [4-8]. In children with ADHD, behavioral characteristics related to this disorder are accountable for the injuries. In addition to core symptoms such as over activity, impulsivity and inattention, motor coordination problems, aggression and risk-taking behaviors affect their susceptibility to injuries [5,9,10]. The relationship between ADHD symptoms and extremity fractures, burns, head trauma and self-inserted nasal or aural foreign bodies has been shown in previous studies [11-13].

The fact that most of the studies which scrutinize the relationship between ADHD and traumatic injuries have been conducted in emergency services. However, to our best knowledge, few writers have been able to draw on traumatic injuries in cases of ADHD in children who were referred to department of orthopedics and

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traumatology. One study by Uslu (2008) investigated which fracture characteristics were associated with impulsive/hyperactive behavior in children with extremity fractures. Other author (see Hailer, 2014) questioned whether the relationship between Legg-Calvé-Perthes disease and ADHD [14,15]. As a result, to determine the ADHD-related risk factors in children who were admitted to the department of orthopedics and traumatology have been difficult. For this reason, the main aim of this investigation is to assess the the association between ADHD symptoms and unintentional injuries in children admitted to the department of orthopedics and traumatology.

Material and Methods

This prospective study was conducted between September 2012 and June 2013 at Gaziantep University Medical Faculty Hospital. Ninety-two patients, aged between 4 and 18 years, who were admitted to the orthopedics outpatient clinic with traumatic injuries were enrolled. Sixty children without a history of traumatic injury constituted the community-based control group matched for age and gender. Children with mental motor retardation and pervasive developmental disorder, and those whose parents who did not provide their consent for participation were excluded from the study. Parents were informed about the study after necessary intervention and treatment of the patients. Each parent who agreed to participate in the study filled a clinical information form with questions about the child's age, gender, and history of previous accidents, child and adolescent psychiatric history, type of treatment, and activity that resulted in the injury. In order to assess the severity and prevalence of ADHD symptoms, the Conner's Parent Rating Scale (CPRS), which consists of four subscales, were used. CPRS is a form consisting of 48 items that are used to evaluate the child's behavior by the parents. Each item is scored on a 4-point Likert scale (0 = no, 1 = rarely, 2 = often, and 3 = always), and the form is filled in by the parents. In the CPRS subscales, a score of ≤ 5 for CPRS-inattention (CPRS-IA), ≤ 6 for CPRS-hyperactivity (CPRS-HA), ≤ 6 for CPRS-oppositional defiant disorder (CPRS-ODD), and ≤ 18 for CPRS-conduct disorder (CPRS-CD) are considered abnormal. The validity and reliability of CPRS were determined by Dereboy et al [16,17]. The scale is used for screening ADHD, ODD and CD in children.

Statistical Analysis

SPSS version 18.0 for Windows was used for statistical analysis. The distributions of continuous variables were tested with the Kolmogorov-Smirnov test. The variables were analyzed with the Student t-test and Mann Whitney U test. If p values were less than 0.05, the difference between the two groups were considered to be statistically significant. The ethics committee of Gaziantep University approved of this study, and it was conducted in accordance with the tenets of the Declaration of Helsinki (No: 14.02.2012/51). Patients and their parents were informed about the purpose of the study before data collection. Parents were informed that personal data and identification information collected during the study would be confidential.

Results

The study group comprised 34 girls (36.9%) and 58 boys (63.1%) (mean age, 9.40 ± 3.32 years), and the control group comprised

25 girls (41.6%) and 35 boys (58.4%) (mean age, 9.35 ± 3.61 years). There was no statistically significant difference between the two groups in terms of age ($p=0.927$) and gender ($p=0.560$). Traumatic injuries were more common in boys than in girls. The injury-related characteristics of the patient group are summarized in Table 1.

Table 1. Injury-related characteristics of the patient group (N = 92)

Variables	N(%)
Type of Injury	
Upper Extremity Fractures	55(59.8%)
Dislocation of the Upper Extremity	4(4.3%)
Lower Extremity Fractures	23(25%)
Dislocation of the Lower Extremity	1(1.1%)
Soft Tissue Trauma	2(2.2%)
Sprain	7(7.6%)
Incident Causing the Fracture	
Fall	51 (55.4%)
Sport Injury	9 (9.8%)
Pedestrian Injury	11 (12.0%)
Physical Fight	3 (3.3%)
Bicycle Injury	8(8.7%)
Playground Injury	9 (9.8%)
Previous Fracture History	
Yes	14 (%15.3)
No	78 (%84.7)
Intervention	
Splint	20 (21.7%)
Plaster	38 (41.3%)
Surgery	25 (27.2%)
Other	9 (9.8%)
Previous Psychiatric History	
Yes	6 (6.5%)
No	86 (93.5%)

Significant differences were found in the hyperactivity subscale on the CPRS between the two groups ($p = 0.009$). The other subscale scores of the patient group was higher than those of the control group; however, no significant difference was detected. All the subscale scores of the study and control groups are summarized in Table 2.

Table 2. The Conner parent rating scale (CPRS) scores of the study and control groups

	Study group (N = 92)	Control group (N =60)	p
CPRS-IA	1.64 ± 1.90	1.43 ± 1.31	0.461
CPRS-HA	3.79 ± 2.88	2.53 ± 2.80	0.009
CPRS-ODD	1.45 ± 2.06	1.33 ± 1.80	0.706
CPRS-CD	3.60 ± 4.63	2.80 ± 3.66	0.257

IA = Inattention, HA = Hyperactivity, ODD= Oppositional defiant disorder, CD= Conduct disorder

The study group was further classified according to their history of trauma. Among the 92 patients, 14 (15.3%) had a history of trauma while 78 (84.7%) had no history of trauma. The patients who had a history of trauma had significantly higher scores for

hyperactivity, inattention and conduct disorder on the CPRS than patients who did not have a history of trauma. The ODD score on the CPRS was higher in the patient group than in the patients without history of trauma group but this difference wasn't significant (Table 3).

Table 3. CPRS scores according to the patients' history of trauma

	History of trauma (n=14)	No history of trauma (n=78)	p
CPRS-IA	1.64±1.90	1.43±1.31	0.461
CPRS-HA	3.79±2.88	2.53±2.80	0.009
CPRS-ODD	1.45±2.06	1.33±1.80	0.706
CPRS-CD	3.60±4.63	2.80±3.66	0.257

IA = Inattention, HA = Hyperactivity, ODD= Oppositional defiant disorder, CD= Conduct disorder

In the study group, 6 patients (6.5%) had a history of psychiatric evaluation. while 86 patients (93.5%) had no history of psychiatric evaluation. Three of the six patients were diagnosed by professionals. Patients who were diagnosed psychopathologically were diagnosed with ADHD and ODD. All of them were used medical treatment. Patients with both ADHD and ODD had a previous history of trauma. There was no psychopathology in the other three patients. Two of them admitted to outpatient clinic with irritability, one of them with distractibility.

Discussion

In this study, we examined the frequency of ADHD symptoms and comorbid behavioral problems in patients admitted to the orthopedic outpatient clinic with traumatic injury. Patients who were admitted to the orthopedic clinic with traumatic injuries had significantly higher hyperactivity scores than the control group. This result is consistent with similar studies in the literature [14,18]. In the study by Uslu et al., which was conducted in pediatric patients with extremity fractures who were admitted to the orthopedic outpatient clinic, it was shown that the CPRS-HI subscale scores were significantly higher in the patient group than in the normal population [14]. This finding is also in agreement with Ertan's (2012) findings which showed that there is a positive correlation between ADHD symptoms and pediatric trauma [18]. Although the ODD and CD scores on both scales were found to be higher in the study group, the difference weren't significantly higher. There are conflicting results in the literature about the relationship between disruptive behavior disorders and increased risk of injury [19,20]. Schwebel et al. examined the relationship between the risk of injury and the symptoms of ADHD and CD among 5th grade students and found a significant relationship between the risk of injury and ADHD and as well as CD symptoms [21]. Bruce et al., however, stated that ADHD symptoms had a stronger association with injuries rather than conduct problems in their study, in which they examined the relationship between unintended injuries and behavioral disturbances [22]. In our study, in which ADHD symptoms and accompanying conduct problems were investigated, unintentional injury found to be associated with ADHD symptoms rather than conduct problems.

We found significantly higher inattention and hyperactivity subscales scores on the CPRS in the patients with a history of

previous trauma. The results were consistent with the data of previous studies. Ertan et al. examined the prevalence and role of ADHD in pediatric trauma patients and found higher scores in trauma patients, especially those who had recurrent traumas. Similarly, Ozer et al. also showed that psychiatric disorders including, especially, ADHD were more commonly seen in patients with recurrent hand fractures [23]. As ADHD is a chronic neurobehavioral condition that continues across life span, children with diagnosed ADHD may experience recurrent traumas [18]. However, the treatment of ADHD may reduce the risk of injuries. In recent years, a few authors suggested this view. In a study which investigated the effect of ADHD treatment on the risk of injuries, Man et al. (2015) found that methylphenidate which is well known treatment of ADHD reduced trauma-related emergency department admissions [24]. Similarly, a nationwide population-based cohort study in this area found that methylphenidate treatment was related to lower risk for fracture among pediatric patients with ADHD [25]. Based on these results, it can be possibly explained that the treatment of ADHD may be decreased the risk of injury. But further studies regarding to the long-term effects of ADHD treatment on the risk of injury would be worthwhile.

Only three (3.3%) of the patients admitted to the orthopedic clinic were diagnosed with ADHD. The ADHD prevalence was relatively low in the patient group compared to the known prevalence of ADHD in our country [26]. However, 26.1% of the patients scored above the cut-off point on the CPRS-HA subscale. Three of 24 patients who had hyperactivity symptoms were used medical treatment. In clinical trials, stimulant treatment was associated with a significant reduction in ADHD symptoms and the risk of injury [7,24]. In our study, even though the patients admitted to the orthopedic clinic due to traumatic injuries had higher hyperactivity scores than the normal population, the number of patients who were diagnosed with ADHD previously was found to be lower than that in the normal population. This result considered that although some cases have severe ADHD symptoms, they are not brought to the child psychiatrist by their family before traumatic injury. Therefore, clinicians must be aware about ADHD in patients presenting with traumatic injuries. This is because inattention, impulsivity, hyperactivity, acting without considering the results, aggression, motor coordination problems and risky behaviors in children with ADHD are related with increased risk of injury [5,6,9,10]. For this reason, patients with ADHD are at an increased risk of severe recurrent accidents and injuries that require visits to the hospital [4-6,27]

Conclusion

Clinicians must look out for ADHD in patients with repeat injuries and consult with a child and adolescent psychiatrist in order to prevent further traumatic injuries and to decrease the of re-injury. Moreover, clinicians should provide information to parents or caregivers of children with ADHD about the increased risks of traumatic injuries.

Limitations

A limitation of this study is that the use of rating scale instead of a structured psychiatric interview and in children with ADHD symptoms, the diagnosis were not confirmed by a psychiatrist. Another limitation of the study is that the sample size is relatively small.

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Competing interests

The authors declare that they have no competing interest.

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Ethical approval

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