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Original Article

The relationship between attention-deficit/ hyperactivity disorder and trauma in adolescents

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Abstract

Objective: Attention-deficit/hyperactivity disorder (ADHD) is characterized by persistent and impairing levels of inattention, impulsivity and hyperactivity. Evidence shows that adolescents with ADHD are more exposed to trauma. This study aimed to investigate the relationship between ADHD symptom severity and trauma severity.

Methods: In this descriptive correlational study, the study population included traumatic adolescents aged 12-18 years referred to Shohada hospital in Tabriz, Iran in 2016. Among this population, 91 subjects were selected. In order to exclude subjects with other psychiatric disorders, a psychiatrist performed clinical interviews with them. In this regard, the short form of Conner's Comprehensive Behavior Rating Scales Revised Edition (CBRS-R) and Pediatric Trauma Scale were used. For data analysis, Pearson correlation coefficient and independent *t* test were applied. Data were analyzed using SPSS software version 22.

Results: There was a significant positive relationship between trauma severity and ADHD score, hyperactivity, and oppositional/Impulsivity ($P<0.01$). Conversely, no statistical significance was observed between attention deficiency and trauma severity. The severity of trauma was higher among ADHD group than normal individuals. There were also correlations between socioeconomic status (SES) and oppositional/impulsive patients. In this regard, higher scores of oppositional/impulsivity were observed among patients with lower SES.

Conclusion: Traumas have significant effects on economic and humanistic aspects of life in modern era. Our findings showed that there was a statistically significant relationship between hyperactivity-inattention and trauma intensity in adolescents. Therefore, to prevent traumatic events, ADHD screening at schools is suggested. By the same token, informing parents through mass media can help reduce the consequences of inattention/ hyperactivity disorder in the society.

Keywords: Hyperactivity, Trauma severity, Attention deficit, Impulsivity, ADHD

Introduction

Attention-deficit/hyperactivity disorder (ADHD) is one of the most common disorders which happens mostly at school years with symptoms like inattentiveness, hyperactivity, impulsive behaviors, or a combination of these symptoms (1). It may impair cognitive abilities and psycho-social functions. Not only it can have some effects on children and adolescents' life, but also it can affect the family's quality of life (2).The Diagnostic and Statistical Manual of Mental Disorders Fifth Edition (DSM-5) specifies this disorder based on two aspects of symptoms: 1) the aspect of attention deficiency and 2) hyperactivity and impulsiveness. Thus, it is necessary to control these symptoms in adolescents as they can cause some problems at school or in social places for them. Also, DSM5 introduces three subcategories (presentations) for ADHD: (*a*) inattentive, (*b*) hyperactive/impulsive and (*c*) combined (3). ADHD children may experience significant problems in adaptability because of their expected level of development or growth with their chronological age (4). In 60% of cases, symptoms rests until the adulthood stage and most cases are concomitant with other mental disorders such as depression, anxiety, obsession, learning disabilities, bipolar disorder, and so on (5-7). In some studies, the education failure and background emotional problems such as anxiety and depression were reported

in adolescents with ADHD (8-11). Evidence shows that children and adolescents with ADHD are more exposed to traumas. Therefore, without doing therapeutic interventions, this disorder could result in car accidents and head traumas (12,13). Other studies revealed that this disorder increases the danger of accidents and injuries to pedestrian adolescents. Weak attention skills and high impulsiveness, while crossing streets, could be the reasons underlying such injuries (14). Many studies have been done throughout the world about children and adolescents with ADHD and trauma**.** In England, about 18 000 people lose their life yearly due to accidents and more than half of them are adolescents and young people under 30 (15). Such studies indicate that most of traumatic cases are males, adolescents and young people. The basic causes of traumatic diseases for younger people, especially in developing countries, are workhouse accidents resulted from low security of those places and road accidents.

Currently, about 50% of trauma cases throughout the world are car and traffic accidents. Also, according to World Health Organization (WHO), inattention to this significant problem will increase this number to 60 by 2020. Three main causes of mortality in the world are cardiovascular diseases, cancer and trauma. Trauma is the second cause of fatality in Iran (16). Impulsivity, inattentiveness and executive dysfunctions are factors which lead ADHD adolescents toward dangerous behaviors and that may result in injuries (17). In addition, studies show that people with ADHD in comparison with their peers have more tendencies for doing dangerous behaviors (18). As there is scant evidence in this area and due to the priority of Iranian health system in preventing morbidity and mortality because of injuries and road accidents, we decided to conduct a study to investigate the relationship between hyperactivity/inattention and trauma among adolescents referred to Shohada hospital in Tabriz, Iran. We aimed to know whether ADHD symptoms were correlated with the severity of trauma in adolescents.

Methods

This was a descriptive correlational study. Participants included traumatic adolescents aged 12-18 years who referred to Shohada hospital in Tabriz in 2016. In order to determine the sample size, we conducted a Pilot study with 30 samples. After measuring the correlation between variables, the final sample size of 91 was obtained at $\alpha = 0.05$, power of 80%. Subjects were selected using convenience sampling technique. The inclusion criteria encompassed patients aged 6-12 years who were hospitalized for trauma due to falling, cycling, riding motorbike, and pedestrian accidents. The exclusion criteria were unwillingness to participate, major psychiatric disorders (e.g. psychosis) at the time of accident, medical disorders leading to clouding of consciousness at the time of accidents (e.g. seizures), indirect role of an adolescent in the occurrence of traumas (e.g. vehicle accidents or fights caused by other people), IQ less than 75 (Raven's Colored Progressive Matrices Test), consumption history of antiepileptic drugs, and medications with an impact on the brain. For rejecting other psychiatric disorders, the subjects were clinically interviewed.

This questionnaire has 27 items with four subscales which is completed by parents. Oppositional, cognitive problems/inattentiveness, hyperactivity and ADHD index .Standard score equals or more than 59 shows significant clinical problems in that subscale. Coefficient internal reliability with a range of 0.75 to 0.90 were reported. The validity of structures in Conner's form was obtained by factor analysis and its differential validity was obtained by a survey on statistical capability of the questionnaire in discriminating people with ADHD from normal individuals and other clinical groups (19).

Evidence indicates that Pediatric Trauma Scale *(*PTS) is a valid tool for predicting traumatic injuries which result in death. The score above 8 in this questionnaire reveals the probability of 9% death and scores below or equal to zero clarifies the probability of 100% death. Between low scores in PTS and the death probability, there is a linear relationship. The lowest score of questionnaire is 6 and the highest is 12. Trauma Severity Score of 7-11 shows minor or slight injuries, 1-6 shows moderate injuries and -6 shows severe and serious injuries (20).

For data analysis, Pearson correlation coefficient and independent *t* test using SPSS software version 20 were utilized.

Results

From 91 people who participated in this study 13 were females (8 in ADHD group and 5 in normal group) and 78 were males (35 in ADHD group and 43 in normal group). The average age of participants was 12.90 ± 2.22 years (13.14 for normal group and 12.62 ± 2.29 for ADHD group). The average age for parents was 41.09 ± 5.8. Concerning parents' education, 57 (62.6%) had guidance school certificate, 11 (12.1%) had diploma, 10 (11%) had associate degree, and 13 (14.3%) had a license or higher degrees. Regarding parents' occupation, 53 (58.2%) were employed, 11 (12.1%) were unemployed and 27 (29.7%) were housewives. In terms of income, 53 (58.2%) had less than $255 monthly and 38 (41.8%) had more than $255 per month. With regard to housing, 34 (37.4%) parents had a renting house and 57 (62.6%) parents owned a house. Socioeconomic status (SES) of 46 participants was weak (15 people in ADHD and 31 in normal group), 31 participants were about average (16 people in ADHD and 15 people in normal group) and 14 participants were in good economical and social conditions (14 people in ADHD and 2 in normal group) (Table 1).

In Table 2, average, standard deviation, the highest and lowest variable scores are represented in two different ADHD and normal groups.

As can be seen from Table 3, 36 adolescents had lacerations (16 in ADHD group and 20 in normal group), 41 had closed fractures (22 in ADHD group and 19 in normal group), and 14 had open fractures (4 in ADHD group and

Table 1. Demographic information of participants and their parents in this study

	ADHD group	Normal group	All
Adolescents sex			
Female, No. %	8 (18.6)	5 (10.4)	13 (14.3)
Male, No. %	35 (81.4)	43 (89.6)	78 (85.7)
Average age of adolescents	12.62±2.29	13.14±2.15	12.90±2.22
Parents sex			
Female, No. %	22 (51.2)	14 (29.2)	36 (39.6)
Male, No. %	21 (48.8)	34 (70.8)	55 (60.4)
Average age of parents	40.44±6.23	41.67±5.45	41.09±5.8

10 in normal group). Adolescents in this study suffered from mild traumas.

Tables 4 and 5 show the frequency and severity of ADHD subtypes as well as types of traumas in ADHD patients in comparison with non-ADHD adolescents.

There was a significant negative correlation between ADHD Oppositional/impulsive components with social and economic situations (Table 6). Correlation matrix among trauma severity variables with ADHD score, hyperactivity, oppositional/impulsive, attention deficit brought results of oppositional/impulsive, hyperactivity and ADHD as follows 0.50, 0.62 and 0.61 respectively. According to the results, there was a positive significant relationship between trauma severity with ADHD score, hyperactivity, and oppositional/impulsive ($P<0.01$). This indicates that with an increase in these variables, trauma severity increases as well. But there was no significant relationship between attention deficit and trauma severity ($P>0.05$).

Independent *t* test was used for calculating trauma severity in adolescents with ADHD and non-ADHD. Levene test for evaluating the equality of variances showed for variables and trauma severity: *F*, sig, *t*, *df* and again sig; 5.15, 0.12, 4.98, 89, 0.001 respectively

The results of independent *t* test showed that the meaningful differences therefore trauma severity in adolescents with ADHD and non-ADHD is different ($P=0.001$, $df=89$, $t=4.98$) and according to the Table 2 trauma severity in ADHD group is more than normal subjects.

Discussion

One of the most common behavioral disorders during childhood and adolescence is ADHD. This disorder involves approximately 3% to 5% of children and adolescents in school years. In this study, the relationship

Table 2. Descriptive index of variables studied in differentiated groups

	Indexes	Average	Standard deviation	The lowest	The highest	Number
ADHD group	ADHD	58.2	9.05	38	76	43
	Hyperactivity	54	13.5	33	83	43
	Attention deficit	54	13.19	37	87	43
	Oppositional/ impulsive	54	8.5	40	77	43
	Trauma severity	10.58	0.88	8	11	43
Normal group	ADHD	44.25	6.62	32	57	48
	Hyperactivity	41.47	5.12	33	53	48
	Attention deficit	44.33	7.88	33	57	48
	Oppositional/ impulsivity	40.04	5.91	33	59	48
	Trauma severity	9.89	0.57	9	11	48

Table 3. Types of trauma frequency in different groups

Types of trauma	ADHD group	Normal group	All
Laceration	16 (38.1%)	20 (40.8%)	36
Closed Fracture	22 (52.4%)	19 (38.8%)	41
Open Fracture	4 (9.5%)	10 (20.4%)	14

Table 4. ADHD subtypes and severity in adolescents with ADHD

ADHD subtypes	No. %	ADHD Severity	No. %
Inattentive Type	12 (28.6%)	Mild	32 (76.2%)
Hyperactive/impulsive type	9 (21.4%)	Severe	8 (19%)
Combined type	21 (50%)	Very severe	2 (4.8%)

Table 5. Trauma frequency in three types of ADHD

Trauma type	Inattentive type	Hyperactivity/impulsivity type	Combined type
Laceration, No. (%)	2 (22.2)	3 (25)	10 (47.6)
Closed fracture, No. (%)	7 (77.8)	6 (50)	9 (42.9)
Open fracture, No. (%)	-	3 (25)	2 (9.5)

Table 6. Correlation matrix between trauma severity, ADHD, attention deficit, hyperactivity, and oppositional/impulsive components with economical and social situations

	ADHD	Attention deficit	Hyperactivity	Oppositional/ impulsive	Trauma severity
Socio economic status	-0.38	0.08	- 0.13	- 0.25*	- 0.16

**Correlation is significant at the 0.01 level (2-tailed).
* Correlation is significant at the 0.05 level (2-tailed).

between the severity of hyperactivity/inattention symptoms and the severity of trauma in adolescents was investigated. The research findings showed that from 91 adolescents participated in the study, 13 were females and 78 were males. This ratio is in parallel with studies of Amiri et al (21), Abolhassanzadeh et al (22), Bener et al (23), and Mugnaini et al (24) as well as other studies on the prevalence of ADHD on higher incidence of this disorder in males than females. Evidence shows that the prevalence of inattention/hyperactivity disorder in males is higher than females. It is important to mention that the diagnosis of hyperactivity in males is faster and easier than females. This is due to the fact that the symptoms of ADHD are more significant in males and also males show more impulsive behavior compared with females. Thus, this disorder can be diagnosed faster in males. Generally, inattentiveness and ignorance of the surrounding issues are among the symptoms of this disorder in females with ADHD, which instead, impulsive behaviors are expected in males (25). Our findings revealed that 46, 31, and 14 people participated in this study were in poor, medium, and good economic and social status respectively. This is consistent with the findings by Esfandabadi et al (26), in which ADHD was most frequent in children with illiterate parents or with primary education. On the other hand, the least frequent rate was seen in parents with intermediate education or diploma. Parents' higher education contributed to the low frequency of ADHD.

Among 42 hyperactive adolescents, 50% had combined ADHD, 28.6% suffered from inattentive hyperactivity, and 21.4% suffered from impulsive hyperactivity. This finding is consistent with the result obtained by Alishahi et al (27), Shahim et al (28). Conversely, it is inconsistent with the result by Abolhassanzadeh et al (22), in which they found the impulsive/hyperactive subtype as the most frequent in ADHD. This finding is mostly related to environmental, social, and cultural factors. Usually, the parents of hyperactive children are sensitive to the symptoms of attention deficit compared with impulsivity symptoms. Therefore, they refer to treatment centers following the incidence of these symptoms. In this regard, combined and inattentive types are more frequent than impulsive type in clinical settings. Another finding of the study suggested that the severity of the injury in all participants was mild. In addition, the results showed that there was a positive significant correlation between trauma severity and ADHD score, hyperactivity and opposition/impulsive scores ($P<0.01$). This is in line with the findings by Schwebel et al, (17), Kaya et al (29), and Kouchakzadeh et al (30) which showed a meaningful association between ADHD symptoms and the possibility of an increased risk of trauma.

The patients with adolescent and adult hyperactivity, are more exposed to injuries caused by vehicle crashes, so adults with serious traumas should be evaluated by a psychiatrist for being an ADHD.

However, in the present study no statistically significant relationship was found between inattention score and trauma severity, because the characteristics of hyperactive ADHD are running impulsivity in an inappropriate place, climbing up the wall and the restlessness (4). We can infer that such symptoms are highly correlated with the probability of injury and trauma in children and adolescents, while the characteristic of inattentive ADHD is associated with cognitive deficit rather than trauma or an injury, possibly due to the fact that no meaningful correlation was found between the attention deficit score and trauma intensity. The results also showed that trauma severity in adolescents with ADHD and without ADHD was different and it was greater in the ADHD group than the control group. This is in line with the results of Biederman et al (31). We could observe a statistically negative correlation between the components of ADHD and oppositional/impulsive and the weak economic and social situation. In this regard, in the weak economic and social situation, the above components were of great value. This finding is inconsistent with the study conducted by Ziaoddini and Shafizadeh (32). Also, no meaningful correlation between the frequency of conduct disorder and hyperactivity with socio-economic status, was reported. This is consistent with the study by Kouchakzadeh et al (30) indicating that there was a statistically meaningful correlation between variables such as education level of parents and family income with inattention disorder and hyperactivity. It is likely that cognitive and emotional development of children in low-income families will be impaired. In poor families, mother and children are more exposed to stressful events, caring problems due to mother's occupation, and lack of physical and mental health. In this regard, Hudson and Rapee in a research came to this conclusion that most social abnormalities were seen in the slum of Chicago, and the highest rate of unemployed people was from discrete families and criminals (33). In the studies conducted by Brault and Lacourse (34) and Ghanizadeh (35), ADHD prevalence was high in families with lower socio-economical conditions. The research findings by Duncan et al (36) showed that there was a meaningful correlation between the indicators of socio-economical condition, mental and physical health, and the prevalence of diseases with low

social prestige, low income and low level of education. In addition, the failure in different stages of treatment was seen in patients with low socio-economical condition. Also, examining the indicators between socio-economical condition and physical disease, they found that welfare and family income were among the indicators of fixed socio-economical condition, and were more significant in women than men and in adolescents than the elderly. Analyzing the risk factors of diseases and the physical injuries such as trauma indicates that the education level was meaningfully correlated with risk factors for physical injuries, and having a healthy lifestyle but in those with a lower education than a high school diploma is more unlikely.

Taking into account the influence of demographic characteristics of parents on the mental disorders of adolescents in a simple way without conducting further accurate studies is impossible.

Acquiring a different result is possible by using other research methodologies with the aim of determining the exact effect of factors, such as parental age, maternal employment and socio–economical class and using other research tools, such as interviews or observations.

The different method applied in this study may be the reason for inconsistent findings of our research. Some studies have indicated that people with ADHD are more interested in participating in high-risk behaviors than their peers (37). In addition, some studies have indicated that this disorder increases the risk of injuries and pedestrian accidents in adolescents. The weak attentive skills and high impulsivity for crossing the street could increase the damage risk (14). Fischer et al (38) studied the behaviors related to driving and its consequences during the adolescence and childhood of the hyperactive children. The results showed that in traffic accidents there was a significant difference between these people with the control group. But, the study by Amiri et al (21) comparing 70 patients with musculoskeletal trauma caused by driving accidents with 70 people as a control group with an experience of repeated trauma indicated that there was no relationship between ADHD in the adulthood and the trauma caused by driving accidents.

Conclusion

The results showed that there was a statistically positive relationship between the severity of trauma and ADHD score, hyperactivity, and oppositional/impulsivity. But there was no statistically meaningful relationship between attention deficit score and trauma severity. Also, the results indicated that trauma severity in adolescents with ADHD and without ADHD was different. The severity was bigger in ADHD group in comparison to normal individuals. In addition, there was a negative significant correlation between components of ADHD and oppositional// impulsivity with socio-economic conditions.

Given the deep influences of trauma on the human and financial resources and the high rate of accidents in children, it is necessary for policymakers to plan consistent programs for screening, education, and prevention. Also, we should take the precaution of helping such children to prevent forthcoming problems.

Limitations of study

In this study we did not consider other traumas resulted from burning, committing suicide, or self-destruction and child abuse. We recommend conducting other studies in adults groups and considering other trauma cases. We also suggest studies to investigate the relationship between trauma severity and attention deficit/hyperactivity among both sexes.

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Ethical issues

This study was approved by Regional Ethical Committee with number TBZMED.REC.1395.263.

Authors' contributions

All authors confirm that they have participated in study design, data gathering, analysis and preparing the manuscript based on recommendations of the International Committee of Medical Journal Editors.

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