

Association of Adult Attention Deficit/Hyperactivity Disorder and Traffic Injuries in Tabriz - Iran

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Objective: Nowadays, it is well known that the attention-deficit/hyperactivity disorder (ADHD) is not confined to children and adolescents. Recent data showed that a considerable portion of the general adult population may be affected by ADHD. On the other hand, the impact of ADHD on driving performance, a major area of adult life, has gained enthusiasm. More recent studies revealed an association between adult ADHD and undesirable driving problems. This study was performed to determine the association between presence of adult ADHD and traffic injuries.

Methods: In this case-control study, in a 13 month period, 140 subjects (70 drivers/riders injured in traffic accidents ,and 70 age- and sex-matched non traumatic controls) were selected to participate in the study and were placed in two groups . Subjects with psychiatric comorbidities were excluded. The Conners' Adult ADHD Rating Scale (CAARS) self-report (screening version) was used for screening adult ADHD in both groups. Finally, the occurrence of this condition was compared between the case and control groups .

Results: Sixty- nine males and one female were recruited in each group with a mean age of 29.31±9.32 (18-61) years in the case and 29.03±9.07 (range: 18-60) years in the control groups (P > 0.05). Previous history of traffic accident was significantly higher in the case group (15.7% vs. 4.3%, P=0.024). The mean driving time in a day was also significantly higher in the case group. In the case group, the scores of CAARS (the ADHD index, ADHD symptoms total, inattentive subscale and hyperactive/impulsive subscale) were positive (higher than 70) in 4.3, 10, 7.1 and 10 percent of patients respectively. Among the controls, the corresponding proportions were 4.3, 14.3, 8.6 and 8.6 percent respectively. The two groups were comparable for the mentioned rates.

Conclusion: The results of this study revealed no significant association between ADHD and traffic injuries in Tabriz- Iran.

Keywords: *Adult, Attention deficit disorder with hyperactivity, Traffic Accidents, Risk factors*

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Attention Deficit / Hyperactivity Disorder (ADHD) is one of the most common problems in children and adolescents. According to the diagnostic criteria, ADHD is characterized by such symptoms as hyperactivity, attention deficit and impulsivity (1, 2). There is a high prevalence of ADHD in the family members of these patients (3). Different studies have shown that 40 to 70 percent of subjects with an ADHD diagnosis during childhood would continuously experience these symptoms up to adulthood. Adverse outcomes of this disorder in adults include poor interpersonal relationships, events and traumas due to impulsivity, educational problems, alcohol and drug abuse, family conflicts, problems in marital and parental relationships, antisocial behaviors, and early sexual relationships. Furthermore, their impulsivity may result in increased car and other accidents (2, 4). Injuries are a growing public health problem affecting

nearly every population in the world. Decreasing the high burden of injuries is considered a major challenge for health policy makers. Globally, road traffic injuries lead to 1.2 million mortalities every year. Road traffic accidents are considered to be the second highest cause of mortality in Iran(5). Among middle-income countries, Iran has one of the highest mortality rates from traffic injuries(6). In Iran, there are about 70 deaths per day from road traffic injuries (7). Deaths from traffic injuries (30.0/100 000) are reported by some researchers to be the highest in the world(8). Different studies have described association between ADHD and traumatic events in children (2, 4). Adolescents with ADHD have increased risk of car accidents and traffic punishments (9, 10). To the best of our knowledge, no study has been published about the prevalence of trauma in adults with ADHD in Tabriz. Since adults with ADHD are at a higher risk of

traumatic injuries, and car accidents are a main mortality cause in Tabriz, conducting this study was needed as this disorder has a high prevalence and economic burden for the society. The aim of this study was to evaluate the association between Adult ADHD and traffic injuries.

Materials and Method

In a case-control study, 140 patients including two equal groups of traumatic due to traffic injuries and non-traumatic patients were evaluated. Using the Persian Version of the Conners' Adult ADHD Rating Scale (CAARS) self-report (screening version), the screening for adult ADHD was performed, and the results were compared. The study was performed in two university hospitals in Tabriz, Iran during a 13-month period - August 2008 to September 2009. The sample size was calculated using SAS software version 9.1 based on proportion comparison tests to ensure 80% statistical power and type 1 error less than 0.05. One hundred forty patients were estimated to be enrolled in two equal groups. The required data for sample size calculation were obtained from a previous study with conservative rounding of figures to come up with possible dissimilarities (11).

Inclusion criteria were as follows: physical trauma, motor vehicle traumas (motorcycle and car), being the driver/rider when injured, age range of 18 to 65 years, and ability to complete the Conner's Questionnaire. The exclusion criteria were as follows: brain trauma resulting in decreased consciousness, non-driver/rider victims of motor vehicle accidents, psychiatric comorbidity, factors affecting the attention and concentration such as drug and alcohol use while driving, and illiteracy. Patients with physical trauma (case group) and those patients admitted due to non-trauma reasons without previous history of trauma hospitalization were recruited during the study period. The subjects of the two groups were matched for age and sex. All the subjects were psychologically evaluated at their earliest convenience. ADHD diagnosis was performed using CAARS, and the psychiatric comorbidities were assessed according to DSM-IV-TR using SCID, and those with a psychiatric comorbidity were excluded. All of the patients were informed about the design and purpose of the study, and a written consent form was obtained from each volunteer patient. The study was approved by the Ethical Committee of Tabriz University of Medical Sciences. The assessed factors in both groups included age, sex, educational level, job, accident history, daily driving amount, weekly driving amount, ADHD index, A subscale (attention deficit symptoms), B subscale (hyperactivity-impulsivity symptoms), and C subscale (Total ADHD symptoms). In addition, type of vehicle, light intensity at accident time, and the location of the accident were recorded in the case group.

Measurement

The Conners' Adult ADHD Rating Scale (CAARS)

Conner's Adult ADHD Rating Scale is used to screen and treatment follow up of patients and its validity and reliability are in accordance with DSM-IV. Among its good characteristics is having multiple indices including attention deficit index (subscale A), hyperactivity-impulsivity index (subscale B), ADHD symptoms total index (subscale C), and ADHD index (subscale D). This questionnaire can be considered a standard measure for ADHD research (12). This questionnaire had been translated to Persian by ICSS (Institute for Cognitive Science Studies) in Tehran. In this study, the overall internal consistency of the Conner's Adult ADHD Rating Scale was estimated as Cronbach's α of 0.83. In case the diagnosis of ADHD was for children, a rating scale for diagnosing ADHD in children designed by Delavar & et al can be used (13). Structured Clinical Interview for DSM-IV (SCID) SCID is a widely-used clinical tool for the classification of psychiatric disorders based on DSM-IV criteria. The reliability and feasibility of the Persian version of this diagnostic instrument were already determined as fair to good for most diagnostic categories ($\kappa > 0.6$). (14)

Statistical analysis

The obtained data were analyzed by SPSS (version 17.0). Comparisons were made using Independent Samples T-test and Mann-Whitney U-test for numerical variables according to data distribution. In addition, the Chi-Square and Fisher Exact tests were used for categorical variables. In all cases, the P values less than 0.05 were considered statistically significant.

Results

A total of 140 participants in two groups of case and control were evaluated. No significant statistical difference was found between case and control groups on age, gender, educational level and occupation. With respect to type of vehicle, 25 cases had a car accident (35.7%) and 45 had a motorcycle accident (64.3%). The light condition was bright in fifty four (77.1%), semi-bright in eight (11.4%) and dark in eight cases (11.4%). Accident location in the case group was within the town in 30 cases (42.9%), side road in 20 (28.6%), main road in 13 (18.6%), and highway in 7 cases (10%). Different variables in two groups are compared in Table 1. Accordingly, the percent of subjects with accident history was significantly higher in case group ($p= 0.24$). Furthermore, the mean driving hours in case group was significantly more compared to controls. No significant difference was observed between the two groups with respect to other factors. In self-report questionnaire of Conner's Adult ADHD Rating Scale, subscales' scores higher than 70 were considered positive. ADHD index was positive in 3 (4.3%) subjects in both case and control groups. $p= 0.660$, OR=1 (0.2-5.1) CI: 95%. ADHD total symptoms were positive in 7 (10 %) and 10 (14.3%) cases in both case and control groups respectively

Table 1- Comparison of measured variables in two groups*

		Case (n=70)	Control (n=70)	P value
Mean age (Years)		29.31±9.32	29.03±9.07	.854
Gender	Male	69 (98.6%)	69 (98.6%)	.752
	Female	1 (1.4%)	1 (1.4%)	
Educational Level	Guidance and lower	37 (52.9%)	33 (47.1%)	.572
	High School and Diploma	26 (37.1%)	26 (37.1%)	
	Higher Education	7 (10%)	11 (15.7%)	
Occupation	Self employed	33 (47.1%)	41 (58.6%)	.133
	Driver	14 (20%)	5 (7.1%)	
	Student	9 (13%)	6 (8.6%)	
	Farmer	7 (10%)	10 (14.4%)	
	Employee	6 (8.6%)	4 (5.7%)	
	Unemployed	1 (1.4%)	4 (5.7%)	
Accident History		11 (15.7%)	3 (4.3%)	.024
Daily Driving Hours		5.89±1.71	4.91±2.11	.004
Weekly Driving Days		3.81±8.5	3.34±2.30	.349

*The data are shown as mean± standard deviation and frequency (percent).

$p=0.438$, $OR=1.5$ (0.5- 4.2), $CI: 95\%$. In A subscale, inattentive symptoms were observed in 5 (7.1%) and 6 (8.6%) participants in case and control groups respectively $p=0.753$, $OR=1.2$ (0.4- 4.2), $CI: 95\%$. In B subscale (hyperactive-impulsive symptoms were observed in 7 (10%) and 6 (8.6%) participants in case and control groups respectively $Pv=0.771$, $OR=0.8$ (0.3- 2.7), $CI: 95\%$.

Discussion

In this study, the frequency of adult ADHD was compared between traumatic adult patients (due to traffic injuries) and a control group. Accordingly, ADHD index was positive 4.3% in both case and control groups, ADHD Symptoms Total were positive 10%, 14.3% in case and control groups respectively. A subscale (inattentive symptoms) was 7.1%, 8.6% in case and control groups respectively; and B subscale (hyperactive / impulsive symptoms) was 10%, 8.6% in case and control groups respectively. Hechtman et al (1984) first described the higher rate of traffic injuries in children with ADHD (15). The next studies performed by Barkley et al., and Jerome et al., accredited the initial report (16-19). The association of ADHD and traffic injuries is so important that Driving Center of Canada was listed the uncontrolled ADHD as an item for giving certificate to the drivers. The higher frequency of each type of accident in ADHD patients was compared to healthy subjects (odds ratio 1.7) and the car accidents are a subgroup of these events (20). Despite of numerous studies about the association of ADHD and car accidents, reports are different. Ludolph et al., reported twofold higher rate of car accidents in these patients compared with the normal population (21). In Barkley et al. studies and Cox et al (2000, 2006), this ratio has been different from two to six (16, 22-24). Sobanski et al., evaluated 27 patients with adult ADHD and 27 age and sex matched subjects as a control group. The frequency of car accidents in first group was 2.6 fold higher than the control group patients, the other related factors in this field were also

(25). Besides the higher rate of car accidents in ADHD higher. Among these, we can point to the higher frequency of losing driving certificate, driving after alcohol and substance use, exceeding the speed limit, and other abnormal traffic behaviors, car accidents trauma, high rate of traffic punishments and rate of suspension of driving certificate and higher rate of being responsible for the accidents (26-30). Besides the epidemiological studies, there are numerous clinical trials showing the strong association between ADHD and car accidents. Cox et al., in two different studies showed that the frequency of car accidents in adults with ADHD receiving Methylphenidate was lower than the group without treatment (23, 31). Barkley et al., in a similar study demonstrated that treatment of adult ADHD may result in decreased rate of car accidents and related injuries (32). Mohammadi et al., in a study on selegiline in comparison with methylphenidate in ADHD children and adolescents showed that selegiline is also effective and well tolerated for ADHD (33). Amiri et al., in a study on modafinil as a treatment for ADHD in children and adolescents found that this drug significantly improves symptoms of ADHD and is well tolerated (34). On the other hand, it is shown that high risk behaviors of ADHD patients during driving would persist despite controlling other factors. In other words, high risk behaviors during driving are an independent factor associated with ADHD (25,30). Different mechanisms are suggested including attention deficit, inability to control impulsivity, early fatigue, anger and aggressiveness (25,35-37). According to the mentioned studies, it may be concluded that there is a significant association between adult ADHD and car accidents. However, the current study showed no similar results. It should be mentioned that in all studies, the patients with ADHD and controls were either under investigation for driving-models or their driving situation while we compared the frequency of ADHD in subjects with and without car accidents. The current study is the first report from Tabriz- Iran on the association of ADHD to traffic injuries. The lack of difference between two groups regarding frequency of

ADHD may be due to the fact that the two groups were matched for job and educational level in this study. It was previously reported that adult ADHD is one of the main causes of educational and job problems (30). Hence, matching of two groups for these variables may be a kind of selection bias. Also driving skill level is one of the main contributing factors in this category (35). Unfortunately, we could not evaluate this condition in our sample. According to available reports, the low driving skill level and lack of sufficient information about driving rules (especially in young person) is one of the main causes for car accidents in our country (38, 39). In other words, high frequency of car accidents in our society is mainly due to lack of sufficient training of young drivers and lack of sufficient respect to the driving rules. Hence, it is very difficult to determine the role of ADHD in this field. High frequency of motorcycle accidents in this study (64.3%) is a congruent factor because of higher rule destruction in this group. Difference in driving duration is another major factor and the mean daily driving hours were significantly higher in patients with car accidents. Large number of severe car accidents would result in death or major injuries. These patients were not included in this study. On the other hand, it has previously been shown that the mortality or major injuries and severity of injury in ADHD patients experiencing car accidents is more than healthy subjects (26, 27). Despite the mentioned restrictions, this study may reflect general conditions in the society. Accordingly, it seems that most car accidents involving driver injury are not related to ADHD. Consequently, the screening programs may not make sense for this group.

Conclusion

This study showed that the odds of adult ADHD was not significantly higher in drivers with traffic injuries compared with the matched controls. Therefore, based on the results of this study, screening ADHD is not recommended. Larger scale studies stratified for different types of traffic accidents are recommended to further investigate such an association

Limitation

No information was available on the subjects' driving skills. Most of the traffic injuries cause death but these case were not included in our study.

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