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Research article

Association between Adult Attention Deficit-Hyperactivity Disorder and Motorcycle Traffic Injuries in Kerman, Iran: A Case-control Study

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Abstract

Purpose: To assess the association between adult Attention Deficit-Hyperactivity Disorder(ADHD) and motorcycle rider traffic injuries

Methods: A case-control study was conducted over a period of six months in 2012. Two hundred and five motorcycle riders involved in traffic accidents, and 200 age-matched non-traumatic controls were enrolled. The Conners' Adult ADHD Rating Scale (CAARS) self-report (screening version) was used for screening in both groups. Finally the score of ADHD was compared between the groups and associations were assessed using multivariate logistic regression analysis.

Results: Two hundred and five males were recruited with a mean age of 24.3±10.2 years in the case and 25.0 ±7.7 years in control groups. Univariate Analysis showed significant association with educational level, job, daily riding amount, driving at night, helmet usage, motorcycle engine size, household income, individual income and socio-economic status. In all ADHD subscales (A,B,C,D), significant associations were found and all subscale scores were higher in the case group. Multivariate analysis confirmed the association of ADHD screening score with motorcycle traffic injuries.

Conclusion: The results indicated existance of an association between Adult ADHD and motorcycle traffic injuries.

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Introduction

Injuries account for about 12% of the world's burden of disease [1]. Irrespective of their intent or cause, injuries comprise a major impact to be left on the health system which in turn is responsible for the care and support of the victims. Researchers believe that about 98% of these cases are preventable [2]. Among the injuries, unintentional ones account for 63 % of injury deaths, with suicide and homicide accounting for 21 %and 13 %, respectively [3]. Despite some success in reducing the age-adjusted injury death rate by 21 % between 1980 and 1997, injury from intentional and unintentional causes remains the leading cause of death for children, adolescents, and young adults which is the fourth leading cause of death over all age groups [3].
Among unintentional injuries, road traffic accidents with 53.5% of cases are considered the most prevalent in this regard [4]. About 85% of the deaths and 90% of the Disability-Adjusted Life Years (DALYs) caused by road traffic accidents in the world, occur in Low and Middle Income Countries (LAMICs) [5]. Whereas in High Income Countries (HICs) car accidents are common, in LMICs, motorcycles, bicycles and pedestrian ones are common.
Khatami et al. showed that motorcycle trauma is so common in Iran that motorcycle traffic injuries comprised 42 % of all extant traumas [6]. Motorcycle traffic injuries have multiple risk factors and some studies have indicated that there is an association between psychological disorders and road traffic injuries such as motorcycle accidents [7]. Among psychiatric disorders, Attention Deficit Hyperactivity Disorder (ADHD) has been neglected and often considered as a childhood disorder while epidemiological studies demonstrate that ADHD is the most common behavioral disorder of childhood and 50% to 80% of adults who had childhood ADHD, no longer meet full Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition (DSM-IV), criteria for the disorder, but continue to show some ADHD symptoms that cause impairment [8,9,10]. Longitudinal studies generally report persistence of ADHD among up to 50% of young adults [11].

Based on a vast literature, it turns clear that the information on association of adult ADHD and traffic injuries is quite scarce both from HICs and LMICs which share the main burden of motorcycle traffic injuries. The aim of the present study was to evaluate the association between the ADHD and motorcycle traffic injuries occurring in Kerman district of Iran.

Methods

In a case-control study, 410 patients including two equal groups of trauma due to traffic injuries and non-traumatic patients were evaluated. The study was performed in the trauma hospital of Kerman, Iran during a 6-month period in 2012. The inclusion criteria in this study were: physical trauma, traumas due to motorcycles, being the rider when injured, and capability of completing the Conners' Questionnaire. The exclusion criteria in present study were defined as; low consciousness due to brain trauma of those injured in a motorcycle accident who were not rider themselves, and illiteracy.

Patients with physical trauma, case group, as well as appropriate controls, who were admitted because of non-traumatic indications but without recent history of trauma hospitalization, were enrolled over the study period. The subjects of the two groups were frequency-matched with respect to age. To ensure reasonable independence of exposure status from sampling, friends and relatives of cases were not selected as controls. ADHD diagnosis was made in each case using Conners' Adult ADHD Rating Scale (CAARS).

After the patients were stabilized, a questionnaire was given to them by the nurses to be filled out by themselves. It is necessary to mentioned that cases and controls were group-matched. Using the Persian version of the CAARS self-report (screening version), the screening for adult ADHD was performed, and the results were compared. The sample size was calculated using PS software version 2.1.31 based on proportion comparison tests to ensure 80% statistical power and type 1 error less than 0.05 with considering 17 variables, 410 patients were estimated to be enrolled in two equal groups.

The study was approved by the Ethical Committee of Kerman University of Medical Sciences. The assessed factors in both groups included age, marital status, educational level, job, accident history, daily driving duration, weekly driving duration, helmet usage, driving certificate, driving history, motorcycle engine size, having hyperactive children, individual monthly income, household monthly income, psychiatric past medical history, birth order, socio-economic status (SES), D subscale (ADHD index), A subscale (Attention Deficit Symptoms), B subscale (Hyperactivity-Impulsivity Symptoms), and C subscale (Total ADHD Symptoms). SES was composed as a combined variable out of several related ones and aggregated to form the total SES score in order to determine the socio-economic status in each subject. Moreover, the accident timing and location, climate conditions, season, road status, and light intensity at accident time were recorded in the case group.

The CAARS is used to screen and follow up 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 Total Symptoms Index (subscale C), and ADHD Index (subscale D). Subscale C is the combination of subscales A and B. In the original reference manual of the CAARS, it is clarified that which questions belong to specified subscales, the scores of which were determined by adding the scores of each subscale questions.

This questionnaire can be considered as a standard measure for ADHD research [12]which has been translated to Persian by Clinical Psychiatry Research Center (CPRC) in Tabriz, Iran and validated by Amiri et al. In this study, the overall internal consistency of the Conners' Adult ADHD Rating Scale was estimated assessing Cronbaches' α which was equal to 0.83. 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) [13].

All statistical evaluations were done by SPSS-version 21.0. For analyzing the data binary logistic regression was used.

The study protocol was approved by the committee of ethics in Kerman University of medical sciences. Written informed consent was obtained from all the study participants.

Results

The study sample was composed of 205 cases and equal number of controls. All of the participants were male. With respect to marital status, singles in case and control groups composed 66.6% and 63% of the subjects, respectively. Diploma held the highest frequency of educational level and the majority of subjects were self-employed in both groups. Cases compared to controls,had less daily driving (2.5 vs. 3.3 hours) and night driving duration (0.89 vs. 1.35 hours). Totally, helmet usage rate was higher in control group. Customary engine size of motorcycles (125cc) was more common in case group but larger engine size motorcycles were more common in control group. Cases had higher proportions of hyperactive children compared to controls. Generally, controls had higher levels of individual and household income compared to cases. Psychiatric referring history was more common in case group. Birth order was higher in case group. Control group subjects had higher socio-economic level compared to case group.

In Univariate Analysis, no significant statistical difference was found between case and control groups over age, marital status, weekly driving amount, driving certificate, driving history, having hyperactive children, psychiatric referring history and birth order. But in all of the subscales, A (Inattention), B (Hyperactivity/Impulsivity), C (Total ADHD Symptoms) and D (ADHD Index), scores were higher in case group and the association was statistically significant.

After running Multivariate Analysis to control group for some confounding variables, significant associations were only detected in three subscales (B,C,D) of ADHD. Through the Multivariate Analysis, in contrast to Univariate Analysis, job was not found to show a significant association. Daily driving amount and driving at night were in the borderline of significance. Associations between seldom-helmet-use were significant between two groups. Socio-economic status either in Univariate or Multivariate Analysis kept significant association, so that socio-economic level was higher in control group (Table 1).

Discussion

In the present study, four subscales of Adult ADHD scale were used to compare injured motorcycle riders and control group patients. Subscale A scored on average 10.04±5.40 and 8.83±4.44, respectively in case and control groups. Subscale B scores were 10.37±5.40 and 9.09±5.08, respectively in case and control groups. Scores of subscale C (A+B) was 20.41±10.29 and 17.92±8.59, respectively in case and control groups. Subscale D scores were 13.26±6.94 and 11.59±6.24, respectively in case and control groups. Obviously, for all the subscales, scores of ADHD were higher in case group. In developed countries some studies has been done focusing on driving and ADHD; for the first time, Hechman et al. expressed that road traffic injuries was higher in children with ADHD [14]. After these studies, some countries such as Canada, paid particular attention to ADHD while giving the driving certificate regarding uncontrolled ADHD [15]. Barkley et al showed that ADHD groups had higher levels of inattention and lower scores on a test of driving rules and decision-making [16]. Studies that have been done by Barkly et al in 1993-1996 and NADA-RAJA et al in 1997 found that participants with ADHD experienced more adverse driving outcomes, such as license suspension, speeding citations and accidents, than control groups with equivalent driving experiences [17,18,19]. Gerring et al and Sherrard et al found that ADHD adolescents are predisposed to head injuries [20,21]. Barkley also showed that ADHD subjects are more involved in driving accidents; ADHD sufferers are affected throughout their lifetime and not only does it affect their driving, but also they have persisting problems in their academic pursuits, employment and sexual relationships. Also their health costs increase[22].

In one of the studies, Lam showed that among hospitalized accident victims, ADHD cases are more common and they suffer from longer length of hospitalization [23]. Association between ADHD and driving is not only constrained to observational studies, but also some clinical trials have shown such an association; Foe example, two studies

done by Cox et al indicated that the frequency of car accidents in adults with ADHD receiving Methylphenidate was lower than the group without treatment [24,25]. Finally all of the mentioned studies indicated that there is a significant association between ADHD and traffic injuries and the current study also confirmed this.

Among other variables, higher daily driving duration and driving at night duration was found to be a significant predictor of motorbike injuries. This may be because of higher level of skill among the controls, so that subjects with much more daily driving hours gradually get better driving skills and in long-term make them less likely to injuries. Also as mentioned, controls had higher driving duration than the cases and it may be due to abnormally elevated attention in darkness driving.

Helmet usage among controls was significantly higher than cases, but helmet usage in the case group was more regular. In both groups, motorcycles with an engine size of 100-125cc were common. But smaller and larger engine size motorcycles were common in case vs. control groups, respectively.

As a limitation of this study, it should be declared that the authors could not collect information about the skills of the drivers and this variable was not considered to be controlled in the present study. Moreover, most of motorcycle traffic injuries cause death, while the current study design allowed only to consider injuries nonfatal at admission and this should be taken into account in interpreting the results.

Table 1: Crude and adjusted odds ratios of possible predictors of motorcycle traffic injuries assessing the role of adult ADHD on these injuries, Kerman 2012

Variables	Cases(n=205)	Controls(n=205)	Crude odds ratios(OR)		Adjusted odds ratios	
			OR	CI of OR	OR	CI of OR
ADHD Subscales						
***A**	10.04±5.40	8.83±4.44	1.64	1.10-2.45	1.48	0.85-2.60
***B**	10.37±5.40	9.09±5.08	1.59	1.09-2.32	1.91	1.15-3.16
***C**	20.41±10.29	17.92±8.59	1.32	1.07-1.63	1.36	1.02-1.81
***D**	13.26±6.94	11.59±6.24	1.47	1.09-1.98	1.51	1.01-2.27
Age	24.39±10.25	25.06±7.75	0.99	0.97-1.01	-	-
Marital status						
Single(ref group)	132(66.6%)	126(63%)				
Married	66(33.3%)	74(37%)	0.91	0.66-1.27	-	-
***Educational level**						
Illiterate(ref group)	15(7%)	6(2.92%)				
Primary	80(39%)	35(17.07%)	0.91	0.32-2.55	0.71	0.18-2.86
Diploma	100(48%)	133(64.87%)	0.30	0.11-0.80	0.36	0.09-1.46
Advanced diploma	3(1%)	15(7.31%)	0.08	0.01-0.38	0.12	0.01-0.83
Bachelor	5(2%)	13(6.34%)	0.15	0.03-0.62	0.38	0.06-2.35
Master and PhD	2(0. 9%)	3(1.46%)	0.26	0.03-2.01	1.91	0.07-47.42
***Job**						
Unemployed(Ref group)	30(14.63%)	38(18.53%)				
Driver	7(3.41%)	11(5.36%)	0.80	0.27-2.33	0.96	0.25-3.64
Student	44(21.46%)	33(16.09%)	1.68	0.87-3.26	2.11	0.94-4.72
Traditional Farmer	9(4.39%)	14(6.82%)	0.81	0.31-2.13	0.50	0.16-1.56
Industrial Farmer	3(1.46%)	3(1.46%)	1.26	0.23-6.73	1.70	0.20-14.11
Civil servant	7(3.41%)	27(13.17%)	0.32	0.12-0.85	0.32	0.08-1.21
Self-employed	102(49.75%)	77(37.56%)	1.67	0.95-2.94	1.21	0.60-2.44
			OR	CI of OR	OR	CI of OR
***Daily driving amount**	2.55±1.68	3.32±2.23	0.81	0.72-0.90	0.86	0.73-1.01
Weekly driving amount	5.99±1.89	5.77±1.90	1.06	0.96-1.18	1.12	0.95-1.33
***Driving at night**	0.89±0.95	1.35±1.46	0.68	0.55-0.85	0.76	0.57-1.00
***Helmet usage**						
Never(ref group)	96(46.82%)	99(48.29%)				
Seldom	32(15.60%)	56(27.31%)	0.58	0.35-0.98	0.50	0.27-0.93

Variables	Cases(n=205)	Controls(n=205)	Crude odds ratios(OR)		Adjusted odds ratios	
Sometimes	35(17.07%)	21(10.24%)	1.71	0.93-3.16	1.89	0.87-4.08
Often	23(11.21%)	17(8.29%)	1.39	0.70-2.77	1.90	0.70-5.17
Always	19(9.26%)	11(5.36%)	1.78	0.80-3.94	5.21	1.64-16.57
Having a driving certificate	149(72.68%)	164(80%)				
No(ref group)	55(26.82%)	40(20%)	0.77	0.53-1.12	0.86	0.51-1.45
Yes						
***Motorcycle engine size(cc)**	19(9.26%)	4(1.95%)				
≥70(ref group)	47(22.92%)	16(7.80%)	0.61	0.18-2.09	-	-
70<V≤100	104(50.73%)	99(48.29%)	0.22	0.07-0.67	-	-
100<V≤125	17(8.29%)	36(17.56%)	0.09	0.02-0.33	-	-
125<V≤150	5(2.43%)	24(11.7%)	0.04	0.01-0.18	-	-
150<V≤200	4(1.95%)	16(7.80%)	0.05	0.01-0.24	-	-
200<V≤250	1(0.48%)	6(2.92%)	0.03	0.003-0.37	-	-
>250						
Having hyperactive children						
No(ref group)	134(65.36%)	148(72.19%)				
Yes	66(34.64%)	56(27.31%)	1.15	0.78-1.72	1.30	0.78-2.16
***Individual income**						
<5Million Rials(ref	141(68.78%)	103(50.24%)				
group)	45(21.95%)	75(36.58%)	0.43	0.28-0.68	-	-
5-10 Million Rials	19(9.26%)	27(13.17%)	0.51	0.27-0.97	-	-
>10 Million Rials						
***Family income**						
<5Million Rial(ref group)	109(53.17%)	82(40%)				
5-10 Million Rials	90(43.90%)	98(47.80%)	0.69	0.46-1.03	-	-
>10 Million Rials	6(2.92%)	25(12.19%)	0.18	0.07-0.46	-	-
Psychiatric referral history	189(92.19%)	194(94.63%)				
No(ref group)	16(7.81%)	11(5.36%)	1.49	0.67-3.30	-	-
Yes						
Birth order	3.16	2.83	1.08	0.98-1.20	1.11	0.98-1.25
***Socio-Economic Status**	17.96±6.26	20.62±6.37	0.93	0.90-0.96	0.94	0.89-0.98

*Significant Association OR is calculated by 10 score increments in ADHD subscales.

Conclusion

The present study showed that ADHD score in terms of its four subscales was significantly different between the case and control study groups; and in all subscales, scores were higher among motorcycle injury cases. It is recommended that there may be a need for possible application of psychological screening and, if required, consultation with respect to ADHD through the process of issuing motorcycle driving certificates. Future cohort studies may be of value in providing further details.

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