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Relationship between Symptoms of Attention Deficit Hyperactivity Disorder and the Severity of Symptoms in Children with Autism Spectrum Disorder

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Abstract

Background and Objective:

Background: The present study investigates the relationship between attention deficit hyperactive disorder (ADHD) and the severity of symptoms in children with autistic spectrum disorder.

Methods: The study was conducted on 80 patients with autistic spectrum disorder visiting Child Psychiatric Clinic of Tehran Psychiatric Institute. The severity of autistic symptoms was measured by sensory profile questionnaire. The Conners' Adult ADHD Rating Scales–Self Report: Screening Version (**CAARS–S**:**SV**) and CSI questionnaire were used to determine the severity of ADHD. The data were analyzed using Pearson correlation coefficient through SPSS v.20.

Findings: There is a significant correlation between total scores of Sensory profile and its subscales and total scores of CAARS and CSI ($r >+0.5$, $P<0.001$). However, there was not any significant correlation between some subscales of sensory profile questionnaire and the scores of CAARS. These subscales include visual sensitivity (r: + 0.18) and sensory processing in connection with tone/strength (r: +0.17). Also, there was not any significant correlation between the subscale of adjustment in relation to posture/movement processing and total score of sensory profile and CSI (r: +0.22).

Conclusion: There is a significant correlation between ADHD and severity of symptoms of autistic spectrum disorder. Both disorders can increase the severity of symptoms and exacerbate the patients' recovery process

Keywords: Attention deficit hyperactive disorder, Autistic spectrum disorder, CAARS, Sensory profile questionnaire, CSI

Introduction

Several studies have shown that children with autism spectrum disorder in many cases have symptoms such as ADHD and impulsive behavior (1). Based on the DSM_5 criteria, autism spectrum disorder diagnosed along with ADHD is possible (2) and many studies suggest that the two disorders often overlap with each other and the rate of the comorbidity has been mentioned between 16 and 50 percent (3). The comorbidity of the symptoms of ADHD and autism is associated with more severe illness and reduced quality of life (4).

The ADHD is a common disorder among children and adolescents (5). Recent studies about autism found an increased rate of autism spectrum disorders prevalence up to 1 in 80.

Studies that have investigated the potential impact of ADHD symptoms on the severity of ASD symptoms have drawn different conclusions. According to some studies, vibrant children with autism spectrum disorder have more severe psychopathology. However, the results of a study con-

ducted by Lutejin et al. found that autistic children with ADHD compared to autistic ones without ADHD comorbidity suffer from the same intensity of psychopathology (6).

To sum up, there is controversy in potential effects of ADHD symptoms on ASD. It should be noted that the studies carried out in this area have had different methodologies and samples.

Another important point is that there is not much research in the relationship between ADHD and autism symptoms in children with autism; on the other hand, as mentioned above, the results of the different studies are inconsistent. Also, there is no study conducted on Iranian children in terms of the comorbidity of these two disorders. The present study investigates the impact of ADHD symptoms on the severity of autism spectrum disorder in Iranian children.

Methods

This study is cross-sectional, which was carried out for one year starting from the summer 2014 at the Tehran Institute of Psychiatry.

The study included all children less than 18 years of age who visited a child psychiatric clinic of Tehran Institute of Psychiatry diagnosed with ASD. Autism diagnosis was done based on DSM-5 criteria and the diagnosis of type of autism spectrum disorder was performed according to the ICD-10 classification for convenient data analysis. According to ICD-10, autism disorder is divided into three groups of Asperger's autism, atypical autism, and high-functioning autism.

Patients who used risperidone were excluded from the study and those who were treated with Ritalin were evaluated a week after cessation of treatment. Therefore, all patients diagnosed with high-functioning autism, atypical autism and Asperger's syndrome were included in the study, and then Conners' parent questionnaire, CSI, and sensory profile were filled by patients' relatives under the guidance of resident of psychiatry.

Convenience sampling was used and the subjects were included in the study sequentially. The sample size was 80 subjects; all were sequentially included in the study during one year.

The Conners' Adult ADHD Rating Scales–Self Report: Screening Version (CAARS–S:SV) was used. The CAARS-S: SV contains 30 questions and measures the symptoms of ADHD. The validity of this questionnaire is reported to be 85% and regarding the respective reliability, its test-retest correlation depending on various items in original questionnaire has been obtained as 0.88 to 0.91(7). In a study on validity and reliability of the Persian CAARS-S: SV, Cronbach's alpha was determined higher than 0.8 and the results showed that this version can be used as a screening tool for adults' ADHD in Iran (8). Sensory profile questionnaire was developed by Ermer et al. (1998) to study sensory experiences of children of 3 to 16 years of age with autism spectrum disorder and ADHD (9). The questionnaire has enjoyed internal correlation coefficient of 90% and examines the different sensory areas.

Results

Eighty patients were included in the study. The mean (SD) age of participants was 8.0 ± 3.0 years ranged 3 to 16 years. There were 69 males (0.86%) and 11 females (0.13%), who were significantly different. The mean age of fathers was 38.0 ± 4.0, mothers' mean age was 33.0 ± 5.03 years. The mean age of autism diagnosis in patients was 3.0 ± 1.0 years. Demographic data frequency is presented in Table 1.

As can be seen, in the total scores of sensory profile questionnaire there is a significant correlation between subscales of this test and Conners' total test scores and CSI questionnaire ($P<0.001$, $r>+0.5$).

However, there was no significant correlation between some subscales of sensory profile questionnaire and Connor's test scores. These subscales include visual processing (with a correlation coefficient of +0.18) and sensory processing in connection with the tone/strength (with a correlation coefficient of +0.17). Also, the adjustment subscale in connection with posture/movement

Table 1. Demographic data of the participants in the study

Characteristics	Total N (%)*
Sex	
Male	69 (86.0)
Female	11(13.0)
Relation of Parents	
Related	27 (33.0)
Not related	51 (63.0)
Education of Father	
Diploma	33(41.0)
Under Diploma	18 (22.0)
University	29 (36.0)
Occupation of Father	
Unemployed	12 (15.0)
Free Job	42 (52.0)
Employee	26 (32.0)
Education of Father	
Diploma	44 (55.0)
Under Diploma	15 (18.0)
University	21 (26.0)
Occupation of Father	
House keeper	66 (82.0)
Employee	13 (11.0)

Table 2. Results of Conners' test scores, sensory profile, and CSI

	N	Minimum	Maximum	Mean	Std. Deviation
Total Sensory profile	78	211.0	440.0	327.0	58.0
Auditory Processing Score	80	11.0	35.0	22.0	5.0
Visual Processing Score	80	11.0	42.0	21.0	6.0
Vestibular Processing Score	80	13.0	44.0	26.0	6.0
Tactile Processing Score	80	23.0	71.0	43.0	11.0
Multiple Sensory Processing Score	80	9.0	31.0	17.0	5.0
Oral Processing Score	78	18.0	55.0	37.0	8.0
Tone/Strength Processing Score	78	9.0	39.0	22.0	7.0
Posture/Movement Processing Score	78	12.0	38.0	24.0	6.0
Movement Adjustment Score	80	6.0	33.0	16.0	4.0
Sensory Adjustment Score	80	4.0	18.0	10.0	3.0
Visual Adjustment Score	80	4.0	21.0	11.0	3.0
Emotional/Social reflection Score	80	4.0	73.0	46.0	12.0
Sensory Processing Outcome Score	80	8.0	28.0	17.01	4.0
Threshold of Reaction Score	80	5.0	13.0	8.03	2.0
Total Conner's Score	79	30.0	100.0	67.0	17.0
CSI Attention Score	78	1.0	27.0	13.0	6.0
CSI Hyperactivity Score	78	1.0	18.0	9.0	4.0
CSI Impulsivity Score	78	.00	9.0	4.0	2.0
Total CSI Score	78	2.00	51.0	28.0	12.0

processing did not correlate significantly with total score of CSI questionnaire (with a correlation coefficient of +0.22). Also, there was no significant correlation between the subscale of visual processing and impulsivity and attention deficit subscales from CSI questionnaire (correlation coefficients were 0.28 and 0.29, respectively)

Discussion

The present study showed that in the total score of sensory profile there was a significant correlation between the subscales of this questionnaire and the total score of Conners' test and CSI. This fact can indicate correlation between autism and ADHD symptoms.

Studies that have examined the potential impact of ADHD symptoms on ASD etiology have come across different results. Some studies indicate more severe psychopathology in children suffering from both diseases. In the study by Lutejin et al. the severity of psychopathology in children with ADHD diagnosis along with autism has been reported as equal to autistic children without ADHD comorbidity (5).

Zhang et al (2013) showed that children with autism and ADHD have higher rates of screaming and antisocial behavior (10). Also in Gadow's study on a group of children with autism and ADHD, it was revealed that anxiety symptoms in these patients are more than children with ADHD alone, or ADHD with tic (11). Another study showed that children with autism and ADHD had fewer social skills and lower ability to behave appropriately and socially; also, anxiety disorders in these children is greater than ADHD children without ASD (12). The results of the above studies are consistent with the results of the present study.

In this study, the results of scores of scales of auditory processing, vestibular processing, tactile processing, multiple sensory processing, sensory adjustment affecting emotional reactions, emotional- social reactions, and behavioral consequences of sensory processing significantly correlated with total scores of CSI questionnaire. This finding may indicate that understanding five senses is associated with the severity of attention deficit symptoms; this association may be due to the similar disorder etiology in these areas mentioned above.

Previous studies partly confirm this hypothesis. It has been shown in many studies that ADHD and autism spectrum disorder usually have comorbidity. According to the DSM-5 criteria, we are allowed to diagnose ASD in the area of ADHD, and this is despite the fact that in the previous versions of the DSM, it would not have been possible. According to reports in the last decade, both ADHD and ASD disorders, particularly ASD, has significantly increased in terms of prevalence over the past 10 years. Following the increased prevalence of both disorders as well as the ability to better diagnose ASD in the ADHD, a variety of research have focused on the comorbidity between ADHD and ASD. Antshel et al has mentioned the case of biological, cognitive and behavioral overlapping between the two disorders and reported biological, cognitive and behavioral overlapping between autism spectrum disorder and ADHD (13). A study by Huisman et al found that autism and ADHD can have the same genetic backgrounds and the comorbidity of these two disorders is caused by the same genetic background (14).

Table 3. Pearson correlation coefficients for total scores, and subscale scores on tests of sensory profile, Conners and CSI questionnaire

	Total Sensory Profile	Auditory Processing	Visual Processing	Vestibular Processing	Tactile Processing	Multiple Sensory Processing	Oral Processing	Tone/Strength Processing	Posture/Movement Processing	Movement Adjustment	Sensory Adjustment	Visual Adjustment	Emotional/Social reflection	Sensory Processing Outcome	Threshold of Reaction	Conners'	Total CSI	CSI attention	CSI hyperactivity	CSI Impulsivity
1. Total Sensory Profile	1	0.57*	0.61	0.72*	0.74*	0.58	0.51	0.60	0.65*	0.66	0.59*	0.71	0.61	0.55	0.61	0.61	0.52	0.52	0.70	0.65
1.1. Auditory Processing	0.57*	1	0.53	0.61	0.60	0.57	0.70	0.63	0.73	0.59	0.60	0.72	0.56	0.64	0.66	0.76	0.63	0.56	0.59	0.52
1.2. Visual Processing	0.61	0.53	1	0.50	0.56	0.63	0.69	0.71	0.52	0.54	0.60	0.69	0.55	0.58	0.63	0.18	0.62	0.28	0.29	0.69
1.3. Vestibular Processing	0.72*	0.61	0.50	1	0.64	0.58	0.66	0.70	0.54	0.61	0.66	0.59	0.64	0.68	0.59	0.50	0.58	0.54	0.51	0.62
1.4. Tactile Processing	0.74*	0.60	0.56	0.64	1	0.59	0.61	0.68	0.56	0.63	0.61	0.64	0.58	0.60	0.66	0.52	0.56	0.62	0.60	0.63
1.5. Multiple Sensory Processing	0.58	0.57	0.63	0.58	0.59	1	0.59	0.65	0.52	0.58	0.59	0.61	0.57	0.62	0.63	0.54	0.52	063	0.62	0.66
1.6. Oral Processing	0.51	0.70	0.69	0.66	0.61	0.59	1	0.62	0.61	0.60	0.63	0.58	0.61	0.64	0.55	0.21	0.58	0.59	0.19	0.16
1.7. Tone/Strength Processing	0.60	0.63	0.71	0.70	0.68	0.65	0.62	1	0.63	0.62	0.52	0.57	0.62	0.60	0.57	0.17	0.22	0.15	0.52	0.16
1.8. Posture/Movement Processing	0.65*	0.73	0.52	0.54	0.56	0.52	0.61	0.63	1	0.58	0.54	0.59	0.61	0.62	0.59	0.62	0.64	0.60	0.54	0.59
1.9. Movement Adjustment	0.66	0.59	0.54	0.61	0.63	0.58	0.60	0.62	0.58	1	0.61	0.62	0.60	0.64	0.61	0.51	0.58	0.60	0.56	0.54
1.10. Sensory Adjustment	0.59*	0.60	0.60	0.66	0.61	0.59	0.63	0.52	0.54	0.61	1	0.58	0.54	0.52	0.60	0.52	0.54	0.66	0.58	0.56
1.11. Visual Adjustment	0.71	0.72	0.69	0.59	0.64	0.61	0.58	0.57	0.59	0.62	0.58	1	0.63	0.54	0.50	0.61	0.52	0.54	0.62	0.54
1.12. Emotional/Social reflection	0.61	0.56	0.55	0.64	0.58	0.57	0.61	0.62	0.61	0.60	0.54	0.63	1	0.58	0.54	0.56	0.57	0.58	0.61	0.55
1.13. Sensory Processing Outcome	0.55	0.64	0.58	0.68	0.60	0.62	0.64	0.60	0.62	0.64	0.52	0.54	0.58	1	0.52	0.59	0.58	0.59	0.60	0.61
1.14. Threshold of Reaction	0.61	0.66	0.63	0.59	0.66	0.63	0.55	0.57	0.59	0.61	0.60	0.50	0.54	0.52	1	0.58	0.54	0.61	0.63	0.57
2. Conner s	0.61	0.76	0.18	0.50	0.52	0.54	0.21	0.17	0.62	0.51	0.52	0.61	0.56	0.59	0.58	1	0.68	0.56	0.63	0.61
3. Total CSI	0.52	0.63	0.62	0.58	0.56	0.52	0.58	0.22	0.64	0.58	0.54	0.52	0.57	0.58	0.54	0.68	1	0.54	0.52	0.60
3.1. CSI attention	0.52	0.56	0.28	0.54	0.62	0.63	0.59	0.15	0.60	0.60	0.66	0.54	0.58	0.59	0.61	0.56	0.54	1	0.50	0.61
3.2. CSI hyperactivity	0.70	0.52	0.29	0.51	0.60	0.62	0.19	0.52	0.54	0.56	0.58	0.62	0.61	0.60	0.63	0.63	0.52	0.50	1	0.62
3.3. CSI Impulsivity	0.65	0.59	0.69	0.62	0.63	0.66	0.16	0.16	0.59	0.54	0.56	0.54	0.55	0.61	0.57	0.61	0.60	0.61	0.62	1

However, the results of this study showed that there was no significant correlation between some subscales of sensory profile and Conners' test scores. These subscales include sensory processing associated with the tone/strength and adjustments associated with posture/movement processing. Since the type of study to measure this type of correlation was not found, it can be hypothesized that sensory processing in the areas of five senses along with sensory processing in the areas of muscle tone can be two different areas with different etiologies. The area of five senses is correlated with the severity of symptoms of hyperactivity but the area of sensory processing related to muscle tone does not have such correlation. The results of the present study also showed that subscale of adjustment in connection with posture/movement processing did not significantly correlate with the total score of CSI questionnaire, hence confirming the hypothesis.

According to several studies, in case of the comorbidity between ADHD and ASD decline in performance of patients is more severe than any of the disorders alone. In Holtman et al studied a group of children with ASD and mental retardation (IQ means: 8.68) with a high level of attention deficit problems. These children had deeper deficits in social interaction and had more severe psychopathology compared to ASD children without ADHD (15). Yerryes et al. found that autistic traits in children with ASD + ADHD are more than ADHD alone. However, the two groups did not differ in the ADI-R and ADOS-G test scores (16). A study conducted using FMRI showed the correlation between neuropsychological ADHD and ASD (17).

Furthermore, this study showed that there is a substantial abnormality in the basal ganglia compared with ADHD alone in Group ADHD + ASD. According to Sprenger, patients with autism spectrum disorder and ADHD symptoms, the severity of autism symptoms had been reported to be higher (18).

Conclusion

In this study, the performance of patients was not measured. However, ADHD is a common condition among autism patients and earlier diagnosis and treatment of this disorder and its comorbidities can better help treat these patients.

Limitations of the study

Due to the sampling selection from one center, our study sample may not be a complete representative of the population of children with autism.

Cohort studies on children and adolescents with autism and ADHD, and long-term follow-up to adulthood are needed to determine what conditions and comorbidities are predictors of performance decline in these patients.

Ethical Considerations

First, the parents of the participants were provided with adequate descriptions about the objectives and the implementation of the project, and then an informed consent form was taken from them.

Conflicts of interest: None declared.

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