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Similarity of subjective symptoms between autism spectrum disorder and attention-deficit/hyperactivity disorder in adults: Preliminary findings

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Abstract

Aim: The purpose of this study was to examine the symptoms of autism spectrum disorder (ASD) and attention-deficit/hyperactivity disorder (ADHD) in the adult clinical population using the Autism-Spectrum Quotient (AQ) and the Adult ADHD Rating Scales self-report screening version (CAARS-S:SV).

Methods: We included 50 adults with ASD and 52 with ADHD diagnosed using the DSM-5 criteria. Clinical symptoms were evaluated using the AQ and CAARS-S:SV.

Results: The AQ score was elevated in the ADHD group and the CAARS scores were increased in the ASD group. Specifically, the total AQ score in adults with ADHD was lower than that in the ASD group, but was higher than that in controls. Similarly, the CAARS scores in adults with ASD were lower than in those with ADHD, but were higher than those in controls. No significant correlations were found between AQ, CAARS Inattention/Memory Problems, and CAARS Hyperactivity/Restlessness scores in both the ASD and ADHD groups.

Conclusion: While adults with ASD and ADHD exhibited similar clinical symptoms, the absence of AQ-CAARS correlations suggests the need for examining factors other than the apparent similarity of clinical symptoms of the two disorders.

KEYWORDS

attention-deficit/hyperactivity disorder, autism spectrum disorder, Autism-Spectrum Quotient, Conners' Adult ADHD Rating Scales, self-rating questionnaires

1 | INTRODUCTION

Autism spectrum disorder (ASD) is defined as repetitive maladaptive behaviors, stereotyped motor mannerisms, and rigid adherence to routines, in addition to difficulty in interpersonal relationships and social interactions.[1] Although the DSM-IV[2] and ICD-10[3] criteria do not allow codiagnosis of ASD and attention-deficit/hyperactivity disorder (ADHD), several researchers have noted that children with ASD frequently have symptoms similar to those of ADHD, such as inattention or impulsivity.[4,5] Similarly, children with ADHD often show interpersonal and social impairment resembling the core symptoms of ASD.[6–8] Given these overlaps, the comorbidity of ASD and ADHD

has been officially noted in the DSM-5 criteria[1] and those with a dual diagnosis reportedly experience greater social, cognitive, and adaptive impairments than those with a single diagnosis[9–12]. While the overlap of ASD-ADHD symptoms and its effects have been reported in children, only a handful of studies have examined and compared ASD and ADHD symptoms in adults[13–15]. For example, Panagiotidi et al[14] reported positive correlations between ASD and ADHD traits in a general population, while Roy et al[15] studied the AQ score in adults with ADHD and found it elevated in those with comorbid ASD. However, to our knowledge, none has explored and compared ASD symptoms in adults with ADHD without ASD and ADHD symptoms in those with ASD without ADHD, and compared them to neurotypical controls to examine the nature of the ASD-ADHD symptom overlap in an adult clinical population.

Accordingly, the present study aimed to explore subjective ASD and ADHD symptoms in adults with either ADHD or ASD who visited a specialty outpatient clinic for adult neurodevelopmental disorders. We used the Autism-Spectrum Quotient (AQ)[16–18] and Adult ADHD Rating Scales self-report screening version (CAARS-S:SV), [19,20] which are widely used for subjective symptom measurements of ASD and ADHD, respectively.

2 | METHODS

2.1 | Subjects

We included 50 adults with ASD without comorbid ADHD (35 men and 15 women; mean age [SD], 28.7 [8.0] years) and 52 with ADHD without comorbid ASD (41 men and 11 women; mean age 31.9 [9.3] years) who were diagnosed using the DSM-5.[1] They were recruited at the specialty outpatient clinic for adult neurodevelopmental disorders at Showa University East Hospital and Showa University Karasuyama Hospital. The control group comprised 38 adults, who were recruited via email and announcements, and were acquaintances of staff at Showa University Hospital and several pharmaceutical companies (29 men and 9 women; mean age 30.5 [4.4] years). They had no ASD or ADHD diagnoses. The exclusion criteria were age under 18 or over 65 years, other psychiatric disorders, substance abuse or dependence, serious physical disorders, and those with an estimated intelligence quotient (IQ) below 85 when assessed using the Japanese Adult Reading Test (JART)-25.[21]

The diagnoses of ASD and ADHD were based on a thorough assessment interview conducted by a team of three experienced psychiatrists and two clinical psychologists. The interview included (1) developmental history taking, both from the participants and their parents, siblings, or relatives who knew the participants from infancy, and checking episodes and symptoms of ADHD and ASD based on the DSM-5 criteria at every year of the life from infancy to adulthood, (2) reviewing a maternal health handbook issued by the local government, which contains children developmental records at the neonatal and infant periods, and (3) checking school records from elementary to high school with comments by teachers and parents on child behavior and academic performance. At the end of the interview, a diagnosis based on the DSM-5 criteria was reached by consensus between psychiatrists and clinical psychologists. Subsequently, the Japanese versions of the CAARS-S:SV[19,20] and AQ[16–18] were administered for the evaluation of subjective symptoms.

TABLE 1 Demographics and means of the estimated IQ, AQ, and CAARS scores

Mean (SD)	ASD (n = 50)	ADHD (n = 52)	Control (n = 38)
Age	28.7 (8.0)	31.9 (9.3)	30.5 (4.4)
Sex (Male) (N; %)	35 (70.0)	41 (78.8)	29 (76.3)
Estimated IQ	110.5 (7.4)	106.7 (8.9)	108.5 (8.1)
AQ (*)	38.8 (5.5)	28.9 (7.9)	15.2 (6.5)
CAARS IM (*)	14.2 (6.6)	18.2 (5.8)	5.8 (4.0)
CAARS HR (*)	8.6 (6.0)	12.0 (7.0)	4.7 (4.0)

Abbreviations: ADHD: attention-deficit/hyperactivity disorder; AQ: Autism Spectrum Quotient; ASD: autism spectrum disorder; CAARS HR: Conners' Adult ADHD Rating Scale, Hyperactivity/Restlessness; CAARS IM: Conners' Adult ADHD Rating Scale, Inattention/Memory Problems; Estimated IQ: assessed by the JART-25.
*ANOVA $P < .0001$

The JART-25[21] was used to include only high-functioning subjects. It is the Japanese version of the National Adult Reading Test developed by Nelson[22] and is composed of 25 Japanese irregular kanji words for reading. The JART-25 has a good IQ prediction validity[21] and is commonly used for simple IQ measurement in psychiatric studies in Japan. In addition, the Japanese version of the Mini-International Neuropsychiatric Interview (MINI)[23] was also administered by psychiatrists to rule out other mental disorders. MINI is a short structured diagnostic interview for DSM-IV and ICD-10, which has satisfactory reliability and validity.[23,24] The three groups did not differ significantly in age, sex ratio, and estimated IQ (Table 1).

2.2 | Assessment tools

The Autism-Spectrum Quotient (AQ), developed by Baron-Cohen et al,[16] is a 50-item self-administered measure for adults with normal intelligence to assess the presence of autistic traits. Each AQ item is a brief statement followed by four possible ratings: definitely agree, slightly agree, slightly disagree, and definitely disagree. A higher score indicates more autistic traits. The Japanese version of the AQ is standardized for use in Japan[17] and is reported to have good internal consistency, reliability, test-retest reliability, and discriminant validity.[18]

The Adult ADHD Rating Scales screening version (CAARS-S:SV) measures the presence and severity of ADHD symptoms.[19,20] The CAARS was developed by Keith Conners and was designed to help assess, diagnose, and monitor the treatment of ADHD in adults.[19] The CAARS forms are available in long, short, and screening versions. Two formats are available as self-report ratings and observer ratings for each version. In the present study, the CAARS self-report

screening version (CAARS-S:SV) was used. The CAARS screening version has 30 items and contains two subscales: Inattention/Memory Problems (IM) and Hyperactivity/Restlessness (HR).

2.3 | Statistical analysis

SPSS 22.0J (IBM Corp., Tokyo, Japan) was used for all statistical analyses. Means with standard deviations were calculated for age, estimated IQ, and scores of AQ, CAARS IM, and CAARS HR. One-way analysis of variance was used to compare these means between the ASD, ADHD, and control groups; post hoc pairwise comparisons were performed with Bonferroni correction. The sex ratios of the three groups were compared using the chi-squared test. Pearson's product-moment correlation coefficients were calculated between the estimated IQ, AQ, and CAARS scores for each group. The significance level was set at .05, except for the correlations, for which .01 was set to count for possible type I error.

3 | RESULTS

Table 1 shows the demographics (age and sex ratio) and means for the estimated IQ, AQ, and CARRS scores of the three groups. For the AQ total score, ANOVA showed the main effect of groups ($F[2,137] = 133.294$), $P < .0001$). Multiple comparisons revealed that the average AQ score of the ASD group was significantly higher than that of the ADHD ($P < .0001$) and control ($P < .0001$) groups; the average AQ score of the ADHD group was significantly higher than that of the control group ($P < .0001$). For CAARS-S:SV, ANOVA showed the main effect of groups for both CAARS IM ($F[2,137] = 52.573$, $P < .0001$) and CAARS HR ($F[2,137] = 17.027$, $P < .0001$) scores. Multiple comparisons revealed a similar trend for IM and HR scores; the average IM score of the ADHD group was significantly higher compared with the ASD ($P < .001$) and control ($P < .0001$) groups, while the average IM score of the ASD group was significantly higher than that of controls ($P < .0001$). The average HR score of the ADHD group was significantly higher than that of the ASD ($P < .05$) and control ($P < .0001$) groups; the average HR score of the ASD group was significantly higher than that of controls ($P < .01$).

Table 2a,b shows the Pearson's product-moment correlation coefficients of the ASD and ADHD groups, respectively. In controls, there were no significant correlations between the estimated IQ, AQ, and CAARS scores. The ASD and ADHD groups demonstrated a similar correlational trend; the CAARS IM score was positively correlated with the CAARS HR score (ASD; $r = .702$, $df = 49$, $P < .0001$, ADHD; $r = .526$, $df = 51$, $P < .0001$).

4 | DISCUSSION

The present study was the first to compare ASD symptoms in adults with ADHD and ADHD symptoms in adults with ASD using the AQ and CAARS-S:SV. Although we excluded individuals with comorbid ASD and ADHD, adults with ASD exhibited ADHD symptoms to a certain extent, while those with ADHD presented certain ASD symptoms. The finding that AQ and CAARS scores were not correlated in both ASD and ADHD groups indicates that despite the significant ASD-ADHD symptoms overlap in clinical adults, factors other than shared genetic risk factors might play a role, and further research is needed to reveal the nature of this overlap.

The considerable ASD-ADHD symptoms overlap in our results is consistent with pediatric studies showing a similarity in clinical symptoms between ASD and ADHD along with a high comorbidity rate.[6,25–27] Simonoff et al[25] reported that the ADHD prevalence among children with ASD was 28.2% and was even higher in those with high functioning individuals, reaching 44%-65%.[26,28,29] Reiersen et al[6] evaluated the Social Responsiveness Scale in children with ADHD and reported that one-third boys and three-fourth girls with combined subtype of ADHD presented with autistic symptoms.

TABLE 2 Pearson's correlation coefficients for the estimated IQ, AQ, and CAARS scores in the ASD (a) and ADHD (b) groups

(a) ASD	Estimated IQ	AQ	CAARS IM	CAARS HR
Estimated IQ		0.188	−0.082	−0.040
AQ			0.057	0.230
CAARS IM				**0.702***
CAARS HR				
(b) ADHD	**Estimated IQ**	**AQ**	**CAARS IM**	**CAARS HR**
Estimated IQ		0.058	−0.102	0.111
AQ			0.292	0.204
CAARS IM				**0.526***
CAARS HR				

Abbreviations: ADHD: attention-deficit/hyperactivity disorder; AQ: Autism Spectrum Quotient; ASD: autism spectrum disorder; CAARS HR: Conners' Adult ADHD Rating Scale, Hyperactivity/Restlessness; CAARS IM: Conners' Adult ADHD Rating Scale, Inattention/Memory Problems; Estimated IQ: assessed by the JART-25.

*$P < .01$

By including a clinical population in comparison with neurotypical controls, our study also adds support to the existing literature regarding adults, showing that ASD and ADHD symptoms overlap to a significant degree even in those without a dual diagnosis. However, our results demonstrated no correlations between ASD and ADHD symptoms, as assessed by the AQ and CAARS, respectively, in both ADHD and ASD groups. One possible explanation is that the symptoms overlap may need to be viewed in dimension-specific manner rather than at diagnostic level, as suggested by Polderman et al[13]. Specifically, they showed that while the restricted and repetitive behaviors (RRB) of ASD symptoms moderately correlated both with the inattention (IA) and hyperactivity/impulsivity (HI) of ADHD, the deficits in social interaction and communication (SIC) of ASD moderately correlated with IA, but only mildly with HI. Since the AQ is mostly based on SIC related questions rather than assessing RRB, the RRB-ADHD symptoms (CAARS scores) association was not reflected and might have resulted in the nonsignificant AQ-CAARS correlation in the present study. The combined use of a scale for RRB such as the Repetitive Behavior Scale-Revised might have produced the positive correlations. Nonetheless, the results can also imply that factors other than shared genetic risks may be at play in ASD-ADHD symptoms overlap. Despite the difficulty in drawing further conclusions from our study, we consider it possible that different causes result in similar symptoms, such that individuals with ASD may seem inattentive because they are indifferent to things around them, while those with ADHD seem to show similar interpersonal relationships to ASD due to frequent social faux-passes. Moreover, factors such as executive function, IQ discrepancies, social circumstances, and mental symptoms such as anxiety or depression may influence the subjective symptoms of ASD and ADHD in adults with either ADHD or ASD. A more detailed assessment of ASD symptoms using the Autism Diagnostic Observation Schedule-2 (ADOS-2) and other objective measurements for ADHD symptoms is crucial for determining the nature of the ASD-ADHD relationship in adulthood.

Our study has several limitations. First, we only used self-rating scales and evaluated subjective symptoms. Since one can over-or under-report symptoms, the additional use of clinician-rating scales is ideal for future studies. Second, since we did not use either the ADOS-2 or the Autism Diagnostic Interview-Revised, we might have included individuals with a dual diagnosis. The use of these assessment tools in diagnosis should improve the quality of future studies. Third, the relatively small sample size (50 ASD and 52 ADHD) may have weakened the statistical power and precision of our results. Fourth, we did not consider the effects of medication, which could have altered the subjective symptoms. A further study on a large nonmedicated ASD and ADHD sample is necessary for a comprehensive analysis.

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CONFLICT OF INTEREST

The authors declare no conflict of interest.

AUTHOR CONTRIBUTIONS

AN performed the data analysis and wrote the first draft of the manuscript. WH and AI contributed to the data interpretation and writing of the manuscript. TN and YH were involved in the study design, data analysis and interpretation, and writing of the manuscript. KA and YO contributed to subject recruitment and clinical diagnostic assessments. All authors contributed and approved the final manuscript.

ETHICAL APPROVAL

Approval of the research protocol by an Institutional Reviewer Board: The study protocol has been approved by the suitably constituted Research Ethical Committee of the Showa University School of Medicine (No793) and it conforms to the provisions of the Declaration of Helsinki.

Informed Consent: All participants provided written consent to the study after a full explanation of the study procedures.

DATA AVAILABILITY STATEMENT

Research data are not shared. This is because the participants did not consent for open data sharing.

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