Which assessment tool is most useful to diagnose adult autism spectrum disorder?

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Objective: To reveal the most useful tool for the diagnosis of adult autism spectrum disorder (ASD).

Methods: The participants were 76 adult patients coming regularly to the special outpatient clinic for adult developmental disorders at the Department of Psychiatry, Kitasato East Hospital from 2013 through 2015. They were divided into an ASD group (n = 23) and a non-ASD group (n = 53) according to the diagnostic criteria of the Diagnostic and Statistical Manual of Mental Disorders-IV-TR or the DSM-5. They were evaluated using three assessment tools: the Autism Spectrum Quotient-Japanese version (AQ-J), the Wechsler Adult Intelligence Scale-third edition (WAIS-III), and the Pervasive Developmental Disorders Autism Society Japan Rating Scale (PARS). We compared the two groups in terms of: the AQ-J score, the largest difference between the WAIS-III subtest scaled scores (SS-difference), in place of discrepancy, and the early childhood peak and current PARS scores.

Results: Significant differences were detected between the two groups in terms of the PARS scores but not with the AQ-J score or the SS-difference. Our analysis of the early childhood peak and PARS scores showed adequate sensitivity (0.71) and specificity (0.69).

Conclusion: Our findings indicate that the early childhood peak score of PARS may be the most useful tool to diagnose adult ASD.

Key words: ASD, AQ-J, PARS, WAIS-III

Abbreviations: ASD, adult autism spectrum disorder; AQ-J, Autism Spectrum Quotient-Japanese version; PARS, Pervasive Developmental Disorders Autism Society Japan Rating Scale; WAIS-III, Wechsler Intelligence Scale for Adults-third edition; PDD, pervasive developmental disorder; DSM, Diagnostic and Statistical Manual of Mental Disorders; IQ, intelligence quotient

Introduction

Diagnosing adult autism spectrum disorder (ASD) has become one of the most important issues in clinical psychiatry in Japan, largely because the concept of ASD has changed from infantile autism to pervasive developmental disorders (PDDs), including high-functioning autism and Asperger’s disorder. These diagnostic concepts have predominantly been used in psychiatric practice involving children and adolescents but are now being highlighted in adult patients. The prevalence of ASD in children and adults is estimated to be approximately 0.98%.1 Studies have also shown that adult patients with ASD exhibit the comorbidities of mood disorder (53%) and anxiety disorder (43%).2 An additional issue in adults is dealing with patients presenting at clinics who are actively questioning whether they have ASD or not. Consequently, it has become necessary for general psychiatrists to develop an accurate method of diagnosing adult ASD. In 2014, Ota et al. investigated the standard methods of diagnosing and treating PDDs in Japan1 by a mail questionnaire survey completed by physicians affiliated with the Japanese Society for Child and Adolescent Psychiatry. Results showed that the main methods used to diagnose PDDs were the Pervasive Developmental Disorders Autism...
Society Japan Rating Scale (PARS) (42.4%) and the Autism spectrum quotient-Japanese version (AQ-J) (33.0%). However, the precise usefulness of these methods remains unknown. The purpose of our present study was to identify the best assessment tool to diagnose adult ASD.

Materials and Methods

Participants

Participating in the present study were 76 patients (>18 years old) who regularly came to the special outpatient clinic for adult developmental disorders and were given a battery of psychological tests at the Department of Psychiatry, Kitasato East Hospital from 2013 through 2015. Seven patients were excluded from the original total of 83 patients, because 1 patient was 17 years old, and the intelligence quotient test or self-rating questionnaire was incomplete for the other 6 patients. The remaining subjects were divided into an ASD group (n = 23) and a non-ASD group (n = 53) by four well-trained psychiatrists according to the diagnostic criteria of the Diagnostic and Statistical Manual of Mental Disorders (DSM)-IV-TR or the DSM-5. The non-ASD group was composed of patients with the main DSM diagnoses as follows: adjustment disorders (n = 21), attention-deficit/ hyperactivity disorder (n = 6), mental retardation (n = 4), schizophrenia (n = 3), borderline intellectual functioning (n = 2), dysthmic disorder (n = 2), social phobia (n = 2), generalized anxiety disorder (n = 2), learning disorder (n = 1), stutter (n = 1), delusional disorder (n = 1), personality disorder (n = 1), and no diagnosis (n = 7). The psychiatrists in the present study each had over 16 years of clinical experience and were trained to diagnose ASD in a case conference for adult developmental disorders. The clinical profiles of the two groups are shown in Table 1. There were no statistically significant differences in age or full intelligence quotient between the two groups.

Table 1. Profile of the ASD and Non-ASD groups

<table>
<thead>
<tr>
<th>Group</th>
<th>ASD</th>
<th>Non-ASD</th>
</tr>
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<tbody>
<tr>
<td>N</td>
<td>23 (30.3%)</td>
<td>53 (69.7%)</td>
</tr>
<tr>
<td>Male</td>
<td>19 (25.0%)</td>
<td>34 (44.7%)</td>
</tr>
<tr>
<td>Female</td>
<td>4 (5.3%)</td>
<td>19 (25.0%)</td>
</tr>
<tr>
<td>Age (median)</td>
<td>25.0</td>
<td>31.0</td>
</tr>
<tr>
<td>Full IQ (mean ± SD)</td>
<td>93.0 ± 20.4</td>
<td>92.2 ± 16.9</td>
</tr>
</tbody>
</table>

ns, not significant

Measures

The assessment tools used in the present study were the AQ-J, the Wechsler Intelligence Scale for Adults-third edition (WAIS-III), and the PARS. The AQ was originally created in 2001 by Baron-Cohen et al. This is a self-rating questionnaire capable of screening for high-functioning PDD and assessing autistic traits in typical developments. There are two translated versions. The Japanese version, the AQ-J, translated in 2004 by Wakabayashi et al., was used in the present study. The questionnaire features 50 items covering five different areas relating to the autistic features of social skills, attention switching, attention to details, communication, and imagination on the four-point Likert scale. During screening, the cut-off point was considered to be 32/33.

The WAIS-III is a standard intelligence test used all over the world. The original test was published in 1991, and the Japanese version was published in 2006. This test features 14 sub-tests and involves the calculation of scaled scores for each subtest: four index scores, verbal and performance intelligence quotient (IQ), and full IQ. In ASD cases, a large discrepancy between subtests is often mentioned to reflect the characteristic of restricted patterns of interest. Due to statistical complexity, we used the largest difference between scaled scores from the WAIS-III sub-tests rather than focusing upon discrepancies between scores.

The PARS was created by the Autism Society Japan in 2006 and features 57 items covering six characteristic domains of PDD. The PARS is assessed by conducting interviews with the patient’s mother or a guardian and determines current infant score, early childhood peak score, childhood score, and current adolescent/adulthood score. The main aim of the PARS test is to assess the need for support. Cut-off points are set to indicate PDD or ASD (early childhood peak score: 8/9, current adolescent/adulthood score: 19/20). This test has proved to be sufficiently reliable and valid. However, it is not always possible to interview the mothers of adult patients because of their age or the fact that they reside some distance away. In the present study, 17 ASD cases (73.6%) and 35 non-ASD cases (66.0%) completed the PARS tests.

All of these assessments were conducted by certificated clinical psychologists. We assessed the participants another full day with the three tools.

Data analyses

Considering the continuity of ASD and as there was no cut-off point for the SS-difference, we analyzed these data in two ways. We compared data arising from the
three assessment tools between the two groups with the Wilcoxon U test. We also calculated the sensitivities and specificities of the AQ-J and the PARS in relation to the cut-off points. As scores from the three assessment tools were non-parametric, we did not use discriminant analysis. All data were analyzed with JMP 11.0.0 statistical software. This study was approved by the Kitasato University School of Medicine Hospital Ethical Committee and was complaint with the declaration of Helsinki.

Results

The results of the present study are shown in Tables 2 and 3. Significant differences were found between the two groups in two PARS scores but not in the AQ-J score or the SS-difference. The distribution of PARS early childhood peak scores in the two groups are shown in Figure 1. It was evident that there were cases of low childhood peak scores in the ASD group and cases of extremely high scores in the non-ASD group. Sensitivities

Table 2. Comparison of the AQ-J and SS-difference in the WAIS-III

<table>
<thead>
<tr>
<th>Group</th>
<th>ASD (n = 23)</th>
<th>Non-ASD (n = 53)</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>AQ-J (median)</td>
<td>33.0</td>
<td>29.0</td>
<td>ns</td>
</tr>
<tr>
<td>SS-difference (median)</td>
<td>9.0</td>
<td>8.0</td>
<td>ns</td>
</tr>
</tbody>
</table>

SS-difference represents the largest difference between the scaled scores of the WAIS-III subtests.

Table 3. Comparison of PARS scores

<table>
<thead>
<tr>
<th>Group</th>
<th>ASD (n = 17)</th>
<th>Non-ASD (n = 35)</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Early childhood peak score (median)</td>
<td>11</td>
<td>5</td>
<td>&lt;0.01</td>
</tr>
<tr>
<td>Adulthood current score (median)</td>
<td>13</td>
<td>9</td>
<td>&lt;0.05</td>
</tr>
</tbody>
</table>

Figure 1. Distribution of the PARS early childhood peak score

The broken line represents the cut-off point.
and specificities (and also positive and negative predictive values) are shown in Table 4. Adequate values were identified in the PARS early childhood peak score (sensitivity and specificity was 0.71 and 0.69, respectively).

**Discussion**

There have been several previous reports of the use of the AQ-J to compare ASD (PDD) in non-clinical and clinical subjects. In 2005, Kurita et al. administered the AQ-J and AQ-J short version to investigate 25 normally intelligent and high-functioning PDD patients and 215 controls who were randomly selected from the general population. These authors concluded that because of their negative predictive values, these tools were useful in ruling out mild PDD but were not useful predictors. Then, in 2006, Kurita et al. also used the AQ-J and the General Health Questionnaire (Japanese version) to study 215 adults who had been randomly selected from the general population and revealed significant association between the two questionnaires (r = 0.52). Consequently, these authors argued that it was important to consider the probability that the AQ-J test may measure mental health problems other than autistic traits. There were no significant differences between the two groups in our study due to the high AQ-J score near the cut-off points in the non-ASD group. This was thought to be a result reflecting variable mental health problems in the non-ASD group as a corresponding finding with Kurita’s study. In 2014, Suehiro et al. administered the AQ-J test to an adult PDD group (n = 20) and a non-PDD group (n = 59), and estimated sensitivity and specificity to be 0.95 and 0.73, respectively. These values were higher than our present results, likely due to sampling issues. Moreover, the non-PDD group in the previous paper comprised psychiatric disorders, including schizophrenia and anxiety disorders, in general psychiatric clinical settings. In contrast, our non-ASD group was recruited at a special outpatient clinic for adult developmental disorders. These sampling conditions may have led to the discrepancies in the results. This suggests that sampling conditions need to be taken into account to use the AQ-J more effectively. Moreover, this particular test may not be useful to assess patients who are in doubt of whether they have ASD or not.

The discrepancies observed with regard to Wechsler’s intelligence tests of sub-tests scaled scores in ASD (PDD) patients are of great interest to clinicians in our country. Some studies have investigated cognitive profile in childhood cases and questioned its competence to discriminate between different types of PDDs. A supplemental diagnostic trial of PDD was later carried out with an original combination score (the sum of Vocabulary and Comprehension subtracted from the sum of Block Design and Digit Span). However, there are few studies describing the use of WAIS-III for adult ASD. Our current results suggest that we should not attempt to diagnose ASD on the basis of WAIS-III discrepancies. We should rather understand that WAIS-III indicates only cognitive features for each individual patient.

Regarding the PARS test, Suehiro et al. also used the current adolescent/adult scores to evaluate the two groups of patients and calculated sensitivity and specificity to be 0.60 and 0.69, respectively. However, the estimations in the present study showed lower sensitivity and higher specificity. These differences were likely caused by sampling conditions. In our special outpatient clinic, there are many patients who were first diagnosed with

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**Table 4. Sensitivities and specificities of the assessment tools**

<table>
<thead>
<tr>
<th></th>
<th>AQ-J Early childhood peak score</th>
<th>PARS Current score</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>ASD (n = 23)</td>
<td>Non-ASD (n = 53)</td>
</tr>
<tr>
<td>Over the cut-off point</td>
<td>12</td>
<td>17</td>
</tr>
<tr>
<td>Under the cut-off point</td>
<td>11</td>
<td>36</td>
</tr>
<tr>
<td>Sensitivity</td>
<td>0.52</td>
<td>0.71</td>
</tr>
<tr>
<td>Specificity</td>
<td>0.68</td>
<td>0.69</td>
</tr>
<tr>
<td>PPV</td>
<td>0.41</td>
<td>0.52</td>
</tr>
<tr>
<td>NPV</td>
<td>0.77</td>
<td>0.83</td>
</tr>
</tbody>
</table>

PPV, positive predictive value; NPV, negative predictive value
ASD (PDD) after they reached adulthood. This may mean that their ASD characteristics are not relatively strong and, therefore, do not attract attention; consequently, the current PARS scores are relatively low. Despite this, the PARS early childhood peak score showed adequate sensitivity and specificity of approximately 0.70. ASD should not, therefore, be diagnosed by the PARS test alone. The PARS test was created to indicate the support needs for ASD (PDD); however, the results of the present study indicate that the PARS early childhood peak score may be the most useful assessment tool. In 2013, Uchiyama13 also discussed the usefulness of ascertaining developmental history in 10 patients using the PARS test to diagnose adult ASD.

There are three limitations to this study. It was a single-center study, and, therefore, a collaborative multicenter study is warranted to confirm these results. And because the study was conducted during the transitional phase of DSM-IV-TR to 5, the ASD group included PDD patients. Consequently, future studies should instigate more rigorous groupings to match the era of DSM-5. Finally, there were a few cases of extremely low early childhood peak score in the ASD group and exceedingly high scores in the non-ASD group (Figure 1). These scores may have been affected by the informer bias. Further investigations are warranted to consider factors influencing such bias to use the PARS test more effectively.

References