Screening methods for autism spectrum disorders in the study of neuropsychological development of preschool children

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Abstract

Aim. To assess the effectiveness of screening methods for diagnosing autism spectrum disorders available to the pediatric service; to prove in practice impossibilities to identify signs of autism spectrum disorders by using the existed pediatric methods.

Methods. The neuropsychological development of 187 preschool children (5–6 years old) was investigated. The neurological status, anxiety according to A.M. Parishioners, level of intelligence using Raven's Progressive Matrices, the presence of hyperactivity according to the method of V.R. Kuchma, mental performance according to V.Ya. Anfimov, screening diagnostics of autism spectrum disorders were studied.

Results. Assessment of the neurological status showed an increase in tendon reflexes in 10.2±2.2% of children, a decrease in 12.3±2.4%. The study of the intelligence levels in the Ravenna test showed that the average intelligence level was in 47.1±3.7% of the studied children, the intelligence was below the average in 52.9±3.7% of children. Screening diagnostics of autism spectrum disorders did not reveal abnormalities, however, 5.3±1.6% of children had signs of predisposition to the autism spectrum disorder (decreased adaptation to changes, nervousness and fears, verbal and non-verbal communication, level of activity and consistency of intellectual response). The indicator of the productivity of mental performance of preschool children was 5.4±0.5. Attention deficit was detected in 5.9±1.7% of children (according to the parent's questionnaire) and 8.6±2.0% children (according to the teachers' questionnaire). The level of anxiety was 9.6±0.3 points.

Conclusion. The currently known screening methods for detecting autism spectrum disorders, available to the pediatric service, in our opinion, are uninformative; the search for the most sensitive markers of autism should be based on an understanding of the epigenetic mechanisms of autism spectrum disorders.

Keywords: autism spectrum disorders, screening diagnostics of ASD.

Background. Recent researchers have often reported about the difficulties in the diagnosis of autism spectrum disorders (ASD). This is due to the increase in the number of children with ASD, especially since the correction of ASD manifestations depends on their early detection [1–3]. According to Rosstat, 0.2–2 cases of ASD are registered per 10 thousand children recently in Russia [4]. This is confirmed by data reported by European researchers [5]. In the United States, approximately 50 children per 10 thousand children have ASD [4, 5]. The Centers for Disease Control and Prevention and the State Agency for Epidemiology (USA) note an increase in the number of children with ASD by 23%, starting from 2012 to the present [6, 7].

To successfully correct and treat manifestations of ASD, early diagnosis is necessary in the first 18–24 months of life [8]. Moreover, the recent diagnostic criteria can be employed only at age 2 years. In practice, ASD is diagnosed when a child enters school or even later [8, 9]. In such conditions, it is extremely important to develop new screening methods for diagnosing ASD.

Purpose. This study aimed to evaluate the effectiveness of screening techniques for diagnosing ASD in the pediatric field.

Material and research methods. A study was carried out to evaluate neuropsychic development of preschool children in Kindergarten No. 186 in Irkutsk. The study included 187 children aged 5–6 years. The observation was carried out from November 2019 to March 2020. The state of the nervous system was investigated based on the assessment of motor activity, reflex activity, sensory sphere, sensitivity, as well as cranial nerve functions [10].

Neuropsychic development was evaluated in terms of motor skills, statics, sensory reactions, speech, and cognitive and emotional development. Intelligence was considered an integral indicator of the psyche [10, 11].

Intellectual development was assessed using Raven's progressive matrices [12]. Screening diagnostics of ASD was carried out using the Childhood Autism Rating Scale (translation and adaptation was carried out by Morozova and Dovbnya in 2011) [13]. Mental performance was studied according to methods by Anfimova [14, 15]. Hyperactivity was identified using the hyperactivity rating scale [14, 15]. Anxiety level was assessed according to the scale of explicit anxiety according to methods presented by A.M. Parishioners [16].

The state of health and neuropsychic development of children was assessed with the written consent of the parents, and results were communicated to the parents and legal representatives. Statistical data were evaluated using the Statistica Base 10 software for Windows. The arithmetic mean (M), mean error of the arithmetic mean (m), and relative error (p) were calculated. The normal distribution was analyzed using Student's t-test (with confidence interval >95%). The study was approved by the ethical committee (Federal State Budgetary Scientific Institution "Research Center for Family Health and Human Reproduction," extract from Minutes No. 3.6 dated 04/07/2019).

Results. The analysis of indicators of neurological status showed that the studied children did not have any significant deviations in development. An increase in tendon reflexes was noted in $10.2 \pm 2.2\%$ of the children, and a slight decrease was observed in $12.3 \pm 2.4\%$. No pathological reflexes were found.

As regards observation during wakefulness and daytime sleep, $64.2 \pm 3.5\%$ of the children were constantly active during wakefulness, $20.3 \pm 2.9\%$ were passive, and $16 \pm 2.7\%$ were irritable.

Individual character traits were distributed as follows: disinhibition, $19.8 \pm 2.8\%$; cruelty, $24.1 \pm 3.1\%$; aggressiveness, $37.4 \pm 3.5\%$; and shyness, $11.2 \pm 2.3\%$. Moreover, $36.4 \pm 3.5\%$ of the children are easy to teach, $9.6 \pm 2.2\%$ were unteachable,

and $24.6 \pm 3.1\%$ showed curiosity. Other individual character traits were as follows: affectionate, $29.4 \pm 3.3\%$; kind, $33.7 \pm 3.5\%$; rude, $26.7 \pm 3.2\%$; contact, $28.9 \pm 3.3\%$; obsessive, $22.5 \pm 3.1\%$; and fearful, $15.5 \pm 2.6\%$.

As regards the appetite, $7.0 \pm 1.9\%$ of the children had good, $50.8 \pm 3.7\%$ had poor, $9.6 \pm 2.2\%$ had unstable, $15.5 \pm 2.6\%$ had increased, and $16.6 \pm 2.7\%$ had selective appetite.

In the analysis of the level of intelligence according to the Raven test [12], $47.1 \pm 3.7\%$ of the children had average level of intelligence and $52.9 \pm 3.7\%$ had below average. Moreover, $48.7 \pm 3.7\%$ of the girls and $45.5 \pm 3.6\%$ of the boys had average level of intelligence. Below-average intelligence was detected in $51.3 \pm 3.1\%$ of the girls and in $54.5 \pm 3.6\%$ of the boys. These values were not different. In total, the children completed $38.7 \pm 1.2\%$ of the tasks, which amounted to 22.1 ± 0.7 points.

The score on the indicator of imagination, attentiveness, and level of visual difference (discrimination), as well as establishment of relationships in the Raven test was 6.7 ± 1.1 points; the score for identifying analogies between figures was 7.3 ± 1.1 points; the score for the level of dynamic attentiveness and establishment of dynamic analogies was 5.2 ± 0.9 points; the score for the ability to perceive quantitative and qualitative changes and order was 2.8 ± 0.6 points; and the score for the ability to observe complex quantitative series, qualitative development of kinetics, dynamic indicators, expression of abstraction, and dynamic synthesis was 1.1 ± 0.3 points.

In the diagnostic screening of ASD [12], all examined children scored less than 30 points, that is, no syndromically completed manifestations of autism were found. However, $5.3 \pm 1.6\%$ of the examined children scored 20–25 points, that is, deviations were still observed. Deviations from the norm were noted according to criteria such as attitude toward people, adaptation to changes, nervousness and fears, verbal and non-verbal communication, level of activity, and consistency of the intellectual response (Fig. 1).

Contrary to expectations, girls had more adverse symptoms than boys. However, the severity of the trait was higher in boys.

In the analysis of the mental performance of preschoolers [14, 15], the productivity level was 5.4 ± 0.5, the errors were 2.4 ± 0.7, and the lines viewed were 11.6 ± 0.4. The girls scanned slightly fewer lines than the boys, but made fewer mistakes.

As regards diagnosis for attention deficit disorder [14, 15], only $5.9 \pm 1.7\%$ of the parents noted hyperactivity in children. In boys, this proportion
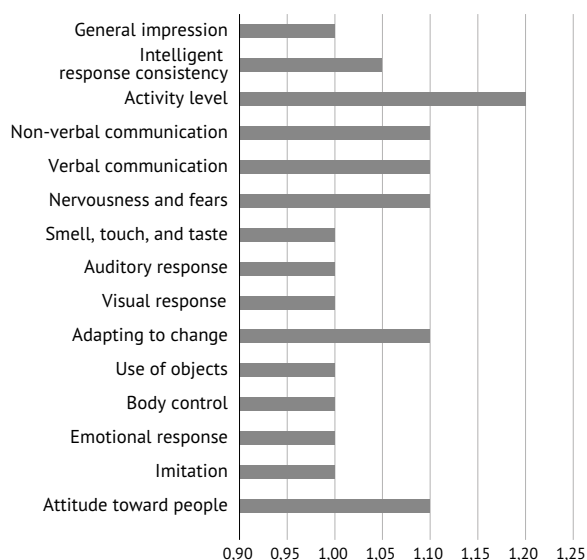
Fig. 1. Distribution of child autism scale indicators

was $22.5 \pm 3.1\%$. Educators noted hyperactivity in $8.6 \pm 2.0\%$ of the children and $26.7 \pm 3.2\%$ among boys.

In the analysis of anxiety in preschoolers using the scale of explicit anxiety, children scored 9.6 ± 0.3 points and boys score little higher with 9.8 ± 0.3 points, on average.

The indicator of interpersonal anxiety was 4.6 ± 0.4 points, and the self-estimated score was 4.9 ± 0.4 points ($p < 0.05$). This indicator was higher in girls (4.2 ± 0.6 points) than in boys (2.8 ± 0.4 points).

In the analysis of projective diagnostics of anxiety according to Prikhozhan [16], along with sociometric studies, a direct relationship was found between anxiety and self-esteem ($r = 0.57$).

Discussion. The diagnostic criteria for ASD according to the International Classification of Diseases (10th revision) are grouped as follows: changes in communication, qualitative disorders of social interaction, repetitive stereotypical movements and patterns in behavior, and nonspecific problems (such as phobias, fears, sleep disturbances, arousal, eating disorder, fits of rage, aggression, self-harm). The diagnosis is established if these features revealed before age 3 years.

Our study showed that screening methods for detecting ASD, as well as the use of other methods of studying the neuropsychic development of children as screening methods, are too painstaking and uninformative. Even with a large sample, techniques cannot detect slight deviations [17]. While conducting screening studies, some authors have noted that cases identified are related to severe obvious disorders, requiring help of a psychiatrist, so the problem of identifying children at risk of ASD remains unresolved.

Intellectual impairments are not always or to an insignificant extent found in ASD, and against the background of a general tendency toward a decrease in intellectual abilities [18], they cannot be also used as diagnostic criteria for screening. Deviations in communication and social interactions in connection with universal informatization are widespread in the society; therefore, indicators of mental performance, intellectual development, and anxiety identified in our study can also mask changes in the autism spectrum.

CONCLUSIONS

1. Currently available methods of screening diagnostics of ASD are ineffective.

2. Research for the most sensitive markers of autism should be based on an understanding of the epigenetic mechanisms of ASD.

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