

Neuropsychic Development of Preschool Children and Screening Diagnostics of Autism Spectrum Disorders

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Abstract:

We have conducted examination of neuropsychic development of 187 preschool children (5-6 years old). The examination included standard procedures of neuropsychic examination and methods of screening diagnostics of autism spectrum disorders (ASD).

Neurologic examination revealed that 10.2%±2.2 of children had brisk tendon reflexes and 12.3%±2.4 of children had hyporeflexia.

Monitoring of the children showed that 64.2%±3.5 of children were active in a wakeful state, 20.3%±2.9 – passive, 16%±2.7 were irritable, 19.8%±2.8 - disinhibited, 24.1%±3.1 - cruel, 37.4%±3.5 – demonstrated belligerency, 33.2%±3.4 of children badly fell asleep, 81.3%±2.9 – had a superficial sleep, 50.8%±3.7 – poor appetite, 9.6%±2.2 – unstable appetite.

IQ study using the Raven-test showed that 47.1%±3.7 of tested children had an average IQ and IQ of 52.9%±3.7 children was below the average.

The screening diagnostics of ASD did not reveal any children with ASD, however, 5.3%±1.6 of tested children had predisposing features of autism spectrum with respect to attitude to people, adaptation to changes, anxiety and fears, verbal and nonverbal communication, activity level and consistency of intellectual response.

Productivity index of preschool children's mental capacity amounted to 5.4±0.5, number of mistakes made – 2.4±0.7, missed lines – 11.6±0.4.

The diagnostics of attention deficit disorder (V.R. Kuchma, 2012) showed that only 5.9%±1.7 of parents noted hyperactivity of the children, but according to the nursery teachers this index amounted to 8.6%±2.0 children.

Anxiety of the preschool children (according to A.M. Prikhozhan) amounted to 9.6±0.3 points.

Summary. The current screening methods aimed at early infantile autism (EIA) detection yield little information. The cases detected in such examinations are related to severe obvious disorders. Search for the most sensitive autism markers shall be based on understanding of ASD epigenetic mechanisms.

Key words: autism spectrum disorders, ASD screening diagnostics.

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I. Relevance

Recently, authors have often raised the problem of autism spectrum disorder (ASD) diagnostics. This is due to increase of amount of children with ASD, because correction of ASD signs depends on its early detection [1, 2].

L. Kanner and H. Asperger were the first who described basic clinical variants of autism spectrum disorders. They determined main disease markers and diagnostics principles. Since then little has changed in spite of numerous examinations of early infantile autism (EIA) [2, 3, 4]. According to Russian researchers, currently from 0.2 up to 2 children with ASD are detected per 10,000 of child population [5, 6]. European researchers have the same data [7]. Up to 50 children with ASD per 10,000 of child population are detected in the USA [8].

The Center for Disease Control (CDC) and State Epidemiologic Agency (USA) register increase of children with ASD by 23% from 2012 up to the present moment [9, 10].

Early diagnostics during the first 18-24 months after birth is required for successful correction and treatment of ASD signs [11]. However, currently used diagnostic criteria may be detected only at the age of 2. In practice, ASD is detected at the primary school age, when a child goes to school and undergoes adaptation to the school community. Sometimes, the autism disorder is diagnosed at the age of adolescence or even later [11, 12]. Under such conditions, development of new screening methods of ASD diagnostics is highly important.

For this reason, the objective of this research was to determine the most perspective trends for development of ASD screening methods basing on the child development criteria, which are known and available to the pediatric service.

II. Material and Examination Methods

Examination of neuropsychic development of preschool children was conducted in a child day-care center of Irkutsk. 187 children at the age of 5-6 participated in the examination. Monitoring was conducted from November 2019 till March 2020.

Evaluation of nervous system was conducted basing on the study of reflex activity, motion activity and sensory activity, sensitivity, function of cranial nerves [13].

Neuropsychic development was studied basing on the indicators of movements (child's motion activity based on reflexes), statics (ability to maintain body position in space), sensory response (behavior acts arising in response to sensory signals), speech (verbal communication) and psychic development (cognitive, emotional and conative processes). Mental capacity was considered as an integral mental indicator [13, 14].

The examination was conducted using the method of neurologic examination, monitoring of the child during wakeful state and day sleep [13, 14], intellectual development using progressive matrices test [15], ASD screening diagnostics using Childhood Autism Rating Scale, CARS (translated and adapted by Morozova T.Yu., Dovbnya S.V., 2011) [16], mental capacity using correction tables of V.Ya. Anfimov [17, 18], hyperactivity indicators were studied by interviewing of parents and teachers (questionnaire for parents and teachers) using hyperactivity rating scale (V.R. Kuchma, 2012) [17, 18], anxiety was studied using the scale of obvious anxiety according to A. M. Prikhozhan [19].

All examinations were conducted after receipt of prior written consent of parents. The results were reported to the parents.

Statistical processing of the result was conducted using Statistica Base 10 for Windows Ru. Statistical processing included calculation of arithmetical mean (M), average error of arithmetical mean (m), and relative value error (p). Statistical significance of differences of quantitative indicators with normal distribution was analyzed using the Student's T criterion within the confidence interval more than 95%. In case of abnormal distribution, statistical significance of differences was analyzed using the Mann-Whitney's test. Statistical significance of differences of qualitative indicators was analyzed using criterion χ^2 .

III. Examination Results

Neurological status. Examination of neurological status indicators showed that the children of examined groups did not have any significant deviations. $10.2\% \pm 2.2$ of children had brisk tendon reflexes, $12.3\% \pm 2.4$ had hyporeflexia. No pathological reflexes were detected.

Monitoring during wakeful state and day sleep. The examination showed that $64.2\% \pm 3.5$ of children were active during the wakeful state, $20.3\% \pm 2.9$ were passive, and $16\% \pm 2.7$ were irritable.

Individual features of the children were distributed as follows: disinhibition – $19.8\% \pm 2.8$, cruelty – $24.1\% \pm 3.1$, aggressiveness – $37.4\% \pm 3.5$, modesty – $11.2\% \pm 2.3$. $36.4\% \pm 3.5$ of children were teachable, $9.6\% \pm 2.2$ were learning-disabled and $24.6\% \pm 3.1$ of children showed curiosity. Other individual features were distributed as follows: tender – $29.4\% \pm 3.3$, kind – $33.7\% \pm 3.5$, rough – $26.7\% \pm 3.2$; communicative – $28.9\% \pm 3.3$, persistent – $22.5\% \pm 3.1$, timid – $15.5\% \pm 2.6$ (Fig. 1).

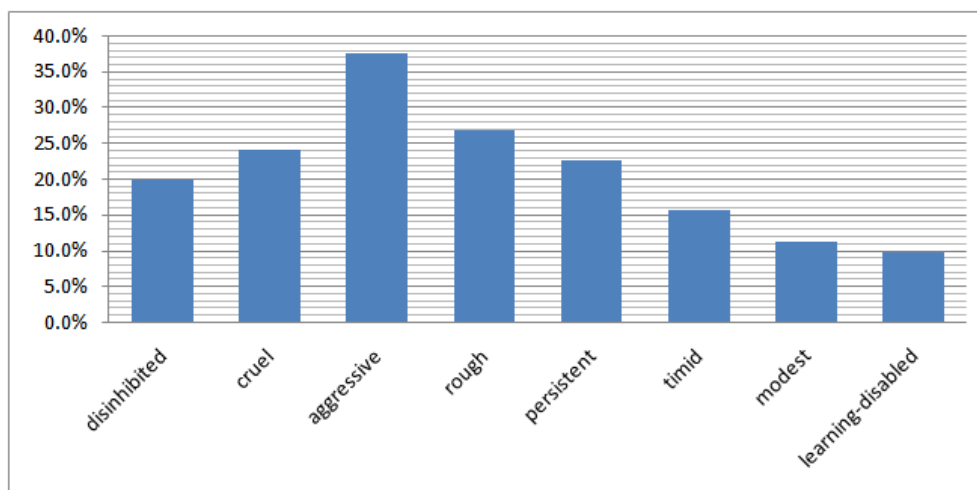


Fig. 1. Individual Features of Preschool Children

Mood study showed that $30.5\% \pm 3.3$ of examined children were in cheerful mood, $32.6\% \pm 3.4$ – in relaxed mood, $20.9\% \pm 3.0$ – in low mood, $7.5\% \pm 1.5$ – in unstable mood.

$33.2\% \pm 3.4$ of children baldly fell asleep, and $81.3\% \pm 2.9$ had a superficial sleep.

Study of appetite showed that $7.0\% \pm 1.9$ of children had a good appetite, $50.8\% \pm 3.7$ – had a poor appetite, $9.6\% \pm 2.2$ – unstable appetite, $15.5\% \pm 2.6$ - hyperorexia, $16.6\% \pm 2.7$ – appetition (Fig. 2).

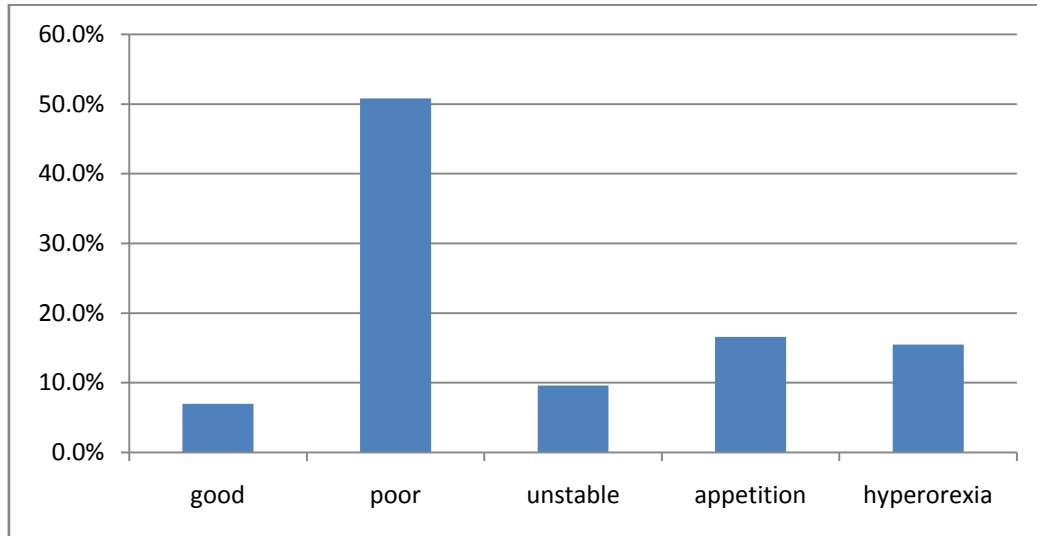


Fig. 2.
Indicators of Children's Appetite

Intellectual Development Using the Progressive Matrices Test. Study of intelligence levels in the Raven's test showed that $47.1\% \pm 3.7$ of examined children had an average intelligence level, and intelligence level of $52.9\% \pm 3.7$ of children was below the average (Fig. 3). Average intelligence level of girls amounted to $48.7\% \pm 3.7$, and of boys – $45.5\% \pm 3.6$. Intelligence level of $51.3\% \pm 3.1$ of girls was below the average and intelligence level of $54.5\% \pm 3.6$ of boys was below the average. The values had no statistical differences.

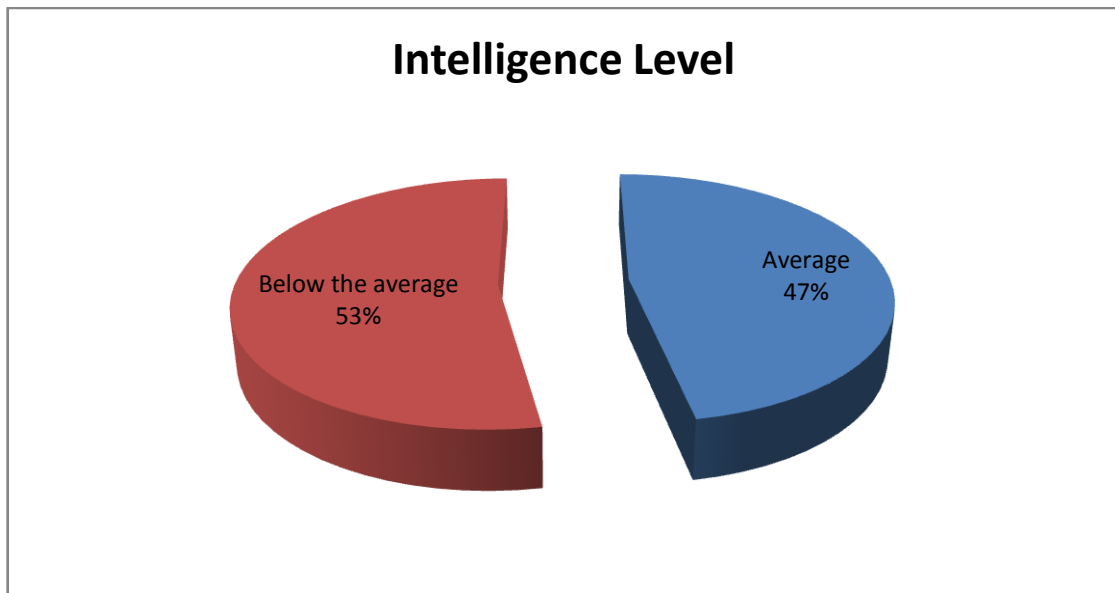


Fig. 3. Indicators of Children's Intellectual Development

Calculation of implemented tasks showed that children fulfilled $38.7\% \pm 1.2\%$ of tasks, which amounts to 23.1 ± 0.7 points. Indicator of attention level, imagination and visual discrimination as well as interconnection in the Raven's test amounted to 6.7 ± 1.1 points, detection of analogies among figures – 7.3 ± 1.1 points, level of dynamic attention and making of dynamic analogies – 5.2 ± 0.9 points, ability to accept quantitative and qualitative changes and to arrange them according to the pattern of used changes – 2.8 ± 0.6 points, ability to

observe complex quantitative and qualitative development of kinetic, dynamic rows displaying abstraction and dynamic synthesis – only 1.1 ± 0.3 points.

ASD screening using CARS (Childhood Autism Rating Scale, adapted by Morozov T.Yu., Dovbnya S.V., 2011).

ASD screening diagnostics showed that all examined children took less than 30 points, i.e. no signs of autism were detected. However, $5.3\% \pm 1.6$ of the examined children took from 20 to 25 points, i.e. there were certain disorders. Deviancies were detected with respect to attitude to people, adaptation to changes, anxiety and fears, verbal and nonverbal communication, activity level and consistency of intellectual response (Fig. 4). Contrary to expectations, girls showed more unfavorable signs than boys, but intensity of boys' signs was higher. However, small amount of sampling does not allow us to judge on statistical significance of the differences.

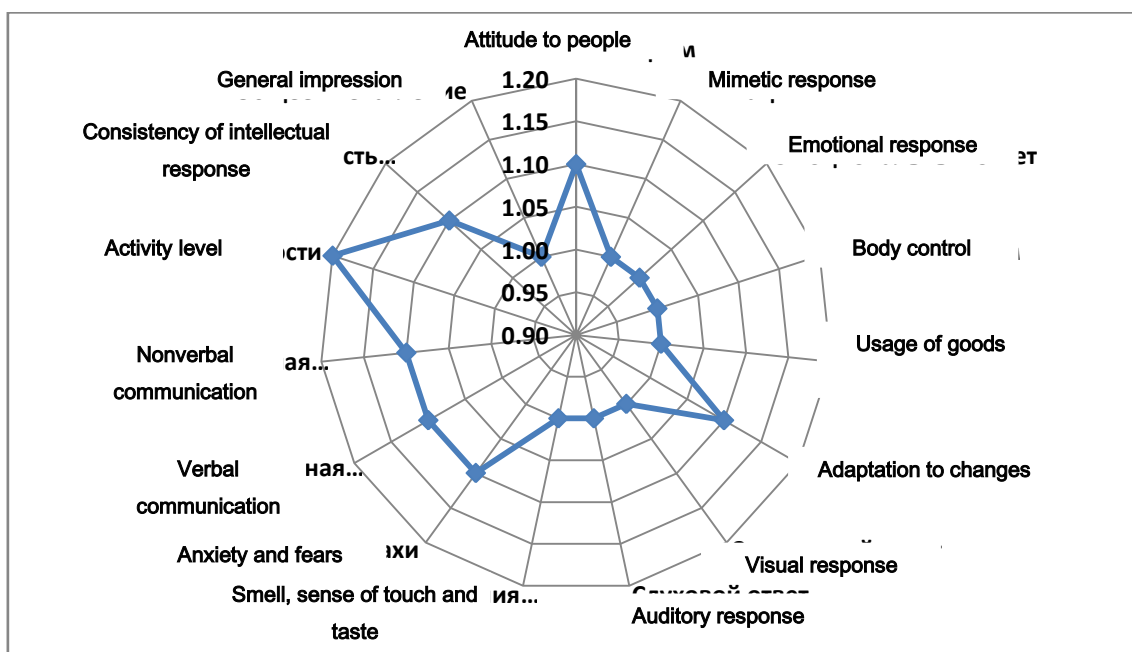


Fig. 4. Distribution of CARS Scale Indicators

Mental capacity using correction tables of V.Ya. Anfimov. Examination of preschool children's mental capacity revealed that productivity indicator amounted to 5.4 ± 0.5 , mistakes amounted to 2.4 ± 0.7 , missed lines – 11.6 ± 0.4 . The girls missed a little bit less lines than the boys and made less mistakes.

Attention deficiency signs using the hyperactivity rating scale (V.R. Kuchma, 2012). Diagnostics of attention deficit disorder showed that only $5.9\% \pm 1.7$ of parents noted hyperactivity of children. This percent amounted to $22.5\% \pm 3.1$ among the boys. Nursery teachers noted hyperactivity among $8.6\% \pm 2.0$ of children and among $26.7\% \pm 3.2$ of boys.

Anxiety evaluation (according to A.M. Prikhozhan). Study of preschool children's anxiety showed that the children took 9.6 ± 0.3 points according to the obvious anxiety scale, the boys took a little bit more – 9.8 ± 0.3 . Interpersonal anxiety amounted to 4.6 ± 0.4 points, self-appraisal anxiety – 4.9 ± 0.4 points ($p < 0.05$). Interpersonal anxiety of girls was higher than the boys' anxiety and amounted to 4.2 ± 0.6 (the boys took 2.8 ± 0.4 points). The method of projective anxiety diagnostics according to A.M. Prikhozhan (using situational pictures) together with sociometric research allowed to detect regularity and direct relation of anxiety and self-appraisal ($r = 0.57$)

IV. Discussion of Results

The ASD diagnostic criteria (determined by ICD-10 and required for establishing diagnosis) are grouped as follows: qualitative abnormalities of social interaction and communication changes, limited, repeated stereotypic templates in behavior and interests (activity), non-specific problems (fears, phobias, excitement, disturbance of sleep and eating habits, outbursts of rage, aggression, self-inflicted injuries). One of diagnostics conditions is that manifestation of these symptoms shall be detected before the child is three years old.

Our research showed that the EIA screening methods as well as other methods of children neuropsychic development examination used as screening ones are too labor-intensive and yield little information. Even with large sampling of the examination [20] variability of obtained data of conducted

epidemiologic examination is high. A consistent approach to examination and data interpretation is required [20]. Conducting screening examinations, some authors note that detected cases are related to severe obvious disorders, which need psychiatric support, and the problem of care delivery to the children of ASD risk group remains unsolved. We still have a current problem of detection of children of ASD risk group, who primarily face the problems of medical pathology, in particular, gastrointestinal and endocrine disorders, in particular, children with obesity [21] and functional gastrointestinal disorders.

Examination of child's neurologic state, as a rule, shows most gross changes on the part of the central organs of nervous system. Therefore, predisposing changes of autism spectrum remain unnoticed. Such disorders can manifest long after, when the situation of oxidative stress occurs [22].

ASD are not always or rarely accompanied by mental development disorders and on the background of general trend of decrease of intellectual abilities in the population they cannot be diagnostic criteria for the screening. Disorders of communicative and social interactions due to global computerization are widely spread in the society. Therefore, the indicators of mental productivity, intellectual development and anxiety obtained in our examination can hide changes of the autistic spectrum.

V. Summary

Conducting of ASD screening diagnostics for children remains a perspective trend, which allows detection of initial signs of mental pathology and detect children of mental pathology development risk group at an early stage and develop optimal algorithms of measures of specialized psychoprophylactic care. However, first of all, in is necessary to understand ASD etiology and pathogenesis or psychogenic nature of autistic spectrum changes.

VI. Conclusion

Increase of amount of children with ASD is a worrying fact for the scientific community. Search for the most sensitive autism markers for examination of child's neuropsychic state and epigenetic mechanisms of autistic spectrum disorders and pathogenesis of its development remains an actual trend of scientific research.

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