

Clinical and Neurological Changes in Children with Down Syndrome Based on The Cytogenetic Profile

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ABSTRACT

Down syndrome is the most common chromosomal pathology. It occurs when another chromosome appears in the 21st pair as a result of a random mutation. Often, children with Down syndrome (DS) and related disorders have some neurological problems, severe forms of stereotyped behavior. The purpose of this article was to study the neurological conditions of children with DS. Clinical, neurological, studies were performed in 120 children (75 boys, 45 girls) with DS. It was found that in children with trisomy, neurological deficits in the form of speech disorders, fine motor skills of the hand, disorders of the coordination sphere and autonomic dysregulation are more severe than in children with mosaic and translocation types.

KEYWORDS: Down syndrome, neurological status, MAS score, Nine-hole peg test, children.

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RELEVANCE

Down syndrome is a genetic abnormality, a congenital chromosomal disease that occurs as a result of the appearance of an extra chromosome. The cells of the human body normally contain 46 chromosomes. In children who born with Down syndrome, the 21st pair has an extra chromosome, resulting in the presence of 47 chromosomes [3,6]. According to the World Health Organization (WHO), "... the incidence of Down syndrome is approximately 1 in 700-800 newborns. This indicator is the same in different countries, climatic zones and social strata. The main factor in the birth of a child with Down syndrome is the mother's age... ". Analytical data show that the birth rate with Down syndrome is equal among boys and girls [1,4,9,18].

Down syndrome (DS) is one of the common genetic abnormalities that lead to disability in the child population. In recent decades, there has been a significant increase in the incidence of this disease, which may be due to unfavorable environmental factors, an increase in the age of parturient women, uncontrolled intake of medications by pregnant women [4]. The risk factor may be the mother's age after 35 years [8,13,15]. Children with DS have a number of predispositions to conditions such as: hearing loss, frequent middle ear infections (otitis media), thyroid

pathology (hypothyroidism), speech disorders, cervical spine instability, visual impairment, sleep apnea, obesity, constipation, infantile spasms, seizures, dementia and early-onset Alzheimer's disease [2,5].

About 18% to 38% of people with Down syndrome have mental or behavioral disorders such as: autism spectrum disorders, attention deficit hyperactivity disorder, depression, stereotyped movement disorders, and obsessive-compulsive disorders [7,9,12]. Speech underdevelopment in these children (pronounced damage to the articulatory apparatus, stuttering) often masks the true state of their thinking, creates the impression of lower cognitive abilities. However, when performing non-verbal tasks (classifying objects, counting operations, etc.), some children with DS may show the same results as other pupils [1, 10]. Children with DS have significant difficulties in developing the ability to reason and build evidence. Children find it more difficult to transfer skills and knowledge from one situation to another. Abstract concepts in academic disciplines are not available for understanding. It can also be difficult to deal with practical problems that arise. Limited ideas, insufficient inferences underlying

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mental activity, make it impossible for many children with DS to learn certain school subjects [11, 16, 19].

Most children with DS have hypomnesia, instability of active attention, increased fatigue and exhaustion, which requires more time to learn and master new skills, and memorize new material. It should be noted that auditory short-term memory and processing of information received by ear in these children are insufficiently developed [3,8,14,17].

The presence of this problem in all countries of the world requires an increase in the effectiveness of habilitation, methods of treatment, and early rehabilitation measures have been taken.

The aim of this study was to study the clinical and neurological conditions of children with DS.

MATERIALS AND METHODS OF RESEARCH

Following the tasks defined in the work, a clinical examination of 120 children with DS was carried out. The diagnosis was made on the basis of the results of cytogenetic and clinical neurological studies with the determination of the phenotype characteristic of DS. Depending on age, the children were divided into two groups - the 1st group of children aged 3 to 6 years old and the 2nd group of children aged 7 to 12 years old with various cognitive deficits and intellectual disabilities. The study included children receiving treatment in the private clinic "ReaCenter" and

brought up in the non-state educational institution "Umnichka" in the period 2019 - 2021.

The age graduation of children ranged from 3 to 12 years old (Table 1). The average age was 6.2 ± 2.8 years.

Table 1. Distribution of children by gender and age.

Children's age	Boys		Girls		Total	
	abs.	%	abs.	%	abs.	%
3-6 years	55	45,8	32	26,7	87	72,5
7-12 years	20	16,7	13	10,8	33	27,5
Total	75	62,6	45	37,5	120	100,0

Of the total surveyed children aged 3 to 6 years and 11 months were 87 (72.5%), the average age was 4.3 ± 1.2 ; there were 33 (27.5%) children from 7 to 12 years old, the average age was 8.5 ± 1.3 years. The duration of follow-up was 2.5 years on average. 45 girls and 75 boys were observed. 97 infants (80.8%) were born full-term, 23 (19.2%) were premature at 35.3 ± 1.1 weeks. The number of boys among patients prevailed over the number of girls, and the ratio was 1.7:1, respectively.

Also, the division of children with DS into groups was carried out on the basis of the results of cytogenetic karyotyping: the main group consisted of 88 children with trisomy on chromosome 21 (73.3%). The comparison group consisted of 11 children (9.2%) with mosaicism and 21 children with translocation (17.5%).

trisomy 21. The majority of children (98.3%) showed diffuse hypotension and hypermobility of joints in the neonatal period; therefore, motor skills were formed with a lag, especially in the main group of children with DS than in the comparison group with mosaicism and translocation.

The delay in motor development in children with DS and the age at which motor skills such as the ability to sit, crawl and walk independently differed significantly from those children who are healthy. In the main group of children with DS, the sitting skill was formed by, on average, 10-16 months. The crawling skill was formed after 12-20 months and persisted for a long time. Independent walking skills were formed on average after 2 years. Moreover, we noted that the delay in the development of fine motor skills, which also accompanied children with DS. Such motor acts as holding a toy and the ability to hold a spoon were also formed with a noticeable delay, which corresponds to the literature data on delayed psycho-motor development in children with DS. In addition, retrospective analyzes of medical records showed that these children had weak inadequate manifestations of emotional reactions (revitalization at the sight of familiar adults, joy from a favorite toy), late humming, which was associated with the late formation of speech and, as a result, underdevelopment of speech functions.

To study fine motor skills on the MAS scale, the study was carried out in all subjects over 7 years of age

Table 2. Distribution of children by cytogenetic forms

Types of DS	The first group		The second group		Total	
	abc.	%	abc.	%	abc.	%
Trisomy 21	54	45,0	34	34,2	88	73,3
Translocation	7	5,83	14	11,7	21	17,5
Mosaic	8	6,67	3	2,50	11	9,2
Total	69	57,5	51	42,5	120	100,0

Research results: according to anamnestic data, at the time of the birth of the proband, the mother's age from 19 to 25 years was 36 (30%) women; at the age from 26 to 35 years 52 (43.3%) women and 32 (26.7%) women aged 36 to 49. A study of the age of fathers at the time of birth of children with DS showed that 37 (40.4%) were aged 36 and older. Of the 120 parents of the proband (95%) were not heredity diseases.

We analyzed the antenatal and perinatal history of all patients based on questionnaires, interviews with parents, and study of outpatient records. pre- and perinatal history were studied. Children with DS were characterized by a lag in psychomotor development, especially children with

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included in the study. It should be noted that in the groups of children with mosaic and translocation forms the average score was 5.5 points, and in the group of children with trisomy - 4 points.

Table 3. Results of the assessment of fine motor skills of the hand in children with DS.

№	Test and Scale	Main group (n=88)	Comparison group (n=32)
1.	MAS(score)	4 score+	5,5 score+
2.	Nine hole peg (sec.)-dominant right hand	Boys-60 seconds Girls-60 seconds	Boys-45 seconds Girls- 40 seconds

According to the results of the 9-peg test, the study is based on the assessment of the dexterity of the fingers of the hand, with the registration of the time spent on placing the 9 pegs. In doing so, we examined the dominant hand, mainly the right one. According to the results of the tests carried out also in children over 7 years old, we can also say that fine motor skills in children with trisomy suffer more than in the comparison group with mosaic and translocation. Thus, in children with DS, there was motor awkwardness, lack of formation of fine differentiated motor acts, which was more pronounced in the main group with DS trisomy 21 type.

It should be noted that all examined children with DS experienced varying degrees of eating, swallowing and speech difficulties due to the high arched palate, small upper jaw, as well as low muscle tone in the tongue and weak muscles of the oral cavity. In these children, phonemic hearing was preserved, but the productivity of expressive speech was greatly reduced. They mainly used communication through simple words and gestures. Children could not always name the object correctly, but with the help of movements they depicted how they use these objects.

In our study, children with DS had a history of very often pathology of ENT organs: adenoids, chronic tonsillitis, rhino-sinusitis, otitis media. Due to frequent episodes of morbidity, children were often included in the group of frequently ill children, upper respiratory tract diseases led to repeated pneumonia, often of a protracted nature, which also negatively affected the psychomotor development of children with DS.

Almost all parents of the examined groups with DS complained of signs of autonomic dysfunction in the form of marbling of the skin (in 59.1% -52 children of the main group and 40.6% -13 children of the comparison group), hyperhidrosis of the palms and feet (in 79, 5% -70 children of the main group and 62.5% -20 children of the comparison group), meteorological stability (in 90.9% -80 of the main group and 56.3% -18 children of the comparison

group), signs of asthenization of the nervous system in the form of increased fatigue (in 81.8% - 72 children in the main group and 62.5% - in 20 children in the comparison group), irritability (in 56.8% - 50 children in the main group and 50% - in 16 children in the comparison group), sleep disorders - in 56.8 % - 50 children of the first and 28% - 9 children of the comparison group, respectively.

Thus, a comparative analysis of the results of the study showed that both the symptoms of asthenization and autonomic dysfunction were more pronounced in the main group of children with trisomy types of DS.

CONCLUSIONS

Thus, the children with DS we observed were born mainly to women aged 20-30 years, and fathers, on average, 30-45 years old. The study of the clinical and neurological characteristics of children with Down syndrome revealed different degrees of severity of neurological disorders, depending on the type of cytogenetic profile. Namely, a more pronounced neurological deficit in the form of speech disorders, fine motor disorders of the hand, disorders of the coordinating sphere, autonomic dysregulation was revealed in children with trisomy, compared with children who were mosaic and translocation types.

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