Hypothyroidism Prediction Analyzing Psychic Behavior in Newborns

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Abstract

Thyroid function disorders are the most common pathology of endocrine glands, which has a significant impact on the physical and mental development of children.
Diagnosis of thyroid pathology in newborns and infants is very difficult. They are caused by peculiarities of functional activity of the thyroid gland in newborns and infants, postnatal modifications of pituitary-thyroid system, as well as numerous "masks" of other pathological processes, under which thyroid pathology can hide. In addition, the formation and functional activity of the child's thyroid gland is closely related to the health of the mother and the course of pregnancy. Transient neonatal hypothyroidism (TNH) is reversible, and thyroid function subsequently recovers, but intellectual development disorders remain lifelong. Unfortunately, data on the consequences of neonatal transient hypothyroidism are rather fragmentary and contradictory.
Aim. The aim of the present study was to investigate the features of mental development in children with congenital transient hypothyroidism during the neonatal period.
Material and Methods: clinical-psychopathological, clinical-catamnestic, experimental-psychological and statistical research methods.
Results. Based on learning and applying research methods, were first studied long-term results of neonatal transient form of hypothyroidism to 11 years. The validity of the timely use of thyroid drugs in combination with neuroprotective showed efficiency.
Conclusion. Given the paramount role of thyroid hormones in the formation and maturation of the nervous system in children, the special significance of transient hypothyroidism among other endocrinopathies of newborns and children becomes obvious, which necessitates its further study.

Key Words: Behavior, Prediction, Analyzing.
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Introduction

Thyroid gland regulates the functional activity of the central nervous system throughout human life (1-3).
Thyroid hormone deficiency at any stage of brain formation turns into trouble: the brain stops in development, it is subjected to degenerative changes, which dramatically worsens the intellectual and motor functions of the person. As a result of hypothyroxinemia, dysontogenesis of higher mental functions occurs in the developing brain. This is associated with impaired maturation and migration of nerve cells, weakened myelination and inhibition of neurocyte outgrowth and synaptogenesis, reduced synthesis of nerve growth factor, neurotransmitters and neuropeptides. Such

abnormalities are a prerequisite for impaired formation of human cognitive functions (4,5).
Thyroid function disorders are the most common pathology of endocrine glands, which have a significant impact on the physical and mental development of children (6-8).
Diagnostics of thyroid pathology in newborns and infants is very difficult. They are caused by peculiarities of functional activity of the thyroid

gland in newborns and infants, postnatal rearrangements of pituitary-thyroid system, as well as numerous "masks" of other pathological processes under which thyroid pathology can hide (9-11).

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In addition, the formation and functional activity of the thyroid gland in the child is closely related to the health of the mother and the course of pregnancy. (12-14). In case of pregnancy pathology, an important aspect is the diagnosis and timely correction of transient thyroid function abnormalities in children.

Thyroid hormone deficiency often occurs at the end of pregnancy and in the first week of postnatal life, i.e. in that critical period of CNS formation when the cortex is actively maturing. Transient hypothyroidism in newborns (TNH) is reversible and thyroid function subsequently restores, but intellectual development disorders remain for life (15,16). Unfortunately, data on the consequences of neonatal transient hypothyroidism are rather fragmentary and contradictory (17-19).

Given the paramount role of thyroid hormones in the formation and maturation of the nervous system in children, the special importance of transient hypothyroidism among other endocrinopathies of newborns and children becomes apparent, which necessitates its further study.

Material And Methods

The palpatory examination of the thyroid gland was performed jointly with endocrinologists of the Republican Scientific and Practical Center of Endocrinology of the Ministry of Health of the Republic of Uzbekistan; its degree of enlargement was assessed according to the WHO classification (20).

The maternal and fetal pituitary-thyroid systems were studied by radioimmune analysis (RIA).

The level of thyroid hormone (TSH) was determined with standard commercial kits "IMMUNOTECH" (Czech Republic) in the laboratory of the Scientific Research Institute of Obstetrics and Gynecology of the Ministry of Health of the Republic of Uzbekistan. The concentration of TSH in the newborns was determined using standard DELPHIA kits.

Clinic-psychopathological examination of the mental status was performed according to the standard technique of early childhood examination. An ethological method (observation of behavior in free communication) was used to observe the child and the mother in the "mother-child" system.

The clinical diagnosis of psychiatric disorders was based on the clinical classification of psychopathological syndromes specific to childhood and the research diagnostic criteria of Title V (Mental and behavioral disorders) of the International Classification of Diseases, 10th revision (ICD-10) (21).

To assess the level of neuropsychological development of children at 1 year of age, the quantitative-qualitative screening technique was used. Psychomotor development of children from 1 to 3 years of age was investigated on the basis of the methodological recommendations for evaluation of early childhood psychomotor development developed by A. Panasyuk and L. Budareva at the Department of Child Psychiatry, COLLIUW, headed by Professor V. V. Kovalev (22). At preschool age, as well as at school age, attention was paid to the development of speech, thinking, memory, social contacts, and general mental status.

The obtained data were statistically processed on a Pentium-4 personal computer using the programs developed in the EXCEL package using the library of statistical functions, calculating arithmetic mean (M), standard deviation (□), standard error (m), relative values (frequency, %), Student's test (t) with the calculation of the probability of error (P). Differences of mean values were considered reliable at significance level $P<0.005$. Correlation coefficient (r) was calculated to

determine the nature of the relationship between the indices.

Results

The work reflects the study of extra-genital history, pregnancy and childbirth complications in women, as well as the condition of newborns with high and normal levels of thyrotropic hormone (TSH).

The observations suggest that thyroid pathology was significantly more common in the study group (P<0.001), and chronic infections were more common in the control group mothers (P<0.001).

The most common extragenital pathology in mothers who gave birth to children with hypothyroidism phenomena was thyroid disease (62.5% of cases), whereas in women who gave birth to children without signs of hypothyroidism chronic infection was predominantly encountered (26.7% of cases, P<0.001).

At the next stage of our study, when assessing the condition of newborns according to the Apgar scale, we found that in children of the 3rd group the mean score was significantly lower than that of children in the first two groups.

A dynamic study of umbilical cord and capillary blood TTH levels in children showed that in the first day of life the mean TTH value in the control group was 7.65±0.20 mEU/l, which was significantly higher than in the first (28.9±0.49 mEU/l, P<0.001) and third (30.7±1.22 mEU/l, P<0.001) groups. The level of TSH in children in the second group (7.74±0.20 mEU/L) corresponded to the control values (Fig. 1).

The study of statomotor function showed that in groups 2 and 3, significantly fewer children held their heads upright by the third month of life (Table 1). In the second and third groups, the delay in the formation of walking function was very significant.

Thus, only 5.0% and 3.3% of the children walked independently before one year of age, while in the first group, there were no significant differences compared to controls. In addition, a significantly lower number (36.7%) of children in the third group were able to sit up independently without support until 9 months of age.

Delayed development of self-care skills due to impaired development of motor components was found more often in children in the main group (4.0% in group 1, 10.0% in group 2, and 26.7% in group 3 vs. 3.3% in the control group P<0.005).

General motor activity was characterized by the following features: in the main group (6.0% in the 1st group, 15.0% in the 2nd group, and 30.0% in the 3rd group vs. 3.3% control; P<0.005) children were disinhibited, hyperdynamic, fidgety. It should be noted that the number of children with hypodynamic syndrome was significantly higher in Group 3 (40.0% vs. 3.3% of controls; P<0.005).

The conducted studies showed that by the 3rd month, the complex of cheerful face appeared in 88.0% (vs. 96.7% in the control, P>0.005), 67.5% (P<0.005) and 36.7% (P<0.001) of the children of the 1st, 2nd and 3rd groups, respectively. Sensory reactions such as visual fixation, auditory concentration, typical for this age, were evoked inconstantly in 33.3% (vs. 6.7% in controls, P<0.005) of children in group 3. In 13 (43.3%) children of the same group, already in the first 3 months of life, a delay in the formation of emotional symptom complexes and modes of interaction with adults was observed. Elements of visual-motor coordination were absent in 20.0% of the children. The majority of Group 3 children were characterized by lethargy, insufficiently expressed positive emotional reactions. By the 4th-6th months, distinct positive emotional reactions were already noted in 30.0% of children, though the complex did not contain all of its components (motor, vocal, emotional).

The study of children with HHT showed that in Groups 1 and 2, children in the quantitative assessment of neuro-psychological development belonged to the unconditional risk group, although positive developmental dynamics were noted. By one year of observation, the PDC (psychological development sufficiency) in these groups was 25.7±0.4 points and 25.4±0.7 points, respectively.

In the structure of mental disorders in children with HHT at the age of one year in the second and third groups, hyperexcitability syndrome (respectively, 37.5±7.8%, P<0.005; 50.0±9.3%, P<0.001), and neuropathy syndrome (respectively, 35.0±7.6%, P<0.001; 40±9.1%, P<0.001) dominated. Temporal delay of pre-speech development was noted in all three groups. The appearance of babbling by 5-6 months was observed in a significantly lower number of children in Group 3 (36.7±9.0; P<0.001), while in the control, first and second groups this figure was 86.7±6.3%, 82.5±6.1%, and 80.0±7.4% (P<0.001), respectively.

Analysis of the formation of eating and self-service skills lagged in significantly more children in all three groups compared to controls.

In the second year of life, children with HHT had a significantly lower mean developmental rate (92.4±1.5 points in Group 1, 90.5±1.5 points in Group 2, and 88.4±1.6 points in Group 2) than controls (96.2±1.4 points, P<0.001). There were no significant differences in CRC (P>0.005) between the groups of children who underwent HHT .

In the third year of life, PDC in children with HHT was also significantly lower (94.2±1.5 points - group 1, 91.6±1.6 points - group 2, and 89.8±1.5 points) than in the control group (97.9±1.4 points, P<0.001). It should be noted that the PDC of Group 3 children was significantly lower than that of Group 1 (P<0.005), but did not differ from that of Group 2 (P>0.005).

Partial mental retardation (20.0%) and hyperkinetic disorders (12%) at the age of 5-7 years were recorded only in children of the main group. At this age, specific disorders of speech development were significantly more frequent in children in the main group (P<0.005) and were represented mainly by specific disorders of articulation (24.0%) and disorders of expressive (12.0%) and receptive (6.0%) speech. Disorders of school skills formation were recorded significantly more frequently in 12 (24.0±6.1%; P<0.005) children of the main group. Their structure was dominated by specific reading disorder - dyslexia in 11 (22.0%) cases, specific counting disorder - dyscalculia in 9 (18.0%) cases, and specific writing disorder - dysgraphia in 8 (16%) cases. There was a significant correlation between speech disorders at 5-7 years of age and disorders in the development of school skills (r=0.72, P<0.005).

Children with HHT had rather frequent sleep disorders. They manifested as parasomnias (sleepwalking and sleep speaking with elementary motor automatisms, less often as nightmares) in 3 children (10.0%), as disomnias (restless sleep, difficulty falling asleep) in 6 children (20.0%), while in the control group only 1 child (3.3%) had such disorders. The structure of neurosis-like disorders also included enuresis (12.0%) and stuttering (4.0%). Neurosis-like enuresis was detected from an early age, initially appearing as a delay in the formation of tidiness skills. Neurosis-like stuttering had the following characteristic features: monotony, low dependence on circumstances, unexpressed experience of a speech defect, etc.

In the clinical picture in 40.0% of the children who had HHT, cerebrasthenic syndromes dominated, asthenodynamic variant with violations of school skills, mainly related to insufficient development of spatial perceptions (children learned mathematics, physics, geography worse). Mental infantilism was revealed in 30,0% of the children.

Mild cognitive disorders in the main group occurred approximately twice as often as in the control group (13.4% and 6.7%). Mental retardation in children of the main group was aggravated by the hyperdynamic syndrome and disorders of sleep, appetite, and adaptation.

Mental infantilism occurred about 4.5 times more frequently in the main group than in the control group. Organic variant of mental infantilism was revealed in 3 (10,0%) children, inorganic - in 6 (20,0%) schoolchildren. There was a moderate correlation between speech disorders at 5-7 years of age and disorders of school skills development in the same children at the age of 10-11 years (r=0.35, P<0.005).

The clinical picture of mental disorders included decreased intellectual productivity,

memory, inertness of mental processes, slowed thinking, difficulties in switching active attention, low work capacity, increased fatigue, easy exhaustion in the process of teaching children school skills.

Discussion

The results of the study allowed us to formulate the following conclusions:

Maternal complications of pregnancy (anemia, gestosis, acute infections during pregnancy) and childbirth (delayed childbirth, labor anomalies, abdominal childbirth) preceded the birth of children with transient hypothyroidism with high frequency. Cases of asphyxia, hemolycdynamic disorders, respiratory distress syndrome, intrauterine hypotrophy, and prolonged hyperbilirubinemia were statistically significantly more frequent among neonates with transient hypothyroidism compared to control groups. There was a strong association between the presence of maternal thyroid pathology and the level of thyroid hormone in the blood of the newborn in the early neonatal period.

In this study, we found that 30% of newborns with high and normal levels of thyrotropic hormone (TSH) had elevated delayed mental development and we also noted that thyroid pathology was significantly more common in newborns whose mothers have extragenital pathology. Of note, the most common cause of TSH elevation in newborns with signs of hypothyroidism was thyroid pathology and chronic infections of their mothers. Elevations of umbilical cord and capillary blood TTH levels were highly common in newborns with signs of hypothyroidism and there was a significant correlation between control and study groups. However, Apgar scale elevation was showed low indicators for the third group (generally mild and transient newborns). We also noted that in newborns signs of hypothyroidism not developed statomotor functions compared to newborns with mild signs of hypothoridism. The most common symptom of hypothyroidism as elements of visual-motor coordination were absent in 20% of newborns with signs of hypothyroidism expressed in lethargy, insufficiently expressed positive emotional reactions, visual fixation, auditory concentration. We also found a correlation between neuro-psychological development and psychological development sufficiency in these newborns, which implicates that the negative effect of increased TTH on the brain is reflected in appearcne of mental disorders such as hyperexcitability syndrome. A previous study investigated the influence of iodine deficiency on neuro-psychical development of children with neonatal transient hypothyroidism and revealed subclinical hypothyroidism and low neuropsychological development index (13). Another study reported that elevation of high level of TSH at mothers that occurred during the pregnancy indicated neuro-intellectual impairment of the child and the study also noted that association between subclinical hypothyroidism (SCH) and impaired neuropsychological development has a prognostic significance (9). In the present study, we found that increase in the number of children with neuro-psychiatric developmental disorders is elevated due to the growth of TH values (22). Similarly, in our study, a significant increase in mental disorders was noted, particularly in patient with high level of TH.

Conclusion

The results of our survey showed that the majority of children with HHT In the first year of life had delayed neuropsychological development, manifested by delayed formation of motor skills, emotional reactions, and cognitive components. The frequency and severity of mental disorders were found to depend on the dynamic characteristics of HHT.

1. With sufficient development of gross motor skills in the second year of life, the majority of children who had HHT in early childhood (1-3 years) showed delayed development of fine movements and speech, as well as formation of self-care and tidiness skills. Children with the least favorable dynamics of HHT most often showed signs of general and partial mental retardation, decreased

or pathologically increased motor activity and attention deficit.

2. Subsequent age dynamics of mental disorders in children who had HHT was characterized by a relative alignment of age-specific indicators of intellectual development, while in some cases, phenomena of mental infantilism, specific disorders of speech development and formation of school skills persisted. At school age, productive psychopathological disorders of borderline level predominated, most often in the form of cerebrasthenic or neurosis-like syndromes.

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Table 1. Statomotor Function Indices in Children with Transient Hypothyroidism

		Groups

	Age	1 n= 50		2 n=40		3 n=30		Control n=30	
		Abs	%	Abs	%	Abs	%	Aba	%
Keeping the head upright	< 3 m.	34	68.0±6.5	24	60.0±6.9	17	56.7±9.0	26	86.7±6.2
	>3 m.	16	32.0±6.5	16	40.0±6.9	13	43.3±9.0	4	13.4±6.2
*<, to control		0.005 0.005		0.001 0.005		0.005 0.005			
Sitting without support	< 9 m.	29	58.0±6.9	22	55.0±7.8	11	36.7±8.7	20	66.7±8.6
	9-12 m.	21	42.0±5.8#	18	45.0±7.8	19	63.3±8.7	10	33.3±8.6
*<, to control						0.005 0.005			
Walking	9-10 m.	5	10.0±4.2	2	5.0±3.4	1	3.3±3.2	7	23.4±7.7
	1 year	36	72.0±6.8###	28	70.0±7.2###	5	16.7±6.8	22	73.3±8.1
	> 15 m.	9	18.0±4.0###	10	25.0±6.4###	24	80.0±7.7	1	3.3±3.2
*<, to control			- - 0.001		0.005 - 0.001		0.005 0.001 0.001		

Note: *- p, ### - Reliability of the data to the 3rd group

Table 2: Indicators of Neurological-Psychological Development of Children in the First Month of Life

Groups	PDC			Total
	27-29 points	23-26 points	> 23 points	
I (n=50)	9 (18%)	29 (58%)	12 (24%)	50 (41.7%)
II (n=40)	-	30 (75%)	10 (25%)	40 (33.3%)
III (n=30)	-	12 (40%)	18 (60%)	30 (25%)
Total:	9 (7.5%)	71 (59.2%)	40 (33.3%)	120 (100%)