



RESEARCH ARTICLE

Incidence of Lesions of Organs and Systems in Iron Deficiency Anemia in Children and Its Predictive Significance in the Development of Diseases of Internal Organs

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Abstract

This article deals with the study of the incidence of somatic pathology in children with iron deficiency anemia. It is shown that children with anemia more often have respiratory pathology, and less often - endocrine diseases. Somatic pathology is almost equally diagnosed in boys and girls and predominates in young children. The authors established the importance of iron deficiency anemia in the development of diseases of internal organs, determining the time of formation and nature of the disease, as well as increasing the risk of involvement of a number of organs and systems in the pathological process.

Keywords: *Iron deficiency anemia, children.*

Introduction

Iron deficiency anemia (IDA) is a common pediatric hematological disease, characterized by a decrease in hemoglobin concentration, as a result of iron deficiency and impaired metabolism [1, 17]. According to WHO, more than 20% of the world's population suffers from iron deficiency and its incidence does not decrease. A risk group for the development of IDA includes small children, adolescents, and women of reproductive age. In Russia, the share of iron deficiency anemia varies from 4 to 76% in different regions [1, 2, 3, 6, 9]. It has been established that iron deficiency adversely

affects the functions of the organs and systems of the child's body.

Studies have shown that iron deficiency anemia causes frequent morbidity, impaired growth, and development of children. Children with iron deficiency anemia show psychomotor retardation, impaired cognitive functions and mental abilities [2, 3, 4, 7, 8, 9, 11, 12, 13, 15]. 500-600 million people are diagnosed with iron deficiency as an accompanying syndrome in chronic diseases, causing a complicated course of the disease [1, 3, 5, 6, 9, 20, 21]. Anemia can be either a primary or secondary syndrome of chronic

diseases. Moreover, anemia on the background of acute diseases in most cases is stopped independently, which distinguishes it from anemias associated with chronic pathological processes [2,3,4,6,8, 15, 17, 18, 19]. The study of the incidence of iron deficiency anemia and the effect of iron deficiency on the formation of somatic pathology in children will help identify the causal relationships of the disease, formulate risk groups, and identify protective factors that determine the nature of the course and outcome of diseases.

In this regard, the definition of the role of anemia in the formation of dysfunctions of internal organs and the development of chronic pathological processes is timely and relevant, will reduce the incidence of complications and improve the outcome of the disease. The objective of the research was to study the frequency of iron deficiency anemia among children with somatic pathology and determine its significance in the course of the disease.

Materials and Methods

The incidence of somatic pathology was studied among 2268 children with iron deficiency anemia, 1157 of which were boys (51.01%), and 1111 - girls (48.99%) aged 1 to 17 years old, undergoing medical treatment in children's somatic units of SBHI DCCH RB. The main group consisted of 100 patients with IDA with somatic pathology, including 48 (48%) boys and 52 (52%) girls aged 1 to 17 years old. The test group included 30 patients with IDA without somatic pathology and the control group - 30 healthy children of similar age. The principles of analytical and descriptive epidemiology were used to study the incidence of IDA in children with somatic pathology.

The selection of the observation contingent was carried out on the basis of descriptive epidemiology using the patient's epidemiological map (computer-oriented for scientific research) No. 601-SRI. A retrospective analysis of medical records (statistical reports, children's medical records - form No. 26, inpatient medical records - form No. 003/U, children's history of development - form No. 112, laboratory study records - form No. 251-U) of somatic units SBHI DCCH RB for 2012-2015.

Clinical examination of patients was carried out according to the generally accepted method, taking into account complaints, anamnesis, and assessment of the objective status of the child. Laboratory examination included peripheral blood test with leukocyte count, indicators of erythropoiesis and iron metabolism (the content of erythrocytes and hemoglobin, mean corpuscular volume (MCV), average hemoglobin content in one erythrocyte (MCH), the mean concentration of hemoglobin (MCHC), the degree of anisocytosis erythrocytes (RDW), the concentration of serum iron and ferritin, TIBC (total iron binding capacity), TSC (transferrin saturation coefficient), sTR (soluble transferrin receptors); urinalysis, stool ova & parasites test, indicators of protein metabolism, bilirubin, enzymes, etc.; according to the indications, additional diagnostic and functional methods of research and expert consultations were carried out.

Statistical data analysis was performed with biomedical statistics methods using the SPSS v.11 package, which includes the determination of mean values (M), arithmetic average errors (m) and Student's t-test (t) to assess the reliability (p) of differences with paired changes. The correlation analysis takes into account relations with a coefficient (r) of 0.7 and higher. The difference was considered significant at $p < 0.05$ (Rebrova O.Iu., 2003).

Results and Discussion

A study of the incidence of iron deficiency anemia was conducted among 2268 children with somatic pathology from 2012 to 2015, including 1157 (51.01%) boys and 1111 (48.99%) girls (Table 1). The study revealed concomitant diseases of the respiratory, digestive, cardiovascular, endocrine systems, kidneys and urinary system, allergic pathology (Table 1).

Respiratory diseases were diagnosed in 1039 (45.81%) patients with IDA, including 590 (56.78%) boys and 449 (43.22%) girls, digestive organs - 158 (6.97%), including 67 (42.40%) boys and 91 (57.60%) girls, cardiovascular system - 349 (15.39%), including 137 (39.25%) boys and in 212 (60.75%) girls, kidney disease - in 479 (21.12%), including 241 (50.31%) boys and 238 (49.69%) girls, the endocrine system - in 117 (5.16%), including 54 (46.15%) of boys

and 63 (53.85%) of girls, allergopathology - among 126 (5.55%), including 68 (53.97) % boys and 58 (46.03%) girls (Table 1). Among

(26.81%), from 4 to 6 years - 319 (14.06%), from 7 to 14 years - 409 (18.03%), and from 15 to 17 years - 188 (8.29%)(Table 1, 2).

them, children under the age of 1 year were 744 (32.80%), from 1 year to 3 years - 608

Table 1: The gender-dependent prevalence of lesions of organs and systems in patients with iron deficiency anemia for the period from 2012 to 2015

Years	Children with IDA				Total:	
	boys		girls			
	Abs. number	%	Abs. number	%	Abs. number	%
2012	352	48.95	367	51.05	719	31.70
2013	227	47.79	248	52.21	475	20.94
2014	356	55.71	283	44.29	639	28.18
2015	222	51.03	213	48.97	435	19.18
Total:	1157	100	1111	100	2268	100

Respiratory diseases (lesions of the upper respiratory tract, bronchitis, pneumonia, etc.) were detected in 64.10% of children under the age of 1 year, from 1 to 3 years old - in 24.45%, from 4 to 6 years old - in 5.10%, from 7 to 14 years old - from 5.0%, and from 15 to 17 years old - in 1.35% (Table 3, 4). Digestive pathologies (chronic gastroduodenitis, cholecystitis, pancreatitis, biliary dyskinesia, etc.) were diagnosed in 8.23% of patients under the age of 1 year, from 1 to 3 years of age - in 22.78%, from 4 to 6 years - in 28.48%, from 7 to 14 years - in 27.22%, from 15 to 17 years - in 13.29% (Table 2, 3).

Cardiovascular diseases (carditis, malformations of the heart and blood vessels, systemic diseases, etc.) were diagnosed in 2.86% of patients under the age of 1 year, from 1 year to 3 years - in 29.8%, from 4 to 6 years old - in 22.64%, from 7 to 14 years old - in 27.22%, from 15 to 17 years old - in 17.48%

(Table 2, 3). Endocrine pathologies (thyroid disease and adrenal gland diseases, diabetes mellitus, etc.) were diagnosed in 9.4% of patients under the age of 1 year, from 1 year to 3 years - in 24.79%, from 4 to 6 years - in 15.38%, from 7 to 14 years - in 33.33%, from 15 to 17 years - in 17.09% (Table 2, 3).

Kidney and urinary tract diseases (urinary tract infections, pyelonephritis, cystitis, etc.) were diagnosed under the age of 1 year in 6.68% of children, from 1 to 3 years - in 28.18%, from 4 to 6 years - in 21.29%, from 7 to 14 years - in 32.15%, from 15 to 17 years - in 11.69% (Table 2, 3). Allergic pathology (allergic rhinitis, atopic dermatitis, urticaria, etc.) was diagnosed under the age of 1 year in 9.52% of children, from 1 to 3 years - in 39.68%, from 4 to 6 years - in 17.46 %, from 7 to 14 years - in 20.63%, from 15 to 17 years - in 12.7% (Table 2, 3).

Table 2: The nosology-based prevalence of lesions of organs and systems in patients with iron deficiency anemia for the period from 2012 to 2015

Diseases	Years								Total:	
	2012		2013		2014		2015			
	abs.	%	abs.	%	abs.	%	abs.	%	abs.	%
Respiratory diseases	331	46	187	39	303	47	215	49	1039	46
Kidney and urinary tract diseases	183	25	107	22	115	18	74	17	479	21
Cardiovascular diseases	98	14	69	15	115	18	67	16	349	15
Digestive tract diseases	41	6	43	9	33	5	41	9	158	7
Allergic diseases	35	5	38	8	36	6	17	4	126	6
Endocrine diseases	31	4	31	7	37	6	18	5	117	5

Analysis of the research results showed that children with IDA more often suffer from

respiratory diseases, rather than kidney diseases, cardiovascular, digestive

pathologies, allergic pathology, and endocrine pathologies (45.81% against 21.12%, 15.39%, 6.97%, 5.55%, and 5.16%, respectively) (Table 2, 3). The share of organ lesions was almost equal in boys and girls (51.01% and 48.99%). Children under the age of 1 year, from 1 year to 3 years and from 7 to 14 years old were more likely to develop somatic pathology than children from 4 to 6 years old and from 15 to 17 years old (32.80%, 26.82%, and 18.03% against 14.06% and 8.29%, respectively). The study found that in 2012, iron deficiency anemia was detected in 719 (32%) children, including 352 (49%) boys and 367 (51%) girls; in 2013 - 475 (21%), including 227 (48%) boys and 249 (52%) girls; in 2014 - 639 (28%), including 356 (56%) boys and 283 (44%) girls; in 2015 - 435 (19%) patients, including boys - 222 (51%) and girls - 213 (49%) (Table 2).

Respiratory diseases were diagnosed in 2012 in 46% of children; in 2013 - 39%; in 2014 - 47%; in 2015 - 50%. Kidney and urinary tract diseases were found in 25% of children in 2012; in 2013 - in 22%; in 2014 - in 18%; in 2015 - in 17%. Cardiovascular diseases were found in 13% of children in 2012; in 2013 - in 15%; in 2014 - in 18%; in 2015 - in 15%.

Diseases of the digestive organs are identified in 2012 in 6% of children; in 2013 - in 9%; in 2014 - in 5%; in 2015 - in 9%. Allergopathology was diagnosed in 5% of children in 2012; in 2013 - in 8%; in 2014 - in 6%; in 2015 - in 4%. Endocrine diseases were diagnosed in 4.5% of children in 2012; in 2013 - in 6.5%; in 2014 - in 6%; in 2015 - in 4% (Table 2). In 2012-2015, the share of respiratory diseases in children under the age of 1 year increased from 57% to 78%; from 1 to 3 years- decreased from 34% to 19%; from 4 to 6 years - from 8% to 1.8%; from 7 to 14 years - from 8% to 0.9%; from 15 to 17 years - from 2% to 1.3%.

The incidence of kidney and urinary tract diseases under the age of 1 year increased from 4% to 9%; from 1 to 3 years - decreased from 34% to 27%; from 4 to 6 years- increased from 17% to 27%; from 7 to 14 years - decreased from 34% to 26%; from 15 to 17 years - not changed (11%). The number of children with cardiovascular pathology under the age of 1 year increased from 27.27% to 36.36%; from 1 to 3 years - decreased from 25.0% to 22.11%; from 4 to 6 years - from 29.11% to 12.66%; from 7 to 14 years - from

29.47% to 17.89%; from 15 to 17 years - from 29.51% to 21.31%.

The incidence of digestive pathologies in children under the age of 1 year decreased from 30.77% to 23.07%; from 1 to 3 years old - not changed (25.0%); from 4 to 6 years - decreased from 31.11% to 24.44%; from 7 to 14 years - increased from 20.93% to 32.56%; from 15 to 17 years - decreased from 23.81% to 19.05%. The share of allergopathology in children under the age of 1 year increased from 25.0% to 8.33%; from 1 to 3 years - decreased from 34.0% to 14.0%; from 4 to 6 years - from 27.27% to 9.09%; from 7 to 14 years - not changed (26.92%); from 15 to 17 years - decreased from 12.5% to 0%. The incidence of endocrine pathology in children under the age of 1 year increased from 9.09% to 18.18%; from 1 to 3 years - from 17.24%, to 24.14%; from 4 to 6 years - decreased from 22.22% to 16.67%; from 7 to 14 years - from 35.9% to 10.26%; from 15 to 17 years - from 35.0% to 10.0%.

The results of the study showed a decrease in the incidence of diseases of internal organs from 31.7% in 2012 to 19.18% in 2015, including among boys from 30.42% to 19.19%, and girls from 33.03% to 19.17% (Table 2, 3). A decrease in the share of respiratory diseases was from 31.86% to 20.69%, kidney and urinary tract diseases-from 38.2% to 15.45%, cardiovascular system-from 28.08% to 19.2%, endocrine system-from 26.49% to 15.38%, allergic pathology-from 27.78% to 13.49%.

The incidence of digestive pathologies (25.95%) remained unchanged, although boys showed a slight increase from 22.39% to 23.88% and girls showed a decrease from 28.57% to 27.47%. The decline was found in children under the age of 1 year- from 29.97% to 24.86%, from 1 year to 3 years-from 30.59% to 17.6%, from 4 to 6 years-from 32.6% to 15.67%, from 7 to 14 years-from 36.43% to 15.4%, from 15 to 17 years- from 30.32% to 15.96% (Tables 1, 2, 3).

There was a decrease in the incidence of respiratory pathologies in children under the age of 1 year from 30.78% to 25.22%, from 1 year to 3 years - from 26.38% to 16.14%, from 4 to 6 years - from 49.06% to 7.55%, from 7 to 14 years - from 53.85% to 3.85%, from 15 to 17 years-from 35.71% to 21.42%; allergopathology - under the age of 1 year -

from 25.0% to 8.33%, from 1 to 3 years - from 34.0% to 14%, from 4 to 6 years - from 17.14% to 5.71%, from 15 to 17 years - from 12.5% to 0%; gastric pathology - under the age of 1 year - from 30.77% to 23.08%, from 4 to 6 years - from 31.11% to 24.44%, from 15 to 17 years - from 23.81% to 19.05%; endocrine pathology - from 7 to 14 years - from 35.9% to 10.26%, from 15 to 17 years - from 35.0% to 10.0%; cardiovascular pathologies - from 7 to 14 years - from 29.47% to 17.89%, from 15 to 17 years - from 33.33% to 24.07%; kidney and urinary tract diseases - from 1 to 3 years - from 45.92% to 14.81%, from 4 to 6 years - from 30.39% to 19.61%, from 7 to 14 years - from 14.93% to 12.34%,

from 15 to 17 years - from 35.71% to 14.28% (Table 3). Simultaneously, there was an increase in the number of patients with gastric pathology at the age from 7 to 14 years - from 20.93% to 32.56%; endocrine pathology under the age of 1 year - from 9.09% to 18.18%, from 1 to 3 years - from 17.24% to 24.14%; cardiovascular pathology - under the age of 1 year - from 30.0% to 40.0%. No changes were revealed in the incidence of allergic diseases in children aged 7 to 14 years (26.92%); digestive organs - at the age of 1 to 3 years (25.0%); kidney and urinary tract diseases - under the age of 1 year (21.87%) (Table 3).

Table 3: The nosology- and age-dependent prevalence of lesions of organs and systems in patients with iron deficiency anemia

Diseases	Age, years								Total:	
	1-3		4-6		7-14		15-17			
	abs.	%	abs.	%	abs.	%	abs.	%	abs.	%
Respiratory diseases	9	25.71	11	31.43	9	25.71	6	17.14	35	35
Kidney and urinary tract diseases	3	15.0	6	30.0	5	25.0	6	30.0	20	20
Cardiovascular diseases	4	25.0	2	12.5	2	12.5	8	50.0	16	16
Digestive tract diseases	5	33.33	2	13.33	3	20.1	5	33.34	15	15
Allergic diseases	2	28.57	3	42.86	1	14.28	1	14.28	7	7
Endocrine diseases	2	28.57	3	42.85	1	14.28	1	14.28	7	7

Endocrine pathologies were diagnosed in children aged 1 to 3 years - in 28.57%, from 4 to 6 years - in 42.86%, from 7 to 14 years - in 14.28%, from 15 to 17 years - in 14.28%. Allergic diseases were diagnosed in children aged 1 to 3 years - in 14.28%, from 4 to 6 years - in 15.0%, from 7 to 14 years - in 14.28%, from 15 to 17 years - in 28.57% (Table 2, 3). The results of the study showed that children with anemia more often suffer from respiratory and kidney diseases, rather than cardiovascular, digestion pathologies, allergic pathology, and endocrine diseases (35% and 20% against 16%, 15%, 7%, and 7%, respectively).

The share of pathologies of organs and systems differed slightly in boys and girls (48% and 52%). Children aged 1 to 3 years and 7 to 14 years are more likely to be at risk for damage to organs and systems in IDA than children aged 4 to 6 years and 15 to 17 years (28% and 27% against 24% and 21%, respectively). Thus, patients with iron deficiency anemia showed to suffer most from

respiratory and kidney diseases; diseases of the cardiovascular system and digestive organs were second; the share of allergic and endocrine pathologies was the lowest.

Susceptibility to the development of somatic pathology was almost the same in boys and girls and prevailed in children under the age of 3 years. During the observation period, children with iron deficiency anemia had a decrease in the incidence of pathologies of all organs and systems in all age groups. There also was a tendency towards an increase in the incidence of cardiovascular pathology in children under the age of 1 year, diseases of the endocrine system - in children under 3 years, and the digestive organs - in children aged 7 to 14 years. The indicators of the risk of abnormalities of the internal organs in children with iron deficiency anemia included the respiratory, kidney, and urinary tract diseases.

Summary

The study established that children with iron deficiency anemia more often suffer from respiratory pathology, less often - from endocrine diseases. Diseases of the internal organs are almost equally diagnosed in boys and girls and are predominant in children under the age of 3 years. The results of the

study indicate the prognostic significance of iron deficiency anemia in the formation of abnormalities of the internal organs, determining the time of their formation and the risk of involvement of a number of organs and systems in the pathological process.

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