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Research Article

CLINICAL-MORPHOLOGICAL ANALYSIS OF PNEUMONIA IN IMMUNE DEFICIENCY IN CHILDREN AT ONE – YEAR – OLD

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ABSTRACT

This article presents the morphofunctional state of the thymus, its absolute weight was measured and its weight index relative to the body was calculated. Area of cortex and nucleus accumbens for analysis of intra-organ structures of the thymus, index of cortex in relation to the stratum corneum, the density of lymphocytes in the conditional area of the histological specimen.

KEYWORDS

Pneumonia, immune system, thymus.

INTRODUCTION

Pneumonia is an acute infectious disease, the main common pathological symptoms of which are inflammation of the distal parts of the respiratory tract, interstitial and

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microcirculatory ducts caused by bacteria, viruses, and simple fungi. Its clinical and pathological manifestations develop depending on the pathogen, the immune status of the organism, the morphological features of the inflammatory reaction, and the extent of damage to lung tissue [1, 4, 6]. In young children, pneumonia in recent years has taken one of the leading positions in the structure of bronchopulmonary pathology. Despite the high effectiveness of treatment with antibacterial drugs, pneumonia is one of the leading causes of death in economically developed countries [3, 2].

According to some researchers, the infant mortality rate due to out-of-hospital abortion is on average 13.1% per 100,000 children. It mainly affects infants, as well as adolescents and adolescents with impaired protection against infection. Acute pneumonia (AP) occurs in 10–25 cases per 1,000 children in the early postnatal period and in 5–8 cases per 1,000 children in older children [5, 7, 8].

MATERIALS AND METHODS OF RESEARCH

In 2015-2021, the Republican Center for Pathological Anatomy (RCPA) under the Ministry of Health of the Republic of Uzbekistan used autopsy materials of 82 children who had confirmed immunodeficiency and died of viral, viral-bacterial pneumonia to achieve our goals and objectives. Autopsy material of children who died of coronavirus was obtained in a study conducted in the Department of Pathological Anatomy of Zangiota Infectious Diseases Hospital.

RESEARCH RESULTS

The morphological condition of the thymus was identified as the main criterion in determining the presence of immunodeficiency in children. Congenital hypoplasia of the thymus, grade 3 to 5 accidental transformation (AT), and acquired atrophy of the thymus were studied as signs of immunodeficiency.

According to the results of morphological analysis, "congenital hypoplasia of the thymus" was assessed based on the following criteria:

- Preservation of the width of the cortex and core layers in the thymus tissue;
- No difference in the structure of the tissue;
- Thymus fragments are different, do not have a specific structure, the presence of a set of lymphocytes in the cortex;

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- The presence of cysts and/or calcinoses in the stratum corneum;
- Low number of lymphocytes in the cortex;
- Hypertrophy of reticular cells;
- The increased proliferation of adipose tissue in the thymus tissue.

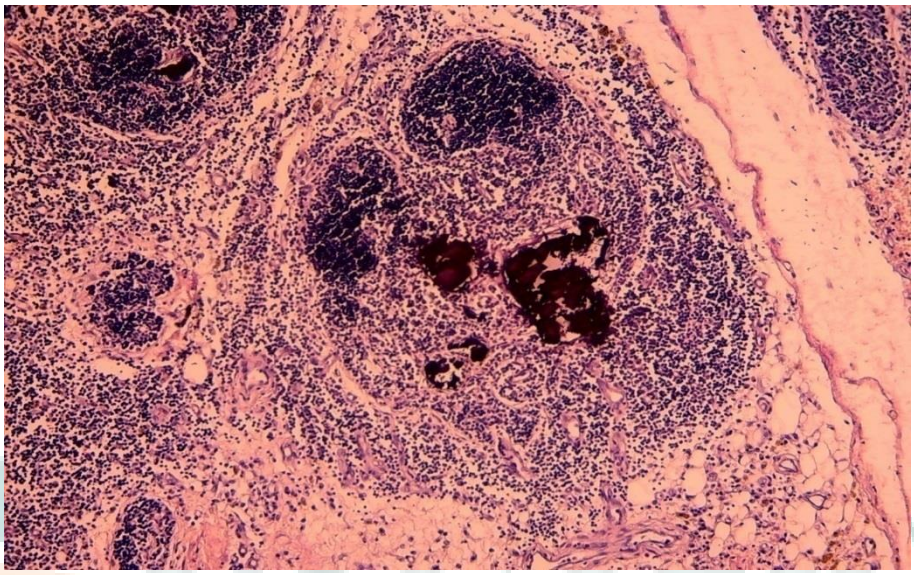

Figure 1. №16-DI Protocol. Thymus fragments are different, a set of lymphocytes in the cortex, calcinosis in the stratum corneum (Color: G-E. X: 10x10).

Based on the above criteria, the results of morphological analysis of our material showed that in 2 of the material the first type of changes from the above, in 3 - the fourth type, and in 2 - premature fatty tissue of the thymus tissue (see Figures 1 and 2).

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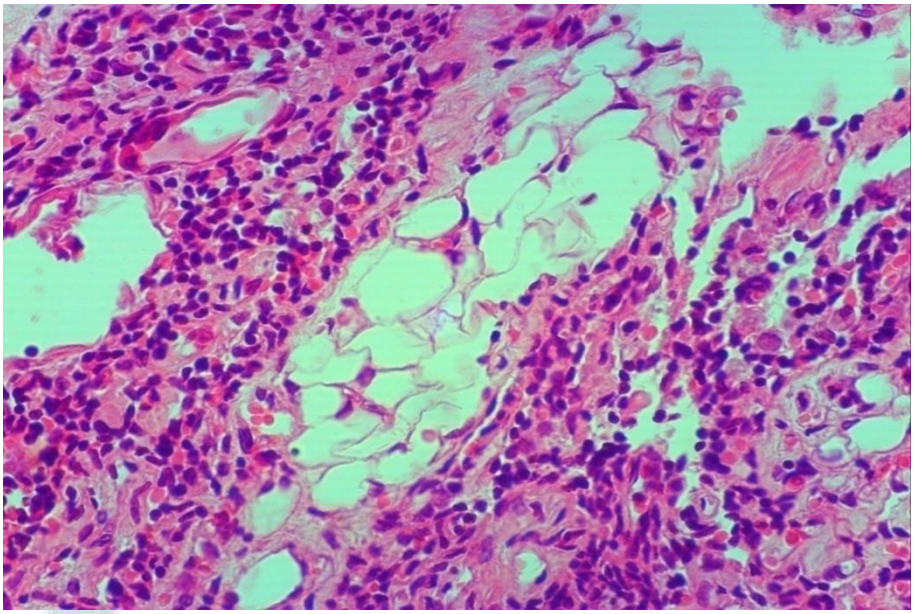

Figure 2. №34-DI Protocol. Fatty tissue has grown and multiplied in the thymus parenchyma (Dye: G-E. X: 10x40).

Early accidental transformation in the thymus has been identified in most cases as morphological signs of immunodeficiency. In our study, a total of 82 children under one year of age with immunodeficiency had congenital hypoplasia of the thymus in 7 (8.54%), 3rd-degree thymus in 12 (14.64%), 4th degree in 27 (32.92%) and 19 (23.17%) had a grade 5 accidental transformation, and 17 (20.73%) had acquired thymus atrophy (see Table 1).

Morphologically, at the AT level, the thymus parenchyma, i.e., lymphocytes, is almost completely atrophied and replaced by hypertrophy of reticular cells. In grade 3 AT of the thymus, there are almost no lymphocytes left in the cortical layer, in their place reticular cells are hypertrophied and dysplasia (see Table 1).

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Table 1

Morphologically indicative of immunodeficiency of the thymus

Morphological condition of the thymus		Groups								Total::	
		I		II		III		IV			
		abs	%	abs	%	abs	%	abs	%	abs	%
Congenital hypoplasia		1	1,22	1	1,22	3	3,66	2	2,44	7	8,54
AT	3rd degree	3	3,66	2	2,44	3	3,66	4	4,88	12	14,64
	4th- degree	4	4,88	4	4,88	10	12,19	9	10,97	27	32,92
	5th- degree	3	3,66	4	4,88	7	8,54	5	6,09	19	23,17
Thymus atrophy		2	2,44	1	1,22	8	9,75	6	7,31	17	20,73
Total:		13	15,86	12	14,64	31	37,80	26	31,70	82	100,0

In the stratum corneum, however, a relatively large number of lymphocytes were found, mainly around the Gassal corpuscles, and most of them were destroyed.

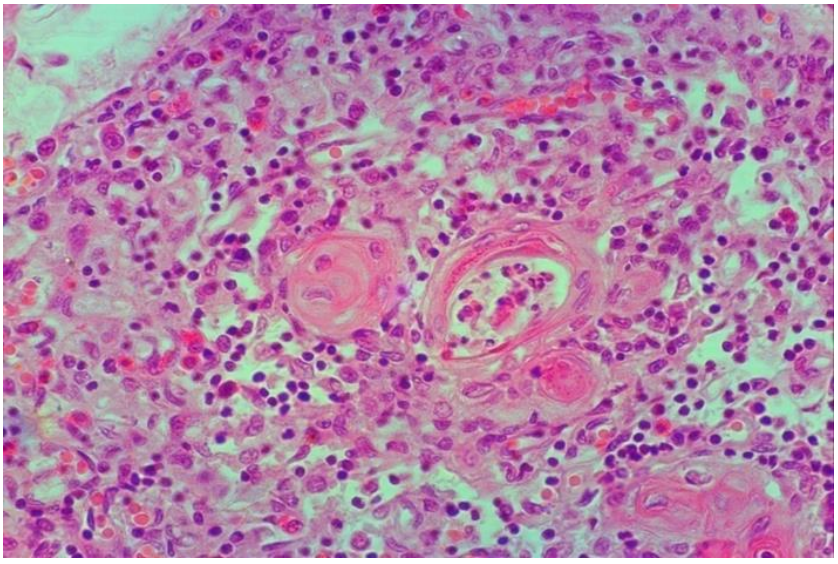

Figure 3. №23-DI Protocol. 3rd degree AT of the thymus, Gassal corpuscles in the stratum corneum, lymphocytes destroyed and killed

(Paint: G-E. X: 10x40).

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Gassel bodies were also found to have been destroyed and turned into cystic cavities of various sizes. It was observed that necrotic substance, calcification salts, appeared in the cavity of the gassel body (see Figure 3).

At levels 4 and 5 of the thymus, which develop as an immune deficiency, the thymus septa become sharply smaller, wrinkled, and atrophied. The reticuloepithelial cells that make up the thymus stroma undergo dystrophy and dysplasia, the size of which increases from the accumulation of fine-grained, light-colored dystrophy products in their cytoplasm. Such a process of advanced dystrophy and dysplasia in the form of hungry cell metaplasia occupies almost completely the fragmented cortical layer.

In grade 4 AT, the layers in the thymus segments are indistinguishable, the reticuloepithelial cells metaplasia and dysplasia into reticulosis and sclerosis, and a small tuft become characteristic scar tissue. Gassel bodies in the nucleus accumbens become cavities and caverns of various sizes, filled with necrotic, fragmented tissue elements (see Figure 4).

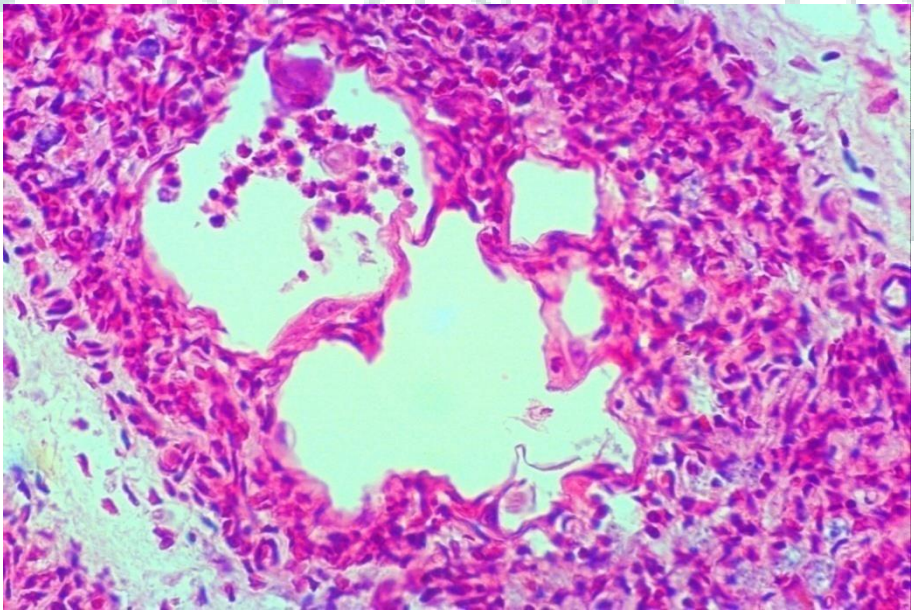

Figure 4. №3-DI Protocol. Grade 5 AT of the thymus, a cavernous cyst appeared in the stratum corneum. (Paint: G-E. X: 10x40).

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Level 5 AT of the thymus In some cases, the cavities and caverns arising from the Gassal corpuscles are sharply enlarged, completely occupying the nucleus accumbens of the organ. The cavity wall is composed of sclerosed and reticulated stroma cell structures. Within the cavities are found dead, fragmented tissue and cell remain, some of which are horny, necrotic, and calcified substances that are part of the Gassal corpuscles. These cavities are surrounded by dense coarse fibrous connective tissue.

Pieces of the thymus that have undergone irreversible atrophy become abruptly atrophied, collapsed, and shrink, surrounded by coarse fibrous connective tissue and fatty tissue. In this process, the parenchyma of the thymus, i.e. the lymphocyte cells, completely atrophy and disappear. The reticuloepithelial cells that make up the stroma undergo dystrophy and dysplasia, and morphologically their cytoplasm expands, filling it with various types of metabolites (see Figure 5).

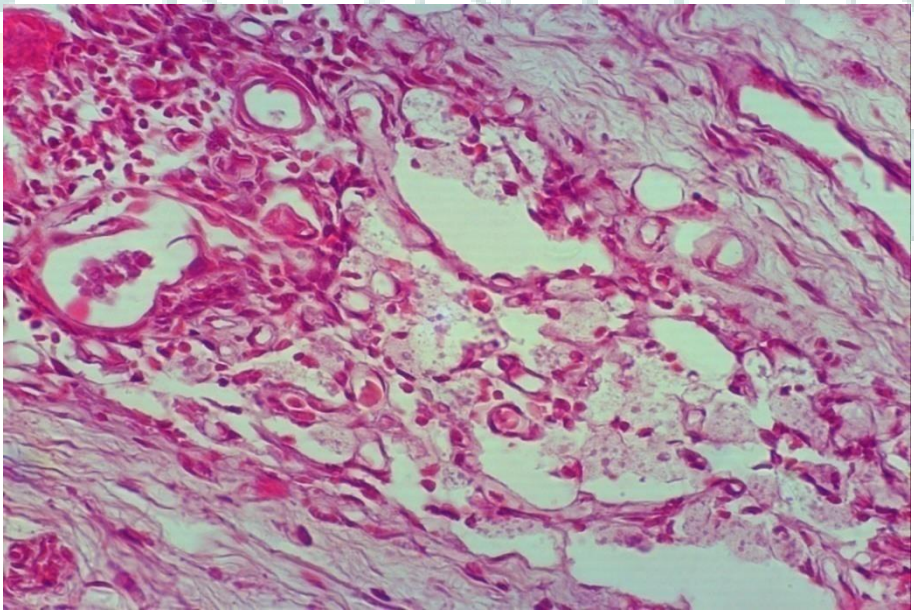

Figure 5. №54-DI Protocol. Acquired atrophy of the thymus, in which the thymus segment is in a state of complete destruction, the connective tissue between the segments is thickened. (Paint: G-E. X: 10x40).

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The nucleus is pushed to the periphery of the cell and undergoes karyopyknosis and karyolysis, in a word, these cells die. Instead, reticulocytes and fibrocytes proliferate and multiply, covering the tissue of the thymus fragments, leading to reticulosis and sclerosis. In parallel with these changes, the connective tissue stroma between the thymus segments also grows and thickens. At the same time, atrophy, dystrophy, and destructive changes develop in the core layer of the thymus, Gassal cells become cystic cavities, reticuloepithelial and reticular cells metaplasia, and turn into reticulocytes. Sometimes this type of atrophy also continues with the proliferation of adipose tissue in the surrounding tissue and its growth into the thymus segments.

When we analyzed the autopsy data of children under the age of one who died of pneumonia disease as a material for our study, it was found that a total of 22 children died in periods of 4 years (7-28 days, 1-3 months, 4-6 months, 7-12 months). (26.83%) in children (44 in total) with acute respiratory viral infection and viral-bacterial pneumonia, 31 (37.8%) bacterial pneumonia, 2 (2.44%) cytomegalovirus, and 5 (6.1%) were found to be coronavirus-based. Outbreaks appear to be exacerbated during influenza, parainfluenza, and respiratory syncytial infections. In the viral-bacterial strain, etiologically, conditionally pathogenic bacteria were found to be associated with viruses.

The main criterion in determining the state of immunodeficiency was the morphological changes developed in the central organ of the immune system, ie the thymus. Out of a total of 82 cases, 8.54% had congenital hypoplasia of the thymus, 14.64% had grade 3 AT, 32.92% had grade 4 AT, 23.17% had grade 5 AT and 20.73% had acquired thymus atrophy observed.

It should be noted that in grade 3-5 AT, which morphologically develops in the thymus, lymphocytes in its cortical layer disappear completely and are replaced by reticuloepithelial, reticulocyte, fibrocyte, and fat cells. Sections of the thymus that are irreversibly atrophied undergo atrophy and collapse, resulting in a sharp reduction in size and the growth of coarse fibrous connective and adipose tissue around it.

CONCLUSIONS

In immunocompromised children, viral pneumonia is mainly manifested in the form of bilateral multifocal, hemorrhagic

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bronchopneumonia, most often with lesions of II, IV, IX, and X-segments, and influenza is often complicated by hemorrhagic bilateral polysegmental pneumonia, parainfluenza serous-desquamates-hemorrhagic, -virus infection is generalized gonorrhea, adenovirus infection is serous-mucous, mixed viral gonorrhea is widespread with hemorrhagic gonorrhea.

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