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The Importance of Structural Changes of the Brain in the Death of Newborns Born with Atelectatic Pneumopathy

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Abstract Neonatal pneumopathy is a non-inflammatory lung disease that is a major cause of respiratory disorders and asphyxia. Congenital or primary pulmonary atelectasis is one of the forms of pneumopathy, characterized by immaturity of the lung parenchyma, diaphragm and muscles involved in respiration, insufficiency of the surfactant system, impaired regulation of respiratory act by the central and peripheral nervous system, and often fatal. In this pathological process, the morphological aspects of the lung have been sufficiently studied and require the identification of morphological changes in brain structures.

Keywords Atelectatic form of pneumopathy, Newborns, Brain

1. Relevance of the Research Problem

According to the World Health Organization (WHO), every year, on average, every tenth pregnancy in the world ends in premature birth, and nearly 15 million premature babies die in one day. Despite the significant advances in perinatal medicine today, according to WHO, acute respiratory distress syndrome is one of the leading causes of perinatal mortality not only in premature infants but also in preterm infants [36]. Every year, 2.8 to 3.2 million infants die from respiratory pathology worldwide, according to WHO data. In the first days of the early neonatal period, direct causes of infant mortality in 70-80% of cases remain respiratory disorders of various etiologies [2].

2. Objective

To identify topical aspects of morphological changes in the brain structures of newborns who died from an atelectatic form of pneumopathy.

Respiratory disorders syndrome is more common, especially in premature infants. It ranks second among all perinatal pathologies [13,17,23]. Morphofunctional features of the respiratory system play a key role in the development of this syndrome. Due to the high mortality rate due to these diseases, this disease has been attracting the attention of researchers for decades [1,4,5,9,15,21,22,31,32]. Although many measures have been developed for antenatal prevention of this syndrome, the prevalence of the disease remains high [5,13,23,32]. According to the latest data, the share of this disease in the total number of newborns is 6-12%. It has been reported that in 25–80% of infants born prematurely in the early neonatal period, respiratory disorders lead to aggravation of their general condition and adverse consequences [8].

There are many conflicting views on the etiology and pathogenesis of respiratory distress syndrome. There are data that the disease is related to genetic factors and is multifactorial [21,22]. Although extensive scientific research on respiratory distress syndrome is currently underway, methods of morphometric examination of lung tissue have been neglected [10]. The results of the analysis of autopsy materials of infants who died of respiratory distress syndrome show that the predominance of structural changes in the lungs is manifested by the absence of inflammatory processes in the environment, including disorders of the lung parenchyma in the form of atelectasis foci and hyaline membranes [7].

In some foreign literature, hyaline membrane disease has been reported as a symptom complex characterized by the sudden onset of respiratory failure and a sharp decrease in lung tissue elasticity due to profound hypoxia in infants [24].

Respiratory distress syndrome in infants depends on the gestational age and is 60% in infants born less than 28 weeks, 15-20% in infants born at 32-36 weeks of gestation, and 5% in infants older than 37 weeks [3].

According to some researchers, respiratory distress syndrome can be diagnosed in 25-80% of the total number of babies born without the disease [19]. High levels of alveolar epithelial weakness have been reported in infants due to the presence of acidosis, surfactant system, and low levels of

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fibrinolytic enzymes leading to the development of interalveolar edema [32]. Hypoxia and hypercapnia in the body of a pregnant mother are important among the factors that can lead to respiratory disorders in infants. It is also known from the literature that perinatal circulatory disorders play an important role in respiratory distress syndrome and may lead to placental insufficiency [20].

According to the literature [33,39], the leading cause of neonatal death is respiratory failure. A. According to Mehrabadi and co-authors (2016), respiratory distress syndrome in the United States was 6.4 per 1,000 live births between 2005 and 2006 [30]. According to Rosstat, 2013-2017, the proportion of respiratory distress syndrome among early neonatal deaths was 18.4% [18].

The morphological immaturity of the mother-placenta-fetal system and lung tissue is directly related to the immaturity of newborns. Therefore, circulatory disorders can lead to functional stress in the lungs and brain during and after birth [16].

Among the morphological manifestations of pneumopathy in the Commonwealth of Independent States countries, the presence of hyaline membranes was found to be aspiration of amniotic fluid into the airways, diffuse atelectasis and massive blood transfusions into the lung tissue. In the literature, respiratory distress syndrome is divided into two types, the first type includes hyaline membranes. This type accounts for 50-70% of premature infant deaths in the United States. The second type includes aspiration syndrome, diffuse atelectasis, and bleeding into the lung tissue. Pneumopathy is divided into nosological forms such as primary pulmonary atelectasis, hyaline membranes, pulmonary hemorrhage, and massive aspiration syndrome. These forms are described as noninfectious pathological processes in the lungs [28].

Ismoilova Yu.S. (2012) conducted a clinical and morphological analysis of premature infants who died with clinical manifestations of respiratory distress syndrome. During the autopsy, 72 deaths of newborns weighing 500–999 grams were analyzed (gestational age 22–28 weeks). Microscopic examination of the lungs of infants who died of respiratory distress syndrome showed morphological changes leading to acute pulmonary insufficiency in the form of primary diffuse atelectasis and hyaline membranes [7].

3. Conclusions

Based on the above data, it should be noted that the study of morphological and morphometric changes in the structure of the brain in respiratory syndrome is a topical scientific problem in the study of the week of birth and life expectancy of infants.

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