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Study of morphometric indicators of structural units of lung tissue according to the forms of primary atelectasis.

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Resume
Qualitative indicators of primary atelectasis of the lungs, the degree and pathogenetic mechanism of macroscopic and microscopic changes in the lungs were studied. Qualitative indicators of primary atelectasis are assessed based on the color, size, degree of deviation from lung tissue, and lack of air filling of macroscopic and microscopic changes in the lungs. According to the pathomorphological signs of atelectasis development, 3 degrees are distinguished: 1) mild - alveolar thickening; 2) moderate - circulatory disorders due to pulmonary edema; 3) severe atelectasis - involvement of the lungs with secondary pathological tissue, i.e., pneumosclerosis, retention cysts of the bronchi, bronchiectasis. Depending on the prevalence and localization of the pathological process, atelectasis of the entire lung, lobar atelectasis, segmental atelectasis, and subsegmental atelectasis are distinguished.
In the course of the study, morphometric indicators of structural units of lung tissue were studied in a total of 98 children, including 54 premature and 44 full-term newborns. Studies have shown that among maternal diseases, preeclampsia, eclampsia, infectious diseases, endocrine pathology and various extragenital diseases, as well as complications associated with the labor process, can be a risk factor for the development of primary atelectasis in the lungs of newborns to varying degrees. It was noted that primary atelectasis of the lungs in newborns occurs in most cases in premature infants, and the rate of development of diseases identified as a risk factor is also high.
Keywords: newborn, primary atelectasis of the lungs, lung tissue, prematurity, risk factor, maternal diseases, pathologies of childbirth, somatic diseases.

Topic relevance. Diseases of the respiratory system in newborns and neonatal respiratory distress syndrome are the main urgent problems. Among neonatal diseases, respiratory disorders rank 2nd and most often occur in premature infants, depending on the morphofunctional characteristics of the respiratory system. In particular, respiratory distress syndrome in newborns in general accounts for 1-2%, while in premature infants this figure is 8-14.5%. Pulmonary atelectasis is the failure of the pulmonary alveoli to open or close again within 2 days after birth, depending on the specific structure and central regulation of the bronchoalveolar tissue. In neonatology, congenital or primary atelectasis, developed in the lungs of a newborn, morphologically often develops in both lungs of stillborn infants, and they are small in size, produce a creaking sound when cut, and sink in water. In newborns, congenital atelectasis is most often localized in the I, II, IX, and X segments of both lungs, as well as in the IV and V segments of the left lung, depending on the degree of differentiation of these segments. The presence of amniotic fluid, mucus, and blood is usually detected in the cavities of the respiratory tract, bronchi, and alveoli. The appearance of hyaline membranes is observed on the inner surface of the alveoli.

According to the world international classification, primary atelectasis is divided into focal, total, and subtotal, depending on its significance for the body and taking into account its prevalence. By origin, there are congenital and acquired or primary and secondary atelectases. Congenital atelectasis is observed in premature infants with underdeveloped lungs and obstruction of the airways by mucus and amniotic fluid. The mechanism of development of the form of congenital atelectasis consists in the fact that in the fetus, the lungs are in a vacuous state and wait for the first breath; sometimes, even in normally born newborns, atelectasis can develop physiologically, but it soon ruptures. Atelectasis is also classified according to its prevalence: if it develops in a single acynosis, it is called acinar atelectasis; if it occurs in a lobe, it is called lobar atelectasis; if it occurs in a segment, it is called segmental atelectasis; if it occurs in a single lobe, it is called lobar atelectasis; if it occurs in all lung tissue, it is called total atelectasis. Atelectasis is sometimes observed when amniotic fluid enters the lungs, with insufficient anti-alectic factor, in congenital lung defects, in traumatic brain injury, and in respiratory center weakness.

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The literal translation of atelectasis is "incomplete opening," referring to the anatomical state of the lung. The relevance of the problem of atelectasis for neonatology lies in the numerous causes of pulmonary alveolar tissue collapse in newborns at one month of age. In atelectasis, a diffuse reduction of the respiratory surface of the alveolar tissue and the part participating in respiration is observed. The causes of primary atelectasis in newborns are: weakness and slowed excitation of the respiratory center, underdevelopment of the respiratory system, past hypoxia or asphyxia, damage to the brain or spinal cord. In addition, aspiration syndrome with amniotic fluid can also be a cause of primary atelectasis. This syndrome is mainly observed in late or premature births and develops hypoxia, hypercapnia, acidosis in the child's body, stimulating the respiratory center, respiratory act begins in the fetus, intestinal peristalsis increases, meconium enters the amniotic fluid and aspirates into the airways. Risk factors leading to primary atelectasis in newborns mainly include diseases of the mother's body during pregnancy and pathologies associated with the process of childbirth. Since the data determined by the degree of their occurrence have different morphometric indicators, the purpose of this scientific study was to clarify the degree of occurrence of risk factors.

Materials and methods. As material, the autopsy report, medical history, and lung tissue of children examined in the Department of Maternal and Child Pathology of the Republican Specialized Scientific and Practical Medical Center of the Ministry of Health of the Republic of Uzbekistan were studied. A total of 98 cases of infant mortality were examined, of which 44 were full-term and 54 were premature. In each case, clinical and anamnestic data from the mother's medical history were studied, and risk factors contributing to the development of atelectasis in the child were analyzed.

Research results and their discussion. The results of the analysis showed that as a manifestation of risk factors, in 74 out of 98 cases, 75.5% of mothers were younger than 20 or older than 35. It was established that if mothers are under 20 years old, the body is not ready for the reproductive process, if older than 35 years, the development of various diseases leads to complications of pregnancy, as a result of which, along with all pathologies in the newborn, there is a high risk of developing atelectasis in the lungs. Another risk factor is pregnancy toxicosis, i.e., preeclampsia, under the influence of which, in most cases, atelectasis, a manifestation of respiratory distress syndrome, can develop in the fetal lungs. **Indicators of the area occupied by tissue structures by forms of atelectasis, M±m % and ABFC coefficient.**

Groups	Area occupied by structural units, %				ABFK
	Plague	Time	Vqq	Wooh	
Control	**49.7±2.23**	**16.1±1.64**	**3.8±0.85**	**30.4±2.08**	**1.63**
Acinar atelectasis	**21.6±1.84***	**23.8.1±1.90***	**14.7±1.58***	**39.9±2.18***	**0.54**
Segmental atelectasis	**14.3±1.56****	**21.8.1±1.71****	**9.7±1.32****	**54.2±2.22****	**0.26**
Lobular atelectasis	**9.5±1.31*****	**23.4.1±1.89*****	**13.4±1.52*****	**53.7±2.21*****	**0.17**

Appendix: * - P≤0.05 - significance indicator relative to the control group
** -P≤0.01 - significance indicator relative to the control group
*** -P≤0.001 - significance indicator relative to the control group

Along with the qualitative assessment of morphological features characteristic of any pathological process, including primary atelectasis of the lungs, the reliability of the criteria for assessing changes inherent in the pathology will be high if they are assessed by quantitative indicators. When assessing the forms of primary atelectasis of the lungs by quantitative indicators, for comparison, the lungs of newborns who died from traumatic brain injury without lung pathology were taken as a control group. When analyzing the quantitative criteria, we calculated 4 structural structures, i.e., 1) alveolar lumen, 2) alveolar wall or site of atelectasis, 3) blood vessels, 4) areas occupied by hemorrhages. In the control group, the space of the air-filled alveoli in the lung tissue occupied 49.7±2.23% of the area, which indicates that the respiratory system of the lung tissue is not disturbed. Accordingly, the area of the interalveolar tissue is 30.4±2.08%, and there are no pathological changes in its composition. It was established that the blood vessels, i.e., capillaries, which are part of the alveoli, in turn, occupy 16.1±1.64% of the area, which corresponds to the normal morphometric

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indicators of the lung tissue component. At the same time, the presence of hemorrhagic foci, although occupying a small area in the lung tissue, confirms that they developed in connection with other types of pathological processes.

Morphologically, acinar atelectasis is a small-focal atelectasis, which is one of the forms of primary lung atelectasis. This is because the smallest particle of lung tissue is the acinus, in which the developed pathological processes usually manifest as small foci. Morphometric examination of acinar atelectasis showed that the area occupied by the cavity of the respiratory alveoli of the lungs decreased more than 2 times compared to the control group, that is, it was 21.6±1.84%. In this form of atelectasis, due to a sharp dilation and blood filling of blood vessels in the lung tissue, a sharp expansion of their occupied area is observed, which occupies 23.8±1.90*% of the area. In addition to this, foci of hemorrhage appeared, the area occupied by which was 14.7±1.58%. Areas affected by atelectasis occupy a relatively large area, which is 39.9±2.18%*.

The segmental form of primary atelectasis has a larger focal appearance than the acinar form, and the following data were obtained during its morphometric examination. In this form of atelectasis, the alveolar space in the lung tissue is reduced by 3.5 times compared to the control group and by 2 times compared to acinar atelectasis, occupying only 14.3±1.56% of the area. A sharp decrease in the area of the air-filled cavity in the lungs is certainly associated with the development of alveolar shrinkage, i.e., atelectasis. In the form of segmental atelectasis, areas affected by atelectasis increase to 54.2±2.22%, which indicates that almost half of the lung tissue area is affected by atelectasis. In addition to these changes, dilation and fullness of blood vessels are found, and foci of hemorrhage occupy a certain area.

Among primary atelectases, lobar atelectasis is considered a morphologically and functionally severe form. In this form, complete atelectasis of whole lobes of the lung is observed. In lobar atelectasis, the space of the air-entraining alveoli is minimal and occupies only 9.5±1.31% of the area. Such severe shrinkage is certainly associated with the development of large-focal and severe atelectasis, and according to morphometric indicators, the area of atelectatic foci is 53.7±2.21%, and it is also confirmed that almost half of the lung area is affected by atelectasis.

In order to functionally confirm the results of this morphometric study, a coefficient of the ratio of the area of the alveolar lumen to the area occupied by the wall of the alveoli or foci of atelectasis - the alveolar lumen activity coefficient (ALCA) - was developed. This coefficient indicates the filling of the alveoli with air or the degree of respiration in the lung tissue. Calculations showed that this indicator is in the norm, i.e., in the control group, it is equal to 1.63. In acinar atelectasis, this coefficient decreased by 3.5 times compared to the control group and amounted to 0.54. In segmental atelectasis, which is a more severe form of primary atelectasis, it was found that the APVC was even worse, decreased by 6.5 times compared to the control group, and amounted to only 0.26. In lobar atelectasis, which is the most severe form of primary atelectasis, the pulmonary respiratory coefficient was almost zero, decreased by 10 times compared to the control group, and amounted to only 0.17.

Conclusion

It was confirmed in the control group that the area of the alveolar lumen, indicating the degree of air filling or respiration of the lung tissue, morphometrically constitutes half of the total area of the lung tissue, and 1/3 of the area of the alveolar wall.

Depending on the forms of primary atelectasis, a sharp decrease in the size of the alveolar lumen is observed, i.e., in acinar atelectasis - by 2.4 times, in segmental atelectasis - by 3.6 times, in lobar atelectasis - by 5.3 times, on the contrary, an increase in the area of atelectasis is observed.

The coefficient of activity of the alveolar lumen, indicating the level of respiration in lung tissue, was 1.63 in the control group, in acinar atelectasis this indicator decreased by 3.5 times, in segmental atelectasis by 6.5 times, and in lobar atelectasis by 10 times.

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