AMERICAN ACADEMIC PUBLISHER

INTERNATIONAL JOURNAL OF MEDICAL SCIENCES

ISSN NUMBER: 2692 - 5206 Volume 6. No 02. February ,2026

MORPHOLOGICAL CHANGES IN RENAL STRUCTURES IN PNEUMOPATHY IN NEWBORNS WHO DIED IN THE NEONATAL PERIOD

Izzatullaev S.A., Islamov Sh.E.
Department of Pathological Anatomy,
Termez Branch of Tashkent State Medical University,
Samarkand State Medical University, Uzbekistan
E-mail: shavkat.islamov.1972@mail.ru

Abstract

Pneumopathy is one of the main causes of mortality among newborns, as it causes systemic disorders associated with a lack of oxygen and blood supply. The aim of our work was to study in detail the structural changes in the kidneys of newborns who died in the neonatal period due to pneumopathy. We examined the kidneys of 20 such infants using standard histological staining methods (hematoxylin and eosin, van Gieson, toluidine blue) and morphometric analysis. As a result, severe circulatory disorders and degenerative processes were detected: glomerular plethora (in 76% of cases), granular degeneration of the tubular epithelium (in 82%), interstitial edema (in 70%) and venous stasis (in 68%). In addition, there was a statistically significant decrease in the height of the proximal tubular epithelium ($p < 0.01$) and an increase in the size of the renal corpuscle capsule ($p < 0.05$). These findings provide strong evidence that neonatal pneumopathy results in hypoxia- and ischemia-related renal damage.

Key words

newborns, pneumopathy, kidneys, hypoxia, morphometry, neonatal period.

Introduction. Respiratory pathologies occupy a leading position in the structure of perinatal mortality in the early neonatal period. The most common forms are respiratory distress syndrome, congenital pneumonia, and aspiration syndromes [3,4,10].

The development of severe respiratory failure leads to systemic hypoxemia, metabolic acidosis, and microcirculatory disorders. The kidneys of newborns, due to their morphofunctional immaturity, are particularly vulnerable to hypoxic effects [5,11,14].

Despite the available information on pulmonary pathology, morphological changes in the kidneys in neonatal pneumopathy remain insufficiently studied, especially in terms of quantitative morphometric assessment [2,9,13]. This indicates a research gap that requires further investigation.

The aim of the study is to analyze morphological and morphometric changes in renal tissue in newborns who died in the neonatal period due to pneumopathy.

Materials and methods. The object of this study were the kidneys of 20 newborns who died in the neonatal period from pneumopathy of various origins. The gestational age of the cases studied ranged from 28 to 40 weeks. Kidneys from 5 newborns, whose death was not due to hypoxia or infectious pathology, were used as a control group. Biological material was prepared by fixation in 10% neutral formalin, followed by standard histological processing and obtaining paraffin sections with a thickness of 4-5 μm. The following staining methods were used for morphological analysis: hematoxylin and eosin, van Gieson staining and toluidine blue [1,6,7].

Morphometric measurements were performed using a state-of-the-art digital image analysis system capable of capturing images at ×200 and ×400 magnification. The analysis

AMERICAN ACADEMIC PUBLISHER
INTERNATIONAL JOURNAL OF MEDICAL SCIENCES
ISSN NUMBER: 2692 - 5206 Volume 6. No 02. February ,2026

quantified the following characteristics: renal corpuscle area (in square micrometers), glomerular vascular area, and the ratio of these areas. Additionally, tubule diameter, tubular epithelial layer height, and the percentage of damaged structures were measured.

Statistical processing of the obtained data was performed using the Statistica 10.0 software package. The mean (M) and its standard error (m) were calculated for each indicator. The normality of the data distribution was tested using the Shapiro-Wilk test. To identify statistically significant differences between groups, the Student t-test was used; differences were considered statistically significant at a probability level of $p < 0.05$.

Results. Morphological picture: The kidneys' appearance was consistent with gestational age, but moderate venous congestion was observed. Significant changes were detected at the cellular level, affecting both blood circulation and tissue trophism.

Morphological analysis: The kidneys, while macroscopically consistent with gestational age, demonstrated moderate venous congestion. Microscopic examination revealed significant circulatory disturbances and degenerative changes.

Morphometric parameters:

1. Glomerular apparatus. The area of the renal corpuscle was 4125 ± 185 μm², the area of the vascular glomerulus was 3270 ± 160 μm². The ratio of the glomerular area to the area of the renal corpuscle was 0.79 ± 0.03 (in the control - 0.85 ± 0.02; $p < 0.05$). The frequency of morphological changes: glomerular congestion - 76%; capsule dilation - 64%; capillary collapse - 22%; mesangial edema - 58%. Immature nephrons accounted for 18.4 ± 2.1%.

2. Tubular system. The diameter of the proximal tubules is 42.3 ± 1.8 μm. Epithelial height is 9.6 ± 0.4 μm (in the control - 11.8 ± 0.5 μm; $p < 0.01$). Frequency of pathological changes: granular degeneration - 82%; hydropic degeneration - 68%; focal necrosis - 40%; epithelial desquamation - 52%; protein casts - 28%. The tubular damage index was 2.6 ± 0.2 points.

3. Interstitial tissue - interstitial edema - 70%; dilation of intertubular spaces - 62%; hemorrhage - 38%; moderate infiltration - 34%. The interstitial area increased by 24.5% compared to the control ($p < 0.05$).

4. Vascular changes - venous stasis - 68%; capillary stasis - 54%; arteriolar spasm - 26%; perivascular hemorrhage - 32%. The diameter of arterioles decreased by 18.2% ($p < 0.05$).

Discussion. The detected pathological changes are hypoxic-ischemic in nature, indicating the systemic effects of severe pneumopathy. The structure of the tubular apparatus was found to be most sensitive to these effects, as evidenced by the high frequency of degenerative processes and a decrease in the height of epithelial cells. Hemodynamic disturbances contribute to a decrease in the glomerular filtration rate and the development of acute tubular injury. Morphometric analysis statistically confirms the significant severity of these structural changes [8,12].

Conclusion. Pneumopathy in neonates leads to the development of hypoxic-ischemic kidney damage. The most significant morphological changes are localized in the proximal tubules, affecting 82% of cases. The glomerular apparatus exhibits hemodynamic disturbances and capsule dilation ($p < 0.05$), confirmed by statistically significant differences in morphometric parameters compared to the control group. These renal changes are an integral component of multiorgan dysfunction in severe respiratory pathology.

References:

1. Bancroft J. D., Gamble M. Theory and Practice of Histological Techniques. — 8th ed. — Edinburgh: Churchill Livingstone, 2020. 672 p.

AMERICAN ACADEMIC PUBLISHER

INTERNATIONAL JOURNAL OF MEDICAL SCIENCES

ISSN NUMBER: 2692 - 5206 Volume 6. No 02. February ,2026

2. Baranova N. V., Ivanova E. A. Neonatal pathology: a manual for doctors. - Moscow: Meditsina, 2018. 456 p.
3. Blackmon L., et al. Association of severe lung injury with systemic organ damage in preterm infants // American Journal of Perinatology. — 2022. — Vol.39, №8. - P. 845-853.
4. Goldenberg R. L., et al. Neonatal respiratory disease: pathology and outcomes // Seminars in Neonatology. — 2021. — Vol.28, №5. – P. 101-110
5. Ivanova E. A., Petrova N. S. Histological changes in the kidneys in newborns with pneumonia // Russian Journal of Neonatology. - 2022. - V. 16, № 2., P. 42-48
6. Junqueira L. C., Carneiro J. Basic Histology. — 15th ed. — McGraw Hill, 2018. 576 p.
7. Lapitskaya L. I. Immunohistochemistry in perinatal diagnostics // Histology and embryology. - 2021. - №3. - P. 15-21.
8. Lawn J. E., et al. Global report on neonatal morbidity and mortality // Lancet. — 2022. — Vol.399. – P. 1620-1642.
9. Lyakhova L. M. Anatomical and histological changes in organs during intrauterine hypoxia and perinatal complications. - Moscow: GEOTAR-Media, 2017. 128 p.
10. Morozova T. E., Sidorov P. V. Pneumopathy in newborns: clinical presentation and pathogenesis // Neonatology and Perinatology. - 2023. - № 4. - P. 28-34.
11. Smith J. Q., Davis R. F. Morphological features of neonatal kidney injury: correlation with respiratory distress // Journal of Perinatal Medicine. — 2021. — Vol.49, №3. – P. 315-322.
12. Sweet D. G., et al. European consensus guidelines on the management of respiratory distress syndrome — 2023 update // Neonatology. — 2023. — Vol. 104. – P. 3-23.
13. Thomson A., Smith J. Pathology of the Newborn. - 4th ed. - London: Churchill Livingstone, 2019. 512 p.
14. Zhang L., Wang H. Renal histopathology in neonatal respiratory disorders // Pediatric Pathology & Molecular Medicine. — 2020. — Vol.39, №1. – P. 54-62.