THE ROLE OF ENDOCRINE STRUCTURES OF THE RESPIRATORY ZONE OF THE LUNGS IN ONTOGENESIS AND THE PATHOGENESIS OF EXPERIMENTAL PNEUMONIA

Khotamova Gulzoda Bakhodirovna
Samarkand State Medical University
assistant
hotamovagulzoda@gmail.com

Abstract. *Inflammatory lung diseases, including pneumonia, remain a major medical and social problem, requiring detailed study of their morphological mechanisms. The respiratory zone of the lungs functions not only as a site of gas exchange but also as a regulatory and immune component. Endocrine structures within this zone, part of the diffuse neuroendocrine system (DNES), play a significant role in local and systemic regulation, yet their involvement in lung ontogenesis and inflammatory processes is not fully understood. This study aimed to investigate the morphofunctional characteristics of the respiratory zone and its endocrine elements during postnatal development and under experimental pneumonia. Morphological analysis revealed sequential differentiation of alveolar epithelium, formation of the air-blood barrier, and maturation of microcirculation, accompanied by quantitative and functional development of endocrine structures. Experimental pneumonia induced alveolar epithelial damage, thickening of the air-blood barrier, microcirculatory disturbances, and inflammatory infiltration. Reactive changes in endocrine elements, including neuroendocrine cell hyperplasia and increased secretory activity, were observed, indicating their participation in reparative processes. These findings suggest that endocrine structures of the*

respiratory zone are integral to lung tissue adaptation and may provide a morphological basis for the development of pathogenetically justified therapeutic strategies for inflammatory lung diseases.

Keywords: *respiratory zone, lungs, neuroendocrine system, DNES, pneumonia, morphofunctional changes, ontogenesis, experimental model, lung tissue adaptation*

Introduction. Inflammatory lung diseases, including pneumonia, remain a significant medical and social problem worldwide, emphasizing the need for a detailed understanding of their underlying morphological and functional mechanisms [3,4,6,7]. The respiratory zone of the lungs serves not only as the primary site for gas exchange but also as a critical regulatory and immune component of the respiratory system, maintaining tissue homeostasis and responding to pathological challenges. Endocrine structures within this zone, which are part of the diffuse neuroendocrine system (DNES), secrete biologically active substances that modulate bronchiolar tone, alveolar epithelial proliferation, and local immune responses [1,2,9,10]. Despite their potential significance, the role of these endocrine elements in lung ontogenesis and in the pathogenesis of inflammatory processes remains insufficiently studied.

Investigation of morphofunctional changes in the respiratory zone and its endocrine structures during experimental pneumonia provides valuable insights into the mechanisms of lung tissue adaptation, injury, and repair. Understanding these dynamics can help clarify the contribution of neuroendocrine regulation to both normal postnatal lung development and pathological remodeling in response to inflammation [5,8]. This knowledge is

essential for the development of pathogenetically grounded strategies aimed at preventing and treating inflammatory lung diseases.

Methods. Morphological investigations were performed on the respiratory zone of the lungs of 60 laboratory animals, divided into two groups: 30 animals at different postnatal developmental stages (1, 7, 14, 21, and 28 days) and 30 animals subjected to experimentally induced pneumonia. The study assessed the structural organization of alveolar tissue, the integrity of the air-blood barrier, and the development of the microcirculatory network. Quantitative and functional characteristics of endocrine structures, including neuroendocrine cells and neuroepithelial bodies, were evaluated to determine their role in lung development and response to inflammatory injury.

Light microscopy combined with morphometric analysis was employed to identify and quantify both adaptive and pathological changes in lung tissue. Tissue samples (n = 120 sections per group) were fixed in 10% neutral buffered formalin, embedded in paraffin, sectioned at 5 μm, and stained using hematoxylin and eosin (H&E) and immunohistochemical markers specific for neuroendocrine cells. Morphometric measurements included alveolar surface area, thickness of the air-blood barrier, density of neuroendocrine cells (cells/mm²), and size of neuroepithelial bodies (μm²).

Data were statistically analyzed using ANOVA with post hoc Tukey test, with significance set at $p < 0.05$, to compare developmental stages and pathological alterations. This approach allowed detailed evaluation of the structural and functional dynamics of endocrine elements in the respiratory zone during ontogenesis and in response to inflammatory processes.

Results. During ontogenesis, sequential stages of alveolar epithelial differentiation, formation of the air-blood barrier, and maturation of the microcirculatory network were observed, accompanied by the quantitative and

functional development of endocrine structures. Neuroendocrine cells and neuroepithelial bodies demonstrated progressive increases in density and secretory activity.

Experimental pneumonia induced significant morphofunctional alterations, including alveolar epithelial destruction, thickening of the air-blood barrier, microcirculatory disturbances, and pronounced inflammatory infiltration. On this background, reactive changes in endocrine structures were detected, characterized by hyperplasia of neuroendocrine cells and enhanced secretory function, suggesting their involvement in regulating reparative processes.

Discussion and Conclusion. The morphofunctional state of endocrine structures in the respiratory zone of the lungs is closely associated with both stages of ontogenetic development and the nature of pathological exposure. Reactive changes in DNES elements during experimental pneumonia indicate their role in modulating inflammatory and reparative responses. These findings emphasize that endocrine structures are key components of lung tissue adaptation mechanisms and may serve as a morphological basis for developing pathogenetically justified therapeutic approaches to inflammatory lung diseases.

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