Volume 3, Issue 2, February 2025 ISSN (E): 2938-3765

MORPHOMETRY OF INTESTINAL LYMPHOID TISSUE IN EXPERIMENTAL PULMONARY FIBROSIS IN RATS

Togaev Jurabek Fakhriddinovich
Bukhara State Medical Institute
Bukhara, Uzbekistan. E-mail: jurabek37@gmail.com

Abstract
The article reveals morphological changes in lymphoid structures of the rectal wall of mongrel rats with experimental pneumosclerosis. The study of the immune status of rats against the background of prolonged hypoxia in experimental pneumosclerosis revealed significant violations in the form of a sharp decrease in the number of lymphocytes. This served as a basis for comparative analysis of various morphological changes in lymphoid tissue and dynamics in rats, and also allowed to determine structural changes in intestinal tissues.

Keywords: Intestine, pneumosclerosis, experiment, hypoxia, morphometry, lungs.

Introduction

According to the World Health Organization, lung diseases are among the most serious global health concerns, accounting for 1 in 6 deaths worldwide. The term "pneumosclerosis" defines a pathological condition in which pulmonary parenchyma undergoes an irreversible process of excessive growth, sclerosis, and/or scarring, associated with the excessive deposition of extracellular matrix components, including collagen. Pulmonary fibrosis is an irreversible process that can only be prevented or halted at early stages [1, 2, 11].

Interstitial lung diseases (ILDs) represent a heterogeneous group characterized by a variety of clinical, radiological, and pathological patterns that extensively affect the pulmonary parenchyma. Some ILDs are associated with varying degrees of pneumosclerosis, the most representative of which is idiopathic pneumosclerosis (idiopathic pulmonary fibrosis, IPF). IPF has a poor prognosis, with a median survival of 2–5 years after diagnosis, making it a serious and unresolved medical challenge. IPF is more common in older adults, affects men more frequently than women, and occurs without any specific provoking factors. Pneumosclerosis also represents the end stage of IPF [3, 4, 5, 13, 14].

Fibroblasts play a crucial role in tissue repair by proliferating, differentiating into myofibroblasts, and modulating the extracellular matrix volume [7, 8, 9]. Myofibroblasts produce a denser extracellular matrix than fibroblasts, and the presence of smooth muscle actin leads to spatial reorganization of collagen fibrils. Thickening and densification of lung tissue impair gas exchange and ultimately result in reduced lung function.

Web of Medicine: Journal of Medicine, Practice and Nursing
webofjournals.com/index.php/5

The aim of the study

Determine the dynamics of the state and characterization of lymphoid tissue in different parts of the intestinal wall in experimental pneumosclerosis.

MATERIALS AND METHODS

120 sexually mature white mongrel rats weighing 220-240 g at the age of 5-6 months were used in the experiment. All animals were divided into experimental and control groups. Prior to the experiment, the rats were acclimatized for 7 days in standard housing conditions corresponding to the sanitary norms of Uzbekistan. The housing conditions included temperature 20-24 °C, humidity was 50-70%, light regime was 12-hour cycle (day/night). Standard pelleted feed and free access to water were used in the diet. The experimental group included 96 animals; the control group - 24. Inhalation of nitric oxide (NO) was used to reproduce pneumosclerosis. The concentration of NO in air was 10 ppm for a long diapason. Exposure was carried out daily for 1 hour in a sealed chamber with controlled gas composition. The exposure period was 6 days. It promoted induction of chronic inflammatory process in lung tissue, which is the key pathogenetic mechanism of pneumosclerosis development. After the end of the experiment, the animals were euthanized and lung tissue samples were taken for histologic study.

RESULTS AND DISCUSSION

Based on morphological indicators, the following morphometric data of the colon were obtained. In the morphological and morphometric study of colon tissue obtained from the autopsy of white outbred rats in the control group, the colon wall consisted of four layers, with the mucosal layer covered by a single-layered columnar epithelium. Within the field of view, tall columnar epithelial cells, goblet cells, and a large number of undifferentiated cells were observed.

The mucosal layer was composed of thin layers of connective tissue between the crypts, with an average thickness of 3.1–5.3 μm in the control group of white rats. The crypts were deep with a slightly expanded apical part, and their diameter in control white rats averaged 9.4–9.7 μm. Microscopically, the crypts consisted of weakly oxyphilic cytoplasm and were composed of goblet cells. The number of goblet cells per crypt ranged from 7 to 19.

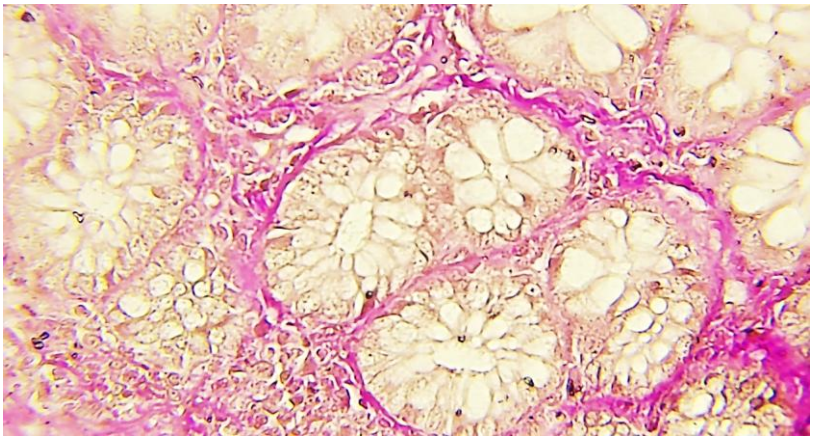

Figure 1. In the mucosal tissues of the colon in the experimental group of rats, an increase and thickening of the connective tissue around the crypts were observed, indicating collagenization. Staining: Van Gieson; Magnification: 10x40.

Web of Medicine: Journal of Medicine, Practice and Nursing
webofjournals.com/index.php/5

The figure demonstrates the thickening of the connective tissue surrounding the crypts, indicating a process of collagenization, which reflects an increase in collagen content within the tissues. Thickening of the membrane surrounding the crypts was noted, reaching 5.12–5.55 µm. These changes suggest tissue adaptation and response to various pathomorphological factors in the experiment - specifically, a reaction to NO_2 exposure. The obtained data highlight the importance of studying the microscopic structure of the intestine to understand its functional state and potential pathologies.

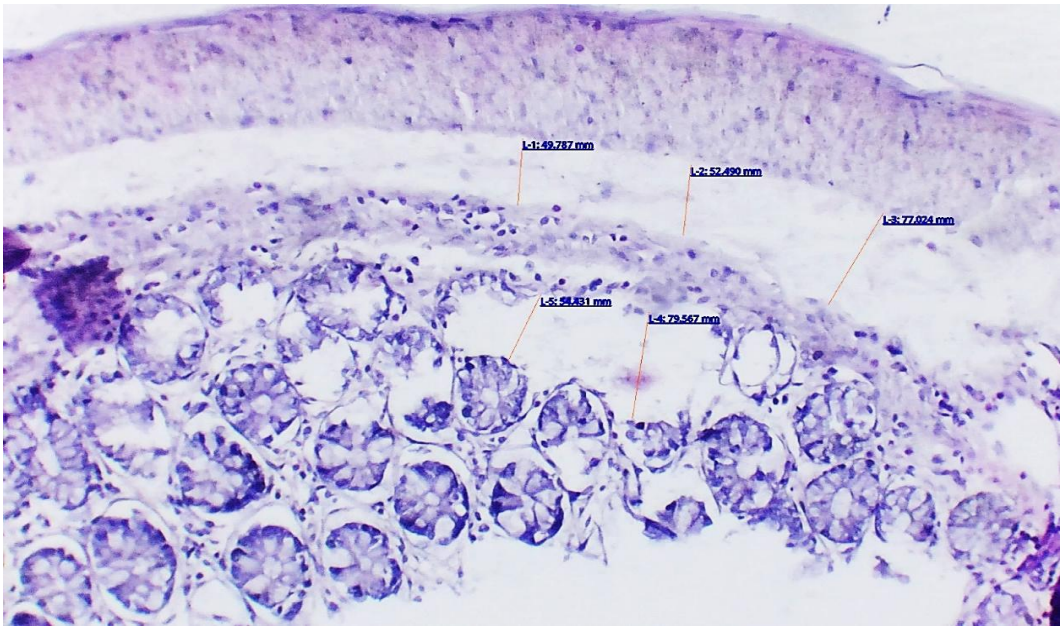

Figure 2. In the mucosal tissues of the colon in the experimental group of rats, goblet cell destruction was observed. In some crypts, the lumen was indistinct. Staining: Alcian blue; Magnification: 10x40.

As a result of the study, it was found that the crypt diameter in cross-section was 7.2–7.8 µm in the control group and 17.98–19.31 µm in the experimental group of rats (Figure 2). In the lymph nodes, between the cortical and medullary layers, the paracortical zone was identified. Its thickness in the control group of white outbred rats ranged from 117 to 325 µm. Scattered T-lymphocytes were observed at different levels within this area. In this zone, T-lymphocytes undergo blast transformation and develop into effector T-lymphocytes, functioning through interactions with macrophages.

Table No. 1 Morphometric Parameters of the Colon in White Outbred Rats from the Control and Experimental Groups

Indicator (ICD)	Control group	Experimental group
Crypt wall thickness	3,1-5,3	4,2-6,9
Crypt diameter	9,4-9,7	2,5-4,3
Thickness of the submucosal layer and muscularis mucosae measured together	492,43	560,87
Number of goblet cells per crypt (pcs)	7-19	6-8
Number of leukocytes between crypts	57	117

Web of Medicine: Journal of Medicine, Practice and Nursing
webofjournals.com/index.php/5

These data indicate perfusion in the postcapillary venules of the cortical layer and the migration of macrophages along with a small number of lymphocytes into perivascular zones. In the medullary layer, intermediate edema and exposure of stromal structures were observed around the medullary cords.

In the germinal center, developing secondary follicles were identified. The diameter of this center was 175.32 μm² in the control group of rats and 193.13 μm² in the experimental group. As a result, foci of diffuse hyperplasia developed in the lymphoid follicles of the cortical layer.

Secondary lymphoid follicles consist of a lightly stained proliferative center (germinal center) surrounded by a darkly stained, corona-shaped aggregation of lymphocytes. It was established that the germinal center of the lymphoid follicles contains actively proliferating B-lymphocytes, lymphoblasts, macrophages, dendritic cells, and lymphocytes (Figure 3).

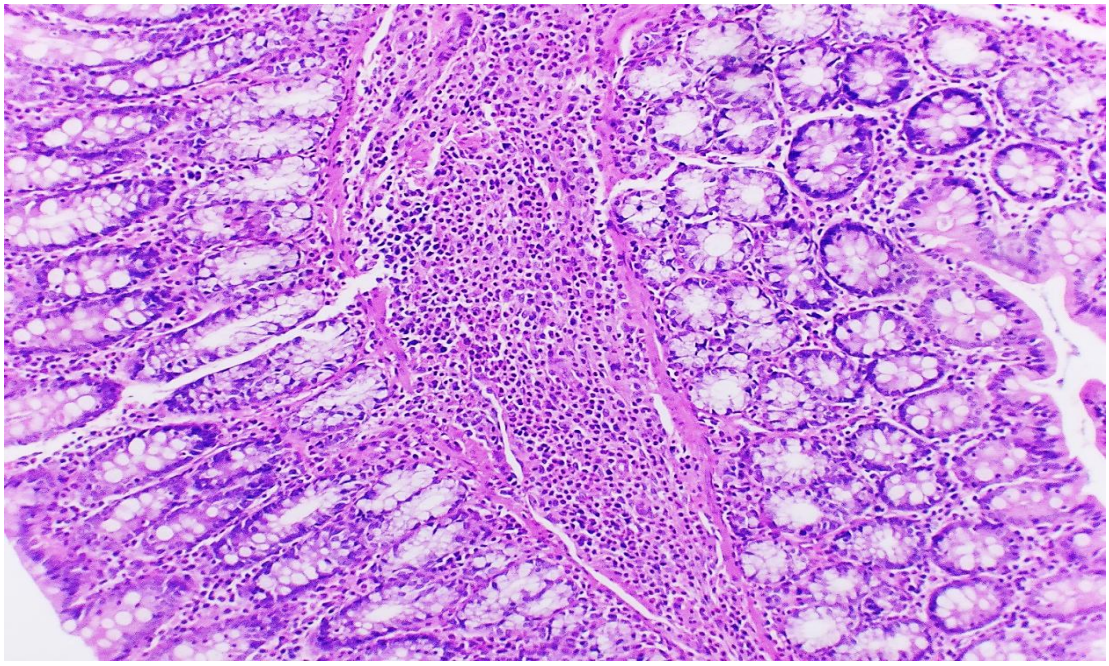

Figure 3. In the mucosal tissues of the colon in the experimental group of rats, an increased number of goblet cells and a pronounced lymphohistiocytic infiltrate were observed. Stained: H-E. Size: 10x40.

As a result, foci of diffuse hyperplasia develop in the lymphoid follicles of the cortical layer. Secondary lymphoid follicles consist of a light-colored center of cell proliferation (germinative) and surrounding dark-colored crown-shaped cluster of lymphocytes. It was found that the germinal center of lymphoid follicles contains intensively proliferating B-lymphocytes, lymphoblasts, macrophages, dendritic cells and lymphocytes.

This indicates an increase in the proliferative activity of cells in response to nitrogen dioxide (NO_2) exposure used to model experimental pneumosclerosis.

CONCLUSION

Thus, we studied morphological changes in lymphoid structures of the colon wall in purebred rats with experimental pneumosclerosis. When studying the immune status of rats against the background of prolonged hypoxia, significant disorders in the form of a sharp decrease in the

Web of Medicine: Journal of Medicine, Practice and Nursing
webofjournals.com/index.php/5

number of lymphocytes were revealed. This served as a basis for comparative analysis of various morphological changes in lymphoid tissue and their dynamics in rats, and also allowed to determine structural changes in intestinal tissues.

REFERENCES

1. Avdeev S.N., Trushenko N.V. Antifibrotic therapy for idiopathic pulmonary fibrosis: correlation of efficacy and safety. Medical Council. 2018; 15: 131–136. DOI: 10.21518/2079-701X-2018-15-131-136.
2. Alistratova F.I., Skoprichev V.G. Study of animal behavior in conditions of chronic normobaric hypoxia and ways of its correction // Scientific Notes of the Kazan State Academy of Veterinary Medicine named named after N.E. Bauman. - 2019. - T. 239. – No.3. PP. 9-14.
3. Ananyeva LP et al. Chronic fibrosing interstitial lung diseases with a progressive phenotype // Scientific and Practical Rheumatology. - 2020. - T. 58. – No.6. PP. 631-636.
4. Aptekar I.A., Kostolomova E.G., Sukhovei Y.G. Changes in the functional activity of fibroblasts in modeling compression, hypercapnia and hypoxia // Russian Osteopathic Journal. - 2019. No. 1-2. PP.72-84.
5. Artamonov A.V. et al. Means for the prevention and treatment of pneumofibrosis and the method of its preparation. - 2018.
6. Astafieva D.V., Okunev D.A., Taiguzin R.Shk. Microscopic structure of the lymph nodes of the stomach and colon of Orenburg goats // Bulletin of the Orenburg State Agrarian University. - 2019. No.3 (77). - PP.232-234.
7. Akilov H.A., Magroupov B.A., Primov F.Sh., Yuldashev T.A., Dzhuraev J.A. Morphological and functional dynamics of pathological processes in the colon at chronic colostasis in an experimental model // Bulletin of Emergency Medicine. - 2020. No.5.
8. Belevtseva S.I., Ruksha K.G., Korol K.S. Cytomorphologic features of Paneth cells of human intestinal crypts in norm and at HP-associated atrophic gastritis. - 2023.
9. Belevskiy A.S., Chikina S.Y. Fibrosing interstitial lung diseases (literature review) // Practical Pulmonology. - 2020. No.1. – PP.60-66.
10. Bolotova E.V., Yurkova Y.G. Biological markers of the progressing fibrotic phenotype of interstitial lung diseases // Innovative Medicine of Kuban. - 2023. No.4. - PP. 126-133.
11. Juraeva G.B. Histopathology of lymphoid tissue of intestine in children with AKI // Science and education of southern Kazakhstan. Chimkent, 2007 – No.5. PP-105-107.
12. Juraeva G.B. Israilov R.I. Morphometric and morphological changes of the lymphoid tissue of the large intestine of infants in acute intestinal infection// Pediatrics. - Tashkent, 2008, No.1-2. PP 109-114.
13. Juraeva G.B., Rasulova O.T. Najapova B. Pathomorphologic changes and immunologic parameters in acute intestinal infection in newborn children up to one year old//IX Russian Conference of Morphologists: Abstracts. Moscow, 2008, P.43.
14. Juraeva G.B., Allaberdiev B.T. Morphometric indicators of intestinal lymphoid tissue in acute intestinal infection in children // Information letter. Bukhara, 2008, P.1-4.
15.Juraeva G.B., Isroilov R.I. Pathomorphological characteristics of intestinal lymphoid tissue in infants with AII // Information letter - Bukhara, 2008 - P.1-4.

Web of Medicine: Journal of Medicine, Practice and Nursing
webofjournals.com/index.php/5