CHAPTER «VETERINARY SCIENCES»

PECULIARITIES OF PATHOMORPHOLOGICAL DIAGNOSIS OF THE MOST COMMON RESPIRATORY INFECTIONS OF A PIG

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Abstract. The active spread of respiratory infections in pig farms raises the issue of differential pathomorphological diagnosis of diseases related to a single syndrome of respiratory pathologies.

Pathological autopsy and histopathological examinations of organs from 72 carcasses of pigs during the fattening period were performed. Pathological autopsy of pigs was performed by complete evisceration. Histologically examined 360 lung samples with regional lymph nodes. The presence of bacterial and viral infections was confirmed by bacteriological and PCR studies.

The aim of the study is to establish the characteristic differential features at the macro- and micro-level in the lungs of domestic pigs for viral and bacterial pathogens. The main tasks of the work are to determine the morphofunctional features and dynamics of pathomorphological changes in the parenchyma and immune formations of the lungs in respiratory pathology.

As a result of complex pathomorphological studies of the lungs in respiratory infections of pigs found that structural and functional changes in the body have different localization, stage and nature of the pathological process, which depend on the direct action of the etiological factor.

Acute catarrhal bronchopneumonia is registered in respiratory mycoplasmosis (enzootic pneumonia), which in a prolonged course

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turns into chronic catarrhal or catarrhal-purulent pneumonia. Hemorrhagic necrotizing pneumonia is a manifestation of actinobacillary pleuropneumonia. Interstitial (diffuse proliferative) pneumonia develops with viral pathogens – circovirus infection and reproductive and respiratory syndrome of pigs (PRRS). Serous fibrinous and fibrinous pleurisy develop in hemophilic polyserositis and actinobacillary pleuropneumonia.

Pathomorphological changes of the lungs in the reproductive and respiratory syndrome of pigs are polymorphic and are manifested by the gradual progressive development of the inflammatory process from congestive hyperemia, acute catarrh to diffuse interstitial pneumonia. Pathomorphological changes of the lungs in mycoplasmosis (enzootic pleuropneumonia) of pigs are polymorphic and are manifested by the gradual progressive development of the inflammatory process, which is localized in the cranial, middle and peripheral parts of the diaphragmatic particles and is characterized by acute catarrhal bronchopneumonia.

In actinobacillary pleuropneumonia pathohistological studies revealed a pronounced stage of morphological changes in the lungs and regional lymph nodes in actinobacillary pleuropneumonia. Depending on the form of the disease, serous-hemorrhagic exudation is exacerbated by fibrinogen exudation and increased migration of lymphocytes and mononuclear cells. In subacute and chronic forms of the disease, necrotic phenomena prevail in combination with areas of serous-fibrinous inflammation.

In the future, further studies of immunohistochemical analysis to establish the tropism of the pathogen and the study of markers of lymphoid cells.

1. Introduction

Respiratory diseases of pigs in farms and industrial enterprises cause significant economic damage, which are associated with the death of animals, reducing the average daily increase in live weight, reducing product quality, as well as the high cost of treatment [14, pp. 20–21; 17, p. 47; 20, p. 9].

Widespread and progressive growth of viral and bacterial diseases of the respiratory organs of pigs actualizes the conduct of morphological studies of respiratory infections [1, p. 127; 6, p. 119; 8, p. 253; 10, pp. 20–26]. According to current data in the scientific and production literature, respiratory diseases of pigs are classified as a single complex (PRDS), which are associated with the multifaceted enhanced effect of bacterial and

viral antigens on the population of animals with different immune status in conditions of intensive housing technologies [2, p. 131]. The study of immune structures of the respiratory organs is also relevant in connection with the demands of modern veterinary medicine because the immune system is of paramount importance in ensuring antigenic and structural homeostasis in the animal organism [7, p. 30].

In connection with the active spread of respiratory diseases in pig farms, the issue of pathomorphological diagnosis of infectious diseases at different stages of their development is relevant and timely. However, the scientific literature does not sufficiently cover the features of pathomorphological changes of the respiratory organs at the macro- and micro-levels, taking into account the etiological factor and the form of the disease progress.

The main target of respiratory pathogens are the lungs, which in addition to aerodynamic and barrier function performed by the mucous membranes of the bronchial tree and alveolar macrophages, bronchus-associated lymphoid tissue, perform a variety of cellular and humoral immune responses, the nature of which may vary depending on in cases of lesions of the lung parenchyma in various pathological processes [2, pp. 131–146; 3, p. 227–231; 16, p. 1020]. Clinical manifestations of respiratory infections in pigs are primarily due to tropism of pathogens that affect not only the immune structures of the respiratory system, but also their parenchyma. Some viruses have properties for long-term persistence in cells of the immune system, namely in cells belonging to the group of mononuclear phagocytes [4, p. 257; 5, pp. 1638–1642; 18, pp. 5–32].

To date, the issues of classification and biology of the pathogen, as well as epizootiological aspects of respiratory infections are studied in most detail. In the scientific literature there is enough information about the clinical and general pathological manifestations of these pathologies in the relationship with the properties of different variants of the pathogen, the nature and composition of microbial associations [13, pp. 78–80; 15, pp. 1–6; 21, pp. 11–20].

Given that the vast majority of pathogens of respiratory infections in pigs are lymphotropic, and the immune system in mammals has a complex hierarchical organization, a deep understanding of aspects of pathogenesis is not possible without defining a general concept of pathological effects on various parts of the immune system [18, pp. 5–32; 23, pp. 347–351].

It is known that the epizootological features of the manifestation of respiratory infections depend on the composition of microbial associations, which in the conditions of intensive technologies are dynamic and multicomponent. According to scientists [14, pp. 20–21; 17, p. 47], in the pathological material from sick and dead piglets with respiratory syndrome there are most often found: virus of reproductive and respiratory syndrome (54% of the total number of samples tested); circovirus of the 2nd type (69%); cytomegalovirus (70%); lymphotropic herpesvirus (61%); mycoplasmas and chlamydia (38%); bacterial microflora – *Haemophilus parasuis, Pasteurella muitocida, Actinobacillus pleuropneumoniae, Bordetella bronchiseptica, Streptococcus suis* (almost 42%). It is well known that mycoplasmas, unlike bacteria, do not have a cell wall, but are surrounded only by a tricuspid cytoplasmic membrane. As a result, they are localized in the crypts of membranes, which makes them, on the one hand, inaccessible to antibodies and complement, and on the other hand, in the process of membrane interaction of mycoplasmas with the host cell there is the exchange of some components, which contributes to the phenomenon of antigenic mimicry [3, pp. 227–231; 8, pp. 253–255; 24, pp. 186–195].

Viruses of PRRS, influenza, *Actinobacillus pleuropneumoniae, Pasteurella multocida, Streptococcus suis, Haemophilus parasuis and Mycoplasma hyopneumoniae* bacteria show a synergistic effect and cause an aggregated antigenic complex [1, pp. 127–133; 2, pp. 131–146]. It is established that *Mycoplasma hyopneumoniae* increases the severity and duration of pneumonia caused by reproductive and respiratory syndrome (PRRS). *Mycoplasma hyopneumoniae* attaches to the cilia of the respiratory epithelium of the trachea and bronchus, resulting in loss of mucociliary function of the respiratory system, which leads to a significant risk of secondary infections. *Mycoplasma hyopneumoniae* also causes immunosuppression, stimulates lymphocytes, increasing the level of anti-inflammatory cytokines: tumor necrosis factor, interleukins 1 and 6, which induce further local inflammation and tissue damage. In turn, PRPS also causes lysis and weakening of the function of pulmonary alveolar macrophages, which reduces the resistance of the respiratory tract to secondary pathogens [3, pp. 227–231; 8, pp. 253–255; 24, pp. 186–195].

However, the main aspects of virus damage by *PRRS* and *PCV 2* of peripheral immune system localized in the lungs of pigs are still largerly unknown. The nature and dynamics of pathomorphological changes of immune formations of the respiratory tract at the stage of formation of adaptive specific immunity for different types of specific response have not been determined. There are significant differences in the scientific literature regarding the understanding of the mechanisms of varying degrees of damage to the immune system of pigs due to different bacterial and viral infections. There are almost no generalized data on pathomorphological changes in the immune structures of the lungs in latent and subclinical forms of infectious diseases.

Thus, revealing the features of morphological changes in the development of reactive and pathological processes in the immune system of the lungs depending on various respiratory pathogens is one of the main conditions for developing and improving an effective strategy for prevention and control of respiratory diseases in intensive pig breeding.

The purpose of the study is to establish the characteristic differential features at the macro- and micro-level in the lungs of domestic pigs for viral and bacterial pathogens. The main tasks of the work are to determine the morphofunctional features and dynamics of pathomorphological changes in the parenchyma and immune formations of the lungs according to respiratory pathology.

2. Main material and methods of research

Pathanatomical examinations of pig carcasses, as well as histological examinations of samples of biological material were conducted in the Department of Morphological Research of Scientific Research Center for Biosafety and Environmental Control of Agro-Industrial Complex and Laboratory of Epizootology and Infectious Diseases of Dnipro State Agrarian Economic University. Biological material was selected from pig farms in Dnipropetrovsk, Zaporizhzhia, Kyiv and Cherkasy oblasts.

Pathoanatomical autopsy and histopathological examinations of organs from 72 carcasses of pigs during the fattening period were performed. Pathoanatomical dissection of pigs was performed by the method of complete evisceration. Pathomorphological examination of the affected lungs was performed according to the generally accepted scheme, taking into

account the degree of organ collapse, color, lobular structure, consistency, "Galen's test", the condition of the pleura, trachea and bronchus, regional lymph nodes. A total of 360 organ samples were histologically examined.

The presence of bacterial and viral infections was determined by bacteriological and PCR studies. Tissue samples with pronounced characteristic macroscopic pathomorphological changes typical for viral disease (circovirus infection, reproductive and respiratory syndrome) and enzootic pneumonia (mycoplasmosis) were taken for the polymerase chain reaction. Amplification and detection of results were performed on CFX 96 Real-Time Systemfirms, BioRad (USA) with BioRad CFX Manager software. Bacterial diseases (actinobacillary pleuropneumonia, hemophilic polyserositis (Glesser's disease) were confirmed by appropriate bacteriological studies.

Classical pathohistological methods were used to examine fragments of lungs selected from pig carcasses with signs of different types of inflammatory processes and to confirm the diagnosis by PCR and bacteriological studies. Selected lung fragments were fixed in 10% aqueous neutral formalin solution for 48 hours. Subsequently, the fixed material was stored in the archive if necessary for retrospective diagnosis. At the next stage, the biological material was dehydrated in alcohols of increasing strength, compacted in histological paraffin in accordance with conventional methods [12, pp. 9–67]. Sections 3-5 μm thick were made on a sliding microtome. The prepared histological sections were stained with hematoxylin and eosin. After staining with a microscope "Leica DM1000" pathohistological changes were determined, photographed and the microphotos made were archived.

3. Results and discussion

It has been established that in respiratory infections of pigs, morphological changes in the lungs are polymorphic and depend on the type of pathogen, the presence of co-infections and the stage of the disease. As a result of monitoring studies, it has been found that the most common respiratory pathogens that cause great economic damage in enterprises are circovirus infection type of 2nd type (*PCV 2*), reproductive and respiratory syndrome (PRRS), enzootic pneumonia (mycoplasmosis), actinobacillary pleuropneumonia (APP) and hemophilic polyserositis (Glesser's disease).

Circovirus infection of pigs of the 2nd type is an urgent problem on a global scale today. Pathomorphological manifestations of circovirus infection in pigs are characterized by diversity and affect not only the central and peripheral lymphoid organs, but there is also the affection of almost all internal organs of animals, depending on the prevalence of the syndrome PCV 2 has a pronounced tropism to immunocompetent cells, its actively multiplying leads to depletion of lymphoid tissue and reduced immune status [7, pp. 30–31; 10, pp. 20–26].

Examining circovirus-associated pneumonia, it has been found that during the latent form of infection in the lungs there are nonspecific changes: edema and acute congestive hyperemia, with a gradual transition to acute catarrhal bronchopneumonia.

In the lungs of animals with clinically pronounced circovirus associated pneumonia there was recorded the development of proliferative (interstitial) pneumonia, which varied depending on the stage of the disease: at the beginning (early active infection) focal, and the development of the disease (active chronic infection) – diffuse lesions (Figure 1).

With proliferative changes, the lungs were not collapsed, compacted, of light pink or pale gray in the section. Under the pleura and in the section of the stroma of the organ stood out in the form of holes, and the parenchyma acquired a "fat-like" appearance. The localization was dominated by lesions of the caudal lobes of the organ (83.52%). Total interstitial pneumonia was found in only 5.67% of animals with PCR-confirmed circovirus-associated pneumonia.

Histological examination revealed simultaneous lesions of peribronchial, intralobular (intraparticle) and interlobular (interparticle) connective tissue. Lymphoid cells, histiocytes and plasma cells predominated in the affected lung stroma. With the progress of the disease there was an intensive proliferation of connective tissue elements with fibrosis of the affected areas of the organ.

In the latent form of circovirus infection of the 2nd type, macroscopically, the lymph nodes did not have significant deviations from the physiological norm. At the histological level, signs of reactive lymphoid parenchymal hyperplasia were detected.

In clinically pronounced circovirus infection of the 2nd type in animals with signs of circovirus-associated pneumonia in the regional lung to the bronchial and cranial mediastinal lymph nodes, the development of

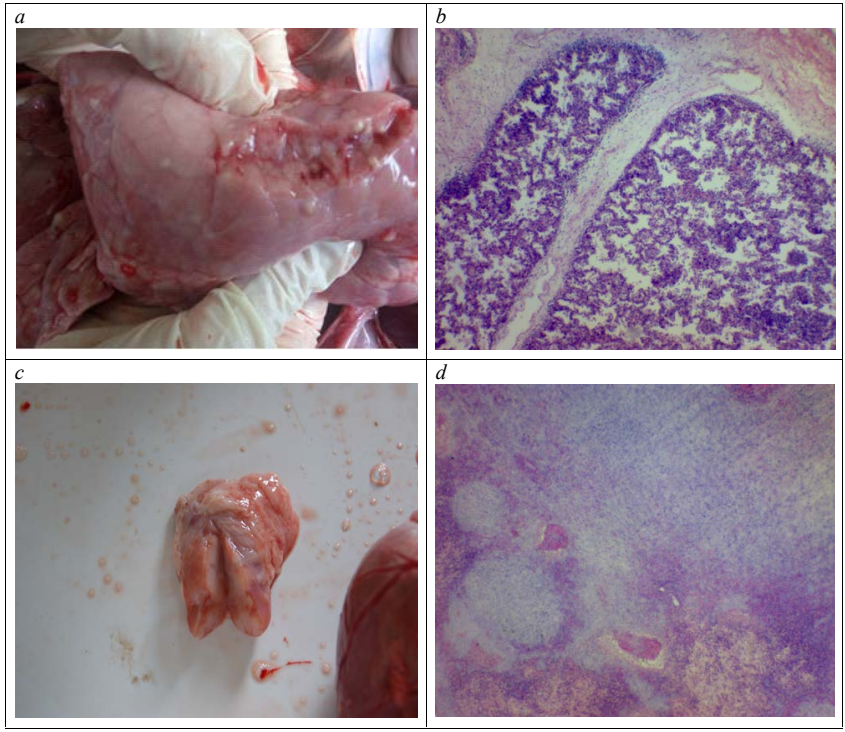

Figure 1. Pathomorphological changes in circovirus-associated pneumonia: *a* – interstitial pneumonia (native preparation); *b* – growth of interparticle connective tissue (histological preparation); *c* – proliferative lymphadenitis (native preparation); *d* – depletion of the lymphoid parenchyma of the bronchial lymph node (histological preparation). Hematoxylin and eosin, × 200

proliferative lymphadenitis with granuloma formation was noted. Lymph nodes during this process were enlarged several times,had dense consistency, their surface became irregular. The capsule of the affected lymph nodes is tense, from the surface the lymph nodes were gray-white. The incision surface of the lymph nodes was dry. At the histological level, lymphoid parenchyma was depleted by lymphocytes against the background of an increase in the relative number of lymphoid cells and macrophages.

Reproductive and respiratory syndrome of pigs is a widespread disease, which today is the most economically significant, often complicated by other viral and bacterial opportunistic pathogens [12, pp. 213–228; 19, pp. 1]. The incidence of this infection reaches 100% and mortality is close to 25%, which depends on the natural resistance and reactivity of the animal. Clinical signs and pathomorphological changes in this pathology are complex, polymorphic, manifested by two different clinical syndromes and require detailed comprehensive study. The target of the *PRRS* virus are lymphoid tissues of the whole organism, and in the lungs, respectively, alveolar macrophages. It has been found that at the beginning of the disease exudative processes with pronounced alteration of the respiratory epithelium predominate. With the development of the disease, lymphoid-histiocytic infiltration of the perivascular and interalveolar connective tissue was registered (Figure 2). Regional lymph nodes are enlarged, in a state of serous, and with the development of the process – proliferative lymphadenitis.

It was found that in the subclinical course of the disease in the lung parenchyma histologically revealed spotted hemorrhages, which also spread to the bronchus.

In the acute course, the affected areas of the lungs are clearly separated from normal tissue, compacted and have a darker color. At massive affection, extensive lobar sites of pneumonia of separate particles and even all organ, which extended in the direction from cranial to caudal sites of lungs, were noted.

During the long course of the disease with massive lung lesions, the development of interstitial pneumonia was registered, which was characterized by manifestations of the inflammatory process in the intraparticle connective tissue of the alveolar walls, peribronchially and interlobularly. Macroscopically, the lungs had a dense consistency, gray-red color, in the section there were heavy stroma of gray color.

Actinobacillary pleuropneumonia of pigs (APP) is manifested by necrotizing pneumonia, high morbidity and mortality. Pathohistological changes in the lungs, regional lymph nodes and pleura depended on the progress of the disease. It is known that the pathogen secretes cytotoxins that affect endothelial cells and alveolar macrophages, which determines the nature of pathomorphological changes during the disease [2, pp. 131–146; 14, pp. 20–24; 22, pp. 347–351].

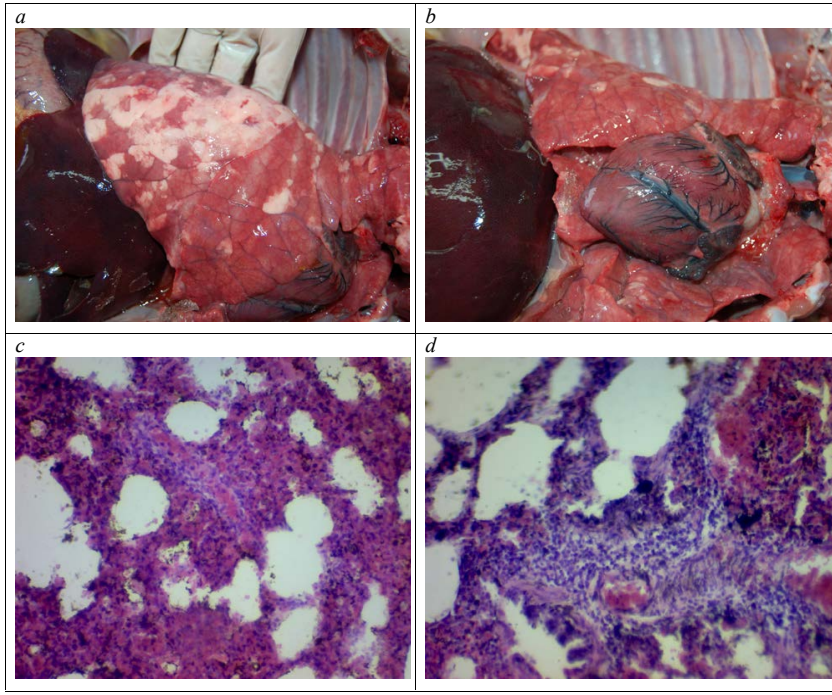

Figure 2. Pathomorphological changes in the reproductive and respiratory syndrome of pigs:
a, b **– acute catarrhal bronchopneumonia (native preparation);**
c **– acute catarrhal bronchopneumonia (histological preparation);**
d **– hyperplasia of peribronchial lymphoid tissue (histological preparation). Hematoxylin and eosin, × 200**

In the acute form of the disease in the lungs there were signs of congestive hyperemia (67%), serous and serous-hemorrhagic inflammation (33%). Macro-scopically, the lungs are not asleep, dark red with a doughy consistency (Figure 3). Congestive hyperemia was accompanied by symptoms of lympho-stasis and edema. Pink-milky foamy fluid was found in the trachea and bronchus.

Histologically, the lumens of the alveoli and bronchus are filled with a pink homogeneous mass – transudate. The blood capillaries of the lungs are dilated and full of blood.

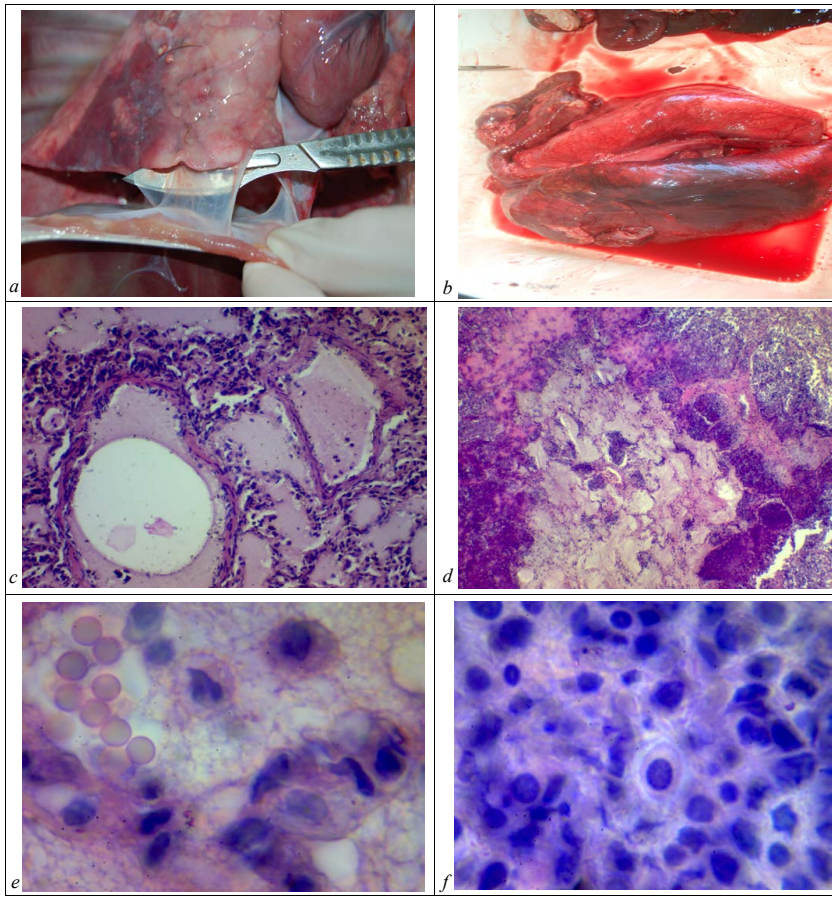

Figure 3. Pathomorphological changes in actinobacillary pleuropneumonia of pigs: *a* – fibrous adhesions between the leaves of the pleura (native preparation); *b* – foci of necrotizing pneumonia (native preparation); *c* – accumulation of exudate in the alveoli (histological preparation); *d* – areas of necrosis of the lung parenchyma with a demarcation line (histological preparation*); *e, f* – infiltration of the parenchyma by neutrophilic leukocytes and macrophages (histological preparation). Hematoxylin and eosin x 200 *(c, d)* × 1000 *(e, f)*

The connective tissue between the lobes, around the blood vessels and bronchus was thickened, in a state of serous edema, loosening of collagen fibers was expressed. Overflow of blood of venous vessels and capillaries, accumulation of edematous liquid in precapillary spaces and a stroma of body were registered. Hemosiderosis and erythrodiapedesis, effusion of serous transudate in the alveoli and bronchus, the presence of clusters of hemolyzed erythrocytes in the middle of the bronchus were detected. Dystrophic and necrotic processes in the lung parenchyma were expressed.

In serous-hemorrhagic pneumonia, the affected areas of the lungs were delineated, their borders were painted from the surface and in section in dark or black-red color, slightly protruding below the pleura and above the incision surface, denser to the touch, drowning in water. Dilated gelatinous stranded of the affected connective tissue with a pale yellow or dark red color clearly appear on the incision surface. The incision surface was smooth, a small amount of bloody exudate flowed from it.

At the micro level in serous-hemorrhagic pneumonia there were registered dilated and filled with erythrocytes alveolar capillaries, which had a tortuous course and nodularly go into the lumen of the alveoli. Pulmonary alveoli and alveolar passages were filled with hemorrhagic exudate, which revealed fibrin threads, alveolar epithelial cells and single leukocytes. Interstitial connective tissue was infiltrated by inhomogeneous serous-hemorrhagic exudate, which had a tendency to loosen, some collagen fibers were swollen and thickened. Regional lymph nodes to the lungs were in a state of acute serous lymphadenitis.

In the acute form of the disease, signs of fibrinous-hemorrhagic pneumonia were found, which was microscopically manifested by a significant accumulation of serous-fibrinous exudate in the alveoli with a high content of neutrophilic leukocytes and macrophages. The formation of foci of tissue necrosis was noted, most of the cells in these areas were in a state of karyopyknosis and karyolysis. The intercostal membranes of the alveoli were thickened, impregnated with serous-fibrinous exudate with a high content of mononuclear lymphocytes. The affected lobes of the lungs were airless, the lumens of the alveoli were filled with fibrin threads, erythrocytes predominated in the exudate. The lungs were compacted.

Fibrin layers were detected on the pulmonary pleura and pericardium, and the fusion of the pulmonary pleura with the costal pleura was recorded.

Tracheobronchial lymph nodes were in a state of acute serous lymphadenitis. It was found that in the acute form of actinobacillary pleuropneumonia inflammatory foci were more often (82%) localized in the cranial and middle lobes of the lungs.

In the subacute and chronic forms of actinobacillary pleuropneumonia, large foci of necrosis were registered in the lung parenchyma, which were located mainly in their caudal lobes. Some of them had a pronounced demarcation line and were in the process of sequestration. In the lungs there were formed foci of softening of various sizes, round shapes, cavities with a pasty mass of brown-gray or almost black color.

At the micro level, areas of necrosis were clusters of lymphocytes and alveolar epithelial cells in the state of karyopyknosis and kareorexis. The cavities of the alveoli and bronchi were filled with cellular exudate with a significant predominance of neutrophils and macrophages, including signs of dystrophy and necrosis. There were other alveolar exudate cells: respiratory epithelium, lymphoid cells and colonies of microorganisms, in the bronchi – neutrophils, desquamated epitheliocytes and mucus. Hemosiderin particles were located in some macrophages (a sign of hemorrhages in the bronchial mucosa and alveolar cavity). Lymphoid-histiocytic infiltration were active around the bronchus and vessels. On the periphery of the foci of purulent melting there were insignificant fibroblastic proliferates. Fields of serous-fibrinous inflammation are located on the periphery of necrotic foci. In the lung parenchyma at the site of inflammatory foci there were areas of fibrous tissue growth. Respiratory epithelial cells, macrophages, lymphoid cells and colonies of microorganisms; leukocytes, desquamated epitheliocytes and mucus in the bronchus. Tracheobronchial lymph nodes were in a state of serous-hemorrhagic lymphadenitis.

Hemophilic polyserositis (Glesser's disease) is a highly contagious infectious disease manifested by pneumonia, polyserositis, polyarthritis and meningoencephalitis. Hemophilic polyserositis virus has a pronounced tropism to the serous membranes [2, pp. 131–146; 9, p. 214].

In the acute course of hemophilic polyserositis, serous-fibrinous inflammation of the leaves of the pleura, pericardium and peritoneum was registered (Figure 4).

Accumulations of turbid serous exudate with fibrin flakes were diagnosed in body cavities, yellowish-grayish fibrin deposits were

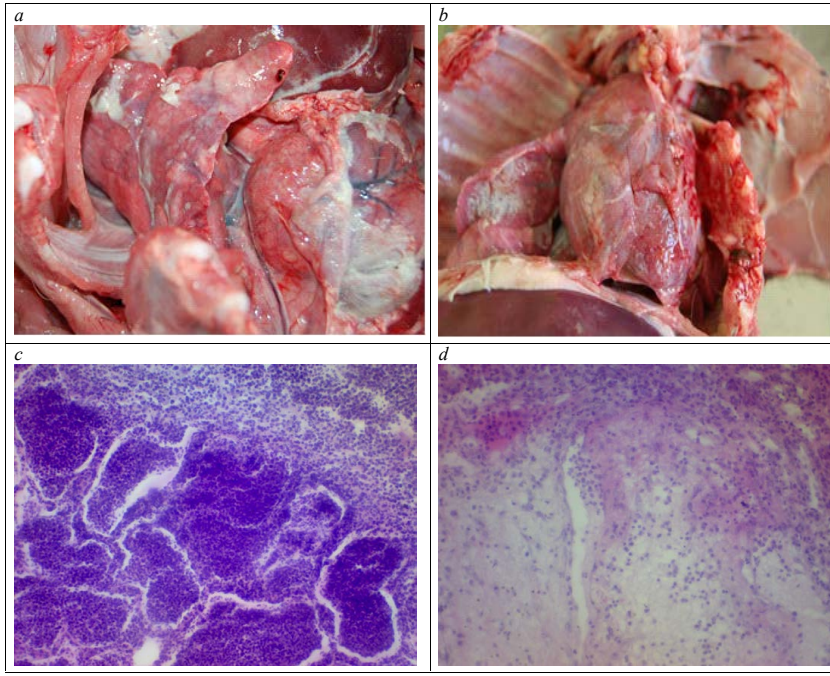

Figure 4. Pathomorphological changes in hemophilic polyserositis: *a* – fibrinous pleurisy (native preparaton); *b* – fibrinous pericarditis (native preparation); *c, d* – accumulation of exudate in the alveoli, areas of necrosis of the lung parenchyma (histological preparation). Hematoxylin and eosin × 200, × 400

deposited on serous membranes. Serous membranes were matte, gray-pink, thickened, in places petechial hemorrhage was recorded. In the subacute and chronic progress of the disease in 78% of cases there was a fusion between the costal and pulmonary pleura. The lungs were in a state of acute catarrhal bronchopneumonia. Some areas of the lungs were compacted, red, an accumulation of mucus was noted in the bronchus. Pathomorphological examination revealed mainly lesions of the caudal lobes of the lungs (78.24%). Histologically, the serous membranes were in a state of edema impregnated with fibrin, areas of necrosis and infiltration

of the parenchyma and stroma of the organ by neutrophilic leukocytes were detected.

Regional lymph nodes were enlarged, light gray, juicy in section. The sinuses of the lymph nodes were dilated, the lymphoid parenchyma was depleted and infiltrated by neutrophils.

Mycoplasmosis (enzootic pneumonia) in pigs is a widespread infectious disease that causes significant economic damage to farms. In disadvantaged farms, the disease covers up to 80% of the livestock, the death of piglets reaches 15-30%. Mycoplasmosis of pigs is manifested not only as a monoinfection, but is often complicated by secondary microflora with the development of purulent, fibrinous, hemorrhagic forms of pneumonia, in this case the mortality of animals increases to almost 90%. It is the most pathogenic mycoplasmosis pneumonia, as a co-infection, together with the causative agent of reproductive-respiratory syndrome [22, pp. 347–351; 24, pp. 186–195].

Mycoplasma hyopneumoniae has tropism to lung tissue, so mycoplasmas actively multiply in the epithelium of the bronchus and lungs and form foci of serous-catarrhal bronchopneumonia (Figure 5).

As a result of the conducted researches it has been established that pathomorphological changes in the lung parenchyma depend on the duration of the disease, the severity of clinical signs and the presence of co-infection.

At the initial stage of the disease, unilateral lobular or lobar serous-catarrhal bronchopneumonia with predominant localization of inflammatory foci in the cranial, middle and ventral edges of the caudal lobes of the lungs was detected. With the progress of the disease, the spread of the inflammatory process deep into the parenchyma of the particles, which gradually covered a significant amount of the organ, was noted. In 86% of cases, bilateral lung lesion was noted. Cranioventral consolidation of lung lesions is characteristic of porcine mycoplasmosis. At the beginning of the disease, the inflamed lobes of the lungs were in a condition of serous inflammation, uncollapsed, doughy, hyperemic, swollen, red.

In the section of the lung parenchyma was juicy, red, against which there were strands of interparticle connective tissue. In the thickness of the lung parenchyma, individual spotted hemorrhages were found, especially around the hyperemic vessels, and turbid fluid flowed from the bronchus in the incision.

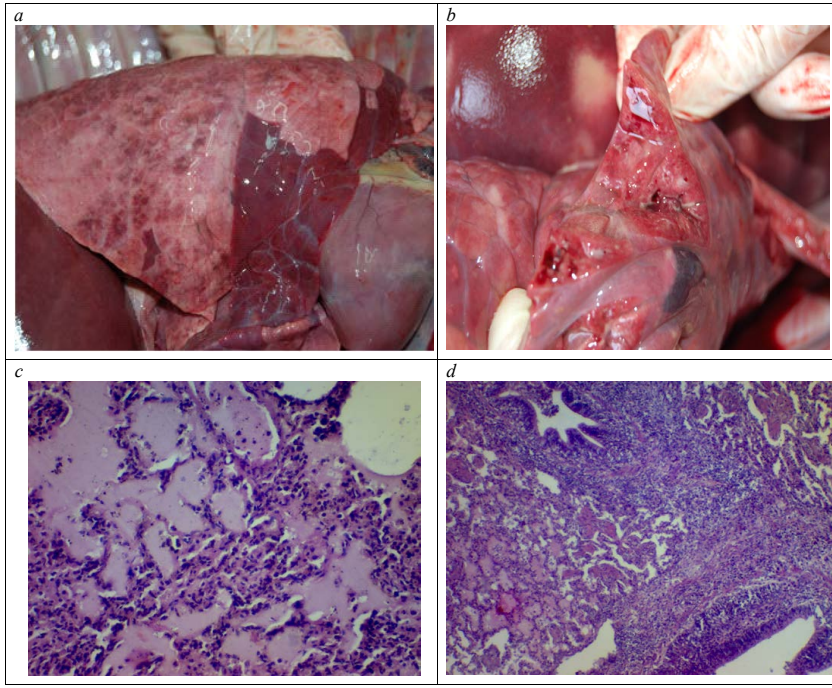

Figure 5. Pathomorphological changes in swine enzootic pneumonia:
***a, b* – acute catarrhal bronchopneumonia (native preparation);**
***c* – accumulation of exudate in the alveoli (histological preparation);**
***d* – hyperplasia of peribronchial lymphoid tissue (histological preparation). Hematoxylin and eosin, × 200**

At the micro-level, severe inflammatory vascular hyperemia, erythrocyte stasis, necrosis and desquamation of the epithelium into the lumen of the alveoli, swelling and fragmentation of the fibers of the alveolar walls and interstitial tissue, emigration of individual leukocytes were recorded. During the prevalence of inflammatory processes, the exudate was mixed with desquamated integumentary and secretory cells of the alveoli. Proliferative phenomena in the lung parenchyma were weak and manifested in the form of proliferation of mainly young connective tissue cells, monocytes around blood vessels, as well as cells of the bronchial and alveolar epithelium.

Proliferative phenomena in the lung parenchyma were weak and manifested in the form of proliferation of mainly young connective tissue cells, monocytes around blood vessels, as well as cells of the bronchial and alveolar epithelium. The lumen of the bronchus was filled with catarrhal exudate, consisting of mucus, desquamated epithelial cells and leukocytes. The phenomena of congestive hyperemia in respiratory capillaries were noted. The lumen of the alveoli was filled with serous fluid containing leukocytes and desquamated epithelial cells.

With a long course of enzootic pneumonia, connective tissue growths formed and the bronchus thickened. Bronchial lymph nodes were enlarged, juicy, the parenchyma was flabby, exploding in section.

4. Conclusions and prospects for further researches

As a result of complex pathomorphological studies of respiratory infections, it was found that pathological changes in the lungs had different localization in the lobes of the organ, the stage and nature of the pathological process, which depend on the etiological factor. Acute catarrhal bronchopneumonia was registered in respiratory mycoplasmosis (enzootic pneumonia), which in the long course turned into chronic catarrhal or catarrhal-purulent pneumonia due to co-infection. Necrotizing or hemorrhagic necrotizing pneumonia was a manifestation of actinobacillary pleuropneumonia. Interstitial (diffuse proliferative) pneumonia developed with viral pathogens – circovirus infection and respiratory and reproductive syndrome of pigs. Serous fibrinous and fibrinous pleurisy were characteristic of hemophilic polyserositis and actinobacillary pleuropneumonia.

In the lungs of animals with clinically severe circovirus-associated pneumonia there was recorded the development of proliferative (interstitial) pneumonia, the manifestations of which depended on the stage of the disease: in the stage of early active infection they were focal, and in the stage of disease, in the stage of active chronic infection hey were diffuse.

Pathomorphological changes of the lungs in the respiratory and reproductive syndrome of pigs were manifested by the gradual progressive development of the inflammatory process from congestive hyperemia, acute catarrh to diffuse interstitial pneumonia.

Pathomorphological changes of the lungs in mycoplasmosis (enzootic pleuropneumonia) of pigs were polymorphic and manifested by the gradual

progressive development of the inflammatory process, which was localized in the cranial, middle and peripheral parts of the diaphragmatic particles and was characterized by acute catarrhal bronchopneumonia.

In actinobacillary pleuropneumonia pathohistological studies revealed a pronounced stage of morphological changes in the lungs and regional lymph nodes in actinobacillary pleuropneumonia. Depending on the form of the disease, serous-hemorrhagic exudation was exacerbated by fibrinogen exudation and increased migration of lymphocytes and mononuclear cells. In the subacute and chronic forms of the disease, necrotic phenomena prevailed in combination with areas of serous fibrinous inflammation.

There are prospects for further studies of immunohistochemical analysis to establish tropism of the pathogen and the study of markers of lymphoid cells.

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