

Effect of the drug “Degelm-14” on spontaneously infected chickens with eimeriosis

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Abstract. The studies show that when using the preparation "Degelm-14" after infection of birds, the histological structure in most of the studied organs was gradually restored. In the glandular stomach and small intestine on the 22nd day after application of the studied preparation the microstructure of the organ recovered completely. Microstructural changes in the cloacal pouch and spleen after application of Degelm-14 indicated restoration of the proliferative activity of the cells of the germinal centers. In the liver, at the final stage of the study, there were no signs of metabolic disorders in hepatocytes, and the dark pink coloration of their cytoplasm indicated an increase in synthetic processes in the cells of the organ parenchyma. But in the kidneys there were still observed signs of impaired glomerular filtration, regulating the function of the organ.

1 Introduction

The introduction of digitalization in poultry farming has caused a change in the epizootic nature of the course of parasitic diseases. The use of modern poultry housing technology has led to the reduction or elimination of helminth infections, but the large concentration of livestock in limited areas has created favorable conditions for the development of protozoal diseases, especially Eimeriosis. Eimeriosis causes death of chickens, causing visible damage, but the main problem is hidden losses [1–3]. To control Eimeriosis, it is necessary to choose the right Eimeriostatic, while taking into account its effect on the host organism. Therefore, it is necessary to conduct histological and histochemical studies of host tissues after the use of drugs before introducing new antiparasitic drugs into practice [4–8].

2 Materials and methods

“Degelm-14” is a composition including H-tetradecyltributylphosphonium bromide, 5.7 – bis – (m – nitroanilino) – 4.6 – dinitrobenzofuroxane in a certain weight ratio and glucose. “Degelm-14” is a crystalline powder of light red color with Tpl – 198°C; it dissolves well in polar solvents such as dimethyl sulfoxide, dimethylformamide and in vegetable oil. Degelm-14 powder is poorly soluble in water and in non-polar solvents such as hexane, heptane, benzene, etc. The active substances of this composition are phosphonium salt that penetrates through cell plasmolemma and causes its destruction. This salt is a structural analog of phospholipid fragments of biological cell biomembranes;

substituted nitrobenzofuroxane, a component generating six molecules of nitric oxide (NO-radical) per molecule in vivo due to phosphorylation processes. Glucose is an excipient at a weight ratio of the active components of 1:10.

Translated with www.DeepL.com/Translator (free version). The coccidiostatic effect of Degelm-14 was studied on three hundred spontaneously invaded broiler chickens of cross 15. During the period of the experiment, birds were under similar conditions of housing and feeding. “Degelm-14” was given to poultry in the morning by group method with half of concentrated feed for two consecutive days at a dose of 35 mg/kg. To study pathomorphological changes in experimental coccidiosis, experimental birds were slaughtered on 7 and 22 days after infection.

3 Results and discussion

The histological structure of the glandular stomach was preserved. In the mesohumeral glands, shortened during the preceding invasive process, the exocrinocytes of round-oval shape with a small volume of cytoplasm were preserved. The mesohumeral glands retained a small volume. In some glands there were detected areas with signs of desquamation and destruction of secretory cells, as well as cells with atrophy phenomena. The folds of epithelial tissue in the area of tube gland mouths were shortened and deformed. Subepithelial lymphoid tissue of the organ was represented by compact formations in which germinal centers were not marked. Muscular basis of glandular region of the stomach had signs of atrophy

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and weakly expressed edema of intermuscular connective tissue (Fig. 1).

The connective tissue base of the reconstructed intestinal villi was represented by numerous reticulocytes, undifferentiated and lymphoid cells and single smooth muscle cells. The highest density of these cells was noted at the base of the villi. The submucosal base was poorly expressed and intermediately passed into the muscle plate, which was not of uniform thickness. The muscular layer retained signs of unfolding. Intermuscular nerve plexuses retained signs of neuroplasma swelling and pale colored nuclei. Eimeric schizonts when stained with SHIF reagent were not detected both on the surface and inside the cells of the epithelium of villi and crypts.

The histological pattern of the glandular gastric pattern on the 22nd day after infection was well preserved. Complex mesenteric glands were distinguished by the well-defined structure of labyrinth, formed of numerous glandular tubes, cells of which had a cubic shape and the presence of granulated secretory material in the supranuclear zone. Areas with signs of disruption of the epithelial monolayer of exocrine cells in the glandular tubes, characteristic of sick birds, were not detected. Under the mucosa of the organ appeared compact, dense clusters of lymphoid tissue, with a weakly marked structure of germinal centers. Lymphoid clusters were most pronounced near the mouths of complex glands. In the small intestine, on the seventh day after application of Degelm-14, the formed intestinal villi were characterized by a polymorphic structure

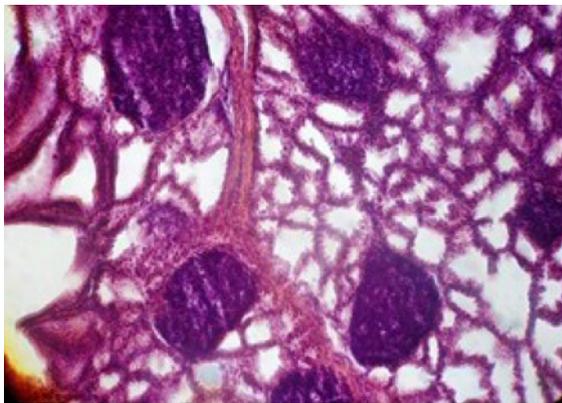


Fig. 1. Gastric gland. Formation of numerous subepithelial lymph nodes on the 7th day after application of Degelm-14. Hematoxylin and eosin staining. Ou.140.

Most of the intestinal villi had a wide base and narrowed apical part. The monolayer of columnar epitheliocytes was mainly located on the lateral surface of the villi. The apical region of individual villi was partially devoid of epithelial cover and partially due to the delayed renewal contained numerous enterocytes with signs of atrophy (Fig. 2, 3).

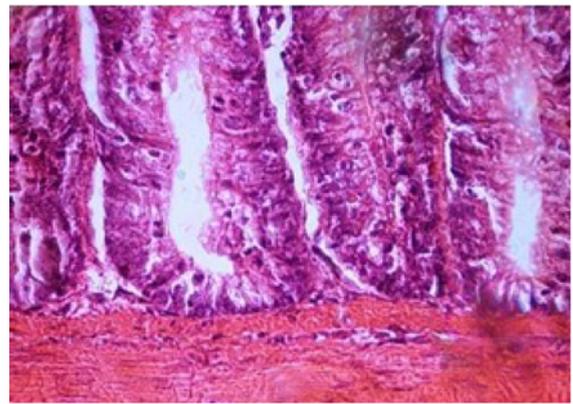


Fig. 2. The small intestine. Single mitotically active cells were detected in the regenerative area of crypts on the 7th day after application of Degelm-14. Staining with hematoxylin and eosin. 240.

On the 22nd day after application of the drug in the mucosa of the small intestine, there were villi with flattened, wide base. The prismatic epithelium of villi was characterized by the presence of numerous bocaloid cells with signs of mucus hypersecretion. Their greatest accumulation was concentrated on the lateral surface of the villi. No increased secretion was noted in the apical zone of villi. The connective tissue base of villi was characterized by hyperplasia of reticulocytes, fibroblasts, endothelial and adventitial cells of blood vessels. Most capillaries of the villi had marked wall profiles and were in a state of full-bloodedness. In the basal part of the crypts, the figures of mitosis were noted among the epitheliocytes (Fig. 4).

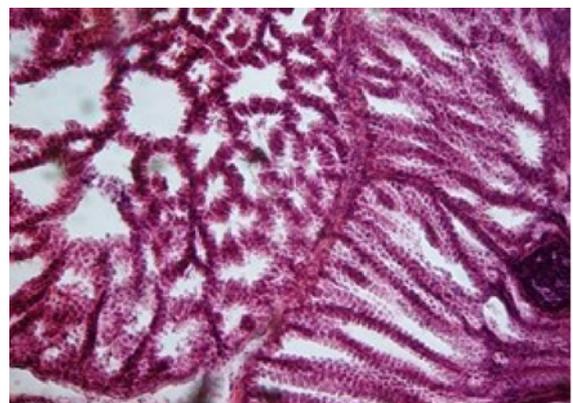


Fig. 3. Glandular stomach. Lymphoid clusters of the greatest expression were observed near the mouths of the complex glands on the 22nd day after application of Degelm-14. Hematoxylin and eosin staining. Stained with hematoxylin and eosin. 240

The nuclei of most crypt epithelial cells, as well as those of villi, were saturated with finely structured chromatin. The muscular layer was located continuously and was characterized by uneven thickness of the inner and outer layers of the muscular shell with weakly expressed signs of edema and disorganization of

intermuscular connective tissue components with preservation of nerve plexus cell structures.

The connective-tissue base of the mucosa was sparse. Single mitotically active epitheliocytes were detected at the bottom of crypts. At the base of villi the connective-tissue base was represented by numerous reticulocytes, lymphoid cells and single myocytes. The submucosal base was weakly expressed and passed into the muscularis, which was not of uniform thickness. In the muscular layer, there were signs of fragmentation. Eimeric schizonts were not detected by SHIF reagent staining.

The pattern of the cloacal pouch structure in birds after seven days of using the preparation was well enough preserved. The lobules were of different size and angular shape. On the 7th day of the drug “Degelm-14” application the lymphoid tissue proliferative activity was observed, as a result the cortical and brain areas of the lobules were clearly manifested. The interlobular fibrous connective tissue was edematous and unfolded. In submucosa there was a formation of new lobules of the organ. It was manifested by appearance of small cell clusters formed by reticulocytes, macrophages and lymphoid cells. Epithelium of bursa mucosa at the top of folds had weakly expressed signs of vacuole dystrophy in some places.

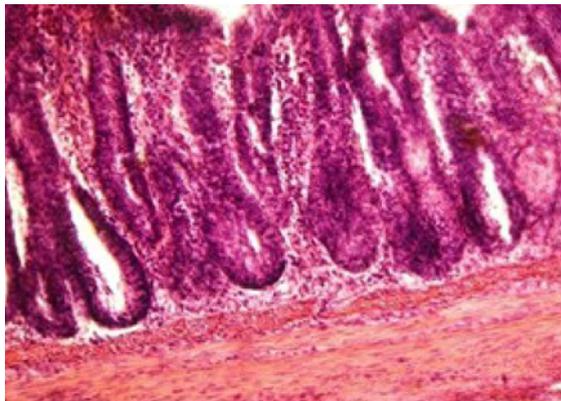


Fig. 4. The small intestine. In the regenerative area of crypts we detected single mitotically active cells on the 22nd day after application of Degelm-14. Staining with hematoxylin and eosin. Stained with hematoxylin and eosin. 240.

Fabricated bursa of birds on day 22 of the preparation had preserved mucosal epithelial layer, which was a cylindrical epithelium formed of equal height cells with a pronounced polar structure. In the folded areas, the height of epitheliocytes sharply increased. Oval, heterochromatin-saturated epithelial cell nuclei were shifted to the basal pole. Mucous membrane loose connective tissue contained numerous fibroblasts, reticular cells, between which there were bundles of collagenic and reticular fibers. Blood vessels had a well-defined endothelial structure. Lymph nodes were numerous oval, round-shaped structures with a sparse center and an increased concentration of lymphocytes along the periphery (Fig. 5). The generative center of the

lymph nodes contained numerous blast cells with mitotic figures. In addition to the formalized lymph nodes, small clusters of lymphoid tissue were detected.

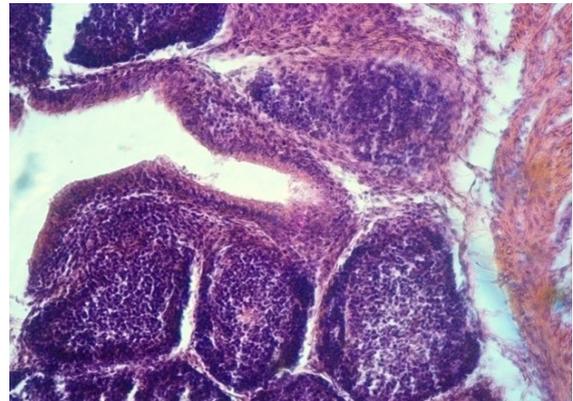


Fig. 5. Fabricated bursa. Significant accumulations of large lymphocytes, cortical and brain substance of nodules on the 22nd day after application of “Degelm-14” were noted. Hematoxylin and eosin staining. 240.

On the seventh day in the parenchyma of the spleen of the birds treated with Degelm-14, rounded lymph nodes of the white pulp were located irregularly. Individual nodules contained pronounced germinal centers containing reticulocytes with thickened processes surrounded by blastic, undifferentiated lymphocytes with mitosis figures. The mantle and marginal zones of the nodules were weakly expressed. The periarterial zone, located around the central artery of the lymph node, was a loose cluster of small lymphocytes.

In birds on the 22nd day of obtaining the studied preparation, the spleen structure pattern was well expressed. White pulp was represented by compact lymph nodes with small germinal centers containing blast cell forms, cells with single mitotic figures and large and medium lymphocytes. The mantle zone of the nodules consisted of small and medium-sized lymphocytes. The periarterial zone of the nodules was characterized by a large accumulation of small lymphocytes. The marginal zone contained dense clusters of lymphocytes, macrophages, and reticulocytes due to increased proliferative activity (Fig. 6). Surrounding lymph nodes, the moderately blood-filled red pulp was distinguished by the presence of compact clusters of small and medium-sized lymphocytes surrounded by reticular cells with swollen processes.

Microstructural changes in the spleen after application of “Degelm-14” indicated the restoration of proliferative activity of cells in the germinal centers of lymph nodes, promoted active formation of small lymphocytes, migration of these cells into the thymus dependent zone of the organ. Moderate and weakly blood-filled central arteries were distinguished by the absence of signs of connective tissue component disorganization and marked wall structures. Only in separate vessels we observed swelling of endothelial cells, large epithelioid-macrophage muffs had well-

defined borders and blood vessel profiles. At the edges of the muffs there were compact non-uniformly thick clusters of macrophage lymphocytes

On the seventh day after exposure to Degelm-14, a significant number of hepatocytes with oxyphilic stained cytoplasm were found in the weakly expressed bar structure of liver parenchyma in birds; simultaneously, a population of small hepatocytes with pycnomorphic nuclei was present. Numerous glycogen granules were found in the cytoplasm of larger hepatocytes when stained with Schiff reagent, while in small liver cells these granules were much fewer. Stellate reticuloendotheliocytes were present in the wall of sinusoidal capillaries. Few clusters of lymphoid cells were found in underdeveloped connective tissue septa.

The liver of birds after seven days of using the preparation "Degelm-14" had a preserved histological structure of the organ. Most hepatocytes were distinguished by the polymorphic structure. Along with small hepatocytes in histological sections, there were clusters of large cells with nucleus with karyoplasm filled with chromatin. Sinusoidal capillaries were moderately blood-filled. Stellate reticuloendotheliocytes located in the walls had basophilically stained cytoplasm.

The histological structure of birds' kidneys after seven days of exposure to the studied preparation was characterized by signs of weak edema of the glomerular capsule cavity. Renal corpuscles were characterized by polymorphism and increased volume. Weakly marked capillary profiles, low number and atrophy of mesangial cells in the glomerular vasculature indicated impaired glomerular filtration. Epithelial cells of the wall of proximal sections of convoluted tubules showed signs of metabolic disorders in the form of granular dystrophy resulting in accumulation of oxyphilic protein mass in the lumen of some tubules of this section. Epithelium of tubules of the nephron loop and distal parts of tubules, as well as collecting tubes were characterized by the absence of destructive phenomena.

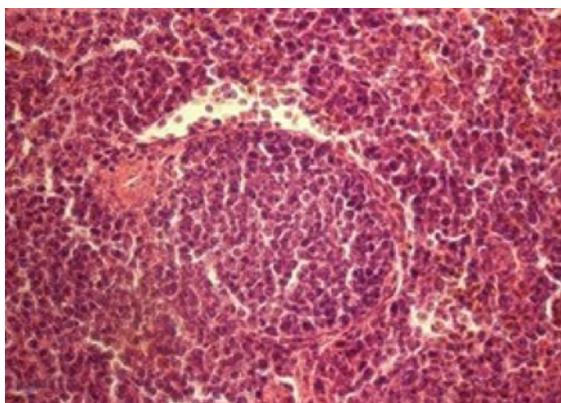


Fig. 6. Spleen. Lymph node with well-marked and structurally functional areas on the 22nd day after application of Degelm-14. Hematoxylin and eosin staining. 140.

The kidneys on the 22nd day of "Degelm-14" application had a well-preserved structure. The capsule cavity of the organ's glomeruli was characterized by slight edema. Nuclei of numerous podocytes were distinguished by low number of hyperchromic nuclei. Weak signs of protein dystrophy with the presence of oxyphilic masses in the tubule lumen were observed predominantly in the epitheliocytes of the proximal wall, creating an additional obstacle for primary urine outflow in some nephrons. Vascular glomeruli of juxtamedullary nephrons were characterized by more significant edema of capsule cavity with flattening of podocytes. Minimal manifestation of metabolic disorders was noted in the epitheliocytes of collecting tubes. Most of them had free lumen.

4 Conclusion

The conducted studies show that the application of the preparation "Degelm-14" after infection of birds, the histological structure in most of the studied organs was gradually restored. In the glandular stomach and small intestine on the 22nd day after application of the studied preparation the microstructure of the organ was completely restored. Microstructural changes in the cloacal pouch and spleen after application of Degelm-14 indicated restoration of the proliferative activity of the cells of the germinal centers. In the liver, at the final stage of the study, there were no signs of metabolic disorders in hepatocytes, and the dark pink coloration of their cytoplasm indicated an increase in synthetic processes in the cells of the organ parenchyma. But in the kidneys there were still observed the signs of glomerular filtration disturbance, regulating the organ function. Pathomorphological evaluation of the action of Degelm-14 showed the presence of active eimeriosis activity of this compound in relation to eimeriosis pathogens. During all periods of the study in the intestinal mucosa it was not possible to detect the presence of pathogenic schizonts. Effective purification of the body of sick birds was detected as early as on the 7th day after exposure to "Degelm-14". In the body, regenerative processes proceeded with increasing their expression both in the structures directly in contact with pathogens of invasion (gastrointestinal tract, liver, pharyngeal bursa), and in the organs which had no direct connection with pathogens of invasion (kidneys, spleen). It should be noted that the changes in the structure of organs and tissues of birds that received this compound were characterized by the lowest level of reactogenic action. Minimal manifestation of disorganization processes of connective and epithelial tissues at the initial period and their almost complete absence of expression on the 22nd day of experiment, against the background of regenerative and biosynthetic processes increase in the studied organs and tissues of birds treated with "Degelm-14", indicated the absence of reactogenic damaging effects of this tested agent. It should also be noted that the compound "Degelm-14" does not cause

side immunosuppressive effects on the structures of the birds' immune system organs, while other studied drugs and compounds acted with significant damage to the structure of spleen lymph nodes, subepithelial lymphoid tissue of gastrointestinal tract organs.

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