

## Conference Paper

# Pathomorphological Changes in Calves with Intrauterine Colibacteriosis

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**Abstract**

Cattle provide valuable food and raw materials for various types of industry, which is why the successful development of breeding of this type of farm animal plays an important role for the economy of the Russian Federation. Unfortunately, calves, due to stressful conditions and improper maintenance, feeding and exploitation of pregnant cows, are susceptible to diseases of the gastrointestinal tract. Colibacteriosis is one of the main causes of loss of productivity and mortality of young cattle. Therefore, the study of methods for the prevention, diagnosis and treatment of this disease is an urgent problem of veterinary medicine. This article examines the clinical and pathological methods of studying calves with intrauterine colibacteriosis. The results are presented in the form of photographs of pathomorphological changes in organs and tissues with a list of eleven pathological diagnoses inherent in escherichiosis, such as dehydration, exhaustion and anemia; hemorrhagic diathesis; acute serous lymphadenitis; acute serous splenitis (septic spleen); fatty degeneration and hemorrhages in the liver; acute catarrhal bronchopneumonia, mainly of the apical and cardiac lobes; hyperemia and hemorrhage under the epi- and endocardium; acute alterative myocarditis; acute catarrhal or hemorrhagic gastroenterocolitis; hemorrhagic or acute catarrhal with banded hemorrhage proctitis; and acute serous nephritis. For the study, we selected 16 calves of Holstein-Friesian and Brown Schwyz breed from the age of newborns to two weeks of age with symptoms of toxic dyspepsia. For the pathological studies, autopsies of 10 corpses of calves from 1 to 5 days of life were performed.

**Keywords:** intrauterine colibacteriosis, calves, pathological changes.

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## 1. Introduction

The political vector of the Russian Federation is the Food Security Doctrine, for the implementation of which the successful breeding of cattle is important. The Government of the Russian Federation allocates huge funds for the import of highly productive

dairy cattle. Since this type of animal provides valuable food products: milk, meat, raw materials for food, leather and other industries. Cows brought from abroad are especially prone to metabolic diseases, factor infections against the background of high milk productivity and climate stress. The primary manifestation of which is the birth of hypimmune young animals susceptible to factor infections [1]. Such animals lose productivity and die if they are not given timely treatment [2]. The most significant damage to livestock worldwide is caused by diseases of the gastrointestinal tract of an infectious nature. Among the gastrointestinal pathology of calves, according to the Department of Veterinary Medicine of the Russian Federation, colibacteriosis holds 30.6% [3].

Colibacteriosis (Escherichiosis) is an acute infectious disease that occurs in young animals in the first days after birth [4]. The underlying cause of the disease is enteropathogenic serotypes of *Escherichia coli*, which have pathogenicity factors such as enterotoxins, hemolysins, and adhesive antigens [5, 6].

Infection of newborn calves occurs via intra-uterine, alimentary and aerogenic ways [7]. Enteropathogenic types of *Escherichia coli* that enter the intestines multiply intensively and secrete toxins causing inflammatory reactions from the intestines: profuse accumulation of exudate, diarrhea, general intoxication [8–10]. With a particularly low resistance of the organism, *Escherichia coli* penetrates into the blood, causing septicemia, accompanied by rapidly developing dehydration, intoxication, and rapid death [11, 12]. Also, clinical signs of escherichiosis are normal body temperature, increasing by 0.5-1 °C in some cases, loss of appetite, diarrhea, which turns into profuse, increasing oppression, hyperpnoea and tachycardia, dehydration, excitement and convulsions are often observed, arthritis and pneumonia is sometimes noted.

The susceptibility and resistance of animals to colibacteriosis depend on many factors. Therefore, it is important to observe certain preventive measures: a set of organizational, economic, sanitary and hygienic and special measures when feeding and keeping pregnant cows, preparing and conducting calving [13].

A limiting factor in the excessive reproduction of *Escherichia coli* is mother's colostrum, which has both high nutritional value and protective properties due to the content of humoral and cellular elements of immunity [14]. Due to lysozyme and bacterial activity, secretory JgA, neutrophils and macrophages, colostrum in the digestive tract is able to inhibit pathogenic bacteria [15].

The initial diagnosis is made on the basis of epizootological and clinical data; the final diagnosis is based on the pathoanatomical study of the calves' corpses and the results of bacteriological analyses.

## 2. Methods and Equipment

### 2.1. Methods

#### 2.1.1. Clinical and pathoanatomical research methods

Clinical examination of animals was carried out according to the generally accepted scheme. During the initial examination, we measured the body temperature, pulse rate and respiratory movements. We determined the duration of the disease, examined the mucous membranes, and the skin. Clinical studies were performed daily. After the death, a postmortem autopsy was performed with a description of organs, tissues and pathological processes with photographing of pathomorphological changes. We prosected 10 corpses of calves from one to five days of life.

For the experiment, calves of Holstein-Friesian and Brown Schwitz breeds were selected from the age of newborns to two weeks of age in the amount of 16 animals with symptoms of toxic dyspepsia.

## 3. Results

The results of the clinical examination: the hairline is dull, felty, contaminated with feces. Turgor and skin elasticity decreased; under severe dehydration, the fold did not straighten for a long time, sometimes up to 15-20 seconds. All the animals studied had normal body temperature, except for three cases of temperature increase of 1-1.5 °C, loss of appetite, profuse diarrhea, sometimes with mucus and blood, lethargy and depression, in three cases severe depression, tachycardia and frequent breathing, dehydration. In mild calves, the body temperature was  $39.0 \pm 0.09$  °C, those with moderate severity had  $39.8 \pm 0.2$  °C; in severe cases the temperature was  $36.9 \pm 0.41$  °C, and in very severe cases it was  $35.0 \pm 0.33$  °C ( $p < 0.05$ ).

During an external examination of the dead animals, signs of dehydration were observed, the hairline was dry, ruffled; near the anus it was stained with liquid, yellowish-white stools. Hair was easily torn from hair follicles. The eyes were sunken. The conjunctiva was hyperemic.

When examining the open cavities of the calf body, hyperemia and hemorrhages were visible in the organs and on the serous integument. Examination of the rectum revealed hemorrhagic proctitis, shown in Figure 1. The kidneys were swollen, with pasty



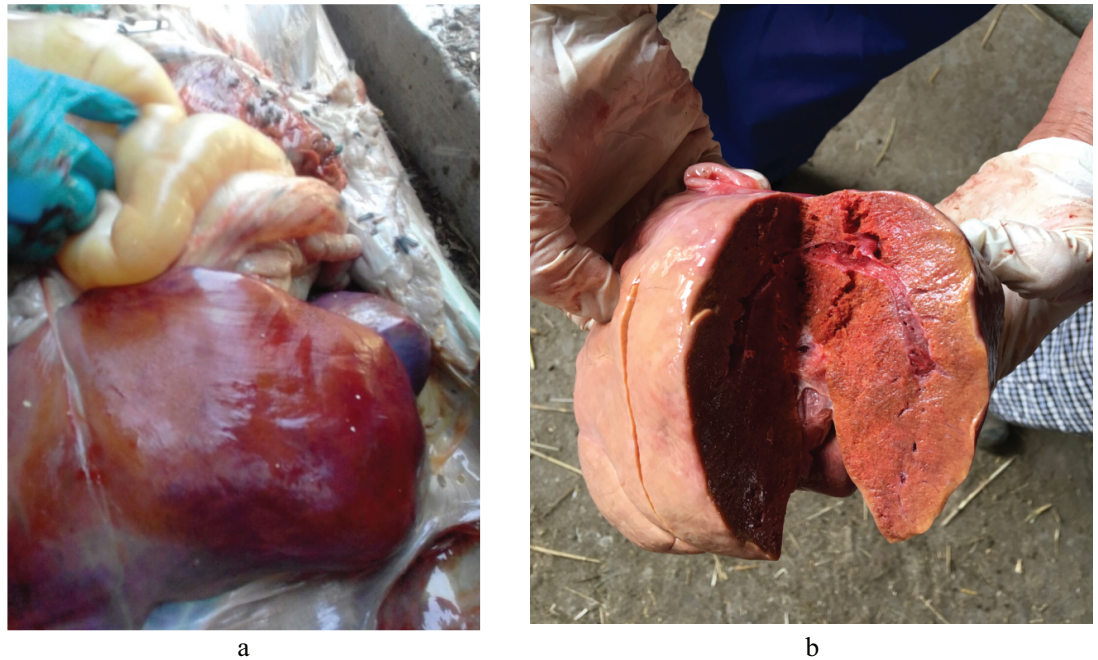
**Figure 1:** Hemorrhagic proctitis



**Figure 2:** Acute serous nephritis

consistency, unevenly colored from the surface: on a grayish-yellow background (granular and fatty dystrophy) under its own capsule there are many clearly defined dotted, spotted and banded areas of dark-red color (hemorrhage). On the section: the surface of the section is succulent, the papillae are dark red in color, clearly delimited from the medulla and swell, i.e. there was acute serous nephrite (Figure 2). The liver is enlarged with blunt edges, swollen, friable or pasty-like consistency, easily tearing; from the surface and in the section an ocher-yellow color with a large number of different sizes of clearly bounded dark-red areas—hemorrhages (Figure 3).

Septic spleen: enlarged, swollen, blunted edges, uneven gray-red color with many clearly bounded to different sizes and shapes areas on the surface—acute alternate splenitis. Lymph nodes were enlarged, dense, and contained hemorrhages under the capsule. On the section: the surface of the section is bulging, succulent, variegated. Against a gray-pink background (hyperemia of the parenchyma and stroma),



**Figure 3:** Liver after autopsy: fatty degeneration and hemorrhage in the liver (a), fatty degeneration, congestive hyperemia and hemorrhage in the liver of a newborn calf (b).

there are many clearly bounded small dotted areas of dark red color—acute serous lymphadenitis. The heart on the side of the epicardium has an uneven mottled color, due to a combination of areas of dark red (hyperemia and hemorrhage), red-brown (areas of an intact myocardium) and grayish-white color (dystrophy and myocardial necrosis)—acute alterative myocarditis (Figure 4). In the area of the heart valve, there was a hemorrhage (Figure 5).



**Figure 4:** Hyperemia and hemorrhages under the epicardium, myocardial dystrophy and necrosis





**Figure 5:** Hemorrhages under the endocardium



**Figure 6:** Surface of calf lungs—acute catarrhal bronchopneumonia

The examination of the lungs from the surface established the following. The color was uneven: it was more specific for the apical and cardiac lobes, sometimes diaphragmatic lobes were dark-red. The lungs were densified and had dulled edges, as shown in Figure 6. In the section: a combination of areas of gray-pink color (hyperemic, but close to normal) and dark red color are areas of acute catarrhal inflammation. Pieces cut from such areas were semi-submerged in water—acute catarrhal bronchopneumonia (Figure 7).



**Figure 7:** Sectional calf lungs - acute catarrhal bronchopneumonia.

## 4. Discussion

Gastrointestinal diseases of young animals represent a complex biological and medico-veterinary problem, the quality of food and human health depend on its solution. Colibacteriosis among other diseases of the gastrointestinal tract in calves occurs in 30.6% of cases and is one of the main causes of death of young cattle. Escherichiosis affects the entire body of the calf, as can be seen from the clinical symptoms and, mainly, after pathological examination.

## 5. Conclusion

During a clinical examination of sick calves of moderate severity, diarrhea, refusal of food, water, and oppression were most often recorded. According to the severity of the clinical manifestation, the enterotoxemic form of colibacteriosis is divided into: mild, moderate, severe and very severe. In severe cases, the temperature was  $36.9 \pm 0.41$  °C and in very severe cases it was  $35.0 \pm 0.33$  °C.

Pathological diagnoses for intrauterine colibacteriosis of calves are as follows: 1) dehydration, exhaustion, anemia; 2) hemorrhagic diathesis; 3) acute serous lymphadenitis; 4) acute serous splenitis (septic spleen) 5) fatty degeneration, hemorrhages in the liver; 6) acute catarrhal bronchopneumonia, mainly apical and cardiac lobes; 7) hyperemia and hemorrhage under the epi- and endocardium; 8) acute alterative myocarditis; 9) acute catarrhal or hemorrhagic gastroenterocolitis; 10) hemorrhagic or acute catarrhal proctitis with banded hemorrhages; 11) acute serous nephritis.

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## Conflict of Interest

The authors have no conflict of interest.

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