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Pathological Morphology of Cattle Leptospirosis in Kazakhstan

G.B. Kuzembekova, Zh.S. Kirkimbayeva,
A.Z. Maulanov, N.B. Sarsembaeva and A.E. Paritova

Kazakh National Agrarian University, Almaty, Kazakhstan

Abstract: This article presents pathologic changes in spontaneous leptospirosis in cattle owned by private individuals in settlements in South Kazakhstan and a dairy farm in the Almaty region of Kazakhstan during 2010-2012. The pathoanatomical situation was characterized by degeneration of the parenchymal organs, especially kidneys and liver, strongly evident haemorrhagic diathesis with multiple haemorrhages in kidneys, liver and lung epi- and endocardium. Histological analysis found marked necrobiotic and necrotic effects in kidneys and liver of the dairy cows.

Key words: Cows · Leptospirosis · Leptospira · Pathological morphology

INTRODUCTION

In many countries, including Kazakhstan, increasing the quantity and quality of meat and dairy products, while reducing the costs and the use of biological resources of agricultural animals, is an important task of agricultural sector. So, for example, in Kazakhstan, the project of beef export potential development has been set by the national government. As part of this project, during the next five years, about 72,000 units of highbred cattle from the world's best beef breeds will be imported to increase the number of breeding stock to 246,000. This project will create conditions for the production of meat for export of about 60 thousand tons of meat by 2016 and over the following five years to 180 thousand tons per year, which will make beef cattle the leading agricultural sector.

When solving such highly challenging tasks, control of the epizootic situation of leptospirosis related to hazardous zooanthroponoses, was and remains an important objective of the veterinary services of the country [1].

Leptospirosis is an infectious disease of wild and domestic animals and humans and is prevalent in different topographical and geographical areas of the world [2-7].

Leptospirosis of cattle, according to many researchers, is pervasive in Kazakhstan and worldwide and brings significant economic losses due to high mortality in cattle (25 to 45% and more), reduced milk yield (23-37%), weight loss (18-28%), reduced thrift in young animals, calf mortality (90%), abortion (15-20%), reduction in commercial quality of leather from the affected animals and rejection of livestock products at meat processing plants and reduced fertility, as well as expenditure of significant funds for diagnostic, preventive, curative and quarantine and restrictive measures [8-12].

Animals of all age groups can be affected by leptospirosis, but young animals are affected more often and with higher morbidity. The disease usually manifests itself in the grazing period following watering of animals from open ponds of stagnant water, or grazing on pasture wetlands.

Experimental Part: The study of spontaneous leptospirosis among cattle was held in farms in the Almaty and South Kazakhstan regions during 2010-2012.

Samples for bacteriological studies were selected from 24 cows *post mortem*. Preparation in nutrient medium was made of kidney [cortex], liver and bladder tissue, 3-5 tubes for each sample. Cultures were incubated in an incubator at a temperature of 28°C. Analysis of growth was performed by microscopically observation of the cultures in the "dark field" every five days. Suspension of internal organ tissue was prepared in parallel and then deposited onto a glass slide, in 1-2 drops of suspension, was covered with a cover slip and was viewed preparations with a “LEICA DM 4000 B” microscope.

Material for pathological histological examination were taken from 24 cows with macroscopically visible changes (several tissue from different parts of the organism), as well as specifically from the kidneys, liver, heart, lung, spleen, stomach, small and large intestine, submandibular and medial iliac lymph nodes.

Corresponding Author: G.B. Kuzembekova, Kazakh National Agrarian University, Abay 26 St., Almaty 050001, Kazakhstan

The pathological materials were fixed in 10% neutral buffered formalin, embedded in paraffin, sectioned at 4 µm and stained with haematoxylin-eosin, an acid fuchsin mixture of Van Gieson.

To detect leptospires in tissue impregnation with silver nitrate by the Levaditi method was used.

RESULTS

At bacteriological examination, in 11 cases culture of leptospires belonging to the Pomona serogroup were determined at serological identification.

When viewing preparations with drops of suspension by microscope, leptospira had different mobility and spiral structures.

The clinical signs of leptospirosis began in all cases in the same way and rapidly. These were: decrease in appetite, general weakness, depression of general condition and unsteadiness of gait. At the onset of disease, body temperature remained for three days at 40 - 41°C. On the third day, the affected animals started to show signs of disease in the form of jaundice and haemoglobinuria. Yields decreased sharply in lactating animals. There were signs of atony in the form of a reduction in the rate of proventriculus peristalsis and rumen tympany was frequently observed. Necrosis of skin in the form of exfoliation of the epidermis in the lower back and neck was typical. There were three cases of abortion in dams at four months gestation.

Post mortem observed changes in organs and tissues were similar between animals. Visible mucous membranes were oily and discoloured a bright ochre-yellow. Yellowness of skin was observed among animals. Subcutaneous tissue was a yellow colour and gelatinous. Skeletal muscles were flaccid with an icteric tint (Fig. 1). Surface lymph nodes were slightly enlarged and were often with symptoms of serous lymphadenitis. The spleen tissue was no different between animals. In cases of total jaundice, the peritoneum, omentum and mesentery icteric were coloured. Changes in the gastro-intestinal tract were expressed by swelling and redness of the mucous membranes of the abomasum and small intestine. The psalterium was always full of tightly compacted feed.

The most consistent changes were found in the liver and kidneys. Liver changes were characterized by blunting of the organ edges, variegation, (yellow-gray and fulvous-brown sections alternated on the liver surface), a loose texture, the liver tissue was easily torn. The gall bladder was stretched and filled with a thick, viscous dark green bile.

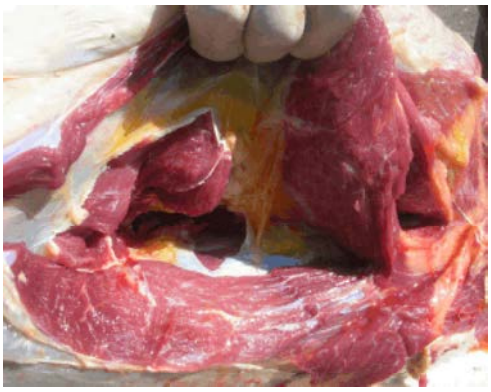

Fig. 1: Skeletal muscles of neck part were flaccid with an icteric tint

Kidneys were usually not enlarged, were firm and had a less flaccid consistency, coloured with alternation of grey, light brown and reddish areas. The capsule was easily removed, the cut surface was moist and the boundary of the cortical and medullary layers was flattened.

In eight of the animals, in addition to the above characteristics, single or multiple haemorrhage foci were identified in the organs and serous membranes.

In all 24 affected animals with *Leptospira spp.* the bladder was distended and full of a clear, dark red coloured urine. Small petechial haemorrhages were found in the mucosa.

The heart was pale red with a yellow tint, a loose consistency, with a pink coloured fluid in the pericardium. Under epicardium and endocardium there were multi-point and banded haemorrhages of varying intensity.

In brain, there was a slight dilation of the blood vessels.

Microscopic examination of organs revealed that in all internal organs, there were severe degenerative changes with foci of necrosis and paranecrosis, especially expressed in the kidney due to total necrosis of the epithelium of the convoluted tubules and in the liver with presence of an increased amount of bile pigments.

In the kidneys, histological changes were characterized by granular dystrophy, paranecrosis and necrosis of the epithelium of the urinary tubules with signs of cytoplasm destruction, desquamation and caryolysis. The convoluted tubule lumen was expanded and filled with an eosinophilic protein mass in the form of lumps, in which there were individual epithelial cells. The epithelium of the tubules was swollen, the boundaries were undifferentiated and the nuclei of many of the cells had lysed. The glomerular capsule was visible.

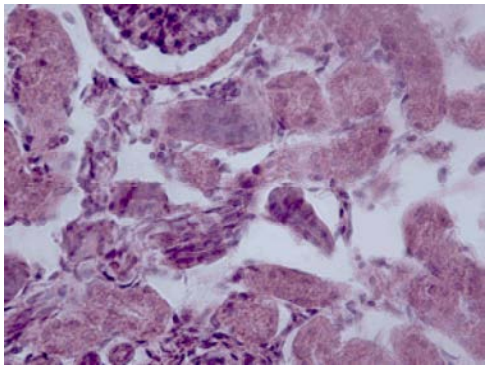

Fig. 2: Necrosis of kidney convoluted tubules (H/E, x 200)

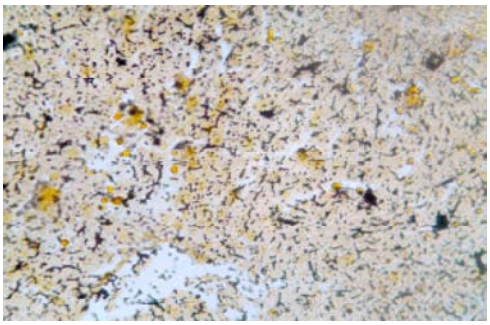

Fig. 3: Leptospira in kidney convoluted tubules (Silver impregnation by Levaditi, x200)

In the vascular loops there were moderate numbers of epithelium nuclei. The luminae of the glomerular capsule were free, or contained an eosinophilic coloured liquid. A significant number of cubic epithelium cores, the lining of the straight tubules, were exposed to pyknosis (Fig. 2).

In sections of kidneys tissue, leptospires were found. Leptospira were localized in the lumen and on the surface of urinary tubules epithelia in the form of clusters, bundles and, less frequently, in the epithelium cytoplasm, mainly in single units (Fig. 3).

In the liver, microscopic changes are largely generated by granular dystrophy of liver cells with disruption of girder structure, sometimes accompanied by weak vacuolar dystrophy and fatty infiltration, acute congestive hyperaemia, presence of various degrees of focal and extensive fields proliferation of lymphocytic cells with mixture of plasma cells. Karyorhexis or karyolysis with coagulation of cytoplasm was detected in single cells.

In the myocardium, granular dystrophy was found: oxyphilie and pale muscle fibres, weak expression or no cross-striation and in a single cases, small separate centres of proliferation of lymphoid cell.

In the lungs, centres of dystelectasis expressed serosanguineous oedema and desquamation of the alveolocytes.

In the meninges and in brain tissue, pronounced swelling was found, expansion and a plethora of vessels of all types. As a result of these changes, marked neuronal degenerative changes developed concluding in death and reaction of glial.

CONCLUSIONS

The pathoanatomical situation with regard to leptospirosis in cattle is characterized by degeneration of the parenchymal organs, especially the kidneys and liver, severe haemorrhagic diathesis in the kidney, liver, lung epi- and endocardium. Histological examination demonstrated the presence of circulatory disorder, variously marked dystrophic and necrobiotic phenomena and proliferative processes in the parenchymal organs.

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