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Pathomorphology of Echinococcosis of Sheep in Kazakhstan

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Abstract: The article presents the results of clinical and pathomorphological study of 579 slaughtered and compulsorily slaughtered sheep in Almaty region. Pathomorphological study has revealed that echinococcosis of sheep mainly affects liver and lungs,other organs are rarely affected. In all cases in affected organs larval echinococcus has been a unilocular cyst filled with liquid and surrounded with two-layer shell of significant sizes. In terms of histology a necrosis zone has been formed around the cyst, then, a site of cellular infiltration from eosinophils, plasmatic cells, lymphocytes, macrophages and fibroblasts. Occasionally sites of accumulation of lymphoid elements have been observed, which form lymphatic nodes.

Key words: Slaughtered sheep · Echinococcosis · Unilocular cyst · Eosinophils · Plasmatic cells · Lymphocytes · Macrophages and fibroblasts

INTRODUCTION

Currently solution of the problems related with production of safe raw materials of animal origin, high quality food products in terms of veterinary and sanitary is the main trend of fundamental and applied investigations aimed at establishment of veterinary security both in a single region and in the whole country, it is of high importance for preservation of population health. The veterinary and sanitary inspection of Almaty region regularly detects such zooanthroponosis diseases as echinococcosis, measles, trichinellosis. Due to affection of internal organs or bodies with various helminths the meat factories, slaughterhouses, slaughter units and markets every year reject and dispose of high amounts of liver, lungs, hearts and other raw meat. Slaughter tankage is also high in the case of echinococcosis [1-3].

Echinococcosis is a helminth zooanthroponosis disease, dangerous for human health, which occupies one of the leading position in terms of caused damage to cattle breeding due to its wide extension. Despite the existing high amount of data on the germ and the disease, echinococcosis is still a major social problem, causing significant economic losses due to affection of numerous kinds of domestic animals and humans. The reason is insignificant knowledge of epizootic process, modern tools of diagnostics, treatment and prevention of echinococcosis [4, 5].

Echinococcosis is encountered both for animals and humans. Economic entities suffer high losses due to mortality of animals and decrease in their productive properties. Affected animals fall behind in their development, their gradual exhaustion is observed. For a human, echinococcosis is a very serious disease, since vital organs are affected: liver, lungs etc. Parasitism can lead to destruction of overall organism with possible fatal outcome. Despite the high level of global veterinary, the problem of parasitic diseases of farm animals, echinococcosis in particular, is still acute and vital [6-10].

The aim of the this work is pathomorphological and histological investigation into the organs of sheep affected with cystic echinococcosis.

Experimental Part: The work was carried out by the Chair of biological safety and Kazakh--Japanese Innovation Center, Kazakh National Agrarian University.

Histological studies were performed with organs and tissues of slaughtered and compulsorily slaughtered animals from economic entities of Almaty region after spontaneous echinococcosis. The histological analysis was carried out on samples of liver, kidney, spleen, heart, thymus, stomach, small and large intestines, echinococcus cysts and brain cord at the distance of 1 cm from the edge of fibrous capsule and from the fibrous capsule itself. The pathological material was fixed in 10 % neutral aqueous solution of formalin. The obtained pieces of organs after appropriate treatment were sealed into

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paraffin and celloidin. Paraffin cross-sections, obtained from paraffin blocks with thickness of 4 μm, were painted with hematoxylin--eosin and Van Gieson's stain and analyzed using microscope at 200--400x magnification. Histological micro-samples were analyzed using Leica DM 4000 B binocular microscope, thin cross-sections were prepared using HEOSTION ER M 3100 semi-automated microtome.

RESULTS

During 2010-2012 in slaughterhouses of Almaty region we examined echinococcosis of sheep supplied for slaughtering from sheep breeding farms. As a result of postmortem studies of 5889 slaughtered and compulsorily slaughtered animal echinococcosis was detected for 9 % (579) sheep. According to our observations, there were no seasonal variations in occurrence of the disease. More often it occurred in spring and autumn.

It can be seen in Table 1 that the most frequent occurrences of echinococcosis are detected in early spring and in autumn months, which, most probably, is related with weakening of immunity, since numerous animals after wintering are especially weak, as well as with poor treatment of domestic dogs against parasites and dog walking in prohibited areas.

As a result of examination of internal organs it was found that echinococcus was mainly localized in liver and lungs, however, in individual cases other organs were found to be affected. In all affected organs larval echinococcus was unilocular cyst filled with liquid and

Table 1: Results of examination of animals for echinococcosis from 2010 to 2012

	Years: 2010-2012		
Months	Animals studied	Number of animals with echinococcosis	% of affected animals
January	288	54	9,3
February	255	33	5,7
March	360	39	6,7
April	894	60	10,4
May	300	27	4,7
June	135	15	2,6
July	294	24	4,1
August	345	63	10,9
September	1053	75	12,9
October	1185	87	15,0
November	780	57	9,8
December	480	45	7,8
Total	5889	579	100

Fig. 1: Macro-sample of sheep liver affected with cyst echinococcosis (original)

surrounded with two-layer shell of significant sizes (up to 1--5 cm in diameter). Together with multiple affection of one lung with echinococcus cysts double affections were also observed, as well as with simultaneous affection of other organs, liver more frequently.

The most sever variations were detected in liver and lungs. Liver of sheep, affected by echinococcosis, had increased volume, it was nodulated, swollen, with blunt edges, sharply compacted in certain sites, it had from brown--grey to clayish color, easily torn within palpation. On the organ surface, in addition to parasitic cysts, grey sinuous paths are well seen and on the cross-section in pulmonary parenchyma grayish, sometimes calcificated, parasitic nodes were detected. Chronic perihepatitis and chronic parasitic cirrhosis were detected, on serous tissues of parenchymatous organs connective tissues were proliferous, which roughened their surface.

Echinococcus cysts in liver were located in various lobes (Fig. 1). However, the right hepatic lobe was affected more frequently, which can be attributed to peculiar features of structure of liver vascular system. They were near the organ surface, overhanging its serous membrane. Sometimes echinococci were located inside liver, in this cases they could be detected by palpation. Growing echinococcus cysts impacted mechanically on tissues, which finally resulted in atrophy of adjacent areas of organ and its pronounced deformation.

The surface of the cross-section is dryish, the pattern is smoothened, the lobulation occasionally is not apparent. Echinococcus cysts of globular shape were surrounded with whitish dense fibrous capsule, which was glomerated with surrounding tissues. Around chitinous membrane of the cysts inflammatory reaction

was always observed with subsequent development of fibrosis. All this deformed liver and caused its dense consistence. Within death and empyema of cyst the anatomico-pathological pattern sharply varied due to acute purulent inflammation of cyst walls. In other areas of the affected organ, which were not compressed, vicarious hypertrophy was observed.

Echinococcus cysts were detected in all lobes of lung, with more frequent localization in the right lung mainly in the unilocular form. The wall of echinococcus cyst consisted of two membranes: interior nucleating (germinal layer) and exterior chitinous (cuticular layer). From outside the echinococcus cyst is surrounded with fibrous capsule, formed as a result of constant impact of the cyst onto surrounding tissue or response variations in them. Only in one case the calcification of capsule of echinococcus cyst was observed. Atelectatic sections of lungs, which surrounded the cysts, fell over the surface and had dense consistence. Portions cut from the atelectatic sections sank in water.

High surface areas of diaphragmatic and cardiac lobes of the lungs were in the state of alveolar emphysema. These sections were pale pink with increased volume. Within incision characteristic crepitation sound was heard. The surface of the kung incision was smooth and dry.

Within histological study of parasitic nodes in various parts of liver their characteristic structure was revealed. In terms of histology necrosis zone was formed around the cyst, then, the focus of cellular infiltration from eosinophils, plasma cells, lymphocytes, macrophages and fibroblasts. Occasionally foci of lymphoid elements were detected, which formed lymph nodes. We consider the described nodes in the capsule wall as a morphological sign of protective reaction against foreign matter. In other sections the necrosis and inflammation zones were replaced with healing connective tissue. While actively penetrating into liver pulp the funnels of nucleation layer, similar to cysts, evolve ferments, toxic waste products, which leads to pronounced dystrophic changes in hepatocytes, up to necrosis, destruction of vascular walls, formation of the productive inflammation torus.

The preserved hepatocytes around parasitic foci are with occurrences of macrovesicular liver dystrophy. Towards the outside of the fibrous capsule there was detected dense network of newly formed blood vessels with thickened walls and signs of fibrinoid swelling. Perivascular lymphohysteocytic infiltrates were observed. Far from the capsule the liver tissue preserved usual angioarchitecture. In bile ducts the changes were

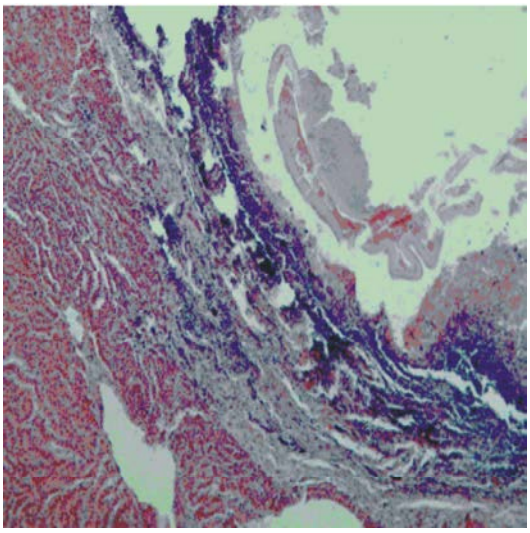

Fig. 2: Violation of framed structure and dystrophy of hepatocytes around the capsule of echinococcus cyst.

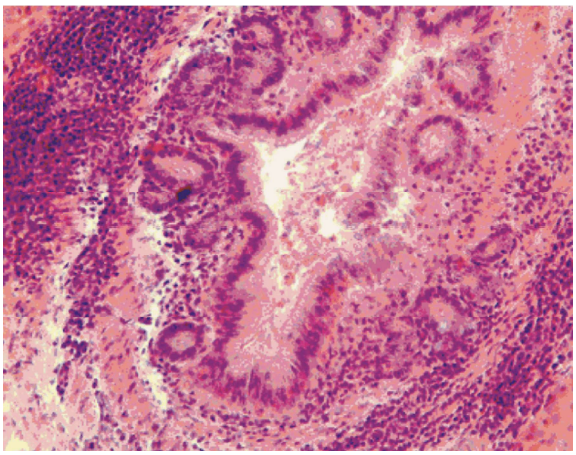

Fig. 3: Desquamative cholangitis. Accumulation of mucus, desquamated epithelial cells in gall opening.

observed, characteristic for desquamative catarrhal cholangitis. In the duct opening high amounts of mucus and desquamated epithelial cells were accumulated. Connective tissue matrix of the duct walls is thickened and infiltrated with eosinophil leucocytes.

In the case of low to medium cysts with live parasite (23 occurrences) liver pulp around fibrous capsule was in the state of albuminous and adipose degeneration with itralobular cell response (Figs. 2-3), which is probably related with tissue hypoxia, developed under the conditions of inadequate arterial blood supply. The foci of hepatocyte necrosis were rare. Proliferation of bile ducts was detected in triads adjacent to fibrous capsule.

Fig. 4: Macro-sample of sheep lung, affected with cystic echinococcosis (original)

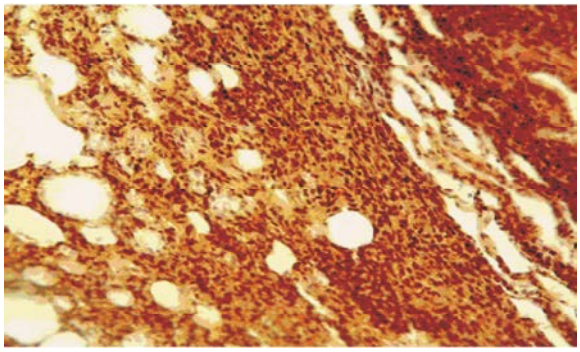

Fig. 5: Atelectatic sections of lungs are strongly compressed, alveoli with thickened interalveolar septa. Van Gieson's stain.

Periportal stroma along portal tract, mainly around bile ducts and interlobular vessels, contained swelling and fine-focal infiltrates, which consisted of lymphoid single plasmatic cells and eosinophils. These changes were revealed mainly against the background of moderate growing of connective tissue and cholestasis (Figs. 4-5).

Within histological study of atelectatic sections of the lings highly compressed alveoli with thickened interalveolar septa were detected. The width of the atelectatic sections and their localization depend on the size of echinococcus cyst. Alveoli and alveolar ducts of emphysematous sections are widened, the capillaries are desolate, the alveoli walls are thin. The alveocytes are atrophied and thin and the respiratory bronchi are expanded.

Therefore, echinococcosis can affect any organ, though it is established that more often the parasitic cyst is localized in liver, 59.5 %, in lungs, 33.1 %, the remaining rare localizations of echinococcus amount in general to 7.4 %.

DISCUSSION

In recent 10-15 years in Republic of Kazakhstan significant increase of echinococcosis is observed among farm animals. Mainly unilocular echinococcus is spread in Kazakhstan.

Taking into account the damage caused by echinococcosis to human health, as well as huge economic loss of economy, it should be understood that the problem of control of this parasitic disease is of vital importance for Kazakhstan and is of nation-wide significance.

Within necropsy of the animals affected by echinococcosis depletion, increase and roughness of the affected organs is observed, the existence of various amounts and sizes of cysts filled with transparent slightly opalescent liquid with floating, scarcely visible, scolices of parasites. Within incision, colorless transparent liquid was evolved from the cysts and internal proper tunic of parasite was easily detached from exterior connective-tissue capsule of the organ. The tissue between the cysts is compressed, anemic, in the state of atrophy, in some cases albuminous and adipose degeneration was detected.

As a result of examination of internal organs it was revealed that echinococcus was mainly localized in liver and lungs and in single cases other organs were damaged. In all cases in the affected organs the larval echinococcus was a unilocular cyst, filled with liquid and surrounded with two-layer shell of significant sizes (up to 1--5 cm in diameter).

CONCLUSIONS

Within spontaneous echinococcosis of sheep the echinococcus was mainly localized in liver and lungs and in single cases other organs were damaged. In all cases in the affected organs the larval echinococcus was a unilocular cyst, filled with liquid and surrounded with two-layer shell of significant sizes. Under the impact of the echinococcus cyst atropohic, dystrophic and necrotic changes are developed in pulmonary parenchyma.

REFERENCES

1. Blokhina, S.V., 2009. Epizootiology of Cystic Echinococcosis in Omsk Region. Tyumen.
2. Fitzpatrick, J.L., 2013. Global food security: The impact of veterinary parasites and parasitologists. Vet Parasitol. doi:pii: S0304-4017(13)00213-6. 10.1016/j.vetpar.2013.04.005.

3. Christine, M. Budke, Hélène Carabin, Patrick C. Ndimubanzi, Hai Nguyen, Elizabeth Rainwater, Mary Dickey, Rachana Bhattarai, Oleksandr Zeziulin and Men-Bao Qian, 2013. A Systematic Review of the Literature on Cystic Echinococcosis Frequency Worldwide and Its Associated Clinical Manifestations. Am. J. Trop Med. Hyg., 12-0692; Published online April 1, 2013.
4. Kereyev, Ya. M., 2010. Echinococcus of Animals. Monograph. Uralsk.
5. Parikh, F., 2012. Echinococcosis--cut to cure but what about control? J Assoc Physicians India, 60: 9-10.
6. Khachatryan, 2011. Pathomorphological Characteristic and Some Epidemiologic Features of Echinococcosis in Armenia. Yerevan, Author's Edition.
7. Almukhanov, S.G., 2005. Pathogenesis within Experimental Helminthoses of Sheep. Veterinariya, 8: 33-37.
8. Bobić, B., A. Nikolić, S.K. Radivojević, I. Klun and O. Djurković-Djaković, 2012. Echinococcosis in serbia: an issue for the 21st century? Foodborne Pathog Dis. Nov; 9(11): 967-73. doi: 10.1089/fpd.2012.1227. Epub 2012 Oct 31.
9. Cardona, G.A. and D. Carmena, 2013. A review of the global prevalence, molecular epidemiology and economics of cystic echinococcosis in production animals. Vet Parasitol., 192(1-3): 10-32.
10. McManus, D.P., D.J. Gray, W. Zhang and Y. Yang, 2012. Diagnosis, treatment and management of echinococcosis. BMJ. Jun 11;344:e3866. doi: 10.1136/bmj.e3866. Review.