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The Ultrastructure of the Blood-Brain Barrier in Experimental Chlamydial Infection

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Abstract: Livestock chlamydia is a large group of diseases associated etiologically, but mostly they differ in the character during the infectious process and the forms of its clinical development. They are characterized with the abortions of breeding stock, the birth of non-viable and weak young animals with the symptoms of polyarthritis, pneumonia, enteritis, conjunctivitis and encephalomyelitis.The results of the scientific research evidence a wide prevalence in many countries including Russia. Scale spread, the ways of contagion, clinical and anatomical forms of chlamydia were found out. Chlamydia refers to the diseases in which there is the destruction of the passability of the blood-brain barrier leading to degenerative changes of brain cells and accordingly to the development of animals' neurologic symptomatology. Pathological processes in spontaneous and experimental chlamydia of animals appear in the brain tissue as diffusive, discirculatory and dystrophic changes, in soft cerebral membrane in white and grey matter of the brain. Microcirculation disturbance in the soft cerebral membrane contributes to its exfoliation from brain matter and it leads to the changes of itstrophism. Pathologically morphological changes become apparent at the level of the structures of blood-brain barrier facilitates Chlamydia implementation in the brain tissues of infected animals and it causes the necrobiosis processes.

Key words: Chlamydia · Brain · Cerebellum · Blood-brain barrier · The destructions of capillary walls · The destruction of endothelium · Psychosis neurons · Osmiofiliya of cytoplasm · Mitochondria's destruction

INTRODUCTION

Chlamydia of animals was widespread in many countries due to the development of animal husbandry in recent years [1-4] A lot of livestock, domestic and wild animals, [5-8] birds have the diseases caused by chlamydia [9-12].

The study of the blood-brain barrier is of great interest as it was always the subject of numerous experiments and clinic researches [13-16].

According to the scientific work of Shtern L.S. (1967) [17] the present barrier has multiform functions and it determines selectivity of the penetration of substances from blood into brain and return passing of any substance.

Many scientists specify close mutual dependence between the function of the blood-brain barrier and nervous system activity [18]. Under pathological processes the barrier function of an organism is reconstructed. The stability of histogematogenous barriers rises or falls. It leads to the change of their permeability. [19][20].

MATERIALS AND METHODS

The research materials are pathogenic microorganisms (Chlamydia). Rats of both sexes were used at the experiments. The causative agent Chl. Psittaci, the stain "Lorry" detailed from a parrot in 1957 were used for the rats` infection.

The description of the microorganism is given in "the Catalogue of strains" edition 4, M., 1962.

There were used 40 pedigreeless rats with sexual maturity (36 females and 4 males). The average mass of the females was 250 grams. The males 'mass was 300 grams. The animals were put in quarantine for 2 weeks before the experiment.

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The infectious material was injected intraperitoneally as 10% suspension purified with the differential centrifugation of aviculture Chl. psittaci strain "Lorry". The infectious titer of theinoculants was $10^{-7}LD_{50}$/0,5 ml for chicken embryos.

The animals were divided into two groups. The first group was experimental and the second one was test. Each group had 18 females and 2 males. All the animals of the first group were undergone to exciter infection. The second group was under the control. Physiological solute was injected intraperitoneally.

The animals were killed in 14 days after infection by the overdose of ether anesthesia. The brain was extracted on the glass and it was fixed in 25% solute of glutaraldehyde aldehyde. The pouring was made in epoxy tars. The slices were prepared with the ultratom LKB-8800. They were contrasted with lead citrate. Besides, the slices were researched in the electronic microscope AMB-100 BR. We presented the cerebral cortex with soft brain tunic of cerebellum as the object of the research in order to describe morphological evidences.

RESULTS AND DISCUSSION

The ultra-structural changes in brain tissues and cerebellum under the experimental chlamydial infection of rats had a focal character.The features of a toxic effect were detected. They appeared in the form of extensive focuses of fusion and discomplexation of nervous tissue, hemorrhages, neurons` death, glial cells and the formation of extensive antrum. There was edema and the effusion of blood, in place of neurons` death. (Fig.1,2). There were swelling, dissociationof myelin abrupt edema of medullatedrames with inside roundish formations, surrounded with membrane in the white substance. They had granular internal structure with the sizes of 350 up to 880 nm. Their morphology and sizes match reticular bodies of Chlamydia. (Fig. 3,4).

Along with these destructive processes the wall of vessels of microcircularcanal was subjected to changes (Fig.5) [21]. There were tumefaction, the thinning and destruction of endothelium in some places in capillaries.There were also the features of capillary walls destruction. (Fig.6).In some places there was perivascular position of erythrocytes and an abrupt perivascular edema (Fig.7).

There were dystrophic changes in neurons and glial elements. The focuses of necrosis and tissue fusion were in some places (fic. 8, 9). Pycnosis neurons,

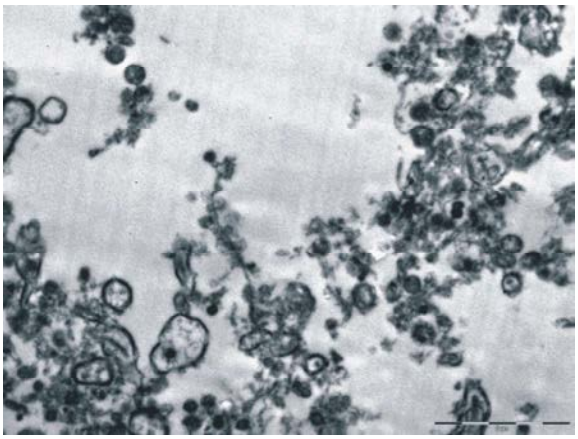

Fig. 1: Rat`s cerebrum. Spacious edema and destructive changes in nervous tissue. Magnification x 4400.

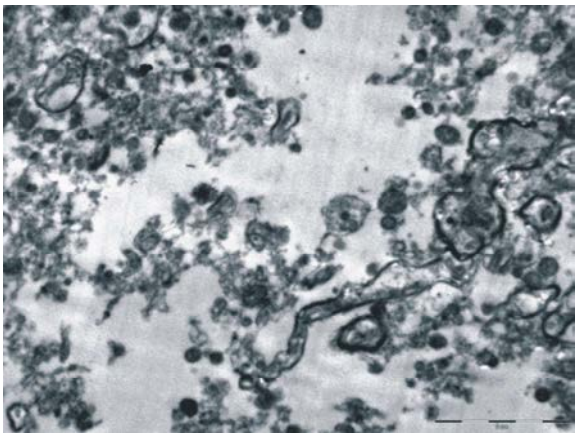

Fig. 2: Rat`s brain. The 4400 fracture of myelin membrane with the destruction of an axial cylinder. Magnification x 4400.

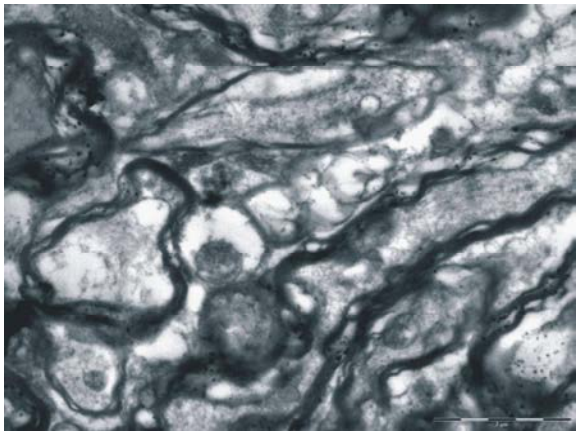

Fig. 3: Rat`s cerebellum. Dissociation and focal destruction of myelin fibres and chlamydia accumulation. Magnification x 11000.

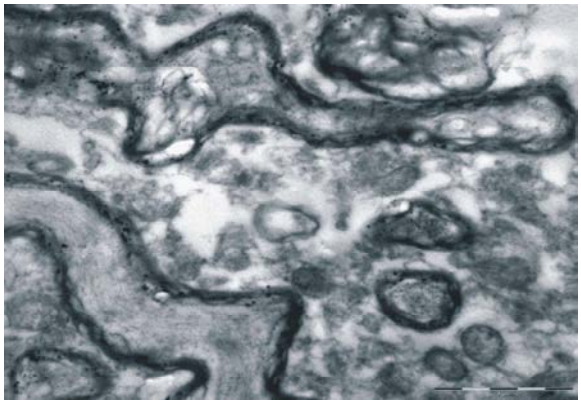

Fig. 4: Ceveebrum. Swelling and dissociation of myelin fibres, the edema of surrounding tissue. Magnification x 11000.

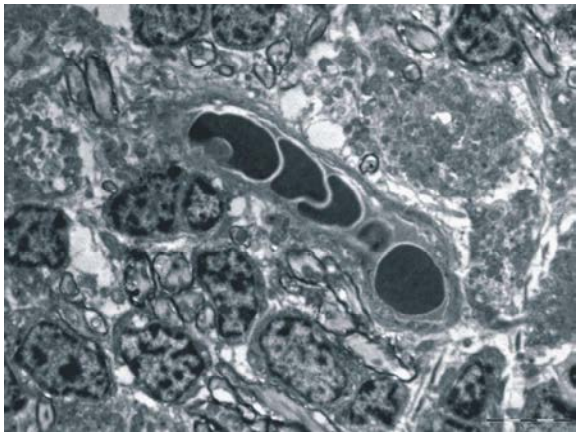

Fig. 5: Cerebellum. The cells of granular layer among neurons` appendies.The loosening of the vessels` walls. Plethora of capillaries, loosening of basal membrane, perivascular edema. The destruction of myelin. Magnification x 28000.

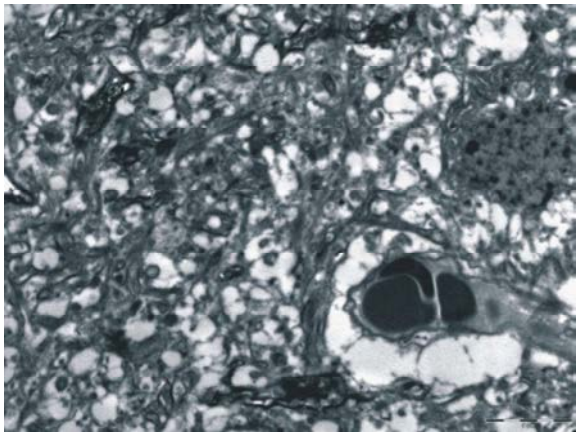

Fig. 6: Brain. Expressed. Perivascular edema destruction of all the layers of the wall of the capillary. Magnification x 2800.

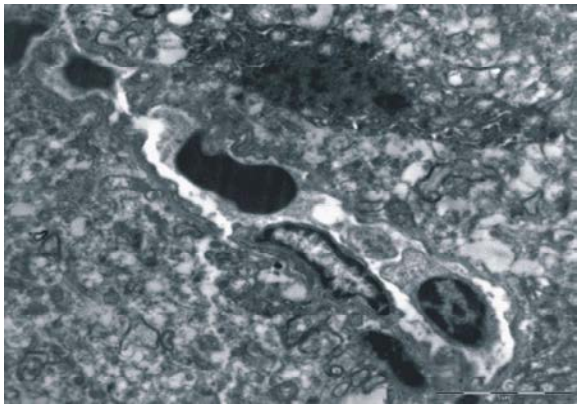

Fig. 7: Rat's brain. Expressed. Swelling and deskva. Endotheliocytes. Karyokinesis of the neuron. Magnification x 4400.

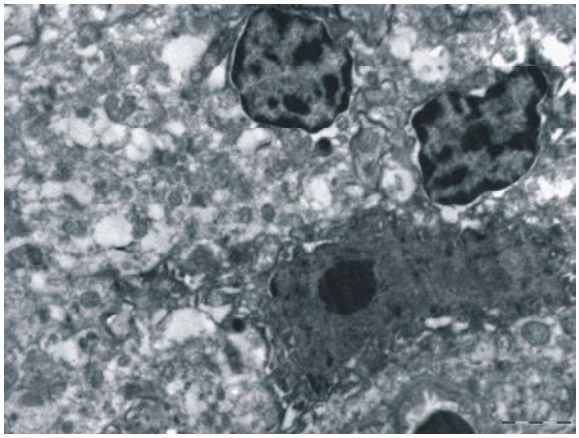

Fig. 8: Rat's brain.Cariopicnos of the neuron and the dystrophy of cells.The edema of surrounding tissue. Magnification x 5600.

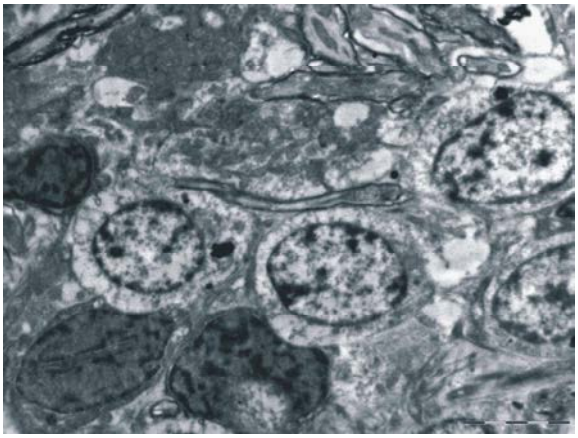

Fig. 9: Grainy cerebellum cortex.Vacuolization of cells'cytoplasm.The edema of perinuclear expanse of gliacytes. Magnification x 3500.

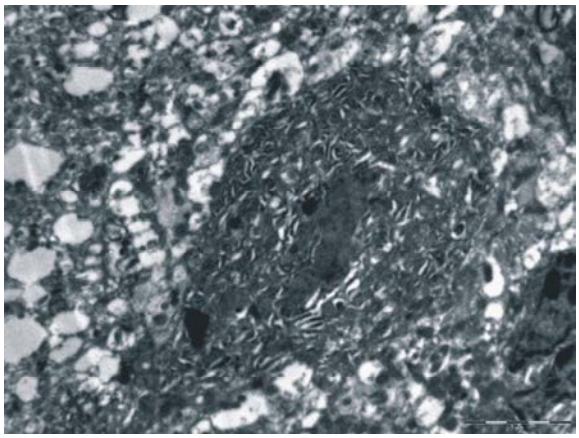

Fig. 10: Ganglionic layer of cerebellum cortex. The expansion of ductule and the cicterns of plasmatic system, the destruction of cells' metochondrions. Magnification x 3500.

the osmiofiliya of cytoplasm, the expansion of tubules and tanks of endoplasmic system, the destruction of mitochondria, the appearance of lysosomes and autophagosome, the infraction of nucleate membrane, irregular distribution of chromatin and the exit of nucleate substance into cytoplasmic matrix were registered.(Fig.10).

In some cases there were nucleus pycnosis with the formation of vane structure and uniform distribution of chromatin. There was a large nucleus, located eccentrically.Also neurons had tearing and the absolute absence of cytoplasmic membrane, the disappearance of ribosome's and polysomes, the destruction of organelles. There was a pericytial edema.The glial cells in the nidi of nerve tissue lesion were dense and picnomorphic in some cases. The other cells had the clarification of cytoplasm and the rarefaction of chloroplast in nuclei.

CONCLUSIONS

Thus, the rough changes in the cells of central nervous system were discovered during the submicroscopic research.They were from dystrophic up to irreversible necrotic. They had a focal character. There was the destruction of organelles in the nidi.The process was followed by the destruction of neurons (the malfunction of nuclear and cytoplasmic membranes with going out of nuclear contents and the destruction of organelles), the destruction of glial cells, the appearance of fusing nidi, tissue discomplexation, hemorrhages, edema, swelling, the dissociation of myelin, a sudden edema of myelinated appendixes with clamydiay inside the bodies. Lysosomes and mitochondrions were subjected to the most considerable changes [22]. There was the destruction of cristas and the disintegration of outer membrane with a complete loss of the structure in the structure of metochondrions. There was the malfunction of one of the main components of hematoencephalic barrier. It was a capillary part as a result of its walls destruction. Its endothelium was presented in the form of a narrow stipe and it was impossible to differentiate organelles of capillaries` walls were revealed by us. Such processes were not viewed histological. In own view, the ultra-structural changes in cerebrum tissues are determined with not only the presence of Chlamydia but the toxic effect of an infectious agent and discircular and dystrophic processes which are irreversible in most cases.

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