

The brain perivascular spaces at neuroinflammation: the ultrastructural investigation.

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Aims. Despite the important role of perivascular spaces in the circulation of cerebrospinal fluid, as well as the use of modern research methods, recent scientific publications show that there is still no consensus on their localization and histological structure. The purpose of the study was to study the histotopography of perivascular spaces or Virchow-Robin in the cerebral cortex in a model of experimental endotoxemia.

Material and methods. Endotoxemia was achieved by introducing purified LPS (1mg / kg taken from *Escherichia coli*, Serotype 0111: B4, San Diego, USA) into the lateral tail vein of white rats. Pieces of the cerebral cortex together with the meninges were processed by conventional methods of light and electron microscopy.

Results. The study of semi- and ultrathin sections of the cerebral cortex showed that the perivascular spaces of Virchow-Robin are not a direct continuation of the subarachnoid space. The presence only one layer of cells of the pia mater around the brain arterioles penetrating into the cerebral cortex of the brain makes it almost impossible to arrange here also elements of the arachnoid matter. A study of the brain by nuclear magnetic resonance methods in recent years has shown that the fluid of the perivascular spaces and the cerebrospinal fluid of the subarachnoid space have a different composition [3]. From a review of the literature, we conclude that topographically perivascular spaces are gaps between the adventitia of the cortical arterioles and the continuation of the pia mater [1, 2]. However, the results of our studies showed that both in normal condition and experimental endotoxemia areas corresponding to the Virchow-Robin spaces are found between the elements of the pia mater and the the glia limitans surrounding the cerebral vessels. The presence of fluid in the Virchow-Robin spaces raises the question of how fluid and substances dissolved in it penetrate through the cells of the pial membrane. So, the presence of one layer of pial cells around the vessels of the brain, as well as the absence of tight contacts between them, excludes the barrier function of the elements of pia mater located here. This is also evidenced by the spread of edematous fluid in the subpial spaces. The data obtained suggest that the main reason for the accumulation of edematous fluid in the perivascular spaces during

inflammation is the “leakage” of pia mater so that low molecular weight compounds pass through membrane surrounding the vessel.

Conclusions. The role of the pia mater in ensuring the direction of fluid flow, as well as the absence of barrier structures in its composition, leads to the conclusion that the actually perivascular spaces of Virchow-Robin include not only the gaps between the adventitia of the cerebral vessels and the pia mater, but also the subpial spaces. It is the latter that preferentially expand as a result of the accumulation of edematous fluid at brain pathologies, including systemic inflammation.

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