Brain lipoprotein metabolism

Lipoproteins are macromolecular complexes composed of lipids and proteins. The role of these complexes is to provide cells of the organism with lipids to be used as a source of energy, building blocks for biomembrane synthesis, and lipophilic molecules (e.g., steroid hormones and vitamin E) for other physiological purposes, such as cell signaling and antioxidative mechanisms. Lipoproteins also promote the cellular efflux of cholesterol for its disposal into bile. Thus, lipoproteins play an important role in the maintenance of lipid homeostasis throughout the organism. Accordingly, lipoprotein particles have been found circulating in blood, lymph, and interstitial fluid. Despite the existence of the blood-brain barrier, lipoprotein particles have been shown to be also present in the cerebrospinal fluid (CSF). Although a portion of their protein components may filter through the barrier from the vascular compartment, experimental evidence indicates that these particles originate from the nervous tissue. The other protein components include apolipoproteins E, J, and D, and these have been shown to be synthesized by cells within the central nervous system (CNS). Furthermore, it was shown that lipoprotein particles can be isolated from the conditioned medium of astrocytic cultures. The differences in size, structure, and composition of in vitro assembled particles compared with those isolated from the CSF suggest that the particles are modified following their secretion in vivo. This is supported by observations that lipoprotein-modifying enzymes and transfer proteins are also present within CNS tissue and CSF. The fate of CSF lipoproteins is unclear but is probably related to the turnover and clearance of lipids from the CNS or, alternatively, the particles may be recaptured and recycled back into the CNS tissue. The presence of several cell surface receptors for apoE-containing lipoproteins on ependymal cells, as well as on neurons and glial cells, supports this notion and suggests that the isolated brain possesses its own system to maintain local lipid homeostasis. This is further exemplified by the salvage and recycling of lipids shown to occur following a lesion in order to allow surviving neurons to sprout and reestablish lost synapses. Not much is currently known about lipoprotein metabolism in neurodegenerative diseases, but lipid alterations have been repeatedly reported in Alzheimer brains in which neuronal loss and deafferentation are major features. Although the mechanism underlying the link between the epsilon4 allele of the apolipoprotein E gene and Alzheimer's disease is presently unclear, it may well be postulated that it is related to disturbances in brain lipoprotein metabolism [1)].

1)
Danik M, Champagne D, Petit-Turcotte C, Beffert U, Poirier J. Brain lipoprotein metabolism and its relation to neurodegenerative disease. Crit Rev Neurobiol. 1999;13(4):357-407. Review. PubMed PMID: 11028681.