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Review

The blood-brain barrier: an overview: Structure, regulation, and clinical implications

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Abstract

The blood-brain barrier (BBB) is a diffusion barrier, which impedes influx of most compounds from blood to brain. Three cellular elements of the brain microvasculature compose the BBB—endothelial cells, astrocyte end-feet, and pericytes (PCs). Tight junctions (TJs), present between the cerebral endothelial cells, form a diffusion barrier, which selectively excludes most blood-borne substances from entering the brain. Astrocytic end-feet tightly ensheath the vessel wall and appear to be critical for the induction and maintenance of the TJ barrier, but astrocytes are not believed to have a barrier function in the mammalian brain. Dysfunction of the BBB, for example, impairment of the TJ seal, complicates a number of neurologic diseases including stroke and neuroinflammatory disorders. We review here the recent developments in our

understanding of the BBB and the role of the BBB dysfunction in CNS disease. We have focused on intraventricular hemorrhage (IVH) in premature infants, which may involve dysfunction of the TJ seal as well as immaturity of the BBB in the germinal matrix (GM). A paucity of TJs or PCs, coupled with incomplete coverage of blood vessels by astrocyte end-feet, may account for the fragility of blood vessels in the GM of premature infants. Finally, this review describes the pathogenesis of increased BBB permeability in hypoxia–ischemia and inflammatory mechanisms involving the BBB in septic encephalopathy, HIV-induced dementia, multiple sclerosis, and Alzheimer disease.



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Keywords

Blood–brain barrier; Tight junction; Germinal matrix; Astrocyte; Pericyte

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