Visualizing the endothelial glycocalyx in human brain tumor vessels

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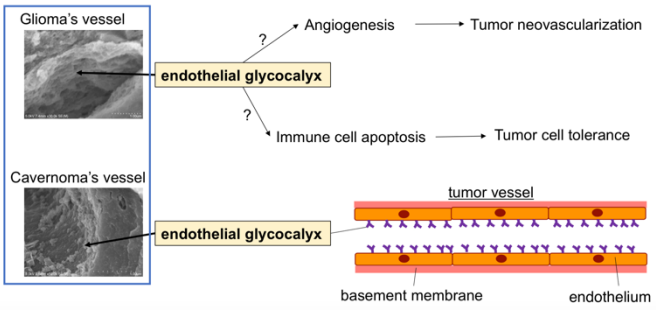
Abstract

The blood vessels in brain tumors play an important role in brain tumor therapy; these vessels are not only a source of nutrients, but also a transport pathway for anticancer drugs and immune cells. However, these vessels are more fragile than normal blood vessels, which makes it difficult for drugs to reach brain tumors, and plasma leakage from these vessels can cause brain edema. Furthermore, the brain tumor vascular endothelium has been implicated in the development of drug resistance, leading to increased attention on the vascular endothelial glycocalyx.[1,2] The endothelial glycocalyx is an intracellular structure of vascular endothelial cells, which are composed of glycans and glycoproteins. The vascular endothelial glycocalyx covers the inner walls of blood vessels and plays an important role in maintaining tissue homeostasis.[3] Recent studies indicate that, in cases of SARS-CoV-2, damage to the vascular endothelial glycocalyx may be involved in the early stages of organ failure.[4]

Previous studies[5] by neurosurgeons have offered insights into the microstructure of brain tumor vessels. However, the structure of the vascular endothelial glycocalyx has not been fully reported and remains unclear. The vascular endothelial glycocalyx is involved in the regulation of vascular permeability and inflammatory cell migration and is closely associated with cancer progression, including cell migration and metastasis, tumor cell adhesion, tumor formation, and tumor growth.[1,2] This study aims to visualize the vascular endothelial glycocalyx of brain tumor blood vessels and to identify structural differences in the vascular glycocalyces of different brain tumors in human tissues. Our group has effectively employed lanthanum nitrate to visualize the vascular endothelial glycocalyx through three-dimensional electron microscopic imaging. Elucidating the structure and role of the vascular endothelial glycocalyx may contribute to improved drug treatments for brain tumors.

Image

"Visualizing"



Recent Publications

1. Zeng Y, Qiu Y, Jiang W, Fu BM (2022) Glycocalyx Acts as a Central Player in the Development of Tumor Microenvironment by Extracellular Vesicles for Angiogenesis and Metastasis. Cancers (Basel) 14:5415.
2. Kang H, Wu Q, Sun A, Liu X, Fan Y, Deng X (2018) Cancer Cell Glycocalyx and Its Significance in Cancer Progression. Int J Mol Sci 19:2484.
3. Suzuki A, Tomita H, Okada H (2022) Form follows function: The endothelial glycocalyx. Transl Res 247:158–167.
4. Okada H, Yoshida S, Hara A, Ogura S, Tomita H (2021) Vascular endothelial injury exacerbates coronavirus disease 2019: The role of endothelial glycocalyx protection. Microcirculation 28:e12654.
5. Shibata S (1989) Ultrastructure of capillary walls in human brain tumors. Acta Neuropathol. 78:561-71.

Photograph



Biography

Dr Ohmura is a young Japanese neurosurgeon who provides general neurosurgical treatment including stroke, brain tumors, and trauma. He investigated brain tumor imaging with ^{11}C-methionine-PET. Recently, he has focused on the endothelial glycocalyx and is fascinated by the visualization of cerebrovascular microstructures. The role of the endothelial glycocalyx in the pathogenesis of brain diseases is still unknown, and he is enthusiastic about his research. If you have any questions, please contact me.

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Notes/Comments: