Glucose transporter 3

Glucose transporter 3 (or GLUT3), also known as solute carrier family 2, facilitated glucose transporter member 3 (SLC2A3) is a protein that in humans is encoded by the SLC2A3 gene.

Glucose delivery and utilization in the mammalian brain is mediated primarily by a high molecular weight form of GLUT1 in the blood–brain barrier, GLUT3 in neuronal populations and a less glycosylated form of GLUT1 in the remainder of the parenchyma. GLUT3 is considered the main but not the exclusive neuronal glucose transporter, whereas other glucose transporters have also been observed in neurons.

GLUT3 expression in neurons in the rat coincides with maturation and synaptic connectivity and a positive correlation between protein levels of GLUT1, GLUT3 and regional cerebral glucose utilization was observed in mouse.

The central role of GLUT3 in cerebral metabolism has been challenged by the astrocyte-neuron lactate shuttle (ANLS) hypothesis, which proposes that astrocytes play the key role in the coupling of neuronal activity and cerebral glucose utilization. In this hypothesis, the astrocyte, which relies on GLUT1 for glucose transport, is the primary consumer of glucose in the brain, providing lactate as the primary energetic fuel for neurons. However, by modeling the kinetic characteristics and glucose concentrations in neurons and glia, it was concluded that the glucose capacity of neurons via GLUT3 far exceeds that of astrocytes via GLUT1. Additionally, demonstrations of increase in GLUT3 expression associated with increased cerebral glucose utilization provides further confirmation of the central role of GLUT3.

GLUT3 facilitates the transport of glucose across the plasma membranes of mammalian cells. GLUT3 is most known for its specific expression in neurons and has originally been designated as the neuronal GLUT. GLUT3 has been studied in other cell types with specific glucose requirements, including sperm, preimplantation embryos, circulating white blood cells and carcinoma cell lines.

To investigate the role of expression of glucose transporter 3 (GLUT3) and glucose transporter 1 (GLUT1) in pituitary neuroendocrine tumors, including effects on size, cystic change, and hormone type. pituitary neuroendocrine tumors from 203 patients were collected from January 2013 to April 2017, and immunohistochemical analysis was used to detect the expression of GLUT3 and GLUT1 in tumor specimens. GLUT3-positive expression in the cystic change group was higher than that in the non-cystic change group (P = 0.018). Proportions of GLUT3-positive staining of microadenomas, macroadenomas, and giant pituitary neuroendocrine tumors were 22.7% (5/22), 50.4% (66/131), and 54.0% (27/50), respectively (P = 0.022). In cases of prolactin adenoma, GLUT3-positive staining was predominant in cell membranes (P =0.000006), while in cases of follicle-stimulating hormone or luteotropic hormone adenoma, Mei et al. from the Fuzhou General Hospital found mainly paranuclear dot-like GLUT3 staining (P = 0.025). In other hormonal adenomas, GLUT3 was only partially expressed, and the intensity of cell membrane or paranuclear punctate staining was weak. In contrast to GLUT3, GLUT1 expression was not associated with pituitary neuroendocrine tumors. Thus, the results indicate that the expression of GLUT3 in pituitary neuroendocrine tumors is closely related to cystic change and hormonal type. This study is the first to report a unique paranuclear dot-like GLUT3 staining pattern in pituitary neuroendocrine tumors [1].

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Mei T, Zhang J, Wei L, Qi X, Ma Y, Liu X, Chen S, Li S, Wu J, Wang S. GLUT3 expression in cystic change induced by hypoxia in pituitary neuroendocrine tumors. Endocr Connect. 2018 Dec 1. pii:

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