

Probably caused by

Case 410

4. Glymphatic system disorder

【Progress】

She was admitted in our hospital for high signal intensity corresponding to bilateral cortex of frontal, parietal lobes to be in a state of watchful observation.

【Discussion】

Fluid attenuated inversion recovery (FLAIR) is based on T2WI. T2WI signals were acquired after null point of fluids. Null points are different among tissues: First, in a situation under inclined magnetic fields, the tissues face along with magnetic fields. When 180-degree pulse is applied, magnetic attraction is reversed. Thereafter, when the pulse cut off, magnetic attraction returns to an original position, through zero point of no signal of the tissue magnetic attraction, calling null point. Null point is different depending on tissues; null point of fat tissue 140msec, fluid 3600msec. Therefore, when T2WI procession initiates after 3600msec, T2WI with suppressed signals of fluids are acquired, calling FLAIR. Namely, both fluids and edema are both depicted on T2WI, while edema is selectively high signal intensity with no signals of fluids on FLAIR.

High signal intensity of deep white matter on FLAIR is becoming appearing as ages advance. The mechanism of this edematous phenomenon is not yet to be clarified. There are hypotheses: extra-vascular edema, cellular edema, myelin degeneration of imbalance between water and lipid components. There are no vessels in deep white matter. If myeline or glia cells fall in disorder, there should be some symptoms such as multiple sclerosis or neuro-myelitis optic spectrum disease. However, high signal intensity of deep white matter appearing as ages advance, usually causes no marked symptoms.

In the biggining of the 2010s, it is reported that the lymphatic system of brain is present, calling glymphatic system: crevasse alongside arterioles and venules; the crevasse connects from arteriole crevasse to venules crevasse, cerebra-spinal fluids (CSF) fluids flow in the crevasse, gives some nutrients and flow out nerve cells wastes (1-6). CSF is produced in ventricles and flows to subarachnoid space and absorbed at arachnoid granules. Some volume of CSF flow to gate of arteriole crevasse calling Aquaporin 4, flow in spaces among nerve cells (myelin), glia cells and flow out to gate of venules crevasse gate, drain along with vein branches, connect to meningeal lymphatic system at subdural space, and further, communicate with deep cervical lymphatic system, finally to venous angle at left subclavian vein, system circulation system.

The gate of the crevasse is called Aquaporin4 that is formed by glia (astrocyte) legs tips. The gate opens widely in sleeping time, proceeding to excrete of nerve cells waste such as Amyloid β (2, 4, 5).

It is considered that as ages advance, disorder of glymphatic systems induces stagnation of glymphatic system inducing the situation like edema, whose images might be depicted on FLAIRMRI. Although the high signal intensity of deep white matter depicted on FLAIRMRI is not known to induce any harmful effect on cognition or motion, thick extensive high signal intensity of white matter might affect brain malfunction, such as that mild edematous lower extremities does not any negative function on motion or walking but thick edema of lower extremities cause to induce to be unable to walk smoothly.

If severe extensively high signal intensity of deep white matter causes lowering cognition and/or motion, new dementia naming of lowering cognition might be necessary adding Alzheimer disease, Lewy body dementia, frontal-lateral lobe dementia and brain vessels dementia.

In our case, not only high signal intensity of deep white matter is depicted on FLAIRMRI, but also high signal intensity is depicted at bilateral frontal, parietal cortex on Diffusion MRI. It is known that high signal intensity of brain cortex, irrespective of symmetrical or not, is depicted on Diffusion MRI for diseases; hypoxia, septic or non-septic embolism, vein thrombosis; infection of Brion Creutzfeldt Jacob disease, viral encephalitis Rabies encephalopathy: metabolic disease, hypoglycemic disease, hepatic encephalopathy: post convulsion state (7-10).

【Summary】

We presented a ninety-year-old female presented in our hospital for continuous sleeping tendency. Brain FLAIRMRI depicts extensively high signal intensity of bilateral deep white matter and Diffusion WI MRI depicts high signal intensity of cortex at bilateral frontal temporal lobes. It is borne in mind that high signal intensity in aged persons depicted on FLAIRMRI might be dependent upon the degree of disorder of glymphatic systems that function excretion of brain cells waste and whose flow in via peri vessels crevasse from CSF draining to meningeal lymphatic, deep cervical lymphatic system. Bilateral high signal intensity on Diffusion MRI is depicted in cases of such as; hypoxia, septic or non-septic embolism, vein thrombosis; infection of Brion Creutzfeldt Jacob disease, viral encephalitis Rabies encephalopathy: metabolic disease, hypoglycemic disease, hepatic encephalopathy: post convulsion state.

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