

Grey and white matter in brain and their disorders – a review

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ABSTRACT

White matter and grey matter disease is responsible for malfunctioning of human central nervous system due to improper functioning of immunological system. The White matter disease is due to fade away, of tissue in the largest and deepest part of brain. This tissue contains millions of nerve fibers, or axons that connect brain and spinal cord and signal nerves to convey messages to one another. And the grey matter disease is an autoimmune, chronic and disabling disease of the human central nervous system, histological characterized by multifocal areas of inflammatory demyelination within white matter (WM).

Keywords: *White matter, Grey matter, Multiple Sclerosis*

The human brain is a very complex structure. Besides, there are parts of brain, which still do not know much about. More importantly, science and medicine still do not know the cure for numerous nervous system diseases and how to repair the damage despite this; scientists have managed to discover a lot about this mysterious organ that is the node of personality and life. Dividing its anatomical structure into lobes, the left and right hemisphere, and brain parts help us understand its structure and, more importantly, its functions and mechanisms in a better way. The vertebrate brain is segregated into white and gray matter¹. Gray matter carries neuron somata, synapses, and local wiring, such as dendrites and mainly nonmyelinated axons. White matter carry global, and in large brains mainly myelinated, axons that implement global communication²

Gray matter

The grey matter is mostly composed of neuronal cell bodies and unmyelinated axons. The processes that extend from neuronal cell bodies are called axons that carry signals between those bodies. In the grey matter, these axons are primarily unmyelinated, that mean they are not sheath by a whitish-colored, fatty protein called myelin.

White matter

White matter is mainly consisting of myelinated axons, which are long relays that extend out from the soma, and due to the relatively high lipid fat content of the myelin protein that sheathes seems whitish in colour. These form connections between brain cells, and white matter is typically distributed into bundles called tracts³

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WHITE MATTER DISEASE

White matter disease is due to fade away, of tissue in the largest and deepest part of brain. This tissue contains millions of nerve fibers, or axons that connect brain and spinal cord and signal nerves to convey messages to one another. A fatty material called myelin protects the fibers and gives white matter its color. This sort of brain tissue helps to think fast, walk straight, and keeps from falling. When it became unhealthy, the myelin breaks down. The signals that help do these things can't get through. Body stops working like it should. White matter disease occurs in older or elderly people.

Diagnosis of white matter disease

White matter disease is mostly detected on brain MRI of elderly people as 'leukoaraiosis or white matter hyperintensities (WMH). It is clear that the presence and extent of WMH is a radiographic marker of cerebral vessel disease and an important predictor of the life-long risk of stroke, functional disability and cognitive impairment. Some studies define the significance of WMH as a biomarker for long-term cerebrovascular disease and dementia⁴. For assessment of WMH severity two main radiographic approaches are the visual grade rating scales used to measure white matter lesion (WML) on MRI or CT. MRI-based scales, such as the Fazekas scale.

Cause

Causes for white matter disease may be high cholesterol, Smoking, Long term high blood pressure, Diabetes, Ongoing blood vessel inflammation, History of stroke, Parkinson's disease and Genetics may also play a role.

Symptoms

Symptoms may include problem while walking, trouble in learning or remembering new things, slowed thinking, depression and leaking urine.

Cure of white matter disease

White matter disease is hard to cure, but there are treatments that can help to manage the symptoms. The primary treatment is physical therapy. Physical therapy can help with any balance and walking difficulties that may develop. Overall physical and mental health can be improved when patient able to walk and get around better with little or no assistance. Based on current research, managing vascular health may also be an effective way to manage the symptoms of white matter disease. Not smoking and taking needed blood pressure medications as directed may help slow the progression of the disease and symptoms.

GREY MATTER DISEASE

Multiple Sclerosis (MS) is an autoimmune, chronic and disabling disease of the human central nervous system, histologically characterized by multifocal areas of inflammatory demyelination within white matter (WM). For this reason, MS has been traditionally considered a "pure" WM disease. However, several recent neuropathological studies disclosed a relevant, extensive and irreversible "neurodegenerative" process involving the gray matter (GM) and the occurrence of focal inflammatory lesions not only in the WM, but also within the cortex and deep GM. In multiple sclerosis abnormal performance in different neurological populations has been variously linked to impairments in risk taking⁶ working memory⁷ or emotional response to feedback.⁸ In MS, neurodegeneration related with progression (leading to atrophy and microstructural changes) may combine with focal cortical demyelination⁹ especially in outer cortical regions¹⁰ or metabolic changes in Grey Matter¹¹ to make greater decision-making deficits than either alone. Some studies have

shown that people of MS have impaired decision-making¹² but have not explain which components are most affected¹³.

Diagnosis of grey matter disease

Through neuroimaging studies, its clearly denoted that cortical lesions arise in all phenotypes of multiple sclerosis, having not just in the late stages of disease, but early on as well. In some cases, cortical lesions have been visualized before white matter lesions have radiologically isolated syndrome and clinically isolated syndrome. Similarly as cortical demyelination, gray matter atrophy can be detectable very early in the disease and accelerates over time. If both demyelination and cortical atrophy are occurring before a diagnosis of clinically definite MS can be made.

Causes

The cause of multiple sclerosis is unspecified. It's considered as an autoimmune disease in which the body's immune system attacks its own tissues. In the case of MS, the fatty substance that coats and protects nerve fibres in the brain and spinal cord (myelin) were destroys by malfunction immune system. When the protective myelin is injured and the nerve fibre is exposed, the transmission of messages along that nerve fiber may be slowed or blocked. Factors appears to be responsible are combination of genetics and environmental factors.

Symptoms

Symptoms for grey matter disease is Dizziness, Slurred speech, Fatigue, Tingling or pain in parts of your body, Problems with sexual, bowel and bladder function.

Cure of grey matter disease

Grey matter disease doesn't have a cure, but there are treatments that can help manage your symptoms. The primary treatment is physiotherapy and medication that suppress the immune system can help with symptoms, and slow disease progression.

CONCLUSION

Understanding the human CNS and about grey and white matter is fundamental for understanding their disorder and how they attack on CNS. Grey matter is made up of cell bodies and unmyelinated axon and white matter is made up of myelinated axon. White matter disease is mainly due to absence of tissue which connects brain and spinal cord and is diagnosed by MRI and its symptoms can be managed. Grey matter disease is due to neurodegeneration and can be treated by physiotherapy and medication.

REFERENCES

1. Wright, R.D. (1934). Some mechanical factors in the evolution of the central nervous system. *J Anat*, 69:86–88.
2. Mitchison, G. (1991). Neuronal branching patterns and the economy of cortical wiring. *Proc R Soc Lond B Biol Sci*. 245:151–158.
3. Ruairi, J M. (2019). Science Writer for Technology Networks.
4. Sander, D., Frankfurt, M. (1898) "Hirnrindenbefunde bei multipler Sklerose," *European Neurology*, vol. 4, pp. 427–436.
5. Manes, F., Sahakian, B., Clark, L. (2002) . Decision-making processes following damage to the prefrontal cortex. *Brain*. 125(Pt 3):624–39.

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6. Weller, R.O. (2008) “Greenfield's Neuropathology (8th Edition),” Neuropathology and Applied Neurobiology, vol. 34, pp. 573–574.
7. Bechara, A., Martin, E.M. (2004). Impaired decision making related to working memory deficits in individuals with substance addictions. *Neuropsychology*. 18:152–62.
8. Bechara, A., Damasio, H., Damasio, A.R. (2000). Emotion, decision making and the orbitofrontal cortex. *Cereb Cortex*. 10:295–307.
9. Simioni, S., Ruffieux, C., Kleeberg, J. (2008). Preserved decision-making ability in early multiple sclerosis. *J Neurol*. 255:1762–9.
10. Samson, R.S., Cardoso, M.J., Muhlert, N. (2014). Investigation of outer cortical magnetisation transfer ratio abnormalities in multiple sclerosis clinical subgroups.
11. Muhlert, N., Atzori, M., De Vita, E. (2014) Memory in multiple sclerosis is linked to glutamate concentration in grey matter regions. *J Neurol Neurosurg Psychiatry* 2014; 85:833–9.
12. Kleeberg, J., Bruggimann, L., Annoni, J.M. (2004). Altered decision-making in multiple sclerosis: a sign of impaired emotional reactivity? *Ann Neurol*. 56:787–95.
13. Nagy, H., Bencsik, K., Rajda, C. (2006). The effects of reward and punishment contingencies on decision-making in multiple sclerosis. *J Int Neuropsychol Soc*. 12:559–65.

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Conflict of Interest

The author declared no conflict of interest.

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