DIFFUSION TENSOR IMAGING: A NEW TOOL IN PSYCHIATRY (1)

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Since Johnstone et al (1976) clearly showed in a computerized tomography study that patients with chronic schizophrenia have a larger lateral ventricle compared to those of controls; many researchers in field of biological psychiatry have focused on neuroimaging field and tried to find new evidences supporting their theories. On the other hand Ingvar and Frazen (1974) had first functional data approving the theory related to hypofrontality in schizophrenia. However, today thanks to engineers and software programmers, we can reach the structural and functional data in a single apparatus called Magnetic Resonance Imaging (MRI).

Basically MRI data has been computed from the reflection the radiofrequency signal which was sent by machine (magnet). Depending on the pulse scans and time parameters number of different images can be obtained. One kind of images, diffusion tensor images (DTI) can be acquired from MRI scanners equipped to perform echo-planer images. DTI measures are thought to be representative of brain tissue microstructure and are particularly useful for examining organized brain regions, such as white matter tracts. In the white matter tracts there is water diffuses along the axes or diffusion encoding directions. However, water in the ventricles has ability to move freely.

Diffusion weighted images are bright where diffusion (measured as apparent diffusion coeffient (ADC)) is small and dark where diffusion is greater. For example splenium of corpus callosum, in which nerve fiber tracts are oriented in the left-right direction, gets dark if the gradients are left-right directions, since ADC is large along direction. Thus, water diffusion along the tracts is anisotrophic.

The anisotrophy of the water has provided by the myelin around axons. Myelin is a spiral structure constituted of extensions of the plasma membrane of oligodendrocytes. It is poorly hydrated structure mainly composed of lipid (70%). Insulation capacity of myelin keeps the water along the axis thus, gives as an idea functional capacity of myelin and neuron.

REFERENCES

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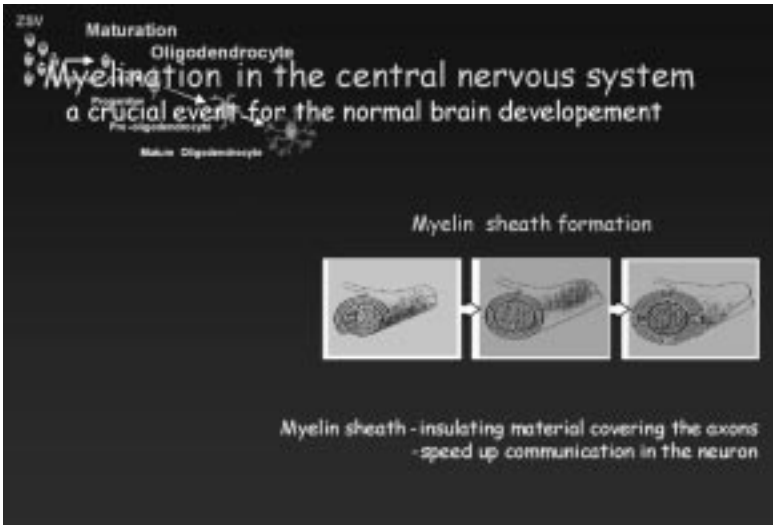

Isotropic case: Water Displacement is equal in all directions

Splenium of Corpus Callosum

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