

Evaluation of brain activity changes occurring in an animal model for multiple sclerosis: a functional Magnetic Resonance Imaging study

Roberta Rigolio¹, Paola Marmioli¹, Guido Cavaletti¹, Virginia Rodriguez-Menendez¹, Silvia Fiorini², Stefano Tambalo² and Pasquina Marzola²

¹ Dipartimento di Neuroscienze e Tecnologie Biomediche, Università di Milano-Bicocca, Monza, Italia

² Dipartimento di Scienze Morfologiche e Biomediche, Università di Verona, Verona, Italia

Multiple Sclerosis (MS) is a chronic inflammatory demyelinating disease of the central nervous system (CNS). Magnetic Resonance Imaging (MRI), showing the extent of the involvement of CNS, plays a major role in the assessment of patients with MS. Further information can be obtained with functional MRI (fMRI) which may be used in MS patients to investigate the functional reorganization of cortical areas. fMRI observations in MS are already available in humans, but deeper knowledge on its usefulness might be gained using reliable animal models.

We investigated by means of fMRI the brain plasticity in a chronic model of MS, i.e. Experimental Autoimmune Encephalomyelitis (EAE) in the Dark Agouti (DA) rat strain. Serial fMRI acquisitions were performed before, 30 and 60 days after EAE induction. fMRI with somatosensory stimulation was performed according to ref [1]. Briefly electrical stimulation (a train of squared pulses with frequency=3Hz, current=2mA, duration=0.5ms) was delivered to the left forepaw during acquisition of MR images sensitive to Blood-Volume. A single stimulation protocol was composed of 30 images under rest condition and 10 images acquired during stimulation. After appropriate image analysis, performed using the FSL software package [2], the brain region activated by the applied stimulus was determined.

Prior to EAE induction, electrical stimulation resulted in a localized response in the contralateral sensory motor cortex according to previously reported results [1]. Thirty and 60 days after EAE Induction, the activated area was greatly increased covering large regions of both contra and ipsilateral somatosensory cortex and extending also to extra-cortical regions.

Our results show that the experimental model of EAE in DA rats reproduces a remarkable findings observed in MS patients, i.e. the functional reorganization of motor cortex. It remains to be investigated whether this effect could represent an innovative platform for testing new therapeutic approaches for MS.

References

- [1] Van Camp N. et al. Stimulation of the rat somatosensory cortex at different frequencies and pulse widths. *NMR in Biomedicine* 2006; 19(1): 10-7
- [2] www.fmrib.ox.ac.uk/fsl/

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