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Citation	The 18th Medical Research Conference (MRC 2013), Hong Kong, China, 12 January 2013. In Hong Kong Medical Journal, 2013, v. 19 suppl. 1, p. 19, abstract no. 19
Issued Date	2013
URL	http://hdl.handle.net/10722/189804
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Relevance of short-range connectivity to brain compensation and cognitive efficiency in healthy and pathological ageing: a combined functional magnetic resonance imaging and tractography study on prospective memory

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Introduction: Cognition and its efficiency are related to the activities of specific brain regions and their interactions. The brain function and structure are vulnerable to both healthy and pathological ageing, and these processes may underlie the impaired cognitive functions in daily life.

Methods: In this functional magnetic resonance imaging (fMRI) study on prospective memory, fMRI and diffusion tensor imaging were used to investigate the neural mechanism underlying prospective memory (PM) impairment in ageing and Alzheimer's disease (AD). Three groups of young, older adults, and patients with AD were recruited. The fMRI data were analysed with SPM8.

Results: Increased brain activations were found in healthy older adults and patients with AD. Furthermore, the PM-specific frontal activations in three groups were found distributed along the rostrocaudal axis in the frontal lobe. These findings indicate that subjects with different cognitive capacity may encounter different levels of conflict during the PM task and they may need different strategies to deal with the task. Analysis on structural connectivity of the brain network revealed that the short-range fibres were impaired in both healthy and pathological ageing. This may underlie their low cognitive efficiency and higher compensatory brain activation during PM task performance. In contrast, the long-range fibre tracts are only impaired in AD. It may be related to the slightly lower PM accuracy in AD patients.

Conclusion: For the first time, this combined fMRI and tractography study showed complementary evidence that the compensative brain activations of healthy and pathological ageing may be more related to the impairment of short-range fibre tracts and regional disconnectivity.

Assessment of autonomic function in patients with a history of neuropsychiatric lupus

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Introduction: Neurological involvement is common in patients with systemic lupus erythematosus (SLE) and can involve both central and peripheral nervous systems. We hypothesise that patients with neuropsychiatric involvement (NPSLE) may be more prone to autonomic dysfunction as a result of focal insult to structures of the central autonomic network. We aimed to study if autonomic dysfunction is more common in NPSLE patients compared to those without NPSLE.

Methods: NPSLE patients with a history of acute confusional state, seizure, stroke and transverse myelitis and age- and sex-matched non-NPSLE patients and healthy subjects were recruited. Symptoms of autonomic dysfunction were screened by questionnaire. Standardised tests on sympathetic and parasympathetic functions of the cardiovascular system were performed.

Results: Autonomic symptoms were reported in 96.6% of all SLE patients (29 NPSLE and 29 non-NPSLE). Although SLE patients, in particular NPSLE patients, were found to have impaired heart rate response to active standing (ratio, 30:15) compared to healthy controls (n=16) [NPSLE 1.13±0.11, non-NPSLE 1.16±0.11, and controls 1.26±0.11; P=0.006 by Kruskal-Wallis test), no difference was observed between SLE and controls and between NPSLE and non-NPSLE patients regarding autonomic function according to Ewing's criteria.

Conclusions: NPSLE patients were found not to have higher autonomic dysfunction compared to non-NPSLE patients and healthy subjects.