A 3 T FUNCTIONAL MRI STUDY OF THE RESTING STATE NETWORKS IN AGING

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Introduction

Previous studies, investigating low-frequency fluctuations in functional magnetic resonance imaging (fMRI) data, have demonstrated a coactivation of distributed cortical networks, which characterizes the default mode, or resting state (RS), of the human brain (1-3). Aim of this study was to investigate the influence of normal aging on RS networks (RSN) identified in a cohort of healthy subjects.

Methods

RS functional MRI data were acquired from 49 healthy controls (male/female=20/29, mean age=34.7 years, range=20-69 years) using a 3T scanner. After data pre-processing (realignment, normalization and smoothing), independent component analysis (ICA) was used to decompose resting fMRI data into spatially independent maps and time courses using the GIFT software (Group ICA of FMRI Toolbox) (4). This analysis produced 44 spatially independent maps. Visual inspection of these maps allowed to eliminate components clearly related to artifacts. Then, a frequency analysis of the time courses was used to identify the components with high (50% or greater) spectral power at low frequency (between 0.01 and 0.05 Hz). One-sample statistics of spatially independent maps and correlation with age were assessed using statistical parametric mapping.

Results

Our analysis detected 10 RSN with potential functional relevance: RSN 1 and 2 included primary and secondary visual cortical areas (Figure 1A, 1B); RSN 3 and 4 included sensorimotor related areas (Figure 1C, 1D); RSN 5, 6 and 7 (Figure 1E, 1F, 1G) included bilateral fronto-parietal-temporal areas; RSN 8 (Figure 1H) included fronto-parietal areas lateralized to the left hemisphere; RSN 9 (Figure 1L) included fronto-parietal areas lateralized to the right hemisphere, and RSN 10 included bilateral parietal areas (including the precuneus) and the posterior cingulum (Figure 1M). Significant correlation with aging were found exclusively for RSN 1 and 4.

Conclusions

ICA was able to detect in our data components which agree well with previous literature (2) and which consist of well-known functional networks. Our results suggest that the different RSN of the healthy brain might respond differently to aging. The absence of a correlation between the majority of the observed RSN and age might help to explain the widespread and sometimes aspecific patterns of over-recruitment frequently observed in several neurological conditions during the performance of different activation tasks.

References.

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Figure 1.

Legend. RS patterns detected in our group of healthy subjects: visual networks (A=RSN1, B=RSN2), sensorymotor networks (C=RSN3, D=RSN4), bilateral fronto-parietal-temporal networks (E=RSN5, F=RSN6, G=RSN7), fronto-parietal networks lateralized to the left (H=RSN8) and to the right (L=RSN9), and bilateral parietal network (M=RSN10).