Right cerebellum as a seed for rs-fMRI analysis of the functional brain reorganization in patients with aphasia

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- Resting state fMRI (rs-fMRI) has several advantages over task-related fMRI in case of patients with cognitive and motor deficits (Lee et al., 2013).
- In order to analyze the functional brain reorganization in patients with aphasia we used the right cerebellum as a seed in rs-fMRI analysis because this brain region: 1) is usually preserved in patients with aphasia; 2) considerably contributes to language processing, as demonstrated in many neuroimaging and brain lesion studies (Ackermann et al., 2007).
- We expected to find a strong relationship between the activation of the right hemisphere of the cerebellum and the left IFG in healthy participants and changes in functional connections of the right cerebellum in patients with aphasia due to a lesion in the left IFG.

Method

Subjects

Ten healthy volunteers participated in the study (mean age 28.6, SD=9.8; 7 females). We also analyzed the data of 67-year-old woman with lesion in the left IFG and Broca's aphasia.

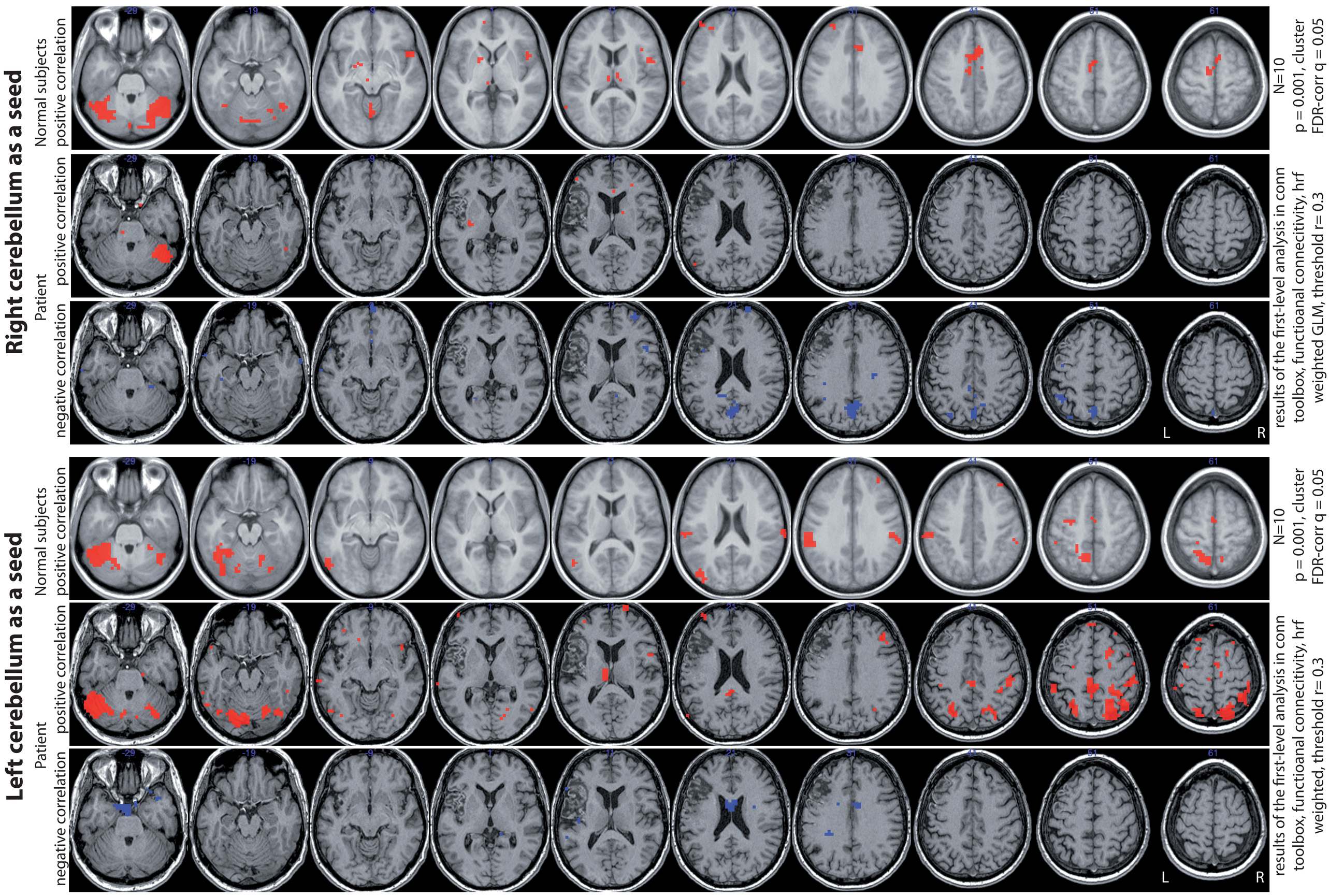
Scanning parameters

T2*-weighted functional images (TR/TE/FA=3 s / 50 ms / 90°, voxel size 3.9x3.9x3 mm, matrix size 64x64, 35 axial slices, 180 measurements) and T1-weighted images (TR/TE/FA=1.9 s / 3.37 ms / 15°, voxel size 1x1x1 mm) were acquired with a 1.5T Siemens Avanto scanner.

Data analysis

fMRI data were processed using SPM12, conn14.p, MarsBar. Seed points for seed to voxel analysis: a sphere with radius 10 mm in {42 -56 -30}; coordinates for seeds were defined according to (Stoodley et. al., 2012) as a part of the cerebellum that were active during language task performance. We also used a ROI in the left cerebellum {-42; -56; -30} as a control seed.

Results



Conclusions

- A wide range of cortical areas positively correlated with time-course of BOLD-signal in seeds in both hemispheres of the cerebellum during resting state in healthy participants. No cortical areas showed negative correlations.

  Contrary to our expectations, we did not find any significant correlations between time-courses of the seed in the right cerebellum and the left IFG.
- In the patient with the lesion in the left IFG we found only negative correlations of BOLD-signal time course between the seed in the right cerebellum and the rest of the brain. No positive correlations were found. These results reflect the complex non-direct relationships between the left IFG and the right cerebellum and the presence of functional changes in the right cerebellum in case of Broca's aphasia despite of anatomical preservation of the cerebellum.
- It 's still controversial whether rs-fMRI is appropriate for detecting a functional brain reorganisation in individual patients with cortical lesions.

References

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