Purpose

Functional connectivity (FC) within the default mode network (DMN) as detected by resting-state (RS) functional MRI (fMRI) has generated significant interests in neuroscience and clinical studies. We proposed a method for improving the sensitivity of the conventional seed-based correlation analysis (SCAC) by incorporating the regional homogeneity information (SCAReHo). The study aimed to analyze DMN connectivity in patients with stenosis of the internal carotid artery (ICA), before and after stenting, and compare the results of SCAC and SCAReHo.

Materials and Methods

Nine patients with unilateral ICA stenosis (1 Female; age: 66±7.84y) were scanned twice (before and six months after stenting) at a 3T MRI scanner. A T2*-weighted single-shot gradient-echo EPI sequence was applied for the RS-fMRI with TR/TE/FA=2000ms/50ms/90° and 150 phases. For SCAC analysis, the correlation coefficients between the reference time course (obtained from the posterior cingulate cortex (PCC) seed region at (0,-51,30) and radius=4mm) and the time course of each voxel were computed across the whole-brain. For SCAReHo analysis, first Kendall coefficient of concordance (KCC) maps were computed for each subject and then the reference time curve were obtained from the common voxels of a PCC mask and the KCC mask (KCC>0.5).

Results

With the SCAC analysis, only few or no voxels in the seed and the DMN regions were detected in most patients. The SCAReHo method significantly improved the detection in all patients. Heterogeneous and bipolar distributions of correlation coefficients were found in the conventional PCC region, which may explain the failure of the SCAC analysis in this patient group. Improvement of FC was found after the treatment with the SCAReHo analysis.

Conclusion

The SCAReHo analysis improved the detection of FC in DMN using the RS-fMRI. This method may be particular helpful for subject groups with functional anatomy that likely differs from the normal population.