

SIMILARITY OF FUNCTIONAL CONNECTIVITY PATTERNS IN PATIENTS WITH MULTIPLE SCLEROSIS DURING AN FMRI BLADDER VOIDING TASK - NEGATIVE CORRELATION WITH MS LESION LOAD: PRELIMINARY RESULTS

Hypothesis / aims of study

MS lesions affect functional brain connectivity (FC) during bladder voiding and the ability to void spontaneously. Size of largest brain region, the existence of an enhancing brain lesion and the ability to void spontaneously were compared with the degree of inter-subject similarity of FC patterns during a functional magnetic resonance imaging (fMRI) task consisting of repetitive bladder voiding.

Study design, materials and methods

Twenty seven ambulatory (with or without assistance) female patients were recruited for this IRB approved study [1]. After motion correction, the Generalized Linear Model created individual fMRI activation maps at initiation of voiding ($p < 0.05$). FC patterns between these regions were calculated and a measure of similarity between individual patterns was quantified as the correlation coefficient (CC) between vectorized adjacency matrices (figure 1). An inter-subject correlation matrix was created from which the similarity of the FC pattern from one patient relative to all others was determined. A correlation analysis was performed to determine the relation of maximum brain lesion size, the existence of an enhancing brain lesion and the ability to void spontaneously to this FC similarity measure where data was available ($n = 18$).

Results

FC similarity negatively correlated with largest MS lesion size ($-0.50, p < 0.03$) and the existence of an enhancing lesion ($-0.82, p < 3e-5$) (figure 1). FC similarity correlated positively with the ability to void spontaneously ($0.57, p < 0.01$).

Interpretation of results

Our results suggest that in the brains of patients with larger MS lesions or with an enhancing MS lesion, FC patterns differ from the ones in patients with a lesser lesion load during the process of bladder voiding. MS lesions may disrupt existing pathways and anatomical connectivity by compromising white matter tracts. To compensate, FC patterns are modified. FC similarity was found to positively correlate with ability to spontaneously void, indicating that FC reorganization is not able to fully recover functionality.

Concluding message

FC connectivity analysis derived from a fMRI task-based study including repetitive voiding cycles is able to quantify the heterogeneity of connectivity patterns in the brain of MS patients. FC similarity decreased with maximum lesion size or the presence of an enhancing lesions affecting the ability to void spontaneously. Further detailed analysis is required to understand contributions from individual brain regions to the FC reorganization in MS.

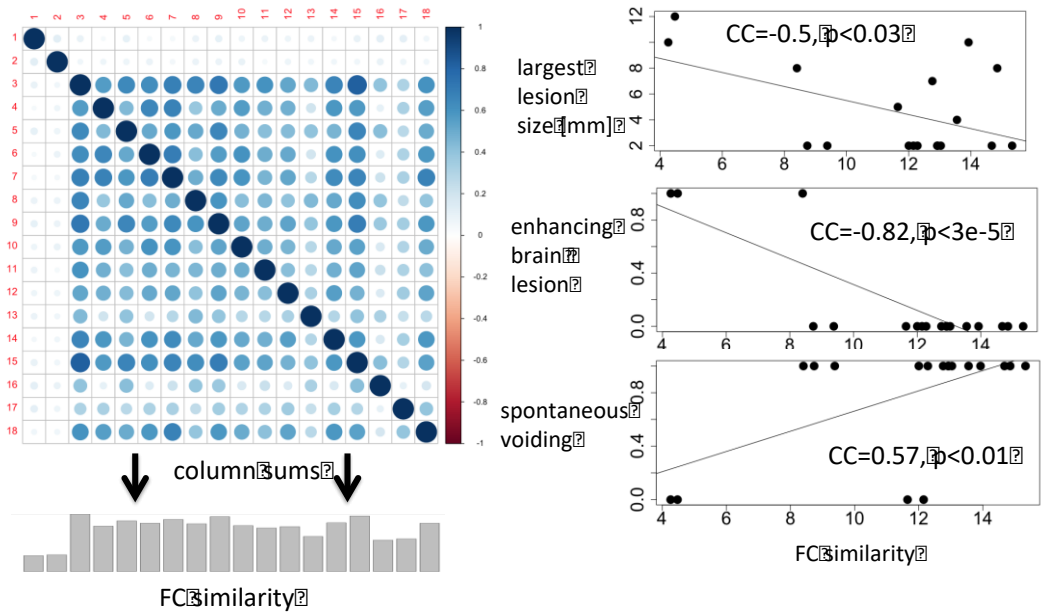


Figure 1: Left: On top, correlation matrix showing similarity between FC patterns, on bottom, FC similarity measure as column sum of this matrix. Right: Correlation plots between listed parameters and this FC similarity measure. Lines show linear relationships, CC: correlation coefficient).

References

1. 1 Khavari R, Karmonik C, Shy M, Fletcher S, Boone T. Functional Magnetic Resonance Imaging with Concurrent Urodynamic Testing Identifies Brain Structures Involved in Micturition Cycle in Patients with Multiple Sclerosis. J Urol. 2017 Feb;197(2):438-444. doi: 10.1016/j.juro.2016.09.077. Epub 2016 Sep 21.

Disclosures

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Helsinki: Yes **Informed Consent:** Yes