Functional activity in the sensorimotor cortex and cerebellum relates to cervical dystonia

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Introduction

Cervical dystonia (CD) is the most common type of focal dystonia, causing abnormal movements of the neck and head. Advances are being made in understanding the brain changes associated with dystonia using noninvasive imaging methods such as resting-state and task-based functional magnetic resonance imaging (fMRI) [1-2]. In this study, we used noninvasive imaging to investigate the motor system of patients with CD and uncover the neural correlates of dystonic symptoms. Furthermore, we examined whether a commonly prescribed anticholinergic medication in CD has an effect on the dystonia-related brain abnormalities. We tested the following hypotheses: (1) dystonic symptoms will relate to differences in functional activity between CD and controls; (2) one dose of trihexyphenidyl will alter part of the affected functional network; and (3) one dose of trihexyphenidyl will not affect structural integrity of the brain as assessed with diffusion and structural MRI.

Experimental

Participants included 16 patients with CD and 16 healthy age-matched controls. We collected functional MRI scans during a force task previously shown to extensively engage the motor system, and diffusion and T1-weighted MRI scans from which we calculated free-water and brain tissue densities. The dystonia group was also scanned ca. 2 h after a 2-mg dose of trihexyphenidyl. Severity of dystonia was assessed pre- and post-drug using the Burke–Fahn–Marsden Dystonia Rating Scale

Results and Discussion

Motor-related activity in CD was altered relative to controls in the primary somatosensory cortex, cerebellum, dorsal premotor and posterior parietal cortices, and occipital cortex. A regression model showed that increased severity of symptoms was associated with decreased functional activity of the somatosensory cortex and increased activity of the cerebellum. Structural imaging measures did not differ between CD and controls. The single dose of trihexyphenidyl altered the fMRI signal in the somatosensory cortex but not in the cerebellum. Symptom severity was not significantly reduced post-treatment.

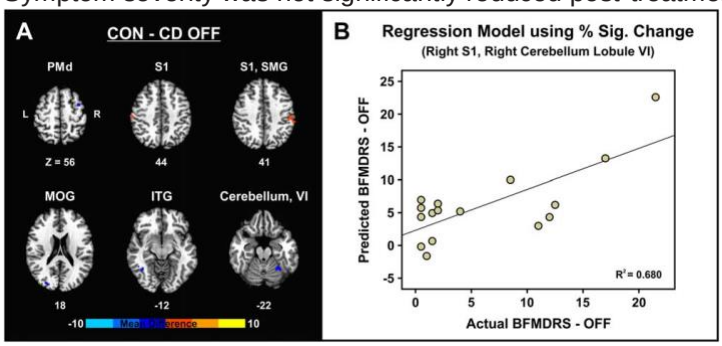

Fig.1 Differences in task-related fMRI activity between controls and CD patients tested off medication (A). Regression model illustrating the relation between dystonic symptoms off medication as assessed by BFMDRS and the predicted values for BFMDRS off medication based on the percent signal change in the right primary somatosensory cortex, and right lobule VI of the cerebellum (B).

Conclusions

The results of this study demonstrate widespread abnormalities in functional brain activity in CD, and an association between increased severity of dystonic symptoms and reduced functional activity in S1 and increased functional activity in the cerebellum. These findings provide new insights into pathophysiology of the disease and may spur the development of new treatment actions in CD by providing targets (e.g., S1 and/or cerebellum) for clinical or drug interventions.

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References

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