

Constrained Spherical Deconvolution Tractography reveals a direct cerebello-ventro tegmental pathway in humans

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Introduction. In addition to its role in motor control, reflex adaption and motor learning in the past years numerous studies demonstrated the role of the cerebellum in non-motor functions. Furthermore, lesional animal and neuroimaging in vivo human studies demonstrated connections of the cerebellum with brain regions involved in cognitive, emotional, motivation linguistic processing [1, 2]. Although, studies suggest the role of the cerebellum in neuropsychiatric disorders of the mesocorticolimbic structure (i.e. schizophrenia), at the present time the existence cerebello-ventro tegmental pathway has been demonstrated in only in rodents and only hypothesized in humans.

Aim. The goal of this in vivo constrained spherical deconvolution (CSD) tractography study is the investigation on the presence of a direct cerebello-ventro tegmental pathway in the human brain.

Material and Methods. We recruited 15 human subjects with no previous history of neurological or psychiatric disorders. The entire study was performed using a 3T Achieva Philips scanner; a SENSE 8 channels head coil, acquiring T1 weighted 3D TFE, DTI sequence; data were analyzed by using constrained spherical deconvolution techniques (CDS). *Results.* We demonstrated with CSD dentate-ventral midbrain connections. In particular, we found a direct route linking between the dentate nucleus and the ventro tegmental area.

Conclusions. This study provides for the first time the existence of a human dentate nucleus connections with the ventro tegmental area, moreover the existence of this cerebello-midbrain pathway suggest that the cerebellum may be involved in the modulation of the mesocorticolimbic system and in related neuropsychiatric disorders such as the schizophrenia.

References

- [1] Cacciola et al. (2017) The known and missing links between the cerebellum, basal ganglia, and cerebral cortex. *Cerebellum* 16:753-755.
- [2] Flace et al. (2017) The neglected cerebello-limbic pathways and neuropsychological features of the cerebellum in emotion. *Cerebellum* (submitted).

Keywords

Cerebellum, dentate nucleus, ventral tegmental area, midbrain, human, connectivity, tractography