ABSTRACT

Title:

Structural Brain Changes in Multiple Sclerosis Patients and Their Clinical Implications

The main objective:

The aim of this thesis is to determine whether lesions of the corticospinal tract can affect motor skills such as balance and walking in people with MS, as measured by the clinical tests Timed Up and Go (TUG), Berg Balance Scale (BBS), and the 12-item Multiple Sclerosis Walking Scale (MSWS-12). Another aim was to determine whether a two-month facilitationn therapy would influence balance and walking assessed by TUG, BBS, and MSWS when the corticospinal tract is affected by lesions in people with MS. And whether the effect of a two-month facilitation therapy varies depending on the involvement of CST.

Methods:

This work is part of the study "Neuroproprioceptive "Facilitation, Inhibition" and Brain Plasticity (NEFAI)", registered under the number NCT04355663, for which paraclinical (magnetic resonance (MR) images) and clinical data (Timed Up and Go test (TUG), Berg Balance Scale (BBS), and the 12-item Multiple Sclerosis Walking Scale (MSWS) questionnaire) were obtained from people with MS between 2015 and 2017. Lesions on MR images of people with MS were delineated in the 3D slicer program as part of my bachelors thesis in 2022. For the master's thesis, these images are aligned in the ITK - SNAP 4.0.2 program (Yushkevich et al., 2006) with the mask of the external brain of T1-weighted MR and overlaid with the external mask, including the corticospinal tract (https://identifiers.org/neurovault.image:1400). Based on whether patients have lesions affecting the corticospinal tract (CST) or not, they are divided into two groups: with lesion in CST and group without lesion in CST. For the analysis of the impact of CST lesion involvement on TUG, BBS, and MSWS-12 results before facilitation therapy, the non-parametric Mann-Whitney U test was used. Furthermore, for the analysis of the impact of CST lesion involvement on TUG, BBS, and MSWS-12 results, the non-parametric Wilcoxon paired test was used. The effect of facilitation therapy on gait and balance (results of TUG, BBS and MSWS-12) depending on involvement of CST lesions was analyzed using Mann Whitney – U test.

Results:

Statistical analysis included data from 20 participants with MS (n=20), 13 women and 7 men age 22 to 71 years with a disease duration of 1 to 22 years from the diagnosis of MS and EDSS scale of 1-6.5. The significance level was set at p=0.05. We did not observe a statistically significant effect of CST lesion involvement on balance and walking test results (TUG: p=0.39; MSWS-12: p=0.15;

BBS: p=0.08). At the same time, we did not observe a significant effect of a two-month facilitation treatment in people with MS with CST lesions in any of the clinical tests (TUG: p=0.48; MSWS-12: p=0.17;BBS: p=0.46). At the same time, we did not observe significant differences in the test results (TUG: p=0.052; BBS: p=0.18; MSWS-12: p=0.31) following a two-month facilitation therapy in either of the groups (with lesions in the CST or without lesions in the CST).

Conclusion:

The influence of specifically located lesions in the CST on walking and balance is not clear. In our sample of subjects, we did not find an influence of CST lesions on balance and walking before therapy. We also did not observe a significant effect of a two-month facilitation therapy in people with MS with CST lesions on balance and walking. We also did not observe the therapy effect in the group without CST lesion involvement compared to the group with CST lesions.