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Changes in Diffusion Metrics of Red Nucleus after Cervical Myelopathy

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Objective
Cervical myelopathy (CM) is a common age-related disorder, which doesn't have proper known treatment for the symptoms such as motor paralysis and sensory disturbances. Nevertheless, some evidences showing significant motor recovery of rubrospinal neurons after few weeks in cervical axotomized rats have been reported and are attracting our attention, which haven't been explored in human despite of its clinical significance. The diffusion tensor imaging (DTI) is most sensitive Method for measuring damage in neural tract. Thus, in this study, we aimed to find out whether there were some differences in red nucleus (RN) diffusion metrics in CM patients compared to controls as well as whether differences existed between pre- and post-operative condition in CM patients.

Methods
Eighteen healthy controls (mean age 50.0±21.7 years) and age-matched CM patients (mean age 56.8±14.2 years) were recruited. Controls acquired DTI once and the CM patients acquired DTI twice (before and 2 weeks after laminoplasty) and obtained modified Japanese Orthopedic Association (mJOA) scale twice. Four areas were selected as region-of-interest (ROI): RN, primary motor cortex (M1), ventral pons (VP: ventral descending motor fibers selected in color coded DTI) and dorsal pons (DP: dorsal descending motor fibers selected in color coded DTI). Fractional anisotropy (FA), mean, axial, and radial diffusivity (MD, AD, RD) were obtained at each ROIs. We performed independent t-test to analyze difference in each value between patient and control, paired t-test to see change before and after surgery. Pearson correlation was conducted between mJOA scale and diffusion metrics. A p-value < 0.00625 were considered to be statistical significant after correction of multiple comparisons problem.

Results
1. In group comparison, there was significant changes in patients' RN network compared to controls (decreased right RN RD, p=0.002; decreased left VP FA, p=0.003). 2. There was no significant change in diffusion metrics between pre- and post-operative condition although there was significant improvement in mJOA score in postoperative condition (p=0.003). 3. In correlation analysis, only in control group, the FA of both RN was significantly increased as the age increased (p=0.012, p=0.004, respectively). Contrast to control group, there was no correlation between age and RN diffusion metrics. .

Conclusion

Our Results imply the importance of rubrospinal tract in recovery of spinal cord injury and illuminate age related change at red nucleus in healthy people. Further investigation should be conducted with a larger number of patients and broad spectrum of severity.