Morphometry of the corpus callosum: comparing male orchestral musicians and non-musicians

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Background and purpose

Corpus callosum (CC) is the main interhemispheric white matter (WM) tract that connects mainly homotopic but also functionally different heterotopic regions of the cerebral cortex thereby playing an integral role in relaying sensory, motor, and cognitive information between the two cerebral hemispheres. It is a structure, easily identifiable on midsagittal MRI section, which has been reported as showing significant differences in cross-sectional area of its anterior half between musicians and non-musicians. Here we adopt a different measurement strategy, originally described by Denenberg et al in a study which employed factor analysis that identified seven factors comprising intercorrelated clusters of CC widths, to address CC regional specificity and shape variations in a sample of professional orchestral male musicians and age- and sex matched non-musicians.

Materials and methods

We recruited 26 right handed male orchestral musicians were compared to 26 age-, sex-, and handedness-matched non-musicians. Brain images were acquired with a 1.5 T SIGNA whole body MR imaging system (GE Electric, Milwaukee, WI) using a proprietary quadrature head coil. A series of 124 coronal T1-weighted images, comprising 1.6-mm-thick tissue slices, were acquired throughout the brain using a 3D spoiled gradient echo sequence using: TE, 9 ms; TR, 34 ms; flip angle, 30°. The field of view was 20 cm, which contained a 256 X 256-pixel matrix. Using in-house software (CALLOSUM) running on Sun workstation, the CC was outlined in midsagittal T1-weighted high resolution MRI sections and automatically divided into 99 widths using a methodology previously described by Denenberg et al (1991) and shown in Figure 1

Results

Multivariate ANOVA revealed that the (W89-94) region, which occupies the mid-portion of splenium of CC, was larger in musicians with a trend of significance. This difference was due to larger (W89-94) region in string players (n=16). No significant findings were revealed in other regions.

Conclusion

We interpret these findings, of larger (W89-94) region notably in string players, support enhanced visuospatial cognition notably sight reading ability in musicians through increasing interhemispheric communication between right visuospatial and left language regions. The discrepancy of our results from previous studies in anterior regions is discussed in view of older age, commencement of training after age of 7 and use of different instruments by our musicians. These results may partially support the hypothesis of the presence of a motor stimuli-sensitive period before or around age of 7 years.
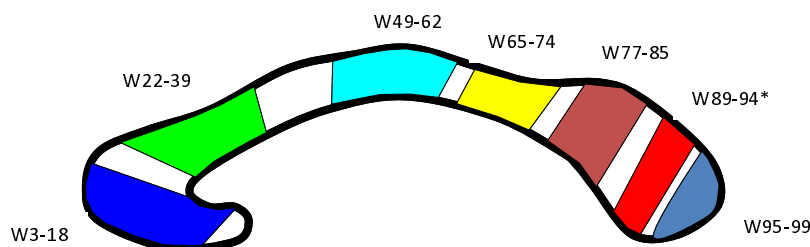

Figure 1 The widths comprising the seven factors, adapted from Denenberg et al. (1991)

Reference

Denenberg, V.H., A. Kertesz, and P.E. Cowell, *A factor analysis of the human's corpus callosum.* Brain Res, 1991. **548**(1-2): p. 126-32