

Increased cross sectional area of genu and splenium of corpus callosum in professional musicians compared to amateur musicians and controls

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Background and purpose

The corpus callosum (CC) is the largest and latest maturing white matter tract in the brain that connects homologous cortical regions in both cerebral hemispheres thereby playing an integral role in relaying sensory, motor, and cognitive information between the two cerebral hemispheres. In musicians, increased cross sectional areas of both anterior ¹ and posterior ² CC halves have been reported. Gender ³ and age of starting musical training ¹ were suggested to be crucial in dictating these differences. Here we examined the effect of musical expertise on CC morphometry.

Materials and method

Thirty-six right-handed adults with normal hearing were divided into three groups: 12 professional musicians (age 29–55; 6 men, 6 women), 12 amateur musicians (age 24–62; 7 men, 6 women) and 12 non-musicians (age range 26–43 years; 6 men, 6 women). T1-weighted 3D-MRI images (Philips Edge System, Eindhoven, Netherlands); 1.5 T, 1 mm slices were obtained. Cross sectional areas of four CC regions corresponding to genu, anterior and posterior body and splenium, respectively were obtained by applying three perpendicular lines at equal intervals along the maximum anteroposterior width of the CC (modified witelson method ⁴). Cross sectional areas of these regions were then measured and compared between groups (figure 1).

Result

MANOVA with Bonferroni correction for multiple comparisons revealed significant difference between groups regarding CC1 and CC4 regions ($F_{2,32} = 5.85$; $p=0.007$) and ($F_{2,32} = 5.85$; $p=0.008$), respectively. No significant difference detected in other CC regions. Pairwise comparison revealed that professional musicians have significantly larger CC1 region compared to amateurs ($p=0.025$) and controls ($p=0.011$); and larger CC4 region compared to amateurs ($p=0.03$) and controls ($p=0.01$). No significant difference was detected between amateurs and controls in all CC regions.

Conclusion

Our study extends the current literature through adding an important factor that dictates CC morphometry in musicians namely, musical expertise. The genu connect the prefrontal cortices while the splenium contain fibers from auditory cortices. The larger CC in professional musicians might suggest use-dependant structural plasticity essential for dexterous musical performance.

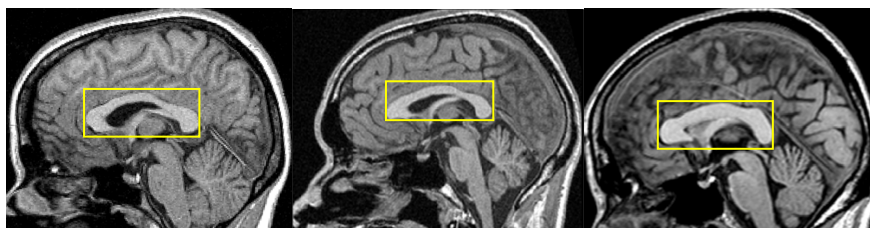


Fig 1. Mid-sagittal MR sections showing the corpus callosa of a professional musician (right), an amateur musician (middle) and a control (left) corrected according to the maximum CC anteroposterior length.

References

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