



No impact of the structural properties of the corpus callosum on handedness: evidence from the constrained spherical deconvolution approach

Victor Karpuchev¹, Tatyana Bolgina¹, Svetlana Malytina¹, Olga Dragoy^{1,2}

¹National Research University Higher School of Economics, Moscow,

²Federal Center for Cerebrovascular Pathology and Stroke, Moscow



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Introduction

Handedness are often used as a proxy for language lateralization [1]. Handedness was shown to be affected by the structural properties of the corpus callosum (CC) [2]. The majority of the previous studies used postmortem examinations, the delineation of the CC midsagittal surface, and diffusion tensor imaging (DTI). We applied the more advanced **constrained spherical deconvolution (CSD)** approach to study the link between handedness and the structural properties of the CC [3].

Methods

Participants

40 healthy participants (15 males, 25 females, mean age = 24.7, SD = 5.1, range = 18 – 37 years). Handedness quotient (HQ) was estimated using the Edinburgh inventory (20 right-handed, 20 left-handed participants) [4].

MRI

DWI data were acquired and analyzed using the following parameters:

- 3T scanner;
- Voxel size = 2 x 2 x 2 mm³;
- FOV = 240 x 240mm, 56 slices;
- 64 volumes with b = 1500 s/mm² and 2b0 with AP- and PA directions;
- **the damped Richardson-Lucy algorithm** with the fiber response of 1.5*10⁽⁻³⁾ mm²/s⁻¹ and 400 iterations in StarTrack software (<https://www.mr-startrack.com>);
- the CC was reconstructed in the TrackVis software (<http://trackvis.org>) (Figure 1).

Statistical analysis

- a **one-way ANOVA** was used to examine the differences in the CC volume in the direction of handedness;
- a **general linear model** was used to evaluate the relation between the degree of handedness (the absolute values of the HQ) and the CC.

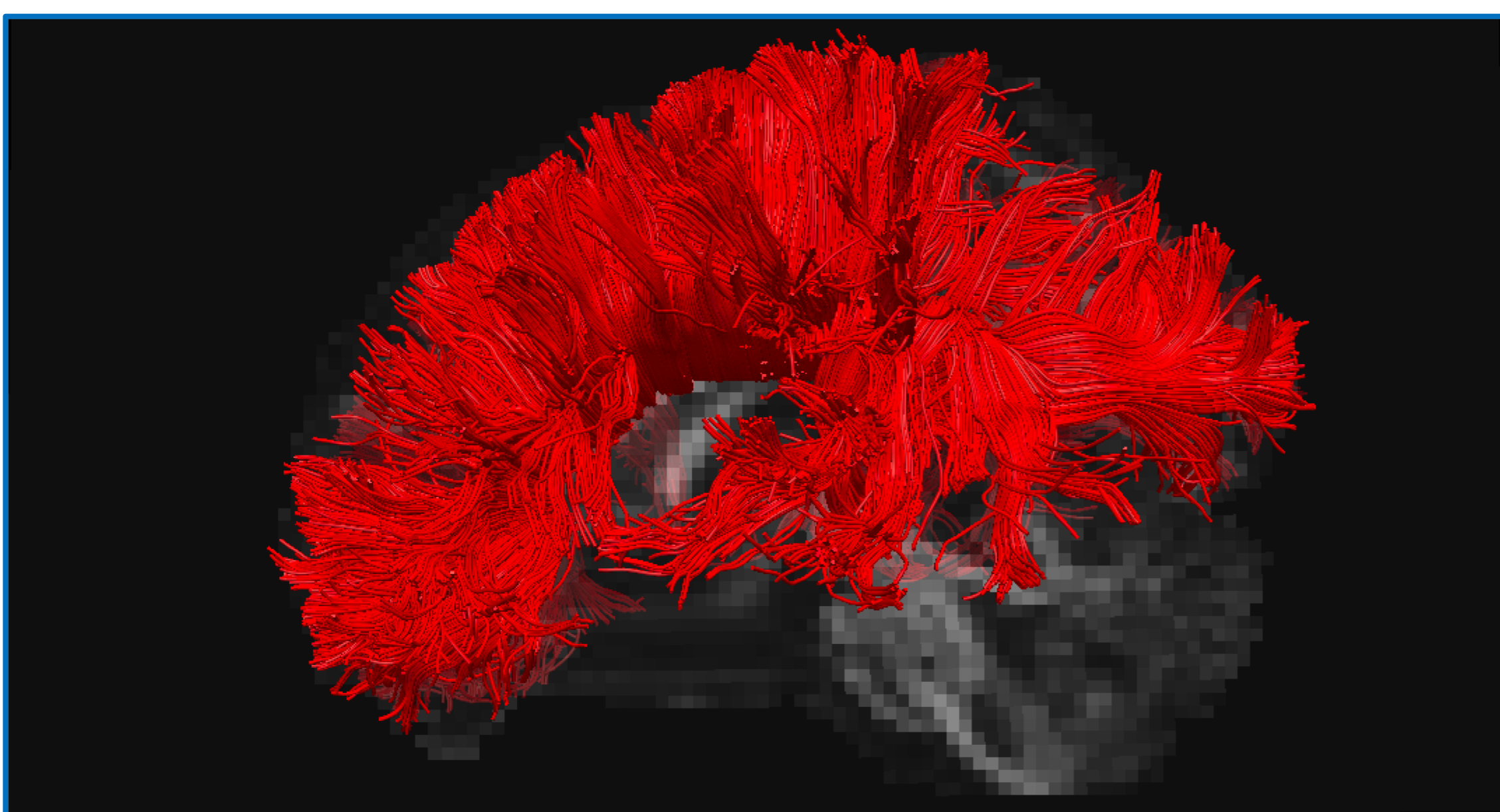


Figure 1. The reconstruction of the CC based on the CSD approach

Results

No significant difference in the CC volume was found between the right-handers (mean = 287.27 cm³, SD = 51.79 cm³) and the left-handers (mean = 272.8 cm³, SD = 45.18 cm³): $F(1,38)=.48$, $p=.49$ (Figure 2).

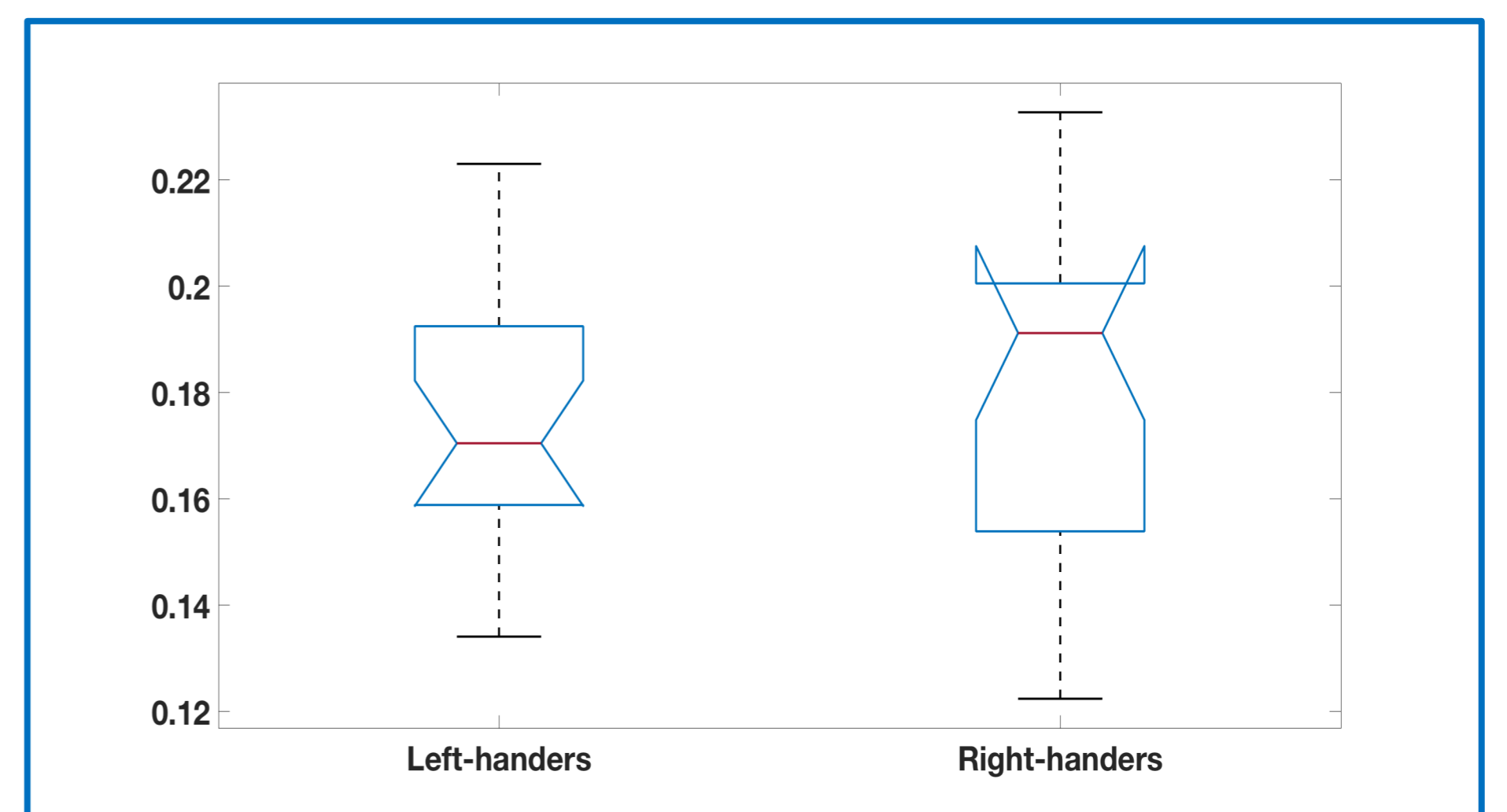


Figure 2. Boxplot showing the distribution of the CC volume

Table 1 presents the results of the general linear model. A general liner model revealed that **the HQ was not related to the volume of the CC.**

| Predictor | Estimate | SE | 95% CI | | p |
|-------------|----------|--------|---------|--------|-------|
| | | | LL | UL | |
| (Intercept) | 73.54 | 28.40 | 17.87 | 129.21 | 0.013 |
| Volume | -43.95 | 159.49 | -356.55 | 268.65 | 0.78 |

Table 1. Results of linear general model

Conclusions

- the study yielded a **non-significant difference** in the CC volume between the groups of the right-handed and left-handed participants;
- **the absence of the direct link** between the CC volume and the degree of handedness;
- thus, **no impact of the structural properties of the CC on handedness**;
- additional neuroimaging studies are needed to confirm the result

karpuchevictor@gmail.com

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