

Sexual dimorphism in volume and surface anatomical parameters of cingulate cortex in normal human brains - A stereologic and macroscopic study

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Abstract

Background&Objective: This study is designed to determine the sex differences in volume and surface anatomical parameters in the cingulate cortex of the left cerebral hemispheres in healthy right - handed subjects.

Materials&Methods: This cross - sectional descriptive study was performed on 72 human brains (38 males, 34 females). The brains belonged to right - handed subjects who had died of non - neurologic causes. The age of males and females was similar. The brains were removed from the cranium no longer than 24 hours postmortem and were fixed in 4% formaldehyde solution. The right hemisphere of each brain was used for neuropathologic examinations (to confirm the health of the brain) and the left one was used for stereologic analyses. The estimation of the volume, surface areas, and thickness of the cingulate cortex was performed on photographs of 5 mm serial coronal sections of the left hemispheres using unbiased stereological methods (with point and linear grids). The results were analyzed by t- student test.

Results: The volumes of the left cingulate cortex in males and females were 10.92 ± 3.06 and $10.5 \pm 2.30 \text{ cm}^3$, respectively. The outer surface area was $43.87 \pm 10.73 \text{ cm}^2$ in males and $43.74 \pm 8.68 \text{ cm}^2$ in females. The inner surface areas in males and females were 34.87 ± 11.56 and $36.55 \pm 8.08 \text{ cm}^2$, respectively. There was no significant difference between two sexes in the volume and surface areas of the left cingulate cortex. The mean thickness of the left cingulate cortex in males and females were 2.88 ± 0.5 and $2.51 \pm 0.3 \text{ mm}$, respectively. The mean thickness of the left cingulate cortex in females was 12.85% smaller than males ($P < 0.05$).

Conclusion: Although the volume and outer and inner surface areas of the left cingulated cortex are similar between two sexes, the cortical thickness of this area in healthy right - handed females is significantly smaller than males. The functional significance of these sexual differences and similarities in human brain is not clear. However, scientists must be aware of them in their morphometrical studies on human brain.

Key Words: Sexual dimorphism- Cingulate cortex- Volume- Surface anatomy- Human brain