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Morphometric analysis and Sexual Dimorphism of Corpus Callosum: A Mri Study

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Introduction: Corpus Callosum (CC) is the major anatomical and functional commissure linking the two cerebral hemispheres. It connects cortical as well as subcortical region of the right and left sides of the brain and plays an essential role in the integration of information between the two hemispheres. Variations in size and morphology of Corpus Callosum are elucidated in a wide range of neuropsychiatric disorders [1-5]. Study of difference in shape and size of Corpus Callosum and its subjective association with intelligence and apprehensive ability has engrossed our scientists. Literature hints towards a possible relation between different morphometry of Corpus Callosum with the difference in cognitivity and behavioural pattern seen in males and females. Hence sexual dimorphism of Corpus Callosum is a matter of increasing research.

Aim: The aim of the present study was to measure the various dimensions of the Corpus Callosum (CC) in normal adult Indian men and women and to identify gender related differences, if any.

Methods: Our study sample comprised 200 subjects (109males and 91 females) who were referred to Dr. Ram Manohar Lohia Institute of Medical Sciences for head MRIs and were reported to have normal images by the Radiologist.

Exclusion Criteria

Individuals who were later diagnosed with neurological problems, brain haemorrhage, trauma or neoplasia and those younger than 20 and older than 80 years were excluded.

Examination was done in Midsaggital Plane (MSP) which was determined using midpoints of Posterior Commissure, Anterior Commissure, and Inter-hemispheric fissure as described by Mitchell et al. Dimensions of interest were manually traced using SYNAPSE PACS Viewer Software (fujifilm USA, Inc.) on T1 weighted magnetic resonance images which were obtained from GE Healthcare 3.0T MRI Scanners. Clearance from the Institutional Ethics Committee was taken before embarking on the study.

Given parameters were measured with following abbreviations-

1.	BL	Brain length; as maximum length from the occipital to the frontal pole of the cerebrum for each hemisphere- BL1 and BL2respectively
2.	CL	Length of Corpus Callosum
3.	CTmid	Thickness of CC in the middle, at the centre of CC length
4.	Tr	Maximum thickness of Rostrum below the genu segment
5.	Ts	Maximum thickness of Splenium starting at posterior most point of CC
6.	CH:	Height of CC; as the distance between a line through the inferior borders of rostrum and splenium and a line parallel to that
7.	Tbmax	Maximum thickness of the body of corpus callosum (anywhere)

8. Tbmin	minimum thickness of the body of corpus callosum (anywhere)
9. MA b	Maximum thickness of the anterior part of corpus callosum excluding rostrum and genu
10. MP b	Maximum width of the posterior part of corpus callosum excluding splenium
11. GA	Distance between anterior most point of CC and anterior commissure
12. CA	Shortest distance from anterior most point of CC to the cortex surface
13. CT	Shortest distance from top most point of CC to the cortex surface
14. CP	Shortest distance from posterior most point of CC to the cortex surface
15. FC	Distance from frontal pole to anterior most point of CC
16. OC	Distance from occipital pole to posterior most point of CC

The measured dimensions were tested for gender-related differences and measurements were also checked for correlation. STATA Software (STATA Inc.) was used for statistical analysis. Student's t-test, one way ANOVA (Analysis of Variance), linear regression and Pearson correlation coefficient were used to analyse the data. P-values less than 0.05 were considered significant.

Results: Statistical analysis of the different corpus callosum parameters was done to compare sexual dimorphism using unpaired student t-test. The mean values of various corpus callosum parameters between the two sexes were compared and corresponding P-values tabulated to see if the difference is statistically significant.

Statistically significant sexual dimorphism were observed in the following parameters -

- 1. Larger CC length and Brain length in the males as compared to females.
- 2. splenial thickness in males in comparison to females. It may represent the importance of distribution of fibers of visual cortex in males due to larger occipital lobe (greater OC in males).
- 3. CA, CP, FC and OC were found to be greater in males signifying their greater brain size.
- 4. The detailed analysis of the findings will be presented in the conference.

Conclusion: We have tried to achieve morphometry of normal CC in different gender groups. Sexual dimorphism though in only certain region is now an evident feature of corpus callosal anatomy. Whether and to what extent these morphological differences are associated with behavioural and cognitive differences between men and women remains unclear. This research would provide reference charts for further studies on neurological diseases affecting corpus callosum and its associated structures.