Original Article

Gender variation of morphology of Corpus Callosum in 30 brain specimens

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***ABSTRACT*:**
Background: The corpus callosum (CC) comprises axons connecting the cortices of the two cerebral hemispheres. The present study was conducted to determine gender differences of CC in adult population. **Materials & Methods:** The present study was conducted on 30 mid-sagittal sections from formalin fixed brain specimens. The diameters measured were length of CC (AB) which was straight distance from anterior most point to posterior most point of CC, width of body of CC at mid point (WMB), maximum width of genu (AE) which is straight length of genu at the level of anterior most point of CC and maximum width of splenium (BD) which was starting point at posterior most point of CC. **Results:** Out of 30 specimens, 18 were of males and 12 were of females. The mean longitudinal length of CC in males was 7.35 mm and in females was 6.12 mm, width of body of CC at mid point in males was 0.41 mm and in females was 0.56 mm, maximum width of genu in males was 1.36 mm and in females was 1.25 mm, maximum width of splenium in males was 1.14 mm and in females was 1.48 mm. The difference was significant (P< 0.05). **Conclusion:** Authors found a significant variation in measurements in size of corpus collusum in males and females.
Key words: Corpus collusum, Genu, Splenium.

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INTRODUCTION

The Corpus Callosum (CC) is the main fiber tract located in the floor of the longitudinal fissure of the mammalian brain connecting the two cerebral hemispheres. It consists of four anatomical parts.[1] Its anterior end is called the genu or "knee", the central part is the trunk, and the posterior bulbus part forms the splenium. The fourth part is the rostrum, which is the prolongation from the genu to the upper end of lamina terminalis.[2]

The corpus callosum (CC) comprises axons connecting the cortices of the two cerebral hemispheres and is the principal white matter fiber bundle in the brain. As recently as the mid 20th century, the CC was thought to serve no other purpose as preventing the two hemispheres
from collapsing on one another. This cynical view was attributable to the failure of the Van Wagenen/Akelaitis split-brain surgery to reveal strong disconnection symptoms.[3]

There have been two main theories regarding the progression of callosal development in utero. For many years, the prevalent theory maintained that callosal axons first cross the midline toward the anterior end and callosal development proceeds posteriorly, with the rostrum added last.[4] Despite its significance, little is known regarding the morphology and the anatomical dimensions of the corpus callosum. Morphological characteristics of fetal corpus callosum (CC) are of value from embryologic and diagnostic points of view. Knowledge of fetal callosal size is an essential prerequisite for the study of its changes during infancy.[5] The present study was conducted to determine gender differences of CC in adult population.

MATERIALS & METHODS

The present study was conducted in the department of Anatomy. It comprised of 30 mid-sagittal sections from formalin fixed brain specimens. Ethical clearance was taken from institute ethical committee.

The whole brains were removed from the cranial cavity and preserved in 10% formol solutions for 4 weeks. Brains were dissected along the midsagittal line considering it as an anatomical landmark. With the help of brain knife, the brains were carefully sectioned in the midsagittal plane passing from the body of CC, the hemispheric fissure, the septum pellucidum, cavity of third ventricle and cerebral aqueduct.

The diameters measured were length of CC (AB) which was straight distance from anterior most point to posterior

most point of CC, width of body of CC at mid point (WMB), maximum width
of genu (AE) which is straight length of genu at the level of anterior most point of CC and maximum width of splenium (BD) which was starting point at posterior most point of CC. Results thus obtained were subjected to statistical analysis. P value less than 0.05 was considered significant.

RESULTS

Graph I Distribution of Specimens

Total- 30		
Gender	**Males**	**Females**
Number	18	12

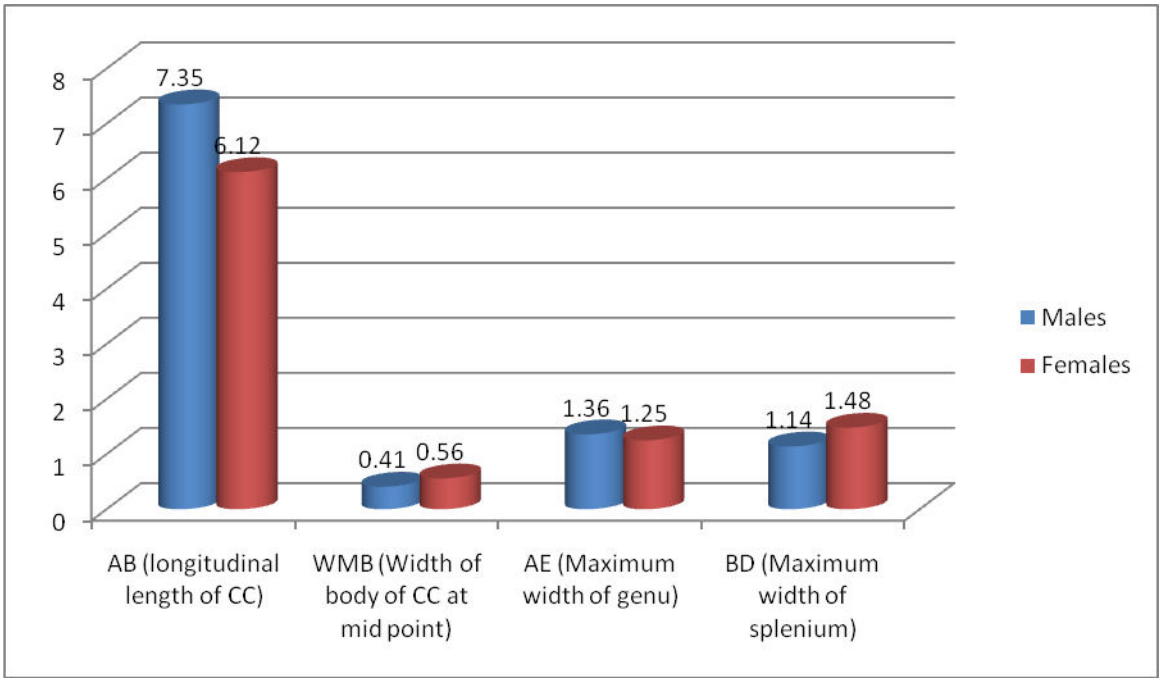
Table I shows that out of 30 specimens, 18 were of males and 12 were of females.

Table II Measurement of Corpus collusum

Parameters	Males	Females	P value
AB (longitudinal length of CC)	7.35	6.12	0.01
WMB (Width of body of CC at mid point)	0.41	0.56	0.71
AE (Maximum width of genu)	1.36	1.25	0.28
BD (Maximum width of splenium)	1.14	1.48	0.02

Table II, graph I shows that mean longitudinal length of CC in males was 7.35 mm and in females was 6.12 mm, width of body of CC at mid point in males was 0.41 mm and in females was 0.56 mm, maximum width of genu in males was 1.36 mm and in females was 1.25 mm, maximum width of splenium in males was 1.14 mm and in females was 1.48 mm. The difference was significant (P< 0.05).

Graph I Measurement of Corpus collusum



DISCUSSION

Morphology of CC and its relation to sex have been studied by many researchers but still remains a matter of debate. Most of the literatures available on sexual dimorphism of CC, have been carried out on MRI scans and relatively few studies are based on formalin-fixed cadaveric brain specimens.[6] Corpus callosum being the major structural connection between the hemispheres is likely to be affected by physiological as well as pathological changes in the cortical and sub-cortical regions of the brain. The fiber system that connects the corresponding cerebral hemispheres travels through specific regions of the corpus callosum. Hence, any morphological changes in corpus callosum may give a clue which will help diagnosis of specific pathological condition.[7]

CC being the major structural connection between the hemispheres is likely to be affected by physiological as well as pathological changes in the cortical and sub-cortical regions of the brain. The precise anatomical knowledge regarding the morphology of CC as well as the gender related changes of the structure in a certain ethnic population will provide baseline data for the diagnosis and assessment of progression of a disease affecting it.[8]

The present study was conducted to determine gender differences of CC in adult population. In this study, out of 30 specimens, 18 were of males and 12 were of females. Ilayperuma et al[9] conducted a study on formalin fixed preserved brains to get comprehensive data regarding gender related differences of CC. Mean values of two parameters (AB and AE) were greater in male than in female. However, 2 parameters (WMB and BD) had greater value in female than male. Only two parameters (AB and BD) showed statistically significant (p value < 0.05) gender differences.

We found that mean longitudinal length of CC in males was 7.35 mm and in females was 6.12 mm, width of body of CC at mid point in males was 0.41 mm and in females was 0.56 mm, maximum width of genu in males was 1.36 mm and in females was 1.25 mm, maximum width of splenium in males was 1.14 mm and in females was 1.48 mm.

Banka et al[10] showed that the distance between genu and splenium and maximum dorsoventral width of splenium seemed to increase with GA but no statistical significance was found. These results suggest that corpus callosum, particularly its rostral part, is progressively enlarged by addition of commissural fibers through the ages (second half of gestation) investigated. The genu grows faster than body and splenium. No gender differences in the callosal length or widths were found.

Several studies have found significant sex differences in the length, shape and area of the CC of males and females; with females having relatively larger splenium. Sexual dimorphism in CC might be due to greater bi hemispherical representation of cognitive functions in females. This might not simply be due to sex related differences in brain size and may reflect difference in connectivity necessitated by differences in brain size.[11]The findings of a study done by Takeda[12] showed that the average length of the corpus callosum was 42.55 mm in males which was more as compared to females (35.78mm). The thickness of splenium is more in females than males.

CONCLUSION

Authors found a significant variation in measurements in size of corpus collusum in males and females.

REFERENCES

1. Aboitiz F, Scheibel AB, Fisher RS, Zaidel E. Fiber composition of the human corpus callosum. Brain Res. 1992;598:143-53.
2. Kulkarni NV. Clinical Anatomy (A Problem Solving Approach). 2nd ed. Jaypee Brothers Medical Publishers. New Delhi. 2011. P 563.
3. Williams PL, Bannister LH, Berry MM, Collins P, Dyson M, Dussek JE. Gray's Anatomy : In The Anatomical Basis of Medicine and Surgery. 38 Ed. Churchill Livingstone, 2000.
4. Sinnathamby CS. Last's Anatomy Regional and Applied. 10 Ed. Edinburgh: Churchill Livingstone, 1999.
5. Bishop KM, Wahlsten D. Sex differences in the human corpus callosum: myth or reality? Neuroscience Biobehavioural Review 1997; : 581–601
6. Sullivan EV, Rosenbloom MJ, Desmond JE, Pfefferbaun A. Sex differences in corpus callosum size: relationship to age and intracranial size. Neurobiol Aging 2001; 22: 603-11.
7. Witelson SF. Hand and sex differences in the isthmus and genu of the human corpus callosum. A postmortem morphological study. Brain 1989; 112: 799-835.
8. Luders E, Rex DE, Narr KL et al. Relationships between sulcal asymmetries and corpus callosum size: Gender and handedness effects. Cereb Cortex, 2003; 13: 1084-93.
9. Ilayperuma I, Nanayakkara G, Palahepitiya N. Gross anatomical study on the gender differences in the corpus callosum. Galle Medical Journal. 2009;14(1):22-5.
10. Banka S, Jit I. Sexual dimorphism in the size of the corpus callosum. J Anat Soc India 1996; 45: 77-85.
11. Suganthy J, Raghuram L, Antonisamy B, Vettivel S, Madhavi C, Koshi R. Gender–and age–related differences in the morphology of the corpus callosum. Clin Anat 2003; 16: 396-403.
12. Takeda S, Hirashima Y, Ikeda H, Yamamoto H, Sugino M, Endo S. Determination of indices of the corpus callosum associated with normal aging in Japanese individuals. Neuroradiol 2003;45:513-8.