

Variation of Antero-Posterior Diameter of Corpus Callosum in Different Age and Sex Groups of Bangladeshi People

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The corpus callosum (CC), the largest commissure of the brain, connects the two cerebral hemispheres and lies at the bottom of the longitudinal fissure. The antero-posterior diameter of the CC was larger in males than in females, but this difference was not significant. Again, the length of CC increased with age and there was also a positive significant correlation between the antero-posterior diameters of the CC with the antero-posterior diameter of the brain. This cross sectional descriptive study was performed into four categories: Group A (20-29 years), Group B (30-39 years), Group C (40-49 years) and Group D (50 years and above). The specimens were collected from morgue in the department of Forensic Medicine, Mymensingh Medical College, Bangladesh by purposive sampling technique July 2016 to July 2017. The antero-posterior diameter of CC was measured by using thread. The mean maximum antero-posterior diameter of corpus callosum was 8.25 cm in group D and minimum was 7.92 cm in Group A. When the diameter was compared between sexes in different age groups, it was significant in Group D and moderately significant in Group C. There was a positive correlation between antero-posterior diameter of corpus callosum and age of individual and it was statistically not significant. For statistical analysis, differences between age and sex groups were analyzed by using students unpaired 't' test. The present study will help to increase the information pool on the antero-posterior diameter of CC of Bangladeshi people and thus will minimize the dependency on foreign standards and also have diagnostic importance for the neurosurgeons and radiologists for clinical investigation and surgery.

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Key words: Corpus callosum, Antero-posterior diameter, Age, Sex

Introduction

The largest commissural fiber of brain is corpus callosum, which connects two cerebral hemispheres. It is the white matter of cerebrum which is composed of myelinated nerve fibers of different diameters supported by neuroglia¹. It lies at the bottom of the longitudinal fissure, measures around 10 centimeters (cm) in length, shaped like the letter 'C' and have four parts: the rostrum, the genu, the body, and the splenium². Corpus callosum is the largest connecting pathway in the brain, made up of more than 200 million nerve fibers which help the brain to control movement and feeling of opposite half of the body. As processing of information of language done in cerebral hemispheres, it requires both sides of the brain to work together for physical coordination and taking in complex information where corpus callosum acts as the connector². The development of corpus callosum (CC) occurs between 12-16 weeks of pregnancy which may be hampered by certain factors like, prenatal viral infection of rubella, genetic abnormalities (autosomal recessive) like Andermann or Aicardi syndromes, toxic metabolic

conditions like fetal alcohol syndrome or brain cyst etc. Children with agenesis may develop blindness, deafness, unable to walk or talk, while others can be very high-functioning (autism).

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Medical problems like seizures are also associated with this, which require medical intervention². So, it is obvious, prenatal diagnosis of certain fatal conditions by using MRI is essential to avoid certain circumstances. It requires detail morphological knowledge of CC, to provide essential management in time. As there is a limited publication on morphological study of CC in Bangladeshi people we have to depend on foreign text and literatures. However, we need our own standard baseline from which we can compare the morphological aspects of diameter of CC of our own population with those of Western and other Asian people. Therefore, this article has been designed to study the antero-posterior diameter of CC to see the variations with age and sex in Bangladeshi people.

Methods

About 60 specimens containing cerebrum were collected from Bangladeshi cadaver of both sexes, age ranging from 20-50 years and above from autopsy laboratory of the Department of Forensic Medicine of Mymensingh Medical College, Bangladesh July 2016 to July 2017. The Ethical Review Committee (ERC) of Mymensingh Medical College approved this cross-sectional descriptive study. Only the medico-legal cases that died within preceding 12 hours were chosen for collection of specimen. Gross and fine dissection was carried out to study this parameter and fixed in 10.0% formol-saline. For convenience of differentiating the changes of diameter of CC in relation to age and sex, collected specimens were divided into four groups which include Group A age ranging from 20-29 years, Group B age ranging from 30-39 years, Group C age ranging from 40-49 years and Group D age ranging from 50 years and above. This study was done with these fixed specimens in spite of some hardening and shrinkage brought about by fixation. These could not be avoided in case of the brains, because in fresh state, brains were too soft to handle. Brain took one week to get sufficiently hard to allow normal handling. Antero-posterior diameter of corpus callosum was measured by placing a thread from its anterior end to posterior end on the medial surface of cerebral hemisphere. Then the length of the thread was measured by measuring scale and expressed in cm. The data collected from specimen of each cadaver was recorded in the pre-designed data

sheet, analysed by SPSS program and compared with the findings of other national and international studies and standard text books.



Figure 1: Photograph showing procedure of measuring antero-posterior diameter of corpus callosum

Results

The maximum antero-posterior diameter of corpus callosum was 9.10, 9.30, 10.00 and 10.10 cm in Group A, B, C and D respectively. The minimum antero-posterior diameter of corpus callosum was 6.0, 6.30, 7.30 and 7.40 cm in Group A, B, C and D respectively. The mean antero-posterior diameter of corpus callosum was maximum in Group D (8.25 cm) and was minimum in Group A (7.92 cm). It was observed that the mean antero-posterior diameter of corpus callosum gradually increased with increase of age.

Table I: Antero-posterior diameter of corpus callosum in different age groups

Age groups (years)	Number of specimen (n=60)	Mean±SD (cm) (Minimum - Maximum)
Group A (20-29)	24	7.92±0.549 (6.00 - 9.10)
Group B (30-39)	15	7.96±0.764 (6.30 - 9.30)
Group C (40-49)	11	8.15±0.790 (7.30 - 10.00)
Group D (50 years and above)	10	8.25±0.593 (7.40 - 10.10)

Original Contribution

Comparison of antero-posterior diameter of corpus callosum among the age groups

Comparison between age groups	Mean difference	Std. error difference	t	p
A & B	-0.041	0.210	-0.196	0.846
A & C	-0.236	0.230	-1.024	0.313
A & D	-0.131	0.212	-0.620	0.539
B & C	-0.195	0.308	-0.632	0.533
B & D	-0.090	0.287	-0.314	0.756
C & D	0.105	0.308	0.340	0.738

Table II: Antero-posterior diameter of corpus callosum in different sex

Age groups (years)	Sex	Number of specimen (n=60)	Mean±SD (cm)
Group A (20 - 29)	Male	09	8.08±0.272
	Female	15	7.82±0.657
Group B (30 - 39)	Male	09	8.22±0.698
	Female	06	7.87±0.739
Group C (40 - 49)	Male	06	8.67±0.703
	Female	05	7.94±0.279
Group D (50 & above)	Male	07	8.80±0.404
	Female	03	7.97±0.603

Comparison of antero-posterior diameter of corpus callosum between different sexes

Comparison between sexes in different age groups	Mean difference	Std. error difference	t	p
Group A	0.263	0.230	1.144	0.265
Group B	0.656	0.376	1.742	0.105
Group C	1.127	0.337	3.345	0.009
Group D	0.833	0.319	2.615	0.031

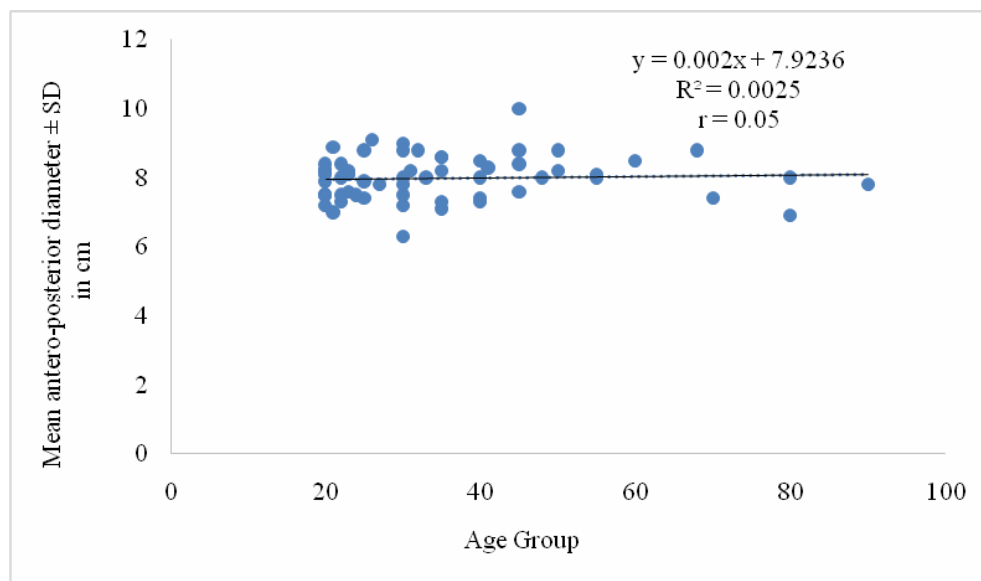


Figure 2: Scatter diagram showing the correlation between age of individual and antero posterior diameter of corpus callosum

In this study, the correlation between age of individual and the antero-posterior diameter of corpus callosum was tested. It was observed that antero-posterior diameter of corpus callosum increased with age of individual. The regression line showed positive correlation between age of individual and antero-posterior diameter of corpus callosum and it was statistically not significant where, $r = + 0.05$ (Figure 2).

Discussion

The antero-posterior diameter of corpus callosum was ranged from 6 mm to 10.10 mm. The mean \pm SD antero-posterior diameter of corpus callosum was 7.92 ± 0.549 , 7.96 ± 0.764 , 8.15 ± 0.790 and 8.25 ± 0.593 mm in Group A, B, C and D respectively. It was also evident that there was a general trend of increasing antero-posterior diameter of corpus callosum as age advanced but their differences were statistically not significant. The maximum mean antero-posterior diameter of corpus callosum was in Group D and minimum in Group A. Again the mean antero-posterior diameter of corpus callosum of the male was found to be greater than that of the female in all age groups and their differences were statistically moderately significant in Group C and significant in Group D. Mohammadi et al. studied on MR images of 100 subjects (45 males and 55 females) in Iran. The subjects were divided into three age groups, including less than 30 years old, 30-44 years and 45 years old and more. The mean antero-posterior diameter of the CC was 7.25 ± 0.08 cm in those subjects who were 45 years old and more. It was 7.19 ± 0.06 cm in those who were 30-44 years old while in those younger than 30 years it was 6.82 ± 0.10 cm ($p=0.001$)³. This study result was nearly similar to the values of this study. Here also the values gradually increased with the age of the individual. Takeda et al. using MR images on the Japanese showed that the antero-posterior diameter of CC was 69.7 ± 4.15 mm in males and 69.4 ± 4.33 mm in females. He concluded that there was no significant difference in callosal measures between two genders⁴. This study values were less than the values of this study. Suganthy et al. studied in India on 100 subjects using MRI, the antero-posterior diameter of CC in males was significantly higher than females (72.6 ± 5.2 mm in male, 70.6 ± 4.0 mm in female)⁵. This study result was nearly similar to the values of this study. Gupta et al. studied on Indian population. MRI showed that the antero-posterior diameter of CC was 7.57 cm in male and 7.1 cm in female. Furthermore, he reported that the antero-posterior diameter of CC in the Indian population was greater than the Japanese, but

lower than the Caucasian population⁶. This study values were nearly similar to the values of this study. Kocabiyik et al. studied on MR images on healthy males ($n=63$) and females ($n=52$). The age distribution of subjects was 10-84 years and the mean age was 37.50 ± 16.47 . The subjects were divided into 3 groups. Group I consisted of those younger than 25 ($n=33$), Group II consisted of those whose age was between 26 and 40 ($n=43$) and Group III consisted of those older than 41 ($n=39$). In this study, in male total antero-posterior diameter of CC was 56.60 to 81.60 mm with SD 4.69 and in female total antero-posterior diameter of CC was 38.50 to 84.0 mm with SD 6.73. There was a statistically significant difference between Group I and Group III in antero-posterior diameter of CC ($p=0.009$). There was a weak positive correlation (27%) between age and antero-posterior diameter of CC which was statistically significant ($p=0.004$)⁷. These study results were nearly similar to the values of this study.

Conclusion

The observations and results of the present study are expected to provide an idea about the antero-posterior diameter of corpus callosum and its changes in relation to age of Bangladeshi people. These findings will help to standardize the measurements obtained by other observers in our country. Finally, from the present study it was concluded that maximum mean antero-posterior diameter of corpus callosum was in Group D and minimum in Group A. Thus it gradually increased with age but their difference was statistically not significant among age groups. There was a positive correlation between age of individual and antero-posterior diameter of corpus callosum and it was statistically not significant. Again the male values were greater than female and the mean difference between male and female in Group C was statistically moderately significant at $p<0.01$ and in Group D was significant at $p<0.05$.

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