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CT Scan Based Estimation of Distance of Human Paracentral Lobule from Different Landmarks of Cerebral Hemisphere between Bangladeshi Male and Female Population

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Abstract

Context: *This study was carried out to observe the distance of paracentral lobule in relation to different points of cerebral hemisphere between adult male and female Bangladeshi population.*

Materials & Methods: *This cross sectional study was conducted in the Department of Anatomy, Dhaka Medical College, Dhaka, during the period of January 2017 to December 2017. A total of 70 adult Bangladeshi male & female were selected, age ranging from 20-65 years. CT scan image of brain in midsagittal view was used for this study. Distance of paracentral lobule in relation to different points of cerebral hemisphere was measured and compared between adult male and female Bangladeshi population. Calculation was done using unpaired student's 't' test.*

Results: *In male, mean distance from inferior most point of paracentral lobule to corpus callosum were 11.37±1.79 mm and 11.09±1.87 mm on right and left cerebral hemisphere respectively. In female, mean distance were 11.67±2.36 and 11.20±2.38 mm on right and left respectively. In male, distance from frontal pole to anterior most point of paracentral lobule of right and left were 89.21±5.22 mm and 88.82±5.28 mm respectively. In female, on right and left cerebral hemisphere, distance were 87.81±3.57 mm and 87.23±3.60 mm respectively. In male, distance from occipital pole to posterior most point of paracentral lobule of right and left cerebral hemisphere were 73.11±3.38 mm and 72.68±3.24 mm respectively. In female on right and left, distance were 71.86±4.67 mm and 71.49±5.08 mm respectively.*

Conclusion: *There was no statistically significant difference regarding distance of paracentral lobule from different landmarks of cerebral hemisphere between adult male and female of Bangladesh.*

Key words: *Paracentral lobule, central sulcus, corpus callosum, frontal pole, occipital pole*

Introduction

The paracentral lobule is located on the medial surface of cerebral hemisphere.[1] This specific area of cerebral cortex are concerned with specific parts of the body with specific types of input and activities.[2] This lobule extends from precentral sulcus to postcentral sulcus on superomedial border. By the indentation of central sulcus, this lobule is divided into anterior and posterior parts.[3] The anterior part contain primary motor area representing the muscles of leg and foot [4] and the perineal region of the opposite side. It is responsible for voluntary control of defecation and micturition .[3] The posterior part contains the primary somatosensory area, representing the leg and foot.[4] Ischemia and infarction occurs in cerebrovascular disease which causes lesions of motor cortex and produce contralateral lower limb paralysis.[5] This area may be a primary site for tumors and focal seizures making its surgical excess of great importance for neurosurgery.[6]

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In human, highest level of nervous function is localized in the cerebral cortex. Thickness of cortex decreases with age and also in many diseases such as in Alzheimer's disease[7], chronic schizophrenia, multiple sclerosis.[8] In interstitial cystitis or painful bladder syndrome gray matter thickness is increased in primary somatosensory area (paracentral lobule).[9] Due to advances in the endoscopic neurosurgery it has become extremely necessary to understand the details of the paracentral lobule's anatomy and its location with surroundings.[6]

This study was an attempt to contribute to the knowledge regarding anatomy of the paracentral lobule, conducting an analysis of morphological measurements in this region and its correlation with frontal pole, occipital pole, central sulcus and corpus callosum in both cerebral hemispheres between adult Bangladeshi male and female population. For this study Computed Tomography (CT) scan of brain in mid sagittal view was used because it provides more detailed information about structure of brain than regular radiographs (x-ray).[10]

The result of the present study can be used as a baseline anatomical normative data for future researches and the findings of this study might be useful in providing data for the anatomists, radiologists, neurosurgeons, and forensic experts.

Materials and Methods

This cross sectional study was conducted in the Department of Anatomy, Dhaka Medical College, Dhaka, during the period of January 2017 to December 2017. Seventy adult Bangladeshi people (35 males and 35 females) age ranging from 20-65 years were included in this study. The subject of this study were selected from the Radiology & Imaging Department of Dhaka Medical College & Hospital attending for CT scan of brain advised by their physicians. This study was carried out after permission from Ethical Committee of Dhaka Medical College. Subjects were selected purposively. The study subjects were assured of confidentiality of the study. Personal information of the subjects were recorded on questionnaire by the researcher. Informed written consent was taken. Those CT scan images of brain in mid sagittal view of both cerebral hemispheres were collected which were normal reported by the radiologists. For this study, reconstructed mid sagittal view of both cerebral hemispheres were taken since the paracentral lobule was visible in this way and these images were viewed on a computer monitor for editing and magnifying. Different dimensions of paracentral lobule were measured from these images by using computer with image measuring software program named DICOM (Digital Imaging and Communications in Medicine) version 4.0.3. (64-bit). Due to a total absence of clear morphological landmarks, measurement was standardized by using intercommissural or CA-CP line (CA- anterior commissure, CP- posterior commissure)) system in order to increase precision of data.[11] Unpaired student's 't' test was done for statistical analysis of the results. P value <0.05 was taken as level of significance.

Results

In male, mean distance from inferior most point of the paracentral lobule (IP) to corpus callosum (CC) of right and left cerebral hemisphere were 11.37±1.79 mm and 11.09±1.87 mm respectively. In female, mean distance on right and left cerebral hemisphere were 11.67±2.36 mm and 11.20±2.38 mm respectively. No statistically significant difference in mean distance was found between male and female (Table I).

Table I

Comparison of distance from inferior most point of paracentral lobule (IP) to corpus callosum (CC) between male and female

Variables	Male (n=35) Mean±SD (Range)	Female (n=35) Mean±SD (Range)	p value
Distance from IP to CC in mm (Right)	11.37±1.79 (6.34-14.71)	11.67±2.36 (6.56-15.95)	0.544^{ns}
Distance from IP to CC in mm (Left)	11.09±1.87 (6.36-14.45)	11.20±2.38 (6.57-15.91)	0.843^{ns}

Comparison of values between male and female was done by unpaired student's 't' test,
ns = Non significant,

In male, mean distance from frontal pole (FP) of brain to anterior most point of paracentral lobule (AP) of right and left cerebral hemisphere were 89.21±5.22 mm and 88.82±5.28 mm respectively. In female, mean distance of right and left cerebral hemisphere were 87.81±3.57 mm and 87.23±3.60 mm respectively. No statistically significant difference was found in mean distance from FP to AP of the right (p=0.193) and left (p=0.145) cerebral hemisphere between male and female (Table II).

In male, mean distance from occipital pole (OP) of cerebral hemisphere to posterior most point of paracentral lobule (PP) of right and left cerebral hemisphere were 73.11±3.38 mm and 72.68±3.24 mm respectively. In female, mean distance in right and left cerebral hemisphere were71.86±4.67 mm and 71.49±5.08 mm respectively. Statistically significant no difference was found in mean distance in the right (p=0.205) and left (p=0.248) cerebral hemisphere between male and female (Table III).

Table II

Comparison of distance from frontal pole (FP) of brain to anterior most point of paracentral lobule (AP) of right and left cerebral hemisphere between male and female

Variables	Male (n=35) Mean±SD (Range)	Female (n=35) Mean±SD (Range)	P value
Distance from FP to AP in mm (Right)	89.21±5.22 (79.10-100.91)	87.81±3.57 (79.40-95.00)	0.193^{ns}
Distance from FP to AP in mm (Left)	88.82±5.28 (78.78-99.76)	87.23±3.60 (79.21-94.80)	0.145^{ns}

Comparison of values between male and female was done by unpaired student's 't' test,
ns = Non significant

Table III

Comparison of distance from occipital pole (OP) to posterior most point of paracentral lobule (PP) of right and left cerebral hemisphere between male and female

Variables	Male(n=35) Mean±SD (Range)	Female(n=35) Mean±SD (Range)	p value
Right distance from OP to PP in mm (Right)	73.11±3.38 (66.81-80.31)	71.86±4.67 (62.22-82.76)	0.205^{ns}
Left distance from OP to PPin mm (left)	72.68±3.24 (66.52-78.73)	71.49±5.08 (60.30-84.81)	0.048^{ns}

Comparison between values of male and female was done by unpaired student's 't' test,
ns = Non significant

Discussion

In the present study, statistically non significant difference was observed between male and female in mean distance from inferior most point of paracentral lobule (IP) to corpus callosum (CC) of the right (p=0.544) and left (p=0.843) cerebral hemisphere but the distance was found higher in female than male. By reviewing existing literature, there was no available data on measurement of distance from inferior most point of paracentral lobule (IP) to corpus callosum (CC) of the right and left cerebral hemisphere. So, it was not possible to compare these results with other studies.

In this study, non significant difference was found in mean distance from frontal pole (FP) to anterior most point of paracentral lobule (AP) of the right (p=0.193) and left (p=0.145) cerebral hemisphere between male and female but the distance was found higher in male. Some researchers [12] stated that the distance from frontal pole to anterior boundary of paracentral lobule (precentral sulcus) in male was 94±7 mm and 92±8 mm for the left and the right cerebral hemispheres respectively. The findings of the present study were lower than that findings. There was no available data for comparison with females.

In the present study, non significant difference was observed in mean distance from occipital pole (OP) to posterior most point of paracentral lobule (PP) of the right (p=0.205) and left (p=0.248) cerebral hemisphere between male and female but distance was found higher in male. Another study[12] showed that the distance from occipital pole to posterior boundary of paracentral lobule (postcentral sulcus) was 83±8 mm and 84±8 mm for the left and right cerebral hemispheres respectively in male . The findings of the present study were lower than the findings of that study. There was no published data for comparison with females.

Review of existing literature reveals that few works have been done on this topic in other countries. No study concerning measurements of the paracentral lobule and its relation with different points of cerebral hemisphere was carried out in our country previously. So, the result of the present study was compared with the findings of other researchers of abroad. Some dissimilarities were noticed among the findings of present study and the studies conducted by other researchers. This dissimilarities may be due to mixture of different age and races, different geography, use of cadaveric brain instead of CT scan image from living subject, variation in the radiograph and taking the measurement in different technique.

Conclusion

No statistically significant difference was found regarding distance of paracentral lobule in relation to different landmarks of cerebral hemisphere (corpus callosum, frontal pole, occipital pole) between adult male and female Bangladeshi population.

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