An Mri study to document age related changes in the Morphometry of the Corpus Callosum

Navbir Pasricha

RML Institute of Medical Sciences, India

Introduction: The Corpus Callosum (CC) is the largest commissural bundle with about 100 million fibres connecting the two cerebral hemispheres. It forms a massive arched interhemispheric bridge in the floor of the median longitudinal cerebral fissure. Researches have shown that it is involved in many advanced features of the brain, such as learning, memory, thinking, three-dimensional visual ability, executive functions as well as behavioural patterns. Inconsistencies lie regarding age related changes of Corpus Callosum. Despite rigorous investigations on age-related variations of CC, much controversy still exists in the literature. Morphometric analysis of normal Corpus Callosum is of value in the surgical interventions and stereotactic approaches to the foramen of Munro or third ventricle and in cases of callosectomy for intractable epilepsy. MR imaging is used for preoperative determination of the extent of callosectomy for epilepsy as well as for postoperative evaluation, especially T1 weighted images. Most of the published studies investigated age related CC variations in the western countries and few studies addressed it in any Southeast Asian country like India.

Aim: In view of the importance of the dimensions of CC we took up a study to provide reliable results regarding normal morphometry of Corpus Callosum and possible age related variations using magnetic resonance imaging (MRI) data in the North Indian population.

Material and Methods: The clearance from the Institutional Ethics Committee at Dr. Ram Manohar Lohia Institute of Medical Sciences, Lucknow, was taken.

The study 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.

The participants were divided into three groups of 20-39, 40-59 and 60-80 years of age. 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.

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 age-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: It is believed that corpus callosum shrinks in general with age. But in our study we saw that there was:

1. Decrease in thickness of body, rostrum and splenium with age linked to generalised degeneration of cortical neurons or atrophy of white matter with advancing age

2. Increase in length of corpus callosum with age, possibly due to age mediated structural dilatation in lateral ventricles and its association with CC. Our findings were comparable with the result of many studies on this topic but were in contrast with the studies which justify decreases in CC length simultaneously.

3. Increase in height of CC as reported by Takezaki et al in Japan.

4. The detailed analysis of the findings will be presented in the conference.

Conclusions: Physiological or Pathological factors can affect different sub-regions of the corpus callosum depending upon the region of the brain involved as fibre system connecting corresponding hemispheric regions pass through specific callosal subregions therefore alteration in corpus callosum morphology may give a clue towards diagnosis of specific disease processes. We observed increase in the length and decrease in thickness of CC in older age group. Our study can be considered as a baseline data about normal morphometry of the corpus callosum which can be useful for a further study with larger number of cases which can compare morphometry with specific clinical conditions to make it more clinically relevant.