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The Ventricular System of the Human Brain was Analyzed Morphometrically Using the Dissection Method

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Key Words:
Human Brain, Ventricular System, Dissection Method

Abstract:
The current research aimed to examine the variation in ventricular size among human brains obtained from cadavers and to look for correlations between ventricle size and age, sex, and side of the brain. The 127 formalin-fixed brain specimens included in the research came from both the Department of Forensic Medicine and the remains of people who volunteered to be studied. When comparing males and females, the study discovered that all measures were bigger on the left side. As a normogram for our local setting, the current research defines morphometric measures of the brain's ventricles that may be used by radiologists, neurologists, neurosurgeons, and psychiatrists to make clinical connections.

1. Introduction:

Regression of brain tissues is a hallmark of age-related cognitive decline and certain forms of dementia [1]. Dementia is characterized by an enlargement of the cerebral spinal fluid (CSF) gaps [2, 3], which may be caused by a diminution in the size of nerve cells [4, 5]. Age and dementia make ventricular enlargement a more reliable predictor of cortical atrophy [6]. Different forms of hydrocephalus can cause the fourth ventricle to grow in size. The autistic group had a bigger fourth ventricle compared to the control group [7]. For the purpose of morphometric study, a dry, non-toxic, and long-lasting cast of the hollow cavity of an organ may be prepared using a process called luminal plastination [8-10].

Review of Literature

From the embryonic neural tube's core lumen, a network of cavities and channels emerges to form the cerebral ventricular system. The ventricular system, which is filled with cerebrospinal fluid, plays a crucial role in brain function. Two lateral ventricles, a third and a fourth ventricle in the midline, and the interventricular foramen of Monro and aqueduct of Sylvius link these ventricles.Clinicians, neurosurgeons, and radiologists may benefit from knowing the normal and pathological architecture of the brain's ventricular system [11, 12]. The ventricular system of the brain is an indicator of how the brain will grow and develop [13]. Examining the morphological changes in the cerebral ventricular system as a result of development, ageing, and both internal and external diseases is crucial [14]. Neuroradiologists are sometimes put in the difficult position of determining whether a patient's ventricles are typically sized or abnormally enlarged. This is why it's important to standardise the measurement of ventricular size and establish reference ranges [15]. In chronic alcoholics, the morphology, size, and structure of the ventricular system in the brain will change [16]. Recently, morphometric study of brain structures including volume, form, and size of the ventricular system, notably the lateral ventricle, have been major points of interest in research of certain neuropsychiatric illnesses like schizophrenia and alzheimer's [17]. Neurosurgeons may use morphometric analysis of the ventricular system to pinpoint and completely remove tumours like craniopharyngiomas and gliomas that are pressing on

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the ventricular system. For endoscopic neurosurgery, familiarity with the structure and function of the cerebral ventricular system is crucial. [18].

2. Methodology:

Research Design:

The investigation was carried out in the Anatomy and Cell Biology Postmortem investigations conducted by the Department of Forensic Medicine and remains given to the Department of Medical College, Jhansi provided the brain specimens used in this study. Every death had details recorded, including age, sex, and cause of death. The process of dissection was performed on a total of 127 brain samples. Normal MRI images from 35 patients across age ranges were collected for radiological comparison at the Medical College & Hospital.

Following postmortem removal, the brains were tagged before being stored in 10% formalin solution. The brains were then dissected using the guidelines in Cunningham's Manual of Practical Anatomy.

Antero-posterior length:

The lamina terminalis and posterior commissure were positioned as reference points.

Superior-inferior height:

For this, the highest point of curvature on the fornix's inferior surface served as the superior point, while the fornix's superior surface served as the inferior point.

Data Collection for MRI scans:

Each patient's name, gender, date of birth, address, phone number, and hospital registration number were recorded. MRI images were analysed with the same meticulousness as the dissection technique. Patients were scanned using the Siemens Abanto Fit 1.5 tesla mcchine located in the Medical Imaging Department at the University of Maryland Medical Centre. MRI imaging was performed in the sagittal and transverse axial planes.

Statistical Analysis

Statistical Package for the Social Sciences (SPSS) version 18 was used for the analysis of the data. All measures' means, variances, and standard errors were computed as statistical parameters. Student's t-test was used to assess and evaluate data for statistical significance. Spearman's rank correlation coefficient was used to determine the degree to which a number of measured factors were connected with chronological age. A p value of 0.05 was considered to be statistically significant. Statistical significance has been defined as a p-value less than $p<0.05$ for all analyses.

3. Results and Analysis

The youngest female instance in this research was 15, while the oldest male case was 81. Of the 127 brains on display, 78 (61.42%) belonged to males and 49 (38.58%) to females (Figure 1).

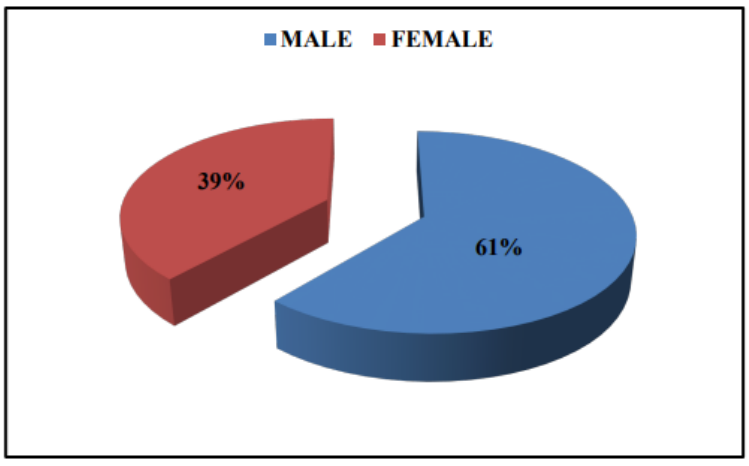

Figure 1: Cases Distribution in Male and Female Gender

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The average length of the left frontal horn in all 127 brain samples was 31.53 mm 4.61 millimetres, 1.77 millimetres longer than the right side's 29.76 mm 4.49 millimetres (Figure 2), a difference that was determined to be statistically significant (p 0.0026).

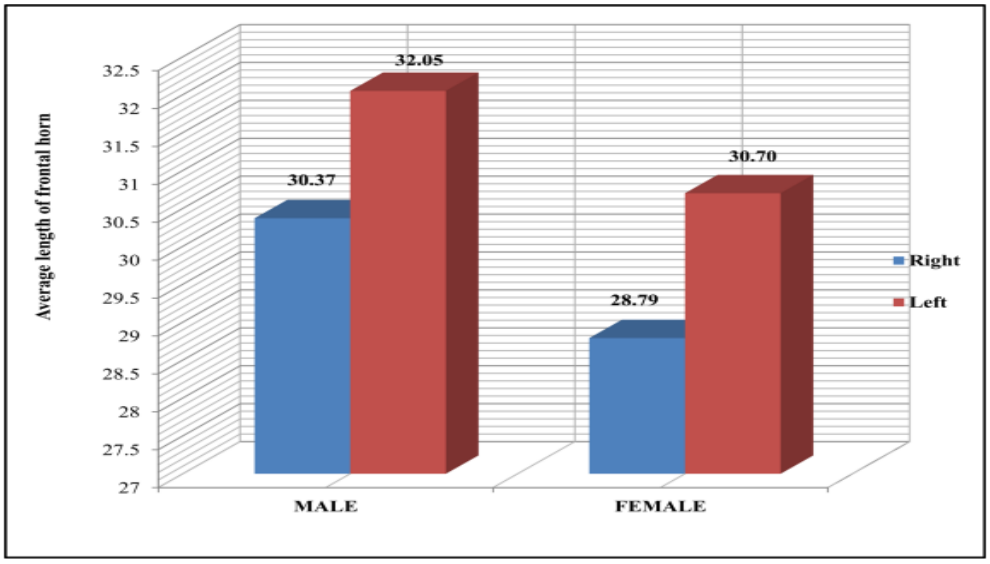

Figure 2: Frontal Horn Sidewise Changes in the Mean Length in Male and Female Cases of Lateral Ventricle

The average length of the lateral ventricle body was measured to be 36.49 mm (SD 4.20) in male brain specimens and 34.69 mm (SD 4.95) in female brain specimens (figure 3).The significance level was moderate (p = 0.0021).

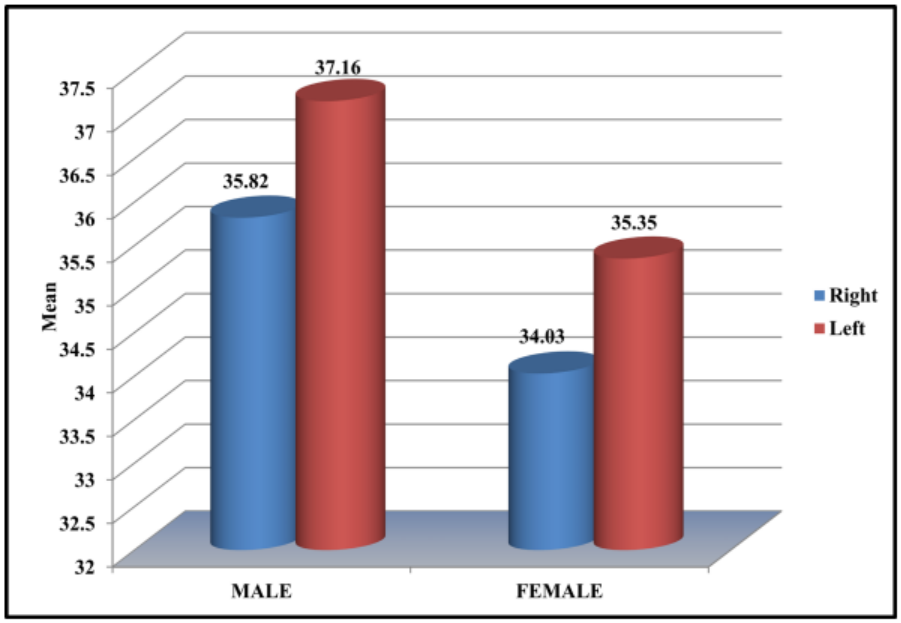

Figure 3: Body Sidewise Changes Mean Length of Lateral Ventricle in Male and Female Cases

Brains from male patients were found to have a significantly longer average posterior horn (27.63mm, SD 4.04) compared to those from female patients (26.08mm, SD 4.03) (Figure 4). This difference was shown to be statistically highly significant (p 0.0031).

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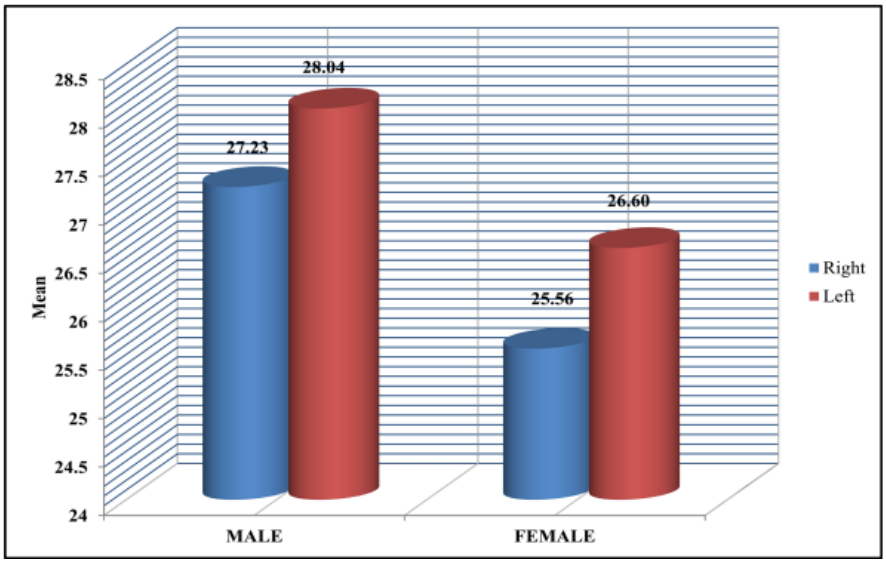

Figure 4: Gender wise and Sidewise Changes Mean Length of Lateral Ventricle of Posterior Horn

The length of the inferior horn of the left lateral ventricle was greater than that of the right lateral ventricle in both sexes and all 127 brain specimens (Figure 5).

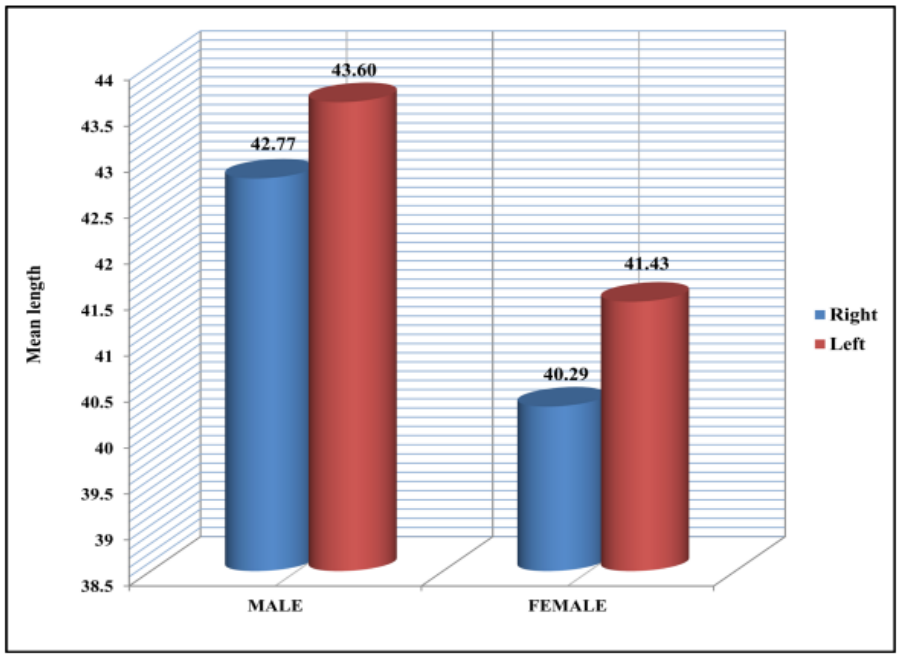

Figure 5: Gender wise and Sidewise Changes Inferior Horn Length of Lateral Ventricle in Male and Female Cases

Age and third ventricle size were shown to be positively linearly correlated. This indicates that the third ventricle's anterior-posterior and superior-inferior diameters both grow with age (Figure 6).

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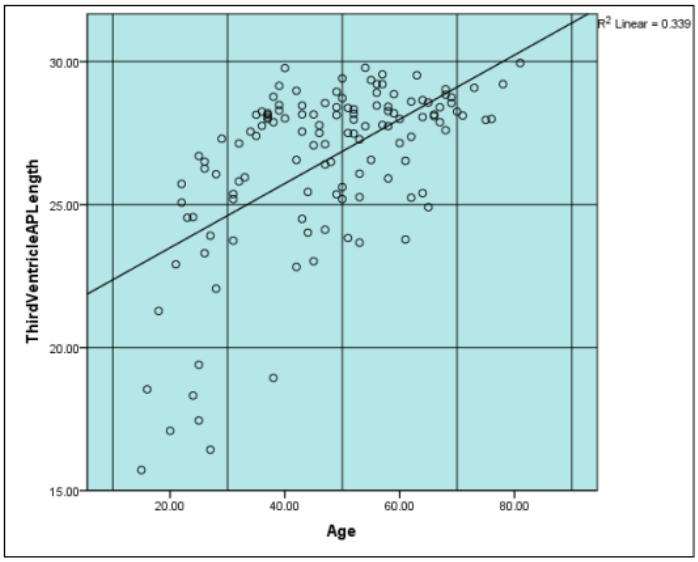

Figure 6: Age and the Mean Anterior-Posterior Length of the Third Ventricle Have a Positive Correlation

The average male was somewhat longer anterior to posteriorly (26.57 mm) and taller superior to inferiorly (22.89 mm) than the average female (26.51 mm), but these differences were not statistically significant ($p>0.05$). (Figure 7)

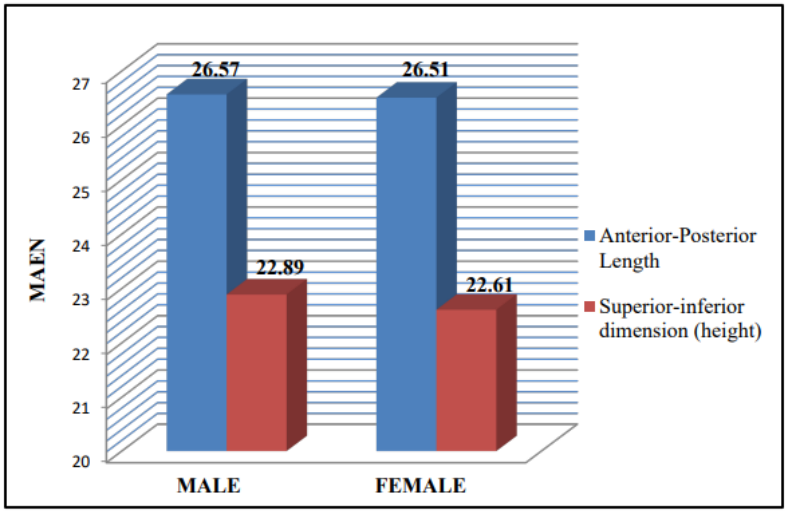

Figure 7: Third Ventricle Different Dimensions Gender Wise Comparison

4. Conclusion:

From the present study, it was concluded that there was great variation in measurements of parts of lateral ventricles of brain which showed statistically significant correlation with one another. The left lateral ventricle was shown to be larger than right in either sex while both lateral ventricles were larger in males. The size of the ventricular system varies with age. All the measurements of lateral ventricle were more in CT compared to dissection method.

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