

MORPHOMETRIC ANALYSIS OF VENTRICLES OF HUMAN BRAIN IN NORMAL POPULATION-A CT SCAN STUDY

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Abstract

Background: The cavity within the brain is ventricles filled with Cerebrospinal Fluid (CSF). The lateral ventricles are the largest paired ventricles present within the cerebrum; the third ventricle is in the diencephalon of the forebrain between the thalami; and the fourth ventricle is located posterior to the Pons and open part of the medulla oblongata of the hindbrain. Knowing the normal measurements of the cerebral ventricles in the living human has great importance in diagnosing and monitoring several pathologies. **Materials and Methods:** This study was carried out on 150 healthy subjects (75 females and 75 males) aged between eighteen and eighty-seven years between January 2021 and October 2022 in GSVM Medical College, Kanpur. **Result:** In our current study we observed the length of the right ventricle was 75.15 ± 8.5 mm, length of the left ventricle was 71.67 ± 6.8 mm, length of the right frontal horn of the lateral ventricle was 28.6 ± 5.3 mm, length of the left frontal horn of the lateral ventricle was 27.56 ± 5.6 mm, width of the 3rd ventricle was 4.8 ± 2.9 mm, height of the 4th ventricle was 8.9 ± 2.9 , width of the 4th ventricle was 11.3 ± 9.8 . **Conclusion:** The study provided valuable morphometric data about the lateral, third and fourth ventricles while diagnosing visual disturbance, hydrocephalus, schizophrenia, psychotic disorders and other pathologies.

INTRODUCTION

The cavity within the brain is ventricles filled with Cerebrospinal Fluid (CSF). The lateral ventricles are the largest paired ventricles present within the cerebrum; the third ventricle is in the diencephalon of the forebrain between the thalami; and the fourth ventricle is located posterior to the Pons and open part of the medulla oblongata of the hindbrain.^[1] Knowing the normal measurements of the cerebral ventricles in the living human has great importance in diagnosing and monitoring several pathologies.^[2] Imbalance in the production and absorption of cerebrospinal fluid results in the enlargement of a ventricular system called hydrocephalus. For the early and precise diagnosis of the type of hydrocephalus, knowledge of ventricular size is mandatory.^[3] Computed Tomography (CT) is an accepted procedure for identifying a wide range of pathologic processes and measuring ventricular size. In the Indian scenario, as compared to MRI, CT

remains an easily available, affordable and faster mode of brain imaging. Ventricular size can be studied by linear or volumetric measurements, out of which linear ratios of the width of ventricles to the width of the skull or brain are the easiest reproducible method.^[4] Accurate measurements of the ventricles provide available and safe means of aiding the diagnosis of some neurological disorders, such as early detection of hydrocephalus, cerebral atrophy etc., and provide important follow-up information in affected patients.^[5] The width and height of the fourth ventricle were 13.0 ± 1.9 and 10.0 ± 2.1 mm in the males and 12.0 ± 2.0 mm and 9.6 ± 2.2 mm in the females, respectively. This study aimed to determine the nomogram for the 4th ventricles of the brain in healthy subjects of our population using Computed Tomography (CT) scan.

MATERIALS AND METHODS

This study was carried out on 150 healthy subjects (75 females and 75 males) aged between eighteen and eighty-seven years between January 2021 and October 2022 in GSVM Medical college, Kanpur.

CT scan technique

CT scanning is ideally suited for 3D imaging and used in, for example, brain, cardiac, musculoskeletal, and whole-body CT imaging. The images can be presented as impressive coloured 3D rendered images, but radiologists usually rely more on black and white, 2D images, being either the 2D axial images or 2D reformats. The patient was placed on the CT table, and the head was centralised and supported for correct positioning and to avoid blurring of images. A lateral scout image was taken to confirm the correct positioning of the patient. The orbit-meatal line was drawn, and a line at an angle of 15 - 20 degrees to and 1 cm above it was drawn, representing the lowest tomographic section, which passed through the base of the skull. The total time of the CT scan was 20-30 seconds. A total of 8 to 10 sections was obtained without any overlap. All processing and measurement of axial CT images were performed in the ADW workstation.

Method

1) Lateral Ventricle

Length of lateral ventricular body inclusive of the level of interventricular foramen. The frontal horn it was brought from tip of the frontal horn to the atrium.

2) Level of Interventricular Foramen

- Length of frontal horns of the right lateral ventricle in mm (measured from its tip to the interventricular foramen).
- Length of frontal horns of the left lateral ventricle in mm (measured from its tip to the interventricular foramen).

3) Level of third Ventricle

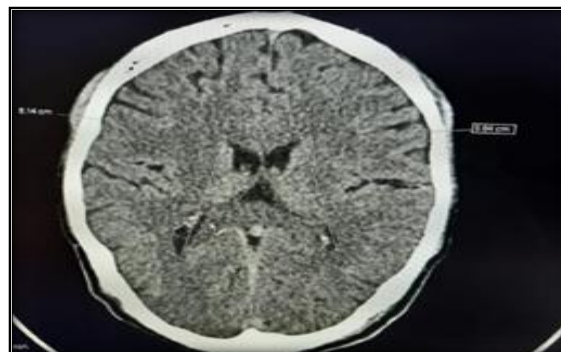
- Greatest width of the third ventricle in mm can be seen

4) Level of Fourth Ventricle

- Greatest height of the fourth ventricle in mm .
- Greatest width of the fourth ventricle in mm

Statistical Analysis: Statistical analysis was performed by using computer based software, Statistical Package for Social Science (SPSS).

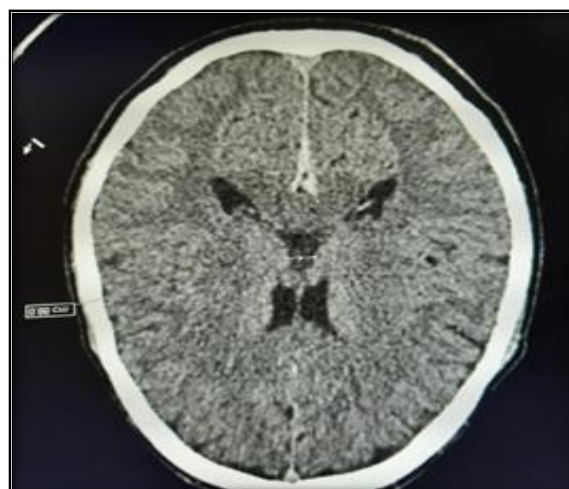
RESULTS



Length of ventricle



Length of frontal horn



Width of 3rd ventricle

In our current study we observed the length of the right ventricle was 75.15 ± 8.5 mm, length of the left ventricle was 71.67 ± 6.8 mm, length of the right frontal horn of the lateral ventricle was 28.6 ± 5.3 mm, length of the left frontal horn of the lateral ventricle was 27.56 ± 5.6 mm, width of the 3rd ventricle was 4.8 ± 2.9 mm, height of the 4th ventricle was 8.9 ± 2.9 , width of the 4th ventricle was 11.3 ± 9.8 as show in table no 1. This value was come from CT scan measurements.



Width of 4th Ventricle

Table 1: showing the statistical measurement of the Lateral Ventricle, 3rd Ventricle and 4th ventricle.

Parameters	Sample size	Mean \pm SD	Min	Max
Length of the right ventricle	150	75.15 \pm 8.5	41	103
Length of the left ventricle	150	71.67 \pm 6.8	22	109
Length of the right frontal horn of the lateral ventricle	150	28.6 \pm 5.3	14	35
Length of the left frontal horn of the lateral ventricle	150	27.56 \pm 5.6	15	36
Width of the 3rd ventricle	150	4.8 \pm 2.9	3	10
Height of the 4th ventricle	150	8.9 \pm 2.9	3	18
Width of the 4th ventricle	150	11.3 \pm 9.8	7	12

DISCUSSION

In our current study, we observed the length of the right ventricle was 75.15 ± 8.5 mm while comparing our study with Honnegowda TM et al,^[6] observed that the length of the right ventricle was 76.23 ± 9.4 mm their data was similar with our data. In our current study, we observed length of the left ventricle was 71.67 ± 6.8 mm while comparing our study with Honnegowda TM et al,^[6] observed that the length of the right ventricle was 72.43 ± 9.4 mm their data was similar with our data. In our current study we observed the length of the right frontal horn of the lateral ventricle was 28.6 ± 5.3 mm, While comparing it from Honnegowda TM et al,^[6] observed that the length of the right frontal horn of the lateral ventricle was 30.54 ± 3.72 mm, In our current study we observed length of the left frontal horn of the lateral ventricle was 27.56 ± 5.6 mm, While comparing it from Honnegowda TM et al,^[6] observed that the length of the left frontal horn of the lateral ventricle was 28.7 ± 2.9 mm.

In our current study, we observed that the width of the 3rd ventricle was 4.8 ± 2.9 mm another study of Honnegowda TM et al,^[6] observed that the width of the 3rd ventricle was 5.8 ± 2.1 mm, another study of Moawia Gameraddin et al,^[7] observed that the width of the 3rd ventricle was 5.57 mm which was similar with our study. In our current study we observed that the height of the 4th ventricle was 8.9 ± 2.9 ; another similar study of Moawia Gameraddin et al,^[7] observed that the height of the 3rd ventricle was 9.68 mm another study of D'Souza and Natekar,^[8] revealed that the height of the fourth

ventricle was 11.8 mm and 11.1 mm for the male and female respectively which was similar with our study.

In our current study we observed that the width of the 4th ventricle was 11.3 ± 9.8 another study of Moawia Gameraddin et al,^[7] observed that the width of the 4th ventricle was 12.5 mm.

Limitations

One of the maximum obstacles to this examine, no volunteers are carried out because x-rays have organic consequences and hazards. Many instances have been excluded from the examination because of minor pathological adjustments within the mind that could impact the measurement. So, we attempted to discover photos with ordinary mind appearances for as long as possible.

CONCLUSION

The study provided valuable morphometric data about the lateral, third and fourth ventricles while diagnosing visual disturbance, hydrocephalus, schizophrenia, psychotic disorders and other pathologies.

REFERENCES

1. Gyldensted C. Measurements of the normal ventricular system and hemispheric sulci of 100 adults with computed tomography. *Neuroradiology* 1977; 14: 183-192.
2. Schmahlmann JD, Smith EE, Eichler FS, Filley CM. Cerebral white matter: neuroanatomy, clinical neurology, and neurobehavioral correlates. *Ann NY Acad Sci.* 2008; 1142: 266-309.
3. Haslam RHA. Hydrocephalous. In: Behrman RE, Kliegman M, Nelson WE, Vaughan VC. (eds). *Nelson Text Book of*

- Pediatrics, 14th edition. Philadelphia, W.B. Saunders Co1992; page 1487.
4. Hamidu AU, Olarinoye-Akorede SA, Ekott DS, Danborn B, Mahmud MR, Balogun MS. Computerized tomographic study of normal Evans index in adult Nigerians. J Neurosci Rural Pract. 2015;6(1):55-58.
 5. Delsi, L.E., Perman, G.P., Targus, S.D. and Wyatt, R.J. (1982) CT in Chronic Schizophrenia Form Disorder and Other Acute Psychiatric Disorders. Archives of General Psychiatry, 39, 778-783. <http://dx.doi.org/10.1001/archpsyc.1982.04290070014004>.
 6. Honnegowda TM, Nautiyal A and Deepanjan M. A Morphometric Study of Ventricular System of Human Brain by Computerised Tomography in an Indian Population and its Clinical Significance. Austin J Anat. 2017;4(4): 1075
 7. Gameraddin, M., Alsayed, A., Ali, A. and Al-Raddadi, M. (2015) Morphometric Analysis of the Brain Ventricles in Normal Subjects Using Computerized Tomography. Open Journal of Radiology, 5, 13-19. <http://dx.doi.org/10.4236/ojrad.2015.51003>.
 8. D' Souza DMC, Natekar PE. Morphometric study of the ventricular system of Brain by Computerised Tomography. J Anat Soc India. 2007; 56: 19-24.