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Study of structural changes in third ventricle of human brain utilising computed tomography scan

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Abstract
Background: The structural result of degenerative changes in brain seen with aging is cerebral atrophy, where in there is decrease in volume of the cerebral substance and the internal fluid space (cerebral ventricles) and external fluid space (cortical sulci and cisterns) enlarge correspondingly. Aging as well as cerebral atrophic changes of the brain is associated with markable brain changes leading to enlargement of the sulci gyri and ventricles. Normal ventricular sizes and sulci is important to understanding these changes.
Aim: To establish the range of various measurements of third ventricle diameter in relation to age and discuss their clinical significance. To find the changes in these parameters in different age group samples.
Materials and Method: The study was an observational, retrospective, cross-sectional and non-interventional study in which the CT scans of 100 individuals in the age group of 20 – 70 and above years of either sex attending the Department of Radio-Diagnosis of Mamata General and Super specialty hospital were used. The study group was drawn from samples (patients) reporting to the department of Radio-diagnosis, for a head CT examination A retrospective review of axial images from Computed Tomography (Somatom Scope 16 Slice) were conducted. Measurements were done using in-built linear calipers of the CT machine. The parameters that were chosen for study Third ventricle ratio/index.
Results: Data was collected in a tabulated sheet and statistically analyzed to see the differences between males and females and age related changes.
Conclusion: The study will add to a baseline data and is valuable information for neurosurgeons, clinicians and radiologists.

Keywords: Computed tomography, third ventricle width, third ventricular ratio/index

Introduction
The human brain is the most complicated organ and is the area of interest in various aspects and fields. The ventricular system of the cerebral hemisphere consists of two lateral ventricles and in the midline third and fourth ventricle connected by the Aqueduct of Sylvius [1]. The ventricles of the brain are formed due to exures of the primitive brain tube. The intracranial CSF volume is estimated to be 123ml out of which 25ml is in the ventricles and 98 ml in the sub arachnoid space [1]. As many new imaging techniques available for the study of ventricles, the most widely common technique available is Computed Tomography (CT) Scan and relatively affordable tool in Indian scenario [2]. The Assessment of brain ventricles can be done by taking linear, plani- metric or volumetric measurements, out of which, linear ratios of the width of ventricles to the width of skull or brain are probably the most easily made and reproducible ventricular measurements [3]. Due to disproportion among the cerebro spinal fluid and brain matter the size in the ventricles is changed. According to Monro Kellie Doctrine the cranial box is rigid containing blood, brain and CSF and if one of the contents increases in volume the other two must be depleted [4]. The aim of present morphometric study is to examine the normal data range of Normal third ventricle width of human brain at a level of superior colliculus, third ventricle ratio at the level of Foramen of Monro, antero posterior and transverse diameter at a level of head of caudate nucleus. In different age and gender groups.
The objectives were to measure the third ventricle width, third ventricle ratio, and to correlate third ventricle width with AP diameter and transverse diameter of cerebrum, and to determine correlation of third ventricle width with gender and age of patient.

Materials and Methods
The study was a observational, retrospective, cross-sectional and non- interventional study in which the CT scans of 100 individuals in the age group of 20 – 70 and above years of either

sex attending the Department of Radio-Diagnosis of Mamata General and Super specialty hospital were used. The study group was drawn from samples (patients) reporting to the department of Radio-diagnosis, for a head CT examination. A retrospective review of axial images from Computed Tomography (Somatom Scope 16 Slice) was conducted. Brain scan was done with 5mm slice thickness of 100 patients (Male-50 & Female-50). The patients were referred from OPD. 100 brain scans reported as normal were selected as ethical aspect does not permit CT scan of normal individual for radiations issues. The images were reviewed and measurements were done using in-built linear calipers of the CT machine. Adult patients of both genders, ≥20 years of age referred for CT scan of head without pathological findings were included in the study The parameters that were chosen for study Third ventricle ratio/index. The sample size for this study was calculated based on the study conducted by Zilundu [5].
All the linear measurements were taken. The parameter chosen for study is third ventricular ratio/index.

The dimensions of third ventricle were measured in axial section of CT head. In axial slice,

- The maximum width of third ventricle (TVW) was measured at a level of superior colliculus.
- The third ventricle ratio (TVR) was measured at a level of foramen of monro. (TVR=ThF/DF)
- The anteroposterior (AP) and transverse diameter (TD) was measured at a level of head of caudate nucleus, because at this level cerebrum dimensions are maximum and image at this level is available in almost all the patient.

Data was collected in a tabulated sheet and Statistical analysis was carried out with the help of IBM SPSS version 26 software

Data was collected in a tabulated sheet and Statistical analysis was carried out with the help of IBM SPSS version 26 software. The mean, SD and comparison of different dimensions of third ventricle were expressed in tables and bar diagrams. Data were presented as mean and SD for all variables. Patient's age, gender, TVW, TVR, AP, TD were recorded.

Statistical analysis

Data were obtained and analyzed using the descriptive statistics to summarize the information, and inferential statistics (paired sample t-test) and spearman's correlation coefficient to compare mean if there were significant difference in patient's gender (male and female). P value less than 0.05 was considered as level of significance.
Those with history of cerebral infraction, injury, focal lesions, and haemorrhage were excluded from the study. The parameter that was measured and calculated as described by Namrata and group [6-8]. Measurements in millimeters (mm) were obtained at the following levels [9]

$$\text{Third ventricle ratio} = \frac{\text{The greatest distance between each lateral margin of the third ventricle(v)}}{\text{The transverse diameter of the brain measured at the level of D(D1)}}$$

Results

The data was collected from 100 subjects found to be normal in 50 males and 50 females with the age from 20 to 70 above years old. Out of 100 patients, 50 were male and 50 were female. Among the brain images of 100 normal subjects, the minimum age was 20 years and the maximum age was 89 years. The mean age of the patients was 46.55 years. Out of the total patients, 11 were in age group 21-30, 19 were between age group 31-40, 18 were between age group 41-50, 18 were between age group 51-60, 21 were between age group 61-70 and 13 were between age group 71 and above, The maximum number of patients were found in the age group71 and above.
The mean±SD of third ventricle width was 0.34±0.08 cm and third ventricle ratio mean±SD was 0.03±0.01cm. The third ventricle width showed very weak negative non-significant correlation with antero-posterior and transverse diameter. The mean±SD age of patient was 46.55 ±15. The spearman's correlation coefficient between TVW and age was 0.31 and the distribution had moderate positive correlation with age. The mean±SD of third ventricle width was 0.32±0.09 cm. The spearman's correlation between TVW and AP showed very weak negative non significant correlation. The spearman's correlation between TVW and TD showed very weak non significant correlation.

Table 1: Distribution of third ventricle indices among male and female subjects.

Parameter	Overall	Male	Female
Maximum diameter of third ventricle (TVW)	0.34±0.08	0.34±0.09	0.30±0.03
Third ventricle Ratio (TVR)	0.03±0.01	0.03±0.01	0.02±0.01

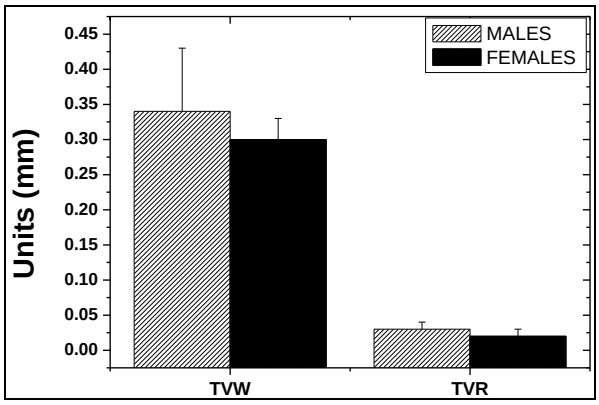

Fig 1: Distribution of third ventricle indices among male and female subjects.

Discussion

The aim of this study was to estimate the normal data range of third ventricle width and third ventricle ratio and to assess its relation to gender and age. The narrowing of cerebral aqueduct can lead to third ventricle enlargement. In atrophic diseases of grey matter including basal ganglion will lead to enlargement of the third ventricle for example in case of multiple sclerosis. Thus, the reliable information about cerebral ventricular diseases in relation to ventricular system of brain parenchyma will be obtained. The sample size of the study consisted of 100 patients undergoing CT scan of head age ranged from 20 to above 70 years. Among 100 samples, 50 were male and 50 were female consisting of 50% each respectively. The mean age of patients was 46.55 years with standard deviation of ±13.20 cm.

In our study the mean of third ventricle width (TVW) was 0.34±0.08 cm at a level of superior colliculus. The mean of third ventricular width was 0.34±0.09 cm in male and 0.30±0.03 cm in female respectively. The values were slightly higher in males. A similar type of study performed by Gameraddin and group [10] and found the width of the third ventricle was 5.70±1.54 mm and 5.40±1.68 mm in the males and females respectively.10 Similarly another study conducted by Patnaik and group observed the mean of third ventricle width was 6.86±2.74 mm [11]. A another study performed by D'Souza and Natekar observed the width of the third ventricle was 0.45±0.29 cm and 0.39±0.17 cm in males and females respectively [12]. Earlier also TVW was reported to be slightly higher in males than in females in all Indian studies [12-14]. However Vidya in MRI study reported TVW to be same in males and females [19].

In our study when correlated to linear diameter of cerebrum, TVW showed very weak negative non-significant correlation to anteroposterior and transverse diameter. The spearman's correlation coefficient between age and third ventricle width was 0.32. The third ventricular width had moderate positive correlation with age and also statistically significance with age (P value 0.01) and gender (P value 0.01) in male. In our study the width of third ventricle was found slightly lower and the difference might be due to the ethnicity and demography of the population. Large sizes of the ventricles, periventricular lucency and the presence of a small degree or the absence of cortical atrophy are considered characteristic evidence of communicating hydrocephalus [14-15]. Thus there is an effect of the size of the ventricles and the cerebral mantle measured in CT images, in the presentations of clinical symptoms.

Additionally, alterations in the vascularity of the periventricular parenchyma structure can explain the mobility dysfunction [14]. In our study, the mean of third ventricle ratio was 0.034±0.08 cm, 0.34±0.09 cm in male and 0.30±0.03 cm in female respectively at a level of foramen of Monro. The value was slightly higher in male than in female. TVR showed statistically significant with anteroposterior diameter and weak negative non- significant with transverse diameter. Third ventricle measurement at this level is supposed to be a good indication of third ventricle enlargement. Further, tumor or cyst at this region can lead to dilation of Lateral ventricles causing pressure changes also in cerebrum. The two parameters of third ventricle do not depend upon the anteroposterior diameter of cerebrum. Anterior inferior 3rd ventricle is dilated in advanced hydrocephalus, but it remains normal in atrophy patients. The appearance of the anterior third ventricle is a helpful feature in distinguishing atrophy from CSF obstruction [16]. The posterior third ventricle and upper aqueduct may also dilate with significant atrophy of the quadrigeminal plate [17-18]. Therefore it is essential that measurements of third ventricle are available at all the level superior colliculus and foramen of monro, so that appropriate diagnosis and management can be initiated.

To conclude, the third ventricle width assessment was very useful to determine the upper limits of normal value and its variation with age. The study should be performed in larger sample size and age groups. Further study on third ventricle in sagittal plane should be performed in relation to anteroinferior part, posterior part and mamillo pontine distance, so that comprehensive data should available which will be rewarding for surgical procedure like third ventriculostomy and intraventricular placement of implants in future

Conflict of Interest

None

References

1. Williams PL. Gray's Anatomy 38th Ed. Churchill Livingstone; c1999. p. 1205-1209.
2. Patnaik P, Singh V, Singh S, Singh D. Lateral Ventricle Ratios Correlated to diameters of cere- brum - a study on CT scans of head. Journal of Ana- tomical Sciences (JAS) 2014;22(2):5-11.
3. Gyldensted C. Measurements of the normal ventricular system and hemispheric sulci of 100 adults with computed tomography: Neuroradiology. 1977;14(4):183-192.
4. Dutta AK. Essentials of Neuroanatomy 2nd Ed. 191.
5. Zilundu Prince LM. Morphometric Study Of Ventricular Sizes On Normal Computed Tomography Scans Of Adult Black Zimbabweans At A Diagnostic Radiology Centre In Harare-A Pilot Study: JUNE 2012; Thesis. University Of Zimbabwe.
6. Haug G. Age and Sex Dependence of the Size of Normal Ventricles on Computed Tomography. Neuroradiology. 1977;14:201-204.
7. Kolsur Namrata, PM Radhika, Shetty Shailaja, Kumar Ashok. Morphometric study of Ventricular Indices in Human brain using computed tomography scans in Indian population. International Journal of Anatomy and Research. 2018;6(3.2):5574-80.
8. Patnaik Poonam, Singh Vishram, Singh Dalvinder, Sing Satbir. Age and gender related variations in natural ventricle Brain Ratios. International Journal of Health Sciences and Research. 2016;6(5):78-84.
9. Moawia G, Abdalrahim A, Amir A, Mosleh A. Morphometric Analysis of the Brain Ventricles in Normal Subjects Using Computerized Tomography. Open Journal of Radiology. 2015;5:13-19.
10. Gameraddin M, Alsayed A, Ali A, Al-Raddadi M. Morphometric analysis of the brain ventricles in normal subjects using computerized tomography. Open Journal of Radiology. 2015;5(01):13.
11. Patnaik P, Singh V, Singh D, Singh S. Gender related differences in third ventricle parameters with correlation to cerebrum size–a study on head CT scans. Int J Health Sci Res. 2015;5(11):140-7.
12. D'Souza SW, Gowland M, Richards B, Cadman J, Mellor V, Sims DG, *et al*. Head size, brain growth, and

lateral ventricles in very low birthweight infants. Archives of disease in childhood. 1986;61(11):1090-1095.
13. Alyavi AL, Sabirjanova ZT, Tulyaganova DK, Radjabova DI, Nuritdinova SK, Khan T. Relationship between cytokines and the remodeling of the structural and functional state of the left ventricle in patients with coronary artery disease.
14. Gammal TE, Allen MB Jr, Brooks BS, *et al*. MR Evaluation of hydrocephalus. AJR Am J Roentgenol. 1987;149(4):807-813.
15. 1El Gammal T. Extraventricular (communicating) hydrocephalus: Some observations on midline ventricles AJR. 1969;106:308328.
16. Mathew LS, Paul M, Bakshi S. Assessment of third ventricle with MRI: morphological variations among different gender and age group. Webmed Central Anatomy. 2012;3(5):WMC003370
17. Usman JD, Zagga AD, Tadros AA, *et al*. Morphological variation of third ventricle using computerized tomography among different gender and age groups: A 5-year retrospective study in Usmanu Danfodiyo University Teaching Hospital, Sokoto, North - West Nigeria. Sahel Med J. 2013;16:83-86.
18. Kohlmeyer K, Shamena AR. CT Assessment of CSF Spaces in the Brain in Demented and Nondemented Patients over 60 Years of Age. AJNR. 1983;4:706-707.
19. Vidya Satapara K *et al*. Morphometry of width of Third ventricle of brain by luminal cast plastination & MRI. IJAR. 2014;2(6):837-842.