Original Article

Indian Journal of Anatomy
Volume 6 Number 1, January - March 2017
DOI: http://dx.doi.org/10.21088/ija.2320.0022.6117.4

Morphometric Study of Anterior Horn of Lateral Ventricle of Brain and Its Correlation with Age, Gender and Side: A CT Study

Rathod Pranjali U.*, Bhoir Mehera**

Abstract

Background: Ventricular enlargement to be a more sensitive indicator ofcortical atrophy due to increasing age anddementias [1]. The two major changes that may occur in elderly individual without neurologic deficits is enlargement of ventricles and cortical atrophy. Aim of the study was to statistically analyse the length of anterior horn of lateral ventricle in humans and to correlate the changes in relation to age, gender and side. *Method:* The CT images of 150 adult individuals (age group 20-80yrs) was studied in both males and females. Length of anterior horn of lateral ventricle was measured using dicomworks software. *Result:* Mean value of length of the anterior horn increases on both sides as the age increases. Values are larger in 61-80 years.Length of anterior horn ismore in males as compared to females. In relation to the side , the length ofanterior horn is greater on the left side as compared to the right side

Keywords: CT Images; Lateral Ventricle; Cortical Atrophy.

Introduction

Morphometric analysis of cerebral ventricular system is important for evaluating changes due to growth, ageing, intrinsic and extrinsic pathologies. Lateral ventricle size is an index of brain atrophy that can be measured noninvasively using X-ray computed tomography (CT) brain imaging. In crosssectionalstudies of healthy aging, lateral ventricle size increases, whereas memoryand visuospatial performance decrease. Variance of lateral ventricle size alsoincreases with age suggesting substantial interindividual differences in age relatedatrophy [2].

As the human brain ages, characteristic structural changes occur that are considered to be normal and are expected. Thus the thorough knowledge of the age relatednormal changes that occur in the brain is required before any abnormal findings are analysed. Both imaging and autopsy studies have revealed that there is a correlationbetween increase in cerebrospinal fluid spaces and reduction in cerebral volume accompanying normal human ageing [3].

In recent years, Computed Tomography (CT) scan and Magnetic Resonance

Imaging (MRI) have replaced the older methods of studying ventricular system

The size of CSF spaces (ventricles and subarachnoid spaces) increases with age

(Nagata, Basugi, Fukshima et al 1987). Most planimetric studies have demonstrated changes in ventricular size to be greatest beginning after about age 60 years [4].

The ventricular enlargement is present early in the course of schizophrenia and there is evidence that in teenage schizophrenic patients there is a tendency of the enlargement of the anterior horn of the lateral ventricle which may be related with a morphological vulnerability in the prefrontal cortex [5].

Ventricular enlargement reflecting cerebral atrophy has been reported particularly in elderly type 2 diabetes patients. Morphological analysis revealed that the expansion of lateral ventricles in the diabetic brain was prominent in the bilateral frontal horns [6].

Author's Affiliation: *Assistant Professor Dept. of Anatomy, Government Medical College, Nagpur. **Professor and Head, Department of Anatomy, Cooper Medical College, Mumbai.

Corresponding Author: Pranjali Uttamrao Rathod, Assistant Professor, Goverment Medical College, Nagpur, Near Hanuman Nagar, Nagpur-440009.
E-mail: drchayarathod2@gmail.com

Received | 27.10.2016, **Accepted** | 23.11.2016

The range of changes in ventricular size of brain encountered in routine clinical practices can mislead most of the physicians and surgeons while making a decision. However, in some conditions precise measurements may be required.

Aim of this morphometric study was to analyse the length of anterior horn and to find its correlation with age, gender and side.

Material and Methods

This was a radiological anatomy study. CT scan images of 150 individuals was studied. CT scan of patients was performed on "Philips Brilliance Slice 64 Multodeteter Spiral Computed Topmography" machine with scanning time of 12-15 seconds and slice thickness of 2mm at the Radiology department of Tertiary Health CareCenters Mumbai. CT scans of patients in the age group of 20-80 years in which the ventricles were reported as normal by radiologist were studied.

CT scan patients with history of local mass lesion, cerebral infarction, hydrocephalus, previous intracranial surgery were excluded from the study.

Data was grouped into threeage group 20-40 years, 41-60 years and 61- 80 years.

Procedure was explained to the patient. Patient was asked to remove metallic items (e.g. earrings, hair pin) and dentures and then positioned on CT table. Patient was placed in a supine position on CT table and was positioned so that therewas no rotation or tilt of midsaggital plane. Measurement were taken on axial section of CT images using Philips Diacom Works Software.

The length of anterior horn was measured on axial CT image passing through cerebral hemisphere showing the anterior horn and the interventricular foramen. Length was measured from the tip of anterior horn uptointerventricular foramen. Section showing maximum length was chosen for measurement.

Results

Table 1: Comparison of the length of anterior horn (mm) on right side in different age groups

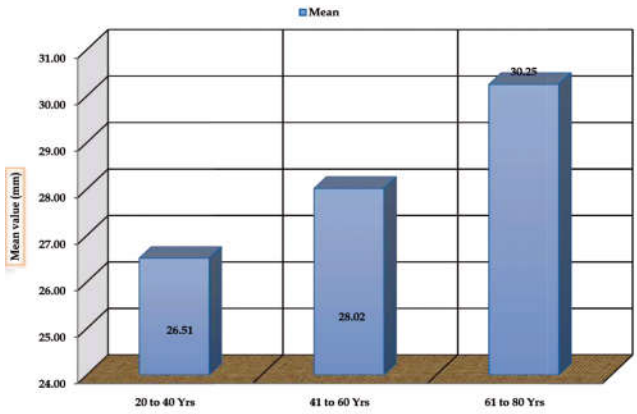
Length of ant horn(mm) on right side	N	Mean	SD	Median	IQR	One way ANOVA test	
20 to 40 Yrs	52	26.51	1.58	26.50	1.78	F Value	P Value
41 to 60 Yrs	59	28.02	1.57	28.00	1.40	54.549	0.000
61 to 80 Yrs	39	30.25	1.98	30.10	2.70	Diff is sig	

Table 2: Comparison of length of anterior horn (mm) on left side in different age groups

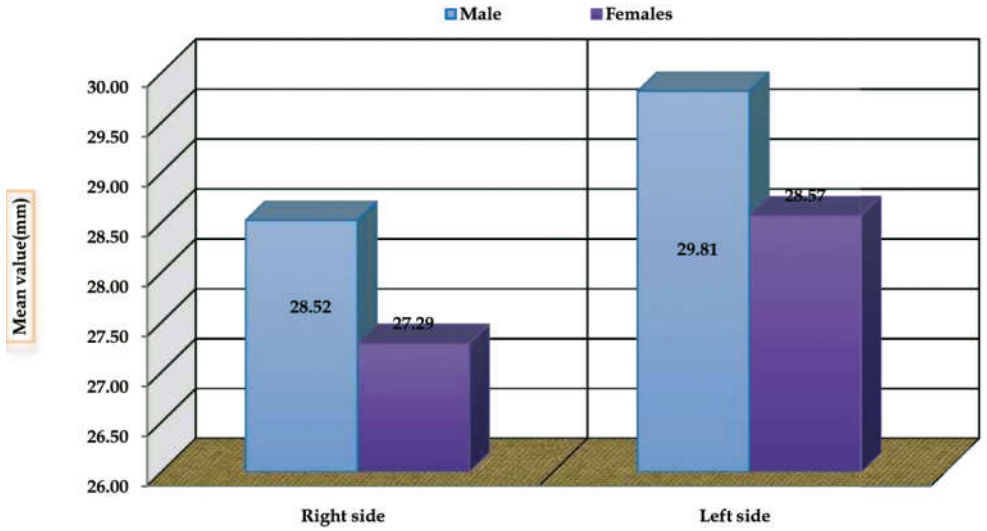
Length of ant horn (mm) on lt side	N	Mean	SD	Median	IQR	Oneway ANOVA test	
20 to 40 Yrs	52	27.62	1.51	27.40	2.28	F Value	P Value
41 to 60 Yrs	59	29.17	1.41	29.20	1.30	81.510	0.000
61 to 80 Yrs	39	31.98	2.02	31.90	2.10	Diff is sig	

Table 3: Comparison of length of anterior horn (mm) in males and females

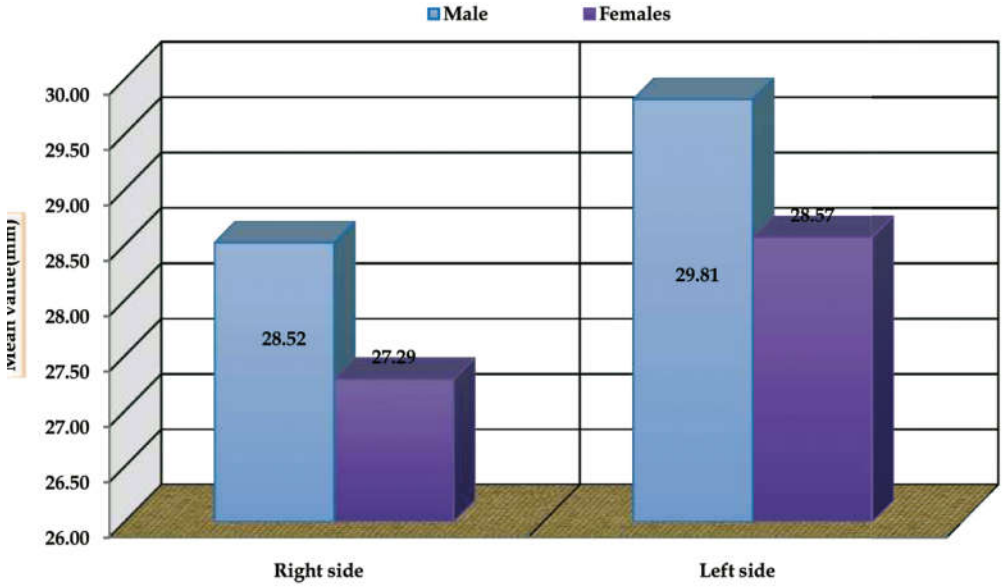
Length of ant horn	Male					Females					Unpaired T	P
	N	Mean	SD	Median	IQR	N	Mean	SD	Median	IQR	Test	Value
Right side	96	28.52	2.26	28.20	2.85	54	27.29	1.91	27.10	2.38	3.383	0.001
Left side	96	29.81	2.41	29.40	2.85	54	28.57	1.99	28.05	2.85	3.227	0.002



Graph 1: Comparison of the length of anterior horn (mm) on right side in different age groups



Graph 2: Comparison of length of anterior horn (mm) on left side in different age groups



Graph 3: Comparison of length of anterior horn (mm) in males and females

Table 4: Comparison of length of anterior horn on right and left side

Parameters (mm)	RT side					Left Side					Unpaired T Test	P Value
	N	Mean	SD	Median	IQR	N	Mean	SD	Median	IQR		
Length of ant horn	150	28.08	2.22	27.90	3.15	150	29.36	2.34	29.25	3.03	4.580	<0.001

Mean length of anterior horn on right side is larger in 61-80years (30.25±1.98).The difference is statisticallysignificant.

Mean length of the anterior horn on left side is larger in 61 – 80 years (31.98±2.02) The difference is statisticallysignificant.

Above Table 1 and 2 suggest that mean value of length of the anterior horn increases on both sides as the age increases. Values are larger in 61-80 years group. Difference is statistically significant.

In the present study the length of anterior horn (mm) in males is 28.52±2.26 and 29.81±2.41 on right and left sides respectively.

In the present study the length of anterior horn (mm) in females is 27.29±1.91 and 28.57±1.99 on right and left side respectively.

The mean length of anterior horn(mm) on right side is 28.08±2.22, on left side it is 29.36±2.34.

Table 3.1: Comparison of length of anterior horn with D'souza study

Parameter	Present Study				D' Souza Study[20]			
	Male		Female		Male		Female	
	Right	Left	Right	Left	Right	Left	Right	Left
Mean length of anterior horn (mm)	28.52	29.81	27.29	28.57	27.4	27.8	25.5	25.8
SD	±2.26	±2.41	±1.91	±1.99	±0.36	±0.37	±0.33	±0.35

Table 3.2: Comparison of length of anterior horn with Brij Raj Singh study

Parameter	Present Study				Brij Raj Singh Study[3]			
	Male		Female		Male		Female	
	Right	Left	Right	Left	Right	Left	Right	Left
Mean length of anterior horn (mm)	28.52	29.81	27.29	28.57	25.00	26.26	25.34	26.53
SD	±2.26	±2.41	±1.91	±1.99	±3.18	±2.94	±3.50	±3.38

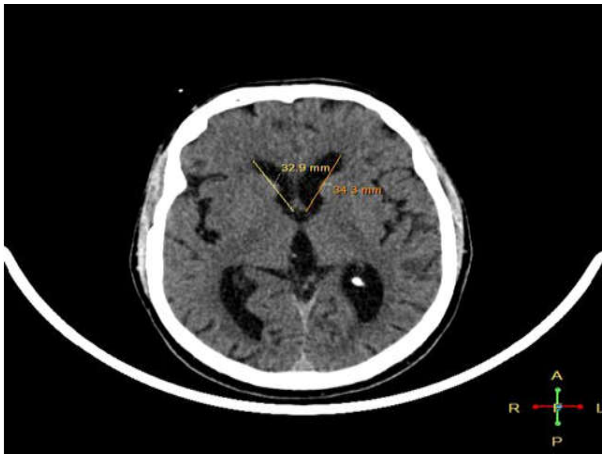


Fig. 1: Length of anterior horn in 60 year male patient

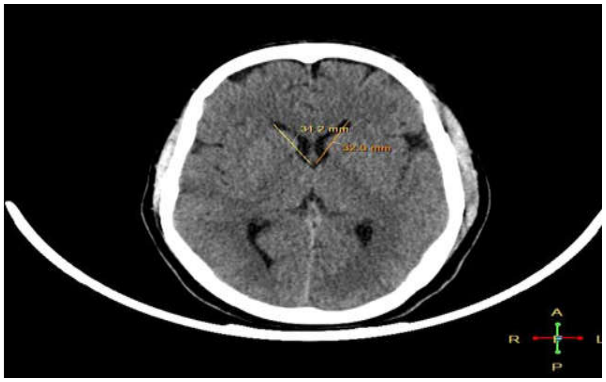


Fig. 2: Length of anterior horn in 60 year female patient

Discussion

The brain grows rapidly in early life and reaches its maximum weight by the third decade; thereafter, regression soon begins. The regression tends to be slow at first, but it accelerates with advancing age, beginning usually by the seventh decade.Regression involves both the cerebrum and the cerebellum [7] .

In literature it has been mentioned that there is great variety and asymmetry in the size of the ventricular system [8]. Counters of the lateral ventricles are relatively constant, except for the occipital horn which may show asymmetry and unilateral or bilateral absence [9].

Variation in the size of the lateral ventricle has been found invarious disorders like Alzheimer's [10], Parkinson's disease [11], schizophrenia [12], anddementia [13].

Before diagnosing abnormal enlargement of the lateral ventricleclinician should know its normal morphometry .

The thorough knowledge of the age related normal changes that occur in the brain is required before any abnormal findings are analysed. As age advances, the brain undergoes many gross and histopathological changes with regression of the brain tissue leading to enlargement of the ventricles [3]. Morphometric changes in the anterior horn of lateral ventricle is seen in teenage schizophrenic patients [5] and type 2 diabetes mellitus patient [6].

To understand these changes the knowledge of normal morphometry and size ofnormalventricular system of the brain is important.

From table no 1and 2 it can be concluded that length of anterior horn increases on both side as the age increases. Values are larger in 60-80 years age group.

Increasing ventricular size with increasing age has been noted by other investigators Roberts MA, Caird F.I. (1976) [14] Hann FJY et al (1976) [15], Barron SA et al (1976) [16], Haug G (1977) [17], Gyldensted C et al (1977) [18], Hughes CP et al (1981) [19]. Our dataalso support the tendency for greater increase in the size of lateral ventricle in theelderly as found by Barron SA et al (1976) [16].

From the present study it can be concluded that the length of anterior horn is more in males as

compared to females. In relation to the side , the length of anterior horn is greater on the left side as compared to the right side.

According to Glydensted C. et al(1977) [18], Takeda and Matsuzawa et al (1985) [21], and D'Souza e Dias Medora C. et al (2007) [20] the left lateral ventricle was larger than the right one and both were larger in males. Present study also found same results for the length of anterior horn is larger in males as compared to females.

In relation to the side , the length of anterior horn is greater on the left side as compared to the right side

Conclusion

Present study has made an attempt to define morphometric measurement of length of anterior horn of lateral ventricle of brain and to find its changes in relation to age, gender and side. This data will be helpful to neurosergons, radiologist and clinician for making the diagnosis.

References

1. Roberts M.A, Caird F.I., Grossart K.W., And Steven J.L. Computerized tomography in the diagnosis of cerebral atrophy. Journal of Neurology, Neurosurgery, and Psychiatry, 1976; 39:909-915.
2. Berardi A., Haxby J.V., De Carli C., and Schapiro M. B.. Face and Word Memory Differences Are Related to Patterns of Right and Left Lateral Ventricle Size in Healthy Ageing Journal of Gerontology . Psychological Sciences 1997; 52(1):54-61.
3. Brij Raj Singh , Gajbe U., Agrawal A, Reddy Y A., Bhartiya S. Ventricles Of Brain: A Morphometric Study By Computerized Tomography. Int J Med Res Health Sci. 2014; 3(2):381-387.
4. Martin l. Albert, Janice E Knoefel Text book of clinical neurology of ageing 2nd edition. Oxford University Press, Inc., 200 Madison Avenue, New York. New York 10016 P no 193.
5. Shiraishi H., Koizumi J.,Ofuku K. Enlargement of the anterior horn of lateral ventricle in schizophrenic patients: Chronological and Morphometrical studies. Jpn J Psychiatry Neurol. 1990 Dec; 44(4): 693-702.
6. Lee JH., Yoon S., Renshaw PF Kim T-S., Jung JJ., et al. Morphometric changes in lateral ventricle of Patients with Recent-Onset Type 2 Diabetes Mellitus. PLoS ONE 2013; 8(4):e60515. doi10.1371/ journal.pone.0060515.
7. LeMay M. Radiologic changes of the ageing brain and skull. AJR Am J Roentgenol. 1984 Aug;143(2): 383-9.
8. Gyldensted C. Measurements of the Normal Ventricular System and Hemispheric Sulci of 100 Adults with Computed Tomography. Neuroradiology 1977; 14:183-192.
9. Usman J. D. Yunusa G. Saidu S. A. Bello A., The Prevalence of the Absence of the Occipital (Posterior) Horns of the Lateral Ventricles among Nigerians (2003 –2008) using Computerised Tomography. International Journal of Health and Medical Information, December 2012; 1(1-3):18-22.
10. Guptha SH, Holroyd E, Campbell G. Progressive lateral ventricular enlargement as a clue to Alzheimer's disease. Lancet. 2002 Jun 8; 359(9322):2040.
11. Lewis MM, Smith AB, Styner M, Gu H, Poole R Asymmetrical lateral ventricular enlargement in Parkinson's disease. Eur J Neurol. 2009 Apr; 16(4):475-81.
12. Malla A.K., Mittal C., Lee M, Computed tomography of the brain morphology of patients with first-episode schizophrenic psychosis J Psychiatry Neurosci 2002; 27(5):350-8.
13. Soininen H., Puranen,M. Riekkinen PJ Computed tomography findings in senile dementia and normal ageing . Journal of Neurology, Neurosurgery, and Psychiatry. 1982; 45:50-54.
14. Roberts MA, Caird FI Computerized tomography and intellectual impairment in the elderly. J Neurol Neurosurg Psychiatry. 1976; 39:986-989.
15. Hahn FJY, Rim K Frontal ventricular dimensions on normal computed tomography. AJR Am J Roentgenol. 1976 Mar; 126(3):593-6.
16. Barron SA, Jacobs L, Kinkel WR. Changes in size of normal lateral ventricles during ageing determined by computerized tomography. Neurology. 1976; Nov; 26(11):1011-3.
17. Haug G. Age and sex Dependence of the Size of Normal Ventricles on Computed Tomography. Neuroradiology. 1977; 14:201-204.
18. Gyldensted C. Measurements of the Normal Ventricular System and Hemispheric Sulci of 100 Adults with Computed Tomography. Neuroradiology. 1977; 14:183-192.
19. Hughes C.P..andGado, M. Computed Tomography and Ageing of the Brain Radiology. 1981 May; 139:391-396.
20. D'Souza e Dias Medora C, Natekar P. E. Morphometric Study Of The Ventricular System Of Brain By Computerised Tomography. J AnatSoc India 2007; 56:19-24.
21. Takeda S. , Matsuzawa T. Age-related change in volumes of the ventricles, cisternae, and sulci: a quantitative study using computed tomography. Journal of the American Geriatrics Society 1985 April; 33(4):264-8.