Original Article

Indian Journal of Anatomy
Volume 6 Number 3, July - September 2017
DOI: http://dx.doi.org/10.21088/ija.2320.0022.6317.26

A Study of Morphometric Variability of Temporal and Occipital Horns of Lateral Ventricle of Human Brains: A Dissection Study

Kalyankar A.G.[1], Kulkarni S.P.[2], Sukre S.B.[3], Shingare P.H.[4]

Abstract

Background and aims: The lateral ventricles lies in each cerebral hemisphere with its three horns and body. The study of normal and variant anatomy of ventricles of brain is very useful for clinicians and neurosurgeons in their routine practice. This study is directed to look for the changes in size of occipital and temporal horn of lateral ventricle as per age and sex of cadaveric brain. *Materials and Methods*: 32 brains(20 males and 12 females) of cadavers with age ranging from 31 to 90 years were dissected and the lengths of occipital and temporal horns were measured. Data was analyzed with respect to age and sex of cadavers. *Results*: It was observed that mean lengths of both the horns increases with advancing age. No significant gender difference in dimensions of both the horns of lateral ventricle was observed. *Conclusion*: The present study showed that the age factor is responsible for change in the size of occipital and temporal horns of lateral ventricle. The present study will be helpful to radiologist and neurosurgeons to differentiate the enlarged size of occipital and temporal horns by aging from that of other pathological conditions.

Keywords: Lateral Ventricle; Occipital Horn; Temporal Horn.

Introduction

The lateral ventricles are the largest of all ventricles of ventricular system in the brain. It has three horns, frontal horn in frontal lobe, occipital horn in occipital lobe, temporal horn in temporal lobe and body in the parietal lobe.

The normal and variant anatomy of ventricles of brain is very useful for clinicians and neurosurgeons in day to day practice [1]. The development of ventricles is a predictor of neurodevelopment and it is unique marker of brain development [2]. Neurosurgeons and radiologist usually face queries like whether ventricles are within normal limits or enlarged with aging of individuals.

Author's Affiliation: [1]Associate Professor [2]Assistant Professor [3]Professor & Head, Department of Anatomy, Government Medical College, Aurangabad, Maharashtra 431001, India. [4]Director, Medical Education & Research, St. George Hospital Compound, 4TH Floor, Govt. Dental College Bldg, Mumbai-400008, Maharastra, India.

Corresponding Author: Kulkarni S.P., Assistant Professor, Department of Anatomy, Government Medical College, Aurangabad, Maharashtra 431001, India.
E-mail: spk2184@gmail.com

Received | 07.06.2017, **Accepted** | 28.06.2017

The cortical atrophy is neurodegenerative condition which ultimately affects the ventricular size. The other pathological conditions such as Balint's syndrome, Gestermann's syndrome, Alzheimer's disease also shows cortical atrophy [1,3].

Asymmetry in size of lateral ventricles found in 5-12% of population. The handedness of individual also determines the size. Left handed person, have longer right occipital horn [4].

The purpose of this study is to look for the changes in size of occipital and temporal horn of lateral ventricle as per age and sex of cadaveric brain. This study will be helpful as temporal and occipital horns are surrounded by important functional areas.

Present study was conducted on 32 cadaveric brains (20 males and 12 females of known age) obtained from donated bodies to the Department of anatomy, Govt. Medical College Aurangabad.

Aims and Objectives

1. To measure and analyse various morphometric parameters of temporal and occipital horns of lateral ventricles by dissection.
2. To compare and contrast the obtained findings of

present study with that of previous studies.

Anatomy and Development of Lateral Ventricles

Each lateral ventricle is C-shaped structure begins with temporal horn in temporal lobe travels through body in parietal lobe and terminates at interventricular foramen into third ventricle. It has extension in occipital lobe as posterior horn and in frontal lobe as frontal horn. The collateral trigone of lateral ventricle is a triangular area formed by temporal horn inferiorly, occipital horn posteriorly and body of lateral ventricle anteriorly [4,5].

The lateral ventricles develop from the central canal of neural tube. The portion of tube in developing prosencephalon during three months of prenatal life gives origin to lateral ventricle by expansion of central canal. Later the choroid plexus appears which produce cerebrospinal fluid [6].

Material and Methods

Present study was conducted on brains of 32 cadavers (20 males and 12 females of known age) received through body donation procedure to the Department of Anatomy, Govt. Medical College Aurangabad in academic year 2015-16 and 2016-17 for period of two consecutive years.

As bodies we received through donations, the age and sex was known ranging from 30-90 years.

During brain dissection the cavity of lateral ventricle on each side was opened after taking median sagittal section of cerebrum. With digital Vernier Calliper length of occipital horn was measured from splenium of corpus callosum to its tip in occipital lobe. Similarly the length of temporal horn was measured from collateral trigone to its tip in temporal lobe. Measurements obtained as per age and sex of cadavers were tabulated.

Observation and Results

The mean length of occipital and temporal horn on both right and left side was calculated and analysed as per age groups 31-40, 41-50, 51-60, 61-70.71-80 and 81-90. Also the finding were grouped under male and female category

Fi. 1: Showing measurement of left Temporal horn

Fig. 2: Showing measurement of left Occipital horn

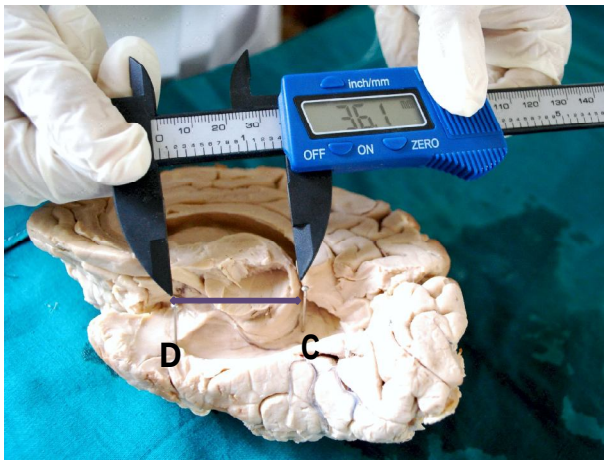

Fig. 3: Showing measurement of Right Temporal horn

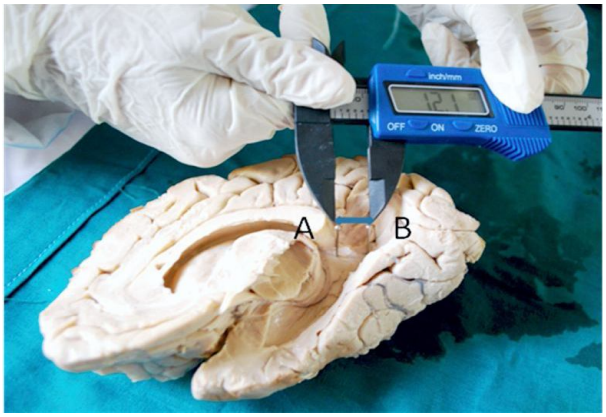

Fig. 4: Showing measurement of Right Occipital horn

Abbreviations

A: Splenium of Corpus Callosum

B:Tip of Occipital horn

C:Collateral Trigone

D:Tip of Temporal horn

The mean length of occipital horns and temporal horns of both sides was found to increase from age group 41-50 to age group 71-80.

Also mean size of occipital and temporal horns showed no gross difference in male and female brains. Thus the difference in size of both horns in male and female was insignificant.

Table 1: Illustrates Mean length (cm) of bilateral temporal and occipital horn as per age group

Age group	No. of Brains Studied	Temporal horn		Occipital horn	
		Right	Left	Right	Left
31-40	1	3.6	3.7	1.2	1.7
41-50	3	3.3	3.4	2.4	2.4
52-60	10	3.4	3.3	2.5	2.5
61-70	12	3.4	3.5	2.6	2.5
71-80	6	3.8	3.7	2.9	2.9
81-90	1	4	4.4	3	3.2
Total brains	32	3.5	3.5	2.6	2.5

Table 2: Illustrates Mean length (cm) as per age group in males

Age Group	No. of Brains Studied	Temporal Horn		Occipital Horn	
		Right	Left	Right	Left
31-40	1	3.6	3.7	1.2	1.7
41-50	2	3.5	3.5	2.6	2.6
51-60	5	3.5	3.4	2.5	2.6
61-70	7	3.6	3.7	2.6	2.5
71-80	4	3.8	3.7	2.8	2.8
81-90	1	4	4.4	3	3.2

Table 3: Illustrates Mean length (cm) as per age group in females

Age group	No. of Brains Studied	Temporal Horn		Occipital Horn	
		Right	Left	Right	Left
41-50	1	3.1	3.2	2.3	2
51-60	5	3.2	3.2	2.5	2.5
61-70	4	3.2	3.2	2.6	2.4
71-80	2	3.8	3.8	3	3

Discussion and Conclusion

The pathological conditions like Alzheimers disease cause posterior cortical atrophy which is neurodegenerative condition. This produce dilatation of posterior horn of lateral ventricle. Similarly enlargement of posterior and temporal horns of lateral ventricle results into development of structural and functional changes in the respective areas of involvement [7,8].

The picture of fairly symmetrical ventricular system of two sides is not cleared in many articles , so frequent asymmetry between both side of normal ventricle are less appreciated . The variant anatomical dimension of lateral ventricles is of great academic interest regarding CSF circulation and also for clinical, radiological and surgical interventions. The volume of cerebral ventricles is determined by nuclei and white matter tracts that abut them and rate of ventricular expansion is accelerated with age. Aging is responsible for loss of white matter integrity. The changes occur in white and grey matter volume in occipito-parietal and temporal region due to aging or pathology causes ventricular expansion [9,10].

The temporal horn enlargement seen in hydrocephalus is due to increased intraventricular pressure. Similarly congenital anomalies showed agenesis of corpus callosum with enlarged temporal horn. Incomplete inversion of hippocampal formation during the development showed the configuration of enlarged temporal horn. These findings were also found in premature infants who have incomplete sulcation. In dogs the ventricular enlargement was found to be related with aging process [11,12].

Baker L analysed 75% of patient with brain anomalies had enlarged temporal horn mostly involving inferolateral aspects of ventricle. The patient with hydrocephalus has also showed

temporal horn enlargement in superolateral region. The ventricular enlargement was as result of increased intraventricular pressure.

The rate of ventricular volume change is highly correlated with an increase in senile plaques due to old age [7,13].

Kunjan M studied 12 patients retrospectively. He noted changes in grey and white matter in parieto-occipital region and ventricular expansion due to recurrent falls. He also mentioned age, hypertension and diabetes could be the factor which aggravates above condition [1,14].

Torkildsen shows greatest variations of occipital and temporal horn size between right and left ventricle. The size of posterior horn of lateral ventricle measured average 1.39 cm in 11 brains and that of temporal horn 4.08cm in left side. On right side occipital horn measured 1.45cm and temporal horn measured 3.97 cm. He measured these horns by ventriculography [5].

So the normal intact size of occipital horn and temporal horn is not mentioned in any previous studies.

By taking into consideration of fact that visual area surrounding the occipital horn and hippocampal area around temporal horn, the enlargement of both occipital and temporal horn ultimately shows disturbance and compression symptoms in nearby and surrounding structures of both horns.

To summarise we have compared the pattern of temporal horn and occipital horn enlargement in different age groups cadavers. The distinct morphology and size of temporal and occipital horn was noticed with remarkable differences as per age of individuals.

As the study was done on brains of cadavers, the detailed clinical history was missing. Our next goal is to measure and analyse occipital and temporal horn size on MRI and compare it with present study.

References

1. Nagaratnam N, Nagatarnam K. Enlargement of the posterior horns of the lateral ventricles and recurrent falls: A clinical study. Journal of Clinical Gerontology and Geriatrics; 2016 March;7(1):27–30.
2. Srijit D, Shipra P. Anatomical study of anomalous posterior horn of lateral ventricle of brain ans its clinical significance, Bratisl Lek Listy, 2007;108(9):422-4.
3. Bates J, Netsky M. Developmental anomalies of the horns of the lateral ventricles. J Neuropathol Exp Neurol. 1955;14(3):316-25.
4. Torkirlson A. The gross anatomy of the lateral ventricle.The department of Neurology and neurosurgery , University of McGrill 1924:480-91.
5. Gray H. Nervous system. Williams PL et al. Gray's Anatomy. 38th edition. Churchill Livingstone Edinburgh;1998:1205-1207.
6. Moore KL, Persaud TVN. The nervous system. The developing human- clinically oriented embryology, 6th edition; WB Saunders company , Toronto 1998: 465-467.
7. Baker LL, Barkovich AJ. The large temporal horn: MR analysis in developmental brain anomalies versus hydrocephalus. American Journal of Neuroradiology. January 1992;13(1):115-122.
8. Heinz ER, Ward A, Drayer BP, Dubois PJ. Distinction between obstructive and atrophic dilatation of ventricles in children. J Comput Assist Tomogr 1980;4:320-325.
9. Sjaastad 0, Skalpe LO, Engeset A. The width of the temporal horn and the differential diagnosis between pressure hydrocephalus and hydrocephalus ex vacuo. Neurology 1969;19:1087-1093.
10. Childe AE, Penfield W. Anatomic and pneumographic studies of the temporal horn. Arch Neural Psychiatry 1937;37:1021-1034.
11. Lindgren E. A pneumoencephalographic study of the temporal horn with special reference to tumors in the temporal region. Acta Radio/ (Suppl) 1948;69: 1-151.
12. Martazami M M , Adeeb M . The ventricular system of the brain: A comprehensive review of its history , Anatomy, histology, Embryology surgical consideration, childs nervous system, 2012;30(1):19-35.
13. Du AT, Schuff N, Chao L, Kornak J, Ezekiel F, et al. White mater lesions are associated with cortical atrophy more than entorhinal and hippocampal atrophy.Neurobiol Aging 2005;26:553-9.
14. Vernooij MW, De Groot M, Van Der Lugt A, Ikram M, Hrestin G, et al. White matter atrophy and lesion formation explain the loss of structural integrity of white matter in aging. Neuroimage 2008;43:470.