Student's Journal of Health Research Africa
e-ISSN: 2709-9997, p-ISSN: 3006-1059
Vol. 5 No. 6 (2024): June 2024 Issue
https://doi.org/10.51168/sjhrafrica.v5i6.1245
Original Article

MORPHOMETRIC STUDY OF ANTERIOR HORN OF THE LATERAL VENTRICLE OF THE BRAIN AND ITS CORRELATION WITH AGE, GENDER, AND SIDE: A CROSS-SECTIONAL STUDY

Ravi Keshri
Assistant Professor, Department of Anatomy, Hi-Tech Medical College and Hospital, Rourkela, India.

Abstract

Background

The anterior horn of the ventricles undergoes peculiar changes as the brain ages. Enlargement of the ventricle horn has been associated with advanced aging. This study is conducted to analyze morphometric changes in the anterior horn of the lateral ventricles of both hemispheres.

Method

This was a cross-sectional study in which 250 computed tomography images of the brain were analyzed thoroughly. The anterior horn of the lateral ventricle was measured using a discomforts software. The age range of the participants was 20–80 years.

Results

The study revealed a significant increase in the size of the anterior horn of the lateral ventricle with advancing age, particularly prominent in the 61–80-year-old age group. The anterior horn was found to be larger in men compared to women, with the left side of the cerebral hemisphere showing greater enlargement than the right side. Specifically, the average length of the anterior horn on the right side was 28.72 ± 2.21 mm in men and 27.49 ± 2.31 mm in women. On the left side, the lengths were 29.92 ± 2.21 mm in men and 28.72 ± 2.41 mm in women. The differences between genders and sides were statistically significant.

Conclusion

The anterior horn of the lateral ventricle is prone to enlargement if it is from the left side, in the male gender, and as age increases, the enlargement of the ventricle horn becomes prominent.

Recommendation

while diagnosed with neurological diseases, enlargement of the lateral ventricles should be analyzed as per the age and gender of the patients.

Keywords: *Morphometric Analysis, Lateral Ventricle, Enlargement*
Submitted: *2024-05-17* ***Accepted****: 2024-06-28*

Corresponding Author: Ravi Keshri
Email: ***keshriravi09@gmail.com***
Assistant Professor, Department of Anatomy, Hi-Tech Medical College and Hospital, Rourkela, India.

Introduction

As humans age, several changes occur in the morphology of various organs. Such a change also occurs in the morphology of the brain. The lateral ventricles undergo several changes including enlargement of the ventricles [1]. The changes in the ventricles are associated with physiological and pathological changes. There are various intrinsic and extrinsic factors associated with these changes. The ventricles are located in the cerebral hemispheres. It consists of 4 ventricles the left, right, third, and fourth ventricle. The left and right ventricles communicate by the foramina of Monro.

The study of the changes in the morphology of the ventricles is called morphometric analysis of the brain [2]. Such changes can be studied using computed tomography scans and magnetic resonance imaging. CT scans and MRIs can be done routinely to analyze the changes in the structures of the brain. It is an X-ray that interacts with the structures of the brain to give us a structure of the transverse section of the brain. It is a safe, simple, and non-invasive technique that can aid in studying the changes associated with different cerebral diseases as well as the changes associated with the physiological growth process [3,4,5].

The lateral ventricle size has been used as an index for brain atrophy any changes associated with the ventricles due to pathological conditions have been studied. The study conducted to assess the changes in the ventricles associated with aging stated that with aging ventricles size changes and memory as well as visual-spatial analysis changes [6,7,8,9]. They found that there can be variability in the changes owing to different lifestyle habits.

It has been suggested in the literature that the cerebrospinal fluid spaces increase with aging and the overall cerebral volume decreases [10]. The increase in the cerebrospinal fluid spaces has a relation with

Student's Journal of Health Research Africa
e-ISSN: 2709-9997, p-ISSN: 3006-1059
Vol. 5 No. 6 (2024): June 2024 Issue
https://doi.org/10.51168/sjhrafrica.v5i6.1245
Original Article

memory. Most of the changes associated with the aging process usually during 60 years of age [11]. Whereas during schizophrenia even in younger patients the changes in the ventricles that are in the anterior horn of the lateral ventricle are observed [12]. During diabetes, it is found that the changes occur in the bilateral frontal horns [13].

However, the fact that the changes in the ventricles occur significantly during schizophrenia a psychological disorder, and diabetes an endocrinology disorder, gives us a better understanding of the prognosis of the disease. Thus, understanding the normal morphological changes associated with aging and other demographical characteristics will ultimately help in determining the changes that are associated with pathological conditions. This study is conducted to analyze morphometric changes in the anterior horn of the lateral ventricles of both hemispheres.

Method

Study design

This study was an observational prospective cross-sectional study

Study setting

The study was conducted at Hi-Tech Medical College and Hospital, Rourkela. For the period of two years from August 2021 to September 2023.

Participants

People volunteering for CT scans were recruited for the study. There were in all 250 volunteers.

Inclusion criteria

The people who had normal CT scans as per the recommendation of a radiologist were only considered for the study.

Exclusion criteria

The people who had previous, intracranial surgery, tumors, and neurological disorders were not considered for the study.

Procedure

Volunteers were instructed regarding the procedure for a CT scan. They were asked to remove any metallic material they were wearing as well as the dentures. They were in a supine position on the CT machine. The machine did scan for 12-15 seconds. It gave the transverse section of 2mm thickness. The anterior horn of the lateral ventricle was measured axially. The anterior horn was measured in each cerebral hemisphere till the intraventricular spaces. The Diacomworks software was used for measuring the anterior horn of the lateral ventricle.

Ethical consideration

The institutional ethics committee approved this study. Informed consent was obtained from the volunteers.

Statistical analysis

The data obtained from the patients was arranged in tabular format. The data was categorized according to the age of the patients. For the variable data mean was calculated. Tables were prepared for a better understanding of the data available. The difference between the data was then determined using the p-value.

Result

The 250 patients underwent the CT scan, their reports were analyzed and they were categorized as per their age group into three categories. The first group consisted of patients with the age between 20 to 40 years, the second group consisted of patients with 41 to 60 years, and the last group consisted of patients with age groups between 61 to 80 years. The length of the anterior horn was measured with discomforts software. The measurements of the right side of the anterior horn of the lateral ventricle were then compared within the age groups. Similarly, the left side of the anterior horn was compared within the age groups. It was observed that the average length of the anterior horn on the right side of the cerebral hemisphere in the age group of 20 to 40 years, 41 to 60 years, and 61 to 80 years were 26.41 ± 1.51 mm, 28.12 ±1.56 mm, and 30.30 ±2.21mm respectively. The length of the anterior horn was highest in the 61 to 80 years of age. Table no.1 gives the details of the average length of horn on the right side within the age groups.

Table no.1: Length of anterior horn on the right side of cerebral hemisphere according to their age group.

Age groups (years)	Number of patients	Average length and standard deviation of the anterior horn	p-value
20-40	87	26.41 ± 1.51	0.00
41-60	98	28.12 ±1.56	
61-80	65	30.30 ±2.21	

The average length of the horn on the left side of the cerebral hemisphere was as follows as per their age group. 20 to 40 years, 41 to 60 years, and 61 to 80 years were 27.82 ±1.5 mm, 29.27 ±1.57 mm, and 32.0 ±2.23mm respectively. The difference between the age groups was found to be statistically significant. Table

Student's Journal of Health Research Africa
e-ISSN: 2709-9997, p-ISSN: 3006-1059
Vol. 5 No. 6 (2024): June 2024 Issue
https://doi.org/10.51168/sjhrafrica.v5i6.1245
Original Article

no.2 gives the details of the length of the anterior horn on the left side of the cerebral hemisphere. It was observed that irrespective of the sides the lateral ventricles increased in size as the age increased.

Table no.2: Length of anterior horn on the left side of cerebral hemisphere according to their age group.

Age groups (years)	Number of patients	Average length and standard deviation of anterior horn	p-value
20-40	87	27.82 ±1.54	0.00
41-60	98	29.27 ±1.57	
61-80	65	32.0 ±2.23	

The length of the anterior horn was compared based on gender both the left and right sides were compared. It was noted that for men the length of the anterior horn on the right and the left side were 28.72 ±2.21 mm and 29.92 ±2.21 mm respectively. For women, the length of the anterior horn on the right and left side were 27.49 ±2.31mm and 28.72 ±2.41 mm respectively. The average length of the anterior horn was greater in men compared to women and the difference between the lengths was statistically significant. Table no.3 compares the length of anterior horns in men and women.

Table no.3: Gender-based comparison of the length of the anterior horn on the right and the left side

Gender	Number of patients	Average and standard deviation of right side of the anterior horn	Average standard deviation of the left side of the anterior horn	p-value
Men	159	28.72 ±2.21	29.92 ±2.21	0.002
Women	91	27.49 ±2.31	28.72 ±2.41	

The length of the anterior horn of the ventricle was compared between the two sides of the cerebral hemispheres. The average length of the left side of the hemisphere was 29.56 ±2.52 mm and that of the right side of the hemisphere was 28.09 ±2.31mm. The difference between both hemispheres was statistically significant.

Table no.4: The length of the anterior horn of the lateral ventricle comparison on the basis of sides

Side of cerebral hemisphere	Number of patients	Average deviation standard of the anterior horn	p-value
Right	250	28.09 ±2.31	0.001
Left	250	29.56 ±2.51	

Discussion

The study evaluated the length of the anterior horn of the lateral ventricle in 250 patients using CT scans, segmented into three age groups: 20-40 years, 41-60 years, and 61-80 years. Results revealed a progressive increase in the anterior horn length with age. Specifically, the average lengths for the right anterior horn were 26.41 ± 1.51 mm in the 20-40 years group, 28.12 ± 1.56 mm in the 41-60 years group, and 30.30 ± 2.21 mm in the 61-80 years group. Similarly, for the left anterior horn, the average lengths were 27.82 ± 1.54 mm, 29.27 ± 1.57 mm, and 32.00 ± 2.23 mm for the respective age groups. Both the right and left anterior horns showed a significant increase in size with advancing age, indicating that ventricular enlargement is associated with aging.

Gender-based comparisons showed that men had a significantly larger average length of the anterior horn compared to women. On the right side, men had an average length of 28.72 ± 2.21 mm, while women had 27.49 ± 2.31 mm. On the left side, men had 29.92 ± 2.21 mm, and women had 28.72 ± 2.41 mm. These differences were statistically significant, highlighting a gender disparity in anterior horn size.

Comparing the two sides of the cerebral hemispheres, the average length of the anterior horn on the left side was 29.56 ± 2.51 mm, while on the right side, it was 28.09 ± 2.31 mm. The difference between the two sides was statistically significant, with the left anterior horn being larger.

Overall, the study indicates that the anterior horn of the lateral ventricles increases in size with age varies between genders, and shows a side-specific size difference.

It has been observed in various studies that changes in the structural histology of the brain occur during the physiological process of aging as well as during neuropathological diseases [9,10,13,14]. These morphometric changes in the brain can help in deducing the complex prognosis of neuropathological disorders such as Alzheimer's and schizophrenia. To determine the changes that happen along with neuropathological disorders it is necessary to identify the normal physiological morphometry.

With ageing the regression in the brain usually causes enlargement of the lateral ventricles. Variation in the CT scan of an individual may depend not only on the demography and neurological disorder but also on endocrinology disorders such as diabetes. Thus, it is necessary to correlate the morphometry with the medical history then only the normal diagnosis and prognosis of the neurological diseases can be done [15,16].

Other studies have reported that the major enlargement of the lateral ventricles of the brain occurs during the 7th decade of life [17,18,19]. Similarly, in out the greatest enlargement has been reported in patients with 60 to 80 years of age. Also, the enlargement is more prominent in males than females. The findings of this study were from the other studies conducted [20,21]. Apart from the gender and age, the side of the cerebral hemisphere also has a significant difference in the enlargement of the lateral ventricle. In this study as well, it was found that the left side of the lateral ventricle had a greater enlargement than the right one [8, 9,10]. Overall, the findings of the study were to the previous literature which states that enlargement is more prominent on the left side, in males and in the age group of 60 to 80 years.

Generalizability

The external validity of this study's findings is potentially limited due to the specific population sample and imaging technology used, which may not fully represent broader, diverse populations or account for variations in measurement techniques. However, the consistent patterns observed across age, gender, and hemispheric differences provide valuable insights that could be generalized with caution to similar populations.

Conclusion

The present study concluded that the morphometry of the lateral ventricle of the brain changes with advanced age. The ventricles are enlarged on the left side of the cerebral hemisphere and the enlargement is prominent in males than in females.

Limitation

This study had a limited cohort, the demography and socioeconomic status of the individuals participating in the study were not taken into consideration while analyzing the CT scan of the brain.

Recommendation

Clinicians should consider the normal morphometry of the brain before diagnosis and determining the prognosis of the neurological disease.

Acknowledgment

We are grateful to the hospital's staff and patients involved in the study for their cooperation during the study.

List of abbreviation

CT scan- Computed Tomography scan

Source of funding

No funding received.

Conflict of interest

The authors declare no conflict of interest.

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 Textbook of Clinical Neurology of aging 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 the lateral ventricle of Patients with Recent-Onset Type 2 Diabetes Mellitus. PLoSONE 2013; 8(4):e60515. doi10.1371/ journal.pone.0060515.
7. LeMay M. Radiologic changes of the aging 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 aging. 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 the size of normal lateral ventricles during aging are 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.

PUBLISHER DETAILS

SJC PUBLISHERS COMPANY LIMITED

SJC Publishers Company Limited
TODAY AND TOMORROW

Catergory: Non Government & Non profit Organisation
Contact: +256 775 434 261 (WhatsApp)
Email:info@sjpublisher.org or studentsjournal2020@gmail.com
Website: https://sjpublisher.org
Location: Scholar's Summit Nakigalala, P. O. Box 701432,Entebbe Uganda, East Africa