

# Comparison of Morphometric Parameters of Third Ventricle among Males and Females and Its Relevance with Age

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Morphometric Parameters of Third Ventricle among Males and Females and Its Relevance

## ABSTRACT

**Objective:** To calculate and estimate the 3rd ventricular measurements in different age groups including both genders.

**Study Design:** Cross-sectional study

**Place and Duration of Study:** This study was conducted at the Department of Anatomy with the collaboration of Radiology Department J.P.M.C Karachi from November 2019 to December 2020.

**Materials and Methods:** Patients with any gross pathology of brain was excluded whereas MRI with no clinical manifestation of 206 patients were included. 3rd ventricle was measured for its dimensions on MRI via Tesla 1 weighted (T1-weighted), Tesla 2 weighted (T2-weighted) and Fluid Attenuated Inversion Recovery (FLAIR) on coronal, sagittal and transverse plane on different levels by 3D technique. Dimensions of 3rd ventricles were measured by measuring the length, width and height of third ventricle.

**Results:** Out of the 206 participants 106 (51.5%) were in group A and 100 (48.5%) were in group B. In total, males were 102 (49.5%) and 104 (50.5%) were females. Mean age of group A was  $29.3 \pm 6.88$  while group B mean age was  $51.7 \pm 6.58$ . The result showed that length of 3rd ventricle was found greater in females as compared to males while width and height found greater in male than females. However in comparison with age third ventricle height was found to be decreased in size while width and length was increased with advancement of age.

**Conclusion:** Study showed that variations are found in measurements of 3rd ventricle in different subjects with age and gender and when we compared it with the studies in different areas and population. This will be helpful for surgeons, neuro-physicians and radiologists to investigate, manage and treat a disease of brain.

**Key Words:** Ventricles, Dimensions, Tesla.

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## INTRODUCTION

Ventricular system is an intercommunicating system present with in the brain. It consist of lateral ventricle, 3rd ventricle and 4th ventricle. Lateral ventricle is communicated with 3rd ventricle via foramen Monro whereas cerebral aqueduct of Sylvius communicates the 3rd and 4th ventricle.

4th ventricle communicates through the sub-arachnoid space via two lateral openings; foramen Lushka and one central opening foramen Megendi. 4th ventricle becomes narrow inferiorly to continue as central canal of spinal cord.<sup>(1)</sup>

The 3rd ventricle is a narrow midline cavity, which is present in between two thalami and hypothalamus. It is bounded superiorly/ roof by tela choroidea and body of fornix along with thalamus. Inferiorly optic chiasma, tuber cinereum, infundibulum and mammillary bodies along with hypothalamus form floor. Posteriorly it is bounded by pineal gland, habenular nuclei and posterior commissure. Anteriorly it is bounded by anterior commissure and lamina terminalis. Tela choroidea of 3rd ventricle produce cerebrospinal fluid (CSF) along with lateral and 4th ventricles.<sup>(2,3)</sup>

Human brain develops in early life up to 3rd to 4th decades, however with the advancement of age degenerative changes progress, this leads to cortical atrophy and ventricular dilatation. Due to these changes, it remains difficult for physician, neurologist and radiologist to rule out the normal morphometric changes with diseased brain. Third ventricle dilatation compressed the thalamus and hypothalamus which are

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essential parts of diencephalon. (4,5) Previously, invasive techniques pneumoencephalograms and contrast ventriculography were used but now computed tomography (C.T Scan) and magnetic resonance imaging (MRI) are in used which are non-invasive techniques. (4,6) However electromagnetic waves of MRI have better sensitivity and safety over ionized radiations of C.T Scan. (7,8) It provides best imaging of fluid and soft tissues of brain. Images can be taken on sagittal, oblique and axial planes without moving patients. (9) All healthy subjects with age group of 20 to 60 were included except participants with any metallic implants and brain related disorders. Objective of this study was to calculate and estimate the 3rd ventricular measurements in different age groups including both genders.

**MATERIALS AND METHODS**

This cross-sectional study was conducted on MRI of 206 patients in Anatomy Department B.M.S.I in association with Radiology Department J.P.M.C Karachi from November 2019 to December 2020. Subjects were divided into two groups containing both genders. Groups A comprise of ages 20 to 40 and group B comprises of 41 to 60. After the consent and complete history participants were counseled and prepared for the procedure. Procedure of MRI completed within 25-30 minutes. MRI was taken on Tesla 1 weighted (T1-weighted) Tesla 2 weighted (T2-weighted) on transverse and Fluid Attenuated Inversion Recovery (FLAIR) on coronal plane via 1.5 Tesla MRI Toshiba scanners at JPMC. Each sequence took 7 minutes to be completed and thickness of each was 5 to 10 mm. Measurements were taken by using Micro Dicom software.

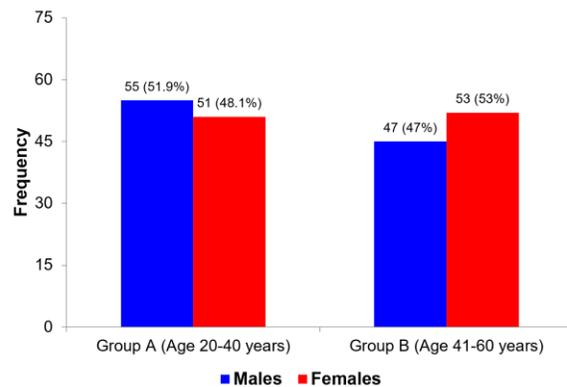
The dimensions of third ventricle were taken by length, height and width. Length was measured from anterior wall (pre-commissure) to posterior wall (pineal gland root) of ventricle in ventro-dorsal dimension on axial plane, height was measured in craniocaudal direction (roof to floor), the distance between the two lateral wall was measured for width (coronal plane was used for measuring the height and width). (10)

Analysis was done by using SPSS version 19.0. Student t-test was used for comparison between two groups.

**RESULTS**

Of the 206 participants, they were divided into group A (20-40) and group B (41-60). Group A consist of 106 (51.5%) participants and group B consists of 100 (48.5%) participants. In which 104 (50.5%) were female and 102 (49.5%) were male. As presented in figure 1. Measurement of mean length, height and width of 3<sup>rd</sup> ventricle with their significant and non-significant values are present in table # 1. These are showing the comparative measurements in group A and B in

between both genders. However, the width of group A showing the significant difference as shown in table 1.



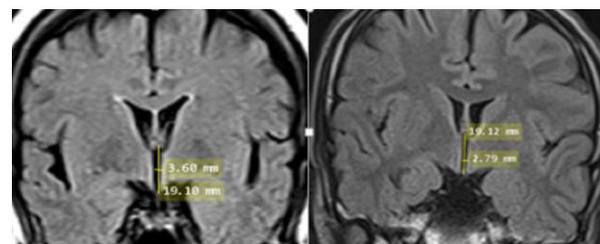
**Figure No.1: Showing the age and gender distribution**

**Table No.1: Comparative measurements of 3<sup>rd</sup> ventricle in both genders in Group A (20-40 years) & Group B (41-60) years**

	Male (n=55)	Female (n=51)	P-value
Group A (20-40) years			
Length	4.7 ± 0.98	4.9 ± 0.88	0.257
Height	20.2 ± 1.00	20.0 ± 0.77	0.203
Width	4.6 ± 0.58	4.3 ± 0.71	0.009
Group B (41-60) years			
Length	5.9 ± 2.80	5.1 ± 1.42	0.098
Height	19.7 ± 1.72	19.5 ± 1.52	0.412
Width	5.1 ± 1.90	4.8 ± 1.44	0.461

**Table No.2: Comparative measurements of 3<sup>rd</sup> ventricle in different age groups in Male of group A & B**

	Male		P-value
	Age (20-40) years	Age (41-60) years	
Length	4.7 ± 0.98	5.9 ± 2.80	0.010
Height	20.2 ± 1.00	19.7 ± 1.72	0.085
Width	4.6 ± 0.58	5.1 ± 1.90	0.090
Female			
Length	4.9 ± 0.88	5.1 ± 1.42	0.430
Height	20.0 ± 0.77	19.5 ± 1.52	0.020
Width	4.3 ± 0.71	4.8 ± 1.44	0.010



**Figure No.2: Length and Width of Group A Male & Female**

On comparison of group A male with group B male and group A female with B female the mean measurements showed significant and non-significant differences which are shown in table 2. Significant difference in length of group A males when compared with males in group B as shown in table 2. Similarly (Table 2) significant difference was observed on comparison of group A and B female.

## DISCUSSION

This cross-sectional study was conducted on both genders in different age groups for study of normal measurements of 3rd ventricle on MRI. We found variation in measurements of 3rd ventricle when compared in different age groups in both genders. 3D quality of MRI along with electromagnetic waves shows better effects and sensitivity over brain soft tissues. It provides pioneer measurements of brain tissue and ventricles.<sup>(11-13)</sup> MRI also provide measurements on different planes and dimensions, which facilitate the neuro-physicians, surgeon and radiologist to rule out and treat a diseased or pathological condition.<sup>(14)</sup>

When length of the third ventricle was compared it was found larger in female as compared to male but width and height were found greater in males as compared to females as shown in figure # 2, similar results were reported by Singh et al studies.<sup>(4)</sup> In our study, we observed that height found reduced in size with advancement of age, which are also in line with Singh et al.<sup>(4)</sup> Duffner et al used mid-sagittal plane for measuring the height, whereas Singh et al used transverse plane and ventrodorsal extension for measuring the 3rd ventricle and we measured the height and width in coronal plane and length in axial plane, so some variations were found in measurements of various studies.<sup>(4,10)</sup> Study by Aukland et al from Norway also reports width of 3rd ventricle was found greater in male as compared to female and it increases with age.<sup>(15)</sup> While study conducted by Shrestha et al on Nepalese, showed results contrary to our study that width of 3rd ventricle was found more in females than in males, but they conclude the same increase in width with age.<sup>(5)</sup> A study from Iraq showed that 3rd ventricle width is age dependent not gender which also support our study for age difference.<sup>(16)</sup> Our study reveals similar results when compared with Indian and European nations no significant racial difference was found. (17-19) Same is true with study by Hamidu et al of Zaria-Nigeria.<sup>(20)</sup>

## CONCLUSION

Our results suggest length of 3rd ventricle was found greater in females as compared to males while width and height found greater in males than females. However in comparison with age we found that height reduced in size whereas length along with width

increased with advancement of age. On comparison with various studies we found with advancement of age, sexual dimorphism is observed in measurements. MRI with quality of 3D and harmless electromagnetic waves is best modality and gives novel and finest images of the ventricles and brain soft tissues.

### Author's Contribution:

Concept & Design of Study: Amatul Sughra  
 Drafting: Amatul Sughra, Syeda Bushra Ahmed  
 Data Analysis: Tanweer Fatima,  
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 Final Approval of version: Khalida Parveen

**Conflict of Interest:** The study has no conflict of interest to declare by any author.

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