



ISSN NO. 2320-5407

Journal homepage: <http://www.journalijar.com>

INTERNATIONAL JOURNAL  
OF ADVANCED RESEARCH

## RESEARCH ARTICLE

## Morphometry of width of third ventricle of brain by luminal cast Plastination & MRI

\*Vidya K. Satapara, Mital M. Patel, Jayesh K. Rathava, Pratik N. Trivedi, Urvik C. Kukadiya, Dilip V. Gohil, Tulsibhai C. Singel

Department of Anatomy, Shri M. P. Shah Government Medical College, Jamnagar

### Manuscript Info

#### Manuscript History:

Received: 19 April 2014  
Final Accepted: 25 May 2014  
Published Online: June 2014

#### Key words:

Third ventricle,  
Luminal cast Plastination,  
MRI,  
Morphometry

#### Corresponding Author

Vidya K. Satapara

### Abstract

#### Introduction

The ventricular system of brain is cavity of brain. The ventricular system of brain consists of two lateral ventricle, third ventricle and fourth ventricle. The third ventricle is the cavity of diencephalon located between two thalami. Plastination is a technique of preparation of dry, colored, nontoxic, durable, odorless, natural looking specimen. The size, shape, consistency and relationships in a 3-dimensional orientation of different biological specimens should be understood. Here, an attempt has been made to establish the ranges of normal values for the width of normal third ventricle of brain by method of luminal cast plastination and radiological method (MRI).

#### Material and Method

In this study total of 83 brains (20 brains by method of luminal cast plastination in department of Anatomy and 63 brains by MRI scans obtained from records of department of Radiodiagnosis) were studied at our institute.

#### Observations

The mean width of third ventricle was 0.52 cm in 63 subjects (males and females) by MRI. The width of third ventricle increases as age increases, which was statistically significant (P-value < 0.05). The mean width of third ventricle in both sexes was 0.52 cm. The mean width of third ventricle was same in MRI and cast method (0.52 cm).

#### Conclusion

The width of third ventricle increases as age increases, which was statistically significant (P-value < 0.05). The mean width of third ventricle is same in males and females in MRI study

Copy Right, IJAR, 2014. All rights reserved.

## INTRODUCTION

The ventricular system of brain is cavity of brain. The ventricular system of brain consists of two lateral ventricle, third ventricle and fourth ventricle. The third ventricle is the cavity of diencephalon located between two thalami<sup>7</sup>. Plastination is a technique of preparation of dry, colored, nontoxic, durable, odorless, natural looking specimen. The size, shape, consistency and relationships in a 3-dimensional orientation of different biological specimens should be understood<sup>6</sup>. Described by **Standing S et al**, The third ventricle is a midline, slit-like cavity which is derived from the primitive forebrain vesicle<sup>9</sup>.

Here, an attempt has been made to establish the ranges of normal values for the width of normal third ventricle of brain by method of luminal cast plastination and radiological method (MRI), as identical studies are scarcely found in Gujarat. Very few studies has been done on difference in the width of third ventricle of brain

between males and females, so this study was done to observe for any differences in the width of third ventricle of brain between males and females.

## Material and Methods

In this study total of 83 brains (20 brains by method of luminal cast plastination in department of Anatomy and 63 brains by MRI (Magnetic resonance imaging) scans obtained from records of department of Radiodiagnosis) were studied at our institute. The study was conducted after taking approval from institutional ethics committee.

The morphometry of width of third ventricle of brain was studied by 2 methods.

### A) Luminal cast plastination method – 20 specimens:

This study was done on formalin fixed brain of human cadaver obtained from the Department of Anatomy at our institute. The first step in preparing brain for resin injection was to drill a hole into each lateral ventricle. The brain rests on tray while the hole were drilled with tube, end of which has been sharpened like cork borer. Then the tube was pushed through the precentral gyrus of each cerebral hemisphere, at right angle to surface of brain and about 1.5 cm away from longitudinal fissure. The tube was rotated as it was pushed into brain so that it cuts the tissue cleanly. The piece of brain tissue inside the tube was removed and the ventricle was entered at a depth of approx. 4.5 cm from the surface of the brain. Whenever the tube was reinserted into the holes, care was needed to avoid slicing a thin piece of brain tissue off. Such tissue, if it falls into the ventricles may block inter-ventricular foramen. The tube was directed in the inferior horn of lateral ventricle and connected to apparatus and then resin was injected via tube. Dissection was started after 3 days and cast had been removed. Cast of ventricles of brain was numbered, measured and photographed<sup>10</sup>.

**Width of third ventricle was measured at the impression of interthalamic adhesion** (Shown in photograph 1)

### B) Radiological method (MRI)- 63 subjects

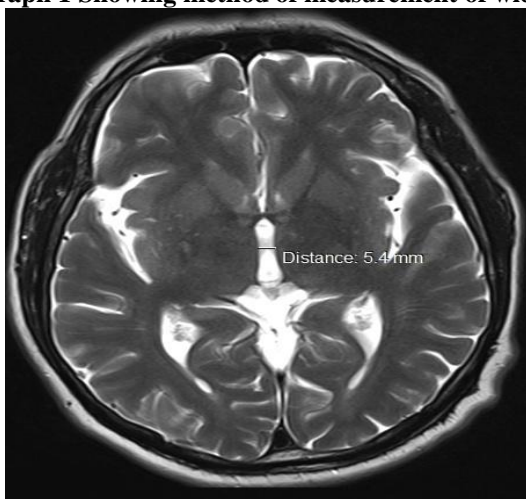
Width of third ventricle in transverse section of MRI below the interventricular foramen of monro (Shown in Photograph 2)<sup>1</sup>

Width of third ventricle obtained was analyzed statistically to find range, mean, standard deviation (SD). Analysis of variance (ANOVA) test was done to compare more than 2 groups at a time. The P-values was found for each parameter. If the P-value was > (Greater than) 0.05, it means that the difference was not significant. If the P-value was between 0.05 & 0.01, it means that the difference was significant<sup>2</sup>.

## Result



**Photograph 1 Showing method of measurement of width of third ventricle by using vernier calliper in cast**



**Photograph 2 Showing width of third ventricle in transverse section of MRI below the interventricular foramen of monro**

The mean width of third ventricle was 0.52 cm in 63 subjects (males and females). The width of third ventricle increases as age increases, which was statistically significant ( $P$ -value  $< 0.05$ ). (Table 1)

The mean width of third ventricle in both sexes was 0.52 cm. (Table 2).

The mean width of third ventricle was same in MRI and cast method (0.52 cm).

**Table 1: Width of third ventricle in various age groups**

Age (years)	No	Mean (cm)	SD (cm)	Minimum	Maximum	p-value
10-19	9	0.34	0.05	0.27	0.45	0.03
20-29	12	0.44	0.09	0.24	0.59	
30-39	8	0.5	0.22	0.29	0.93	
40-49	16	0.52	0.16	0.27	0.89	
50-59	4	0.54	0.13	0.41	0.71	
60-69	6	0.57	0.34	0.27	1.19	
70-79	5	0.76	0.39	0.37	1.24	
80-89	3	0.92	0.42	0.67	1.4	
<b>Total</b>	63	0.52	0.24	0.24	1.4	

(SD- Standard deviation, Cm- Centimeter, P-value- Probability value)

**Table 2: Comparison of width of third ventricle (by MRI & cast)**

Workers	Study done in	Method	No of subjects	Sex	Mean (cm)	SD (cm)	Range (cm)
Gawler J et al <sup>4</sup> (1976)	London	CT	78	M+F	0.46	-	-
Soininen H et al <sup>8</sup> (1982)	Finland	CT	85	M+F	0.92	0.27	-
D'souza e DMC & Natekar PE <sup>1</sup> (2007)	Goa	CT	1000	Male	0.45	0.29	0.00-1.01
				Female	0.39	0.17	0.05-0.72
Meshram P & Hattangdi S <sup>5</sup> (2012)	Mumbai	CT	200	Male	0.77	0.21	-
				Female	0.67	0.25	-
Duffner F et al <sup>3</sup> (2003)	Germany	MRI	30	M+F	0.33	0.18	0.18-0.57
Present study (2013)	Gujarat	MRI	63	Male	0.52	0.23	0.24-1.24
				Female	0.52	0.25	0.27-1.4
				Total	0.52	0.24	0.24-1.4
		Cast	20	Total	0.52	0.14	0.2-0.8

(CT- Computerized tomography, No- Number, M- Male, F- Female)

## Discussion

The width of third ventricle was measured by method of radiology by various workers like **Gawler J et al<sup>4</sup>**, **Soininen H et al<sup>8</sup>**, **D'souza e DMC & Natekar PE<sup>1</sup>**, **Meshram P & Hattangdi S<sup>5</sup>**, and **Duffner F et al<sup>3</sup>**. The finding of these workers were tabulated, compared and discussed with the finding of present study below.

As shown in table 2, the mean width of third ventricle in both sexes as **per our study** was 0.52 cm measured by MRI.

In **Meshram P & Hattangdi S<sup>5</sup>** and **D'souza e DMC & Natekar PE<sup>1</sup>** study, the mean width of third ventricle was higher in males than that in females, but in present study the mean width of third ventricle was same in males and females.

The mean width of third ventricle **in present study by MRI** (0.52 cm) was more than that **in Duffner F et al<sup>3</sup> study by MRI** (0.33 cm).

The mean width of third ventricle **in present study by MRI** (0.52 cm) was more than that **in Gawler J et al<sup>4</sup> study by CT** (0.46 cm).

The mean width of third ventricle **in present study by MRI** (0.52 cm) was less than that **in Soininen H et al<sup>8</sup> study by CT** (0.92 cm).

The mean width of third ventricle **in present study by MRI** (0.52 cm) was more than that **in D'souza e DMC & Natekar PE<sup>1</sup> study by CT** (M- 0.45 cm, F- 0.39 cm).

**In D'souza e DMC & Natekar PE<sup>1</sup> study**, the mean width of third ventricle was higher in males (0.45 cm) than that in females (0.39 cm), but **in present study** the mean width of third ventricle was same in males and females (0.52 cm).

The mean width of third ventricle **in present study by MRI** (0.52 cm) was less than that **in Meshram P & Hattangdi S<sup>5</sup> study by CT** (M- 0.77 cm, F- 0.67 cm).

**In Meshram P & Hattangdi S<sup>5</sup> study**, the mean width of third ventricle was higher in males (0.77 cm) than that in females (0.67 cm), but **in present study** the mean width of third ventricle was same in males and females (0.52 cm).

The mean width of third ventricle in present study by MRI in Gujarat (0.52 cm) was more than study done **Duffner F et al<sup>3</sup> by MRI** in Germany (0.33 cm), because of difference in population studied.

The mean width of third ventricle in present study by MRI in Gujarat (0.52 cm) was more than study done by Gawler J et al<sup>4</sup> by CT in London (0.46 cm) and by D'souza e DMC & Natekar PE<sup>1</sup> by CT in Goa (M- 0.45 cm, F- 0.39 cm), because of difference in method and population.

The mean width of third ventricle in present study by MRI in Gujarat (0.52 cm) was less than study done by Soininen H et al<sup>8</sup> by CT in Finland (0.92 cm) and by Meshram P & Hattangdi S<sup>5</sup> by CT in Mumbai (M- 0.77 cm, F- 0.67 cm), because of difference in method and population.

## Conclusion

**The mean width of third ventricle** is same in males and females in MRI study. The mean width of third ventricle is same in MRI and cast method. The width of third ventricle increases as age increases, which was statistically significant (P-value < 0.05).

The knowledge of the measurement of ventricular system of brain by MRI and luminal cast plastination is of use in diagnosis of some disease (e.g. hydrocephalus, schizophrenia and Alzheimer's disease) and surgical intervention like endoscopic neurosurgery.

## References

1. D'souza e DMC. & Natekar PE; Morphometric study of the ventricular system of brain by computerized tomography; J. Anat. Soc. India; 2007, Volume 56; Issue 1; Page no. 19-24.
2. Das R & Das PN; Biomedical research methodology including biostatistical applications; Chapter 9 Analyze your observations: check statistical significance; 1<sup>st</sup> edition; New Delhi( India); Jaypee brothers medical publisher LTD; 2011; Page no. 123.
3. Duffner F, Schiffbauer H, Glemser D, Skalej M, and Freudenstein D; Anatomy of the cerebral ventricular system for endoscopic neurosurgery: a magnetic resonance study; Acta Neurochir; 2003; Volume 145; Page no. 359-368.
4. Gawler J, Du Boulay GH, Bull JWD, and Marshall J; Computerized tomography (the EMI Scanner): a comparison with pneumoencephalography and Ventriculography; J. Neurol. Neurosurg. Psychiatry; 1976; Volume 39; Page no. 203-211.
5. Meshram P and Hattangdi S; The morphometric study of third ventricle and diencephalon by computerized tomography; Indian journal of applied basic medical science; 2012; Volume 14 B; Issue 19; Page no. 8-13.
6. Shamasundar NM; "plastination" – by indigenous method (a new art in science); cited 2013 Oct 5; available at
7. Singh V; Textbook of clinical neuroanatomy; chapter-10 cerebellum and fourth ventricle, chapter-11 diencephalon and third ventricle, chapter- 14 white matter of the cerebrum and lateral ventricles; 2<sup>nd</sup> edition; India; Elsevier; 2010; Page no. 120-123, 137, 168-171.
8. Soininen H, Puramen M, and Riekkinen PJ; Computed tomography findings in senile dementia and normal ageing; J. Neurol. Neurosurg. Psychiatry; 1982; Volume 45; Page no. 50-54.
9. Standring S, Borley NR, Coliins P, Crossman AR, Gatzoulis MA, Healy JC et al; Gray's anatomy, the anatomical basis of clinical practice; chapter-16 ventricular system and subarachnoid space, chapter-24 development of nervous system; 40<sup>th</sup> edition; Spain; Elsevier; 2008; Page no. 237-240.
10. Tompsett DH; Anatomical techniques; Historical introduction, Part-III Anatomical casting in unsaturated polyester resin, chapter-16 introduction, chapter-21 casts from the brain; 2<sup>nd</sup> edition; Edinburgh & London; E & S Livingstone; 1970; Page no. xi-xvi, 93-95,147-149.