ORIGINAL ARTICLE

Third Ventricular Dimension: A Critical Interpretation In Congenital Hydrocephalus

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Abstract

This is a cross sectional descriptive type study on Congenital Hydrocephalus of children, admitted in Neurosurgery Department of BSM Medical University. The period of study was between 15 th February 2002 to 15 th November 2003. Data was collected from CT scans and MRI images of 69 children. Transverse diameter of 3 rd ventricle, maximum biparietal diameter (BPD) and largest width of Frontal horns (FH) were measured carefully. Result shows a male predominance (2.3: 1) then female. As a whole the mean of transverse diameter (TD) of third Ventricles (at the level of foramen Monro) is 1.85. Mean of Evan's Ratio (ER) of 69 cases is 0.27. So the ratio is 6.85. When data were tabulated, the individual measurements according to age frequency in five (5) rows - the means were 6.2 (± 1.02), 5.9(±1.16), 6.5(±0.94), 6.9(±1.23) and 6.7 (±0.73)with an average of 6.44. In conclusion it was found the ratio of TD of 3 rd ventricle to ER in congenital hydrocephalus of children ranges from 5.9 to 6.9. In this study highest cases (30.4%) were found in age frequency of 1 day to 11 months. Lowest (13%) cases were in age group of 4 years to 4 years 11 months. In case of congenital hydrocephalus pressure changes in third ventricle and lateral ventricle are proportionate. Only getting the diameter of any of the above mentioned variables, the status of hydrocephalus can be assumed. Aims and objectives of our study is to prove the diagnosis of congenital hydrocephalus from radiological images (CT scan and MRI). Functional status of shunt can be assessed by this study also. Direct measurement of CSF pressure for diagnosis of Hydrocephalus can be avoided by this study.

Introduction

Hydrocephalus may be defined as dilatation of ventricles and / or subarachnoid space due to an increase in cerebrospinal fluid (CSF) volume usually resulting from impaired absorption or flow pathway obstruction or rarely from excessive secretion[1].

There are two types of hydrocephalus. Obstructive (non-communicating) and non-obstructive (communicating). In obstructive hydrocephalus block is proximal to arachnoid granulation. On CT or MRI enlargement of ventricles are seen proximal to the block. In congenital hydrocephalus, obstruction is in aqueduct of Sylvius causing lateral and 3 rd ventricular enlargement out of proportion to the 4 th ventricle. It is also termed as triventricular hydrocephalus.

In communicating type of hydrocephalus, CSF circulation blocked at level of arachnoid granulation. Incidence of congenital hydrocephalus is from 0.9 – 1.8 / 1000 births.

On CT scan and MRI there are few suggestive features of hydrocephalus. Suggestive features are[2,5,6,7,8,9]

1. The size of both temporal horns (TH) is > 2 mm.
2. The ratio FH / ID > 0.5 (FH is the largest width of the frontal horns and ID is the internal diameter from inner)

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3. Ballooning of Frontal horns of Lateral ventricles and 3 rd ventricles.
4. The ratio FH / ID > 50%.
5. Evan's ratio:- Ratio of FH to maximal biparietal diameter > 30%.
6. Sagittal MRI may show upward bowing of the corpus callosum.
7. Calculation of Diagonal Ventricular Dimension (DVD).

CSF diversion shunt for hydrocephalus, usually ventriculo-peritoneal shunt is done in maximum neurosurgical center.

Regarding etiology of hydrocephalus[3], congenital is the cause in 38% of cases. Congenital with myelomeningocele in 29% , perinatal hemorrhage 11%, trauma/ subarachnoid hemorrhage 4.7%, tumor 11% and post- infective 7.6%.

Patients and methodology

This is a cross sectional descriptive and prospective study. All the patients admitted into Neurosurgery department of Bangabandhu Sheikh Mujib Medical University as a case of Congenital Hydrocephalus were included in this study. Total 69 cases have been included in this study. Few patients were admitted after doing a CT scan or MRI. Other patients were advised for CT scan or MRI after admission. Diagnosis was confirmed by history, clinical examination and image study. Various measurements were taken from CT scan or MRI (axial views) and were collected as data. Evan's ratio : Largest width of Frontal horns (FH) and maximum Biparietal Diameter (BPD) were measured. Evan's ratio (ER) was calculated as FH / BPD. Transverse Diameter (TD) of 3 rd ventricle (at the level of Foramen Monro) as measured. Ratio of TD of 3 rd ventricle to ER was measured. All data were measured and collected carefully.

Results

Common chief complaints of patients were Headache, Vomiting, Visual disturbance or Gradual enlargement of head size. Among 69 patients 48 were male (69.5%) and 21 were female (30.5%), showing a male predominance at the ratio of 2.3 : 1 (Table- I).

Table – I. Distribution of cases according to sex (n.- 69)

Sex	No. of case	percentage
Male	48	69.5%
Female	21	30.5%

Among 69 cases 21 cases (30.4%) were at the age of under 1 year. 12 cases (17.4%) were between 1 year to 23 months. 12 cases (17.4%) were between 2 years to 35 months. There were 15 cases (21.7%) at the age between 3 years to 47 months. Rest 9 cases (13.0%) were between 4 years to 59 months. Highest percentage was at the first age group. Mean of TD of third ventricle of all 69 cases were calculated. It was 6.85. Individual ratio (TD / ER) was calculated for each patients (Table – II).

Table – II. Distribution of cases according to age frequency (n.- 69)

Age frequency	no. of cases	percentage
1 day to below 1 year	21	30.4%
1 year to below 2 year	12	17.4%
2 years to below 3 years	12	17.4%
3 years to below 4 years	15	21.7%
4 years to below 5 years	09	13.0%

Mean of ratio of each age frequency group were measured (Table – III). They were respectively 6.2, 5.9, 6.5, 6.9 and 6.9. Average of these values was measured. It was 6.44. All the result of ratio were between 5.9 to 6.9 with an average of 6.44.

Table – III. Ratio of mean TD of third ventricle to mean ER according to age frequency (n.– 69)

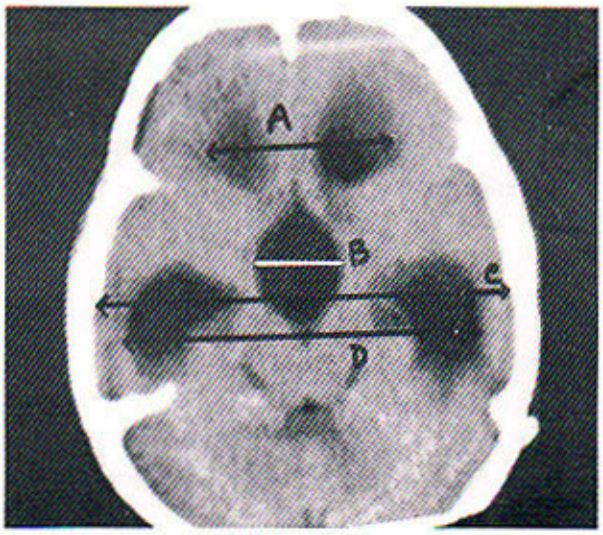
Age frequency	Mean TD of 3 rd ventricle/Mean ER	Mean
1 day to below 1 year	6.2	
1 year to below 2 year	5.9	
2 years to below 3 years	6.5	6.44
3 years to below 4 years	6.9	
4 years to below 5 years	6.7	

Discussion

Study was based on radiological evaluation. There were no such studies exactly similar to us. The sensitivity and specificity of this test regarding diagnosis of congenital hydrocephalus were not measured. But it may help more in follow up serial scans or in to measure the functional status of ventriculo-peritoneal shunt. Patient of congenital hydrocephalus often present with symptoms and signs that are non-specific for increased intracranial pressure. As a result the evaluation of patient can be made by history, physical examination and imaging study of brain. Interpretation of status of ventricular system on the basis of image studies may be difficult because of the unusual and complex anatomy of ventricles in some patients. In addition, the compliance of the ventricular system may change over time, resulting in subtle alterations in ventricular size with large changes in intracranial pressure. For these reasons, a radiologist's subjective interpretation of imaging study may not provide adequate information with regard to the state of cerebrospinal fluid volume and intracranial pressure.

Evans ratio, Fronto-occipital ratio, FH/ID ratio, Diagonal ventricular dimension (DVD) are so far popular methods using for diagnosis of congenital hydrocephalus. In few previous studies, it was observed that sensitivity of Evans ratio, Fronto-occipital ratio, Radiologist's assessment and DVD were respectively 85%, 92%, 85% and 100%. Specificities of the above-mentioned variables were respectively 47%, 73%, 100% and 100%[2,5,6,7,8,9]

As mentioned earlier, there is not much data regarding sensitivity and specificity of the method to compare with others. This study re-establishes the fact that, in congenital hydrocephalus ventricular enlargement of third and both lateral ventricles are homogenous because it involves the diameters of all three (third and both lateral) ventricles. But it's specificity and relationship with other methods needs further studies.



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