

Fontanelle as an Indicator of Hydrocephalus in Early Childhood

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Abstract:

Introduction: The parameters of fontanelle can be very reliable and helpful source to assess the internal status of hydrocephalus in early childhood.

Methods and Materials: We have studied the parameters of 69 patients of hydrocephalus in early childhood to assess the status of hydrocephalus. All the patients - who were admitted in the Bangabandhu Sheikh Mujib Medical University from January 2002 to December 2003.

Results: All patients were evaluated clinically as well as with imaging study. The age range was from newborn to 12 months. There was male preponderance; male to female ratio was 2.6:1. Clinical evaluation of head and face showed 97.10% patients had open anterior fontanelle, 88.41% had apparent large head, 59.04% had presence of sunset sign. Analysis of anterior fontanelle showed 66.67% had bulged fontanelle, 30.43% had flat fontanelle and 2.90% had concave fontanelle. Evaluation of the clinical status of posterior fontanelle revealed that 23.19% had open posterior fontanelle. Among them 15.94% had bulged and 7.25% had flat fontanelle.

Conclusion: By analyzing the result we found that clinical evaluation of fontanelle gives good guidance to assess the status of hydrocephalus in early childhood.

Key words: Fontanelle, hydrocephalus, early childhood.

Abbreviation: CSF (Cerebro spinal fluid).

Introduction:

Hydrocephalus may be defined as dilatation of ventricles and/or subarachnoid space due to increase in cerebrospinal fluid volume usually resulting from impaired absorption or flow pathway obstruction or rarely from excessive secretion¹. It is a hydrodynamic disorder of CSF that leads to an increase in volume occupied by this fluid in the central nervous systems². Theoretically hydrocephalus can result from three mechanisms a) increased production of CSF b) increased resistance of CSF flow c) increased venous sinus pressure³.

Hydrocephalus has puzzled man since the dawn of civilization. It is one of the common conditions neurosurgeons usually encounter in their day-to-day

practice. With the latest advancement of technologies we can diagnose the patients of hydrocephalus far earlier now a days. But about the exact etiology of hydrocephalus the neuroscientists are not very confident in all cases. The incidence of hydrocephalus in new born varies between .12 to 5 per 1000 live births⁴. In Liverpool series it was one per 2500 live birth in another study. The incidence increases among the older primipara family⁵. It has been suggested that 2% of all cases of congenital hydrocephalus may occur in an x-linked recessive state. ⁶ Cerebrospinal fluid (CSF) is normally a clear colorless fluid with a specific gravity of 1.007 and a pH of 7.33-7.35, 80% is produced by the choroids plexuses, located in both lateral ventricles (accounts for approximately 95%

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of CSF produced in the choroids plexuses) and in the 4th ventricle. Rest of intracranial production occurs mainly in the interstitial space. A small amount may also be produced by the ependymal lining of ventricles. In the spine, it is produced primarily in the dura of nerve root sleeves.

On an average the total CSF volume in the newborn is 5 ml and in adult it is 150 ml (50% intracranial, 50% intraspinal). CSF pressure in the lumbar subarachnoid space in a relaxed patient in lateral decubitus position is 9-12 cm of fluid in new born, average 10 cm of fluid in 1 to 10 years children, <18-20 cm of fluid in young adult and 7-15 cm of fluid in adult. CSF production is at a rate of about 0.3ml/min which is approximately 450 ml/24 hrs, which mean that in an adult (with an average 150 ml of total CSF in their body) the CSF is turned over approximately 3 times everyday. CSF is absorbed primarily by arachnoid villi that extend into dural venous sinuses. Other sites of absorption include choroids plexuses and lymphatic. The rate of absorption is pressure dependent⁵.

In developed countries the diagnosis of hydrocephalus is usually not very difficult. But in developing countries like Bangladesh it is not always possible for a patient to have hi-tech supported diagnosis due to less availability of facility and lack of economical ability. In this study patients were evaluated as per clinical findings. Assessing their status of fontanelle clinical evaluation of patients of hydrocephalus was done. This study tried to assess the status of hydrocephalus by evaluating parameters of fontanelle and establish its perfectness in the light of imaging study.

Materials and Methods:

This prospective cross-sectional study was done on 69 patients, all admitted in Neurosurgery Department of Bangabandhu Sheikh Mujib Medical University during the study period of 2 years (Jan 2002 - Dec 2003). Clinical & image proved cases of hydrocephalus having open fontanelle who got admitted in Neurosurgery Department of BSMMU during our study period were included in our study.

Thorough clinical history of the patients was taken with the help of structured questionnaire. Patients were evaluated clinically by three experienced residents remaining blind to the findings. Whenever there were dissimilar it has been reassessed by a

senior and experienced neurosurgeon of consultant status. Collected data were checked for correctness and editing and coding was done and then data were entered into computer. Employing “SPSS” 11.0 software package analysis was done. Both descriptive and inferential statistics were employed for obtaining results.

Results:

Table-I
Sex distribution of patients (n=69)

Sex	Number of patients	Percentage
Male	50	72.46
Female	19	27.54
Total	69	100

A total number of 69 patients were evaluated. Table-I shows the sex distribution of the patients. In this study out of 69 patients of hydrocephalus 50 (72.46%) were male and 19 (27.54%) were female. The male to female ratio was 2.6:1.

Table-II
Age distribution of patients (n=69)

Age group (months)	Number of patients	Percentage
0-3	22	31.88
4-6	24	34.78
7-9	11	15.94
10-12	12	17.39

The age range of hydrocephalus patients in this study was from newborn up to 12 months. The peak age of hydrocephalus in this population was 4 to 6 months age group. (Table II)

Table-III
Head and Face abnormality

Abnormality	Number of patients	Percentage
Apparent large head	61	88.41
Engorged scalp vein	13	18.84
Open anterior fontanelle	67	97.10
Open posterior fontanelle	16	23.19
Presence of sutural diasthesis	19	27.54
Presence of sunset sign	41	59.42

After clinical evaluation of head and face of all 69 patients of hydrocephalus in this study it was found 67 (97.10%) patients had open anterior fontanelle, 61 (88.41%) had apparent large head, 41 (59.42%) had presence of sunset sign. (Table III)

Table-IV
Status of anterior fontanelle

Status	Number of patients	Percentage
Bulged fontanelle	46	66.67
Flat fontanelle	21	30.43
Concave fontanelle	02	2.90

In this study status of anterior fontanelle was analyzed where 46 (66.67%) had bulged fontanelle, 21 (30.43%) had flat fontanelle and only 2 (2.90%) had concave fontanelle. (Table IV)

Table-V
Status of posterior fontanelle

Status	Number of patients	Percentage
Bulged posterior fontanelle	11	15.94
Flat posterior fontanelle	05	7.25

Evaluation of the clinical status of posterior fontanelle revealed that 16 (23.19%) patients had open posterior fontanelle. Among them 11 (15.94%) had bulged posterior fontanelle and 5 (7.25%) had flat posterior fontanelle (Table-V).

Discussion:

We know that up to a certain age fontanelle remains open. These openings of the fontanelle are a useful window for an experienced clinician to evaluate the internal status of the cranial cavity. Fontanelle is used as an indicator of raised intracranial pressure and also for dehydration in clinical practice. Infants and very young children who have open fontanelle and sutures, the Monro-Kellie Doctrine does not apply because the cranial vault can expand with increased volume⁷. Very few studies were found directly related to hydrocephalus and pattern of fontanelle. We are lacking any such study in our population.

In this study sex incidence showed more than double were male babies. 72.46 per cent were male and 27.54 per cent were female. The male to female ratio was 2.6:1. Preponderance of male babies may be due to more concern and more caring of our society for male babies. As it is a government run hospital based data, which reflects patients of lower socio-economic status. May be this social classes are more careful for their male babies with relative neglect to female one.

The study population has an age range from newborn to 12 months. The peak age of hydrocephalus in this study was 4 to 6 months age group. But most of 708 cases congenital hydrocephalus reported on by Ramamurthi in 1971 were between 9 months to 3 years of age.⁸ American Association of Neurological Surgeons mentioned that hydrocephalus can occur at any age but is most common in infants and adults age 60 or older⁹.

This study revealed that 97.10 per cent of hydrocephalic early childhood baby had open anterior fontanelle, 88.41 percent had apparent large head and 59.42 per cent had presence of sun set sign. As described by A K Goyal and S K Pandya the characteristic feature of hydrocephalus in infant is large size of head⁸.

Describing the sun set sign author mentioned that the eyeballs are rolled downward with supracorneal sclera becoming prominent producing "setting sun sign". The appearance is primarily due to weakness of upward gaze as the dilated suprapineal recess compresses the quadrigeminal plate.⁸ Analyzing the status of anterior fontanelle in this study showed 66.67 per cent had bulged fontanelle, 30.43 per cent had flat fontanelle. Tenseness and bulging of fontanelle is dependable parameter of hydrocephalus. Vidyasagar and Raju suggested a simple non-invasive technique for measuring intracranial pressure using fiber optic transducer placed over the fontanelle in the newborn¹⁰.

The causes of hydrocephalus also determines the pattern of enlargement, the expansion of supratentorial compartment with small posterior

fossa being characteristic of aqueduct stenosis and a ballooning of whole head with prominence of posterior fossa of the Dandy Walker Malformation⁸. This study showed 23.19 per cent had open posterior fontanelle and among them 15.94 per cent had bulged post fontanelle.

Conclusion:

Hydrocephalus is one of the common problems encountered by neurosurgeons in pediatrics population. In early childhood these patients can be easily evaluated by their external parameters and physical findings. Fontanelle is a reliable parameter to understand the internal status of hydrocephalus of patients in early childhood. This small scale study enlighten us with the idea that only parameters of fontanelle could be an ideal way to evaluate these patients when expensive imaging studies are beyond reach, moreover it is a good guide to have preliminary idea before going for imaging study. A large scale study is needed to establish this fact.

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