NORMAL VENTRICULAR SIZE AND VENTRICULO-HEMISPHERIC RATIO IN INFANTS UPTO 6 MONTHS OF AGE BY CRANIAL ULTRASONOGRAPHY

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ABSTRACT

Fifty cases each of preterm (>34 weeks), full term and one month to six months age (400 total) were subjected to cranial ultrasonography for determination of ventricular size and ventriculohemispheric ratio. Ventricular size steadily increased from 4.64±1.84 mm in preterm to 10.72±2.92 mm in six months old infant. Ventriculohemispheric ratio increased from 0.12±0.052 in preterm to 0.17±0.056 in three months of age. Then steady level was maintained at 0.17±0.064 upto six months of age.

Key words: *Cranial ultrasonography, lateral ventricle, Ventriculohemispheric ratio.*

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Enlargement of ventricular system in hydrocephalus results from an imbalance between production and absorption of cerebrospinal fluid(1). It is obvious that for early and precise diagnosis of hydrocephalus, knowledge of ventricular size for the age is mandatory. Various methods adopted to measure ventricular size include ventriculography, Computed Tomography Scan, Magnetic Resonance Imaging and Ultrasonography (USG). Due to availability of non-invasive procedures like USG, CT Scan and MRI Scan, ventriculography is not in use now(2). Considering the cost factor, USG is the preferred mode.

Static gray scale(3,4) and real time USG(3,5,6) provide means of measuring ventricular size directly and diagnosing hydrocephalus early and accurately. Ventricular size has been measured by USG for newborns by Johnson *et al.*(7) in trans axial plane; they also described ventriculocortical ratio which correlated with CT Scan. But studies showing the exact growth velocity of ventricles are scanty. The growth velocity of ventricular index in preterm has been reported through transfontanellar route(8). Till today, there are no data available for measurement of cerebral ventricular system other than lateral ventricle, as 3rd ventricle is not usually seen on coronal scan if it is normal and 4th ventricle is difficult to measure because of complicated shape and poor delineation on USG(9).

We undertook cross sectional study to establish the normal lateral ventricular size and ventriculohemispheric (V/H) ratio in the first 6 months of life through transfontanel approach.

Material and Methods

A cross sectional study for establishing ventricular size and V/H ratio was carried

out at Sheth K.M. School of Post Graduate Medicine and Research and affiliated hospitals, Ahmedabad. Four hundred cases were studied from neonatal period to 6 months of age. They were divided into 8 groups:

(i) *Group I:* Fifty preterm newborns of gestational age between 34-37 weeks assessed by last menstrual period and confirmed by Dubowitz Criteria(10).

(ii) *Group II:* Fifty full term newborns appropriate for date.

(iii) *Group III:* Fifty infants each in age group of one month, two, three, four, five and six months, respectively.

Infants with any perinatal insults, CNS problems, born to mother having medical or obstetric problems were excluded from the study. Ventricular size and ventriculohemispheric (V/H) ratio were calculated using a small transducer of 2.5 and 5 MHz frequency on Aloka USG machine with real time sector scanner (because 5 MHz probe was not available initially). Ventricular size was measured in mm from falx cerebri to maximum lateral width of lateral ventricle. Simultaneously, distance from falx cerebri to inner table of skull (hemispheric size) was measured and V/H ratio was calculated.

Results

In preterm newborns (>34 weeks) average size of ventricle was 4.64±1.86 mm. In full term newborns the size was 5.32±1.72 mm. The size of ventricle gradually increased as age advanced, *i.e.*, from 6.60±3.20 mm one month of age to 10.72±2.92 mm at six months of age (*Table I, Fig. 1*). Ventriculohemispheric (V/H) ratio in preterm neonates was 0.12±0.052 and for full term neonates it was 0.12±0.076. The ratio increased from 0.14±0.064 in one month old infant to 0.17±0.056 in three months old infants. A steady level at 0.17 was established from

TABLE I—*Values of Ventricular Size and V/H Ratio According to Age*

Group	Ventricular size (mm)	V/H ratio
	Mean ±2 SD	Mean ±2 SD
Pre term	4.64 ±1.86	0.12 ±0.052
Full term	5.32 ±3.12	0.12 ±0.076
One month	6.60 ±3.20	0.14 ±0.064
Two months	7.30 ±3.06	0.16 ±0.068
Three months	7.56 ±2.44	0.17 ±0.056
Four months	8.22 ±1.80	0.17 ±0.050
Five months	8.50 ±2.78	0.17 ±0.068
Six months	10.72 ±2.92	0.17 ±0.064

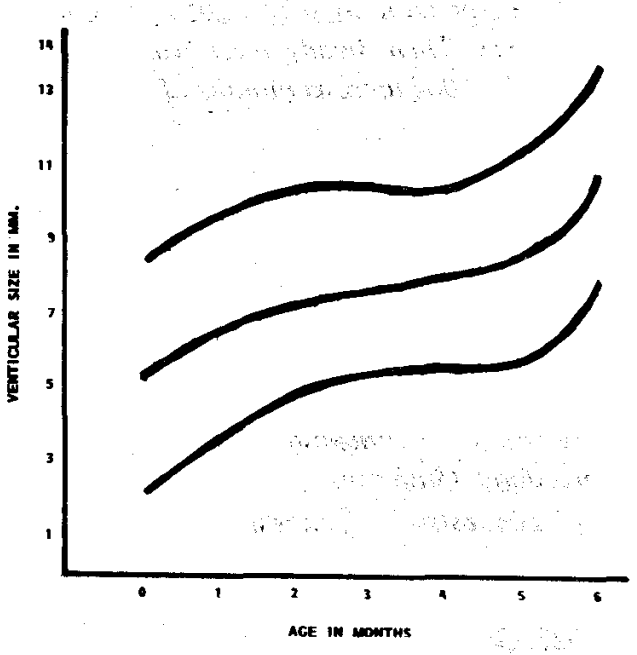

Fig. 1. Graph showing ventricular size with standard deviation according to age.

three months old infants to six months old infants (*Table I, Fig. 2*).

Discussion

In the present study the ventricular size in preterm was 4.64±1.86 mm which correlated with that reported by Levene *et al.*(8). In full term neonates size was 5.32±1.72 mm correlating with that earlier reported by Johnson *et al.*(7). The size of ventricle gradually increased from 6.60±3.20 mm at one month age to 10.72±2.92 mm at six months of age. Elie *et al.*(9) reported that by the end of 1st week of life rapid increase in ventricular size occurred probably in association with the increase in volume of CSF because of change from fetal low pressure to the neonatal high pressure circulatory state occuring during transitional period accompanied by changes in secretion and/or absorption of CSF. Sauerbrei *et al.*(11) reported that width of lateral ventricle averaged 8.6 mm between 25-35 weeks of gestational age with no variation as a function of gestational age, but Levene *et al.*(8) have reported growth velocity in preterm infants starting from 22nd weeks to 42 weeks of gestational age.

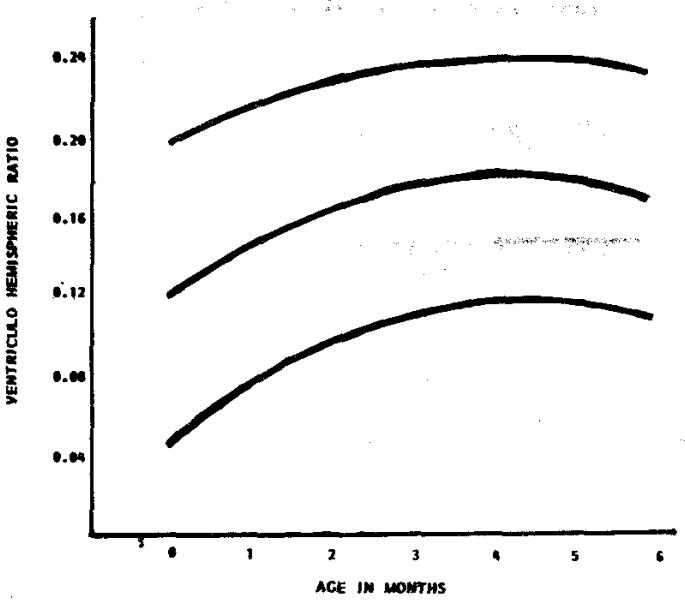

Fig. 2. Graph showing ventriculohemispheric ratio with standard deviation according to age.

In the present study the V/H ratio for preterm was 0.12±0.052 and for full term was 0.12±0.076. Levene *et al.*(8) reported ventricular index of 0.115 and 0.120 for preterm and full term respectively. Johnson *et al.*(7) reported ratio of 0.31 and 0.28 for preterm and full term neonates, respectively which was measured in transaxial plane. It has been suggested that ratio measured in transaxial plane is not proper because of variations in landmarks and difficulty in maintaining similarity in production of results in various babies. So now it has been suggested to use transfontanellar route for measurement of ventricular size(12).

In the past Evans ratio, frontal horn ratio, ventricular size index, Huckman number, cella media index(13,14) were used but because of inconvenience and lack of reproducibility preclude their usage and now a days direct measurement is recommended(12). Elie *et al.*(9) utilized same principle and measured area of lateral ventricle in preterm infants and correlated it with age and skull circumference.

Our data may provide a baseline measurement of ventricular size and V/H ratio for newborn to 6 months of age and may help in detecting an infant with hydrocephalus even at one sitting. Our data may also help in detecting cerebral atrophy due to any cause and may also be helpful in follow up of these patients. Similar studies for infants after 6 months age may be helpful in providing similar data and probably vertical study may provide useful data.

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