MEASUREMENT OF VENTRICULAR SIZE IN TERM AND PRETERM INFANTS

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ABSTRACT

Real time ultrasonography was done in neonates to establish the norms for ventricular size and to see if there is a correlation between ventricle size and gestational age. A total of 153 normal infants admitted to our nursery after September, 1989 were taken up for the study. First ultrasound was performed within six days of birth. Sonography was done with 3.5 MHz transducer through anterior and lateral fontanelle. Results revealed that there is a significant difference in the mean value of falx to lateral wall of the cortex, ventricular index and ratio (VI/FC) of preterm and term infants. The ventricular size of small for gestational age infants is significantly different from appropriate gestational age infant of corresponding gestational ages. The percentile chart of VI for Indian infants is comparable to that of western infants.

Key words: *Cranial Ultrasound, Ventricle size, Preterm and term neonates. Ventricular index, Evan's ratio.*

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Real time ultrasonography has revolutionized the diagnosis of intracranial pathology in neonates. Leksell was the first to use the ultrasound for ECHO encephalography(1). Jhonson *et al.* used 3.5 to 5 MHz, 13 mm transducers with a short or medium internal focus(2). Ultrasound offers the benefit of being noninvasive, portable and radiation free, can be done in uncooperative patients and is easily repeatable. It has been used widely to diagnose intraventricular hemorrhage, ventricular dilatation following intraventricular hemorrhage and ventriculitis, intracranial abscess, congenital cysts and a number of other clinical conditions. The incidence of IVH is 40% in infants delivered before 34 weeks of gestational age(3). Little work has been done on the size of normal lateral ventricle. Lombroso *et al.* gave normal values for third and lateral ventricles. He also compared ultrasound size with pneumoencephalogram size of lateral ventricle and found close correlation between the two(1). No organized work has been done in our country on this aspect. Therefore we decided to undertake this study with following aims:

(*a*) to find out ratio = $\frac{\text{falx to lateral wall of lateral ventricle (ventricular index, VI)}}{\text{falx to lateral wall (surface) of the cortex (FC)}}$

and (*b*) to compare ventricular index (VI) of Western infants and Indian infants.

Material and Methods

All infants admitted to our neonatal unit after September, 1989 were subjected to ultrasound screening. Those who had evidence of intracranial hemorrhage, meningitis with ventriculitis or hydrocephalus,

porencephalic cyst, meningomyelocele and microcephaly were excluded from the study. The gestational age of the newborns was calculated by Ballard's criteria. The gestational age, birth weight, occipitofrontal circumference and other details were recorded on computer in D base file.

A total of 153 normal infants who were admitted to our neonatal unit from September, 1989 were included in the study. Of these 116 were male and 37 were female. Out of these 101 infants were appropriate for gestational age (AGA) and 52 were small for gestational age (SGA). Sixty infants were preterm and 89 were term. The mean weight and head circumference of preterm infants were 1.6±0.4 kg and 29.6±2.05 cm, respectively. The mean weight and head circumference of term new borns were 2.3±.6 kg and 32.6±2.14 cm, respectively (*Table I*).

Aloka ultrasound scanner SSD-248 was used to visualize lateral ventricle in 153 infants. Scanning was performed with a 3.5 MHz transducer through lateral and anterior fontanelle. To measure size of the ventricle one or more reference points were used. Ventricular index (VI) and distance between falx to lateral wall of cortex (FC) were measured by placing transducer against the fairly flat temproparietal region of the infant at the level of a line joining the outer canthus of the eye and the helix of the ear. The transducer was kept parallel to this line and is moved upwards until the body of the lateral ventricle was seen most clearly. Two measurements were made at each examination and averaged. Ultrasound was done by one person only (JPS) so as to decrease the error of observation. For the purpose of comparison the cohort was grouped as below:

(*a*) Preterm and term infants.

(*b*) Preterm infants were further subdivided into 2 groups–one below 32 weeks and another between 33 to 37 weeks. AGA (appropriate for gestational age) and SGA (small for gestational age) were also compared within the groups.

Statistical analysis was done with Student 't' test to calculate value.

Results

Table I shows the basic anthropometric data of the cohort studied. The mean value of FC, VI and Evan's ratio (VI/FC) are significantly (p = 0.001) different for term and preterm infants (*Table II*). The mean value of FC, VI and Evan's ratio (VI/FC) are significantly (p = 0.001) different for term (>38 weeks) and preterms infant of

TABLE I–*Basic Anthropometry of Cohort*

Gestation (wk)	No.	Weight (mean±SD)	p value	HC (mean±SD)	p value
<37	64	1.63 ±0.40		29.64 ±2.05	
			0.001		<0.05
>38	89	2.30 ±0.60		32.60 ±2.14	

HC : Head circumference.

TABLE II—*Temporal View Parameters of the Cohort*

Gestation (wk)	No.	FC mean ± SD	p value	VI mean ± SD	P value	VI/FC ratio mean ± SD	p value
<37	64	2.29 ± 0.30	0.001	1.05 ± 0.10	0.001	0.32 ± 0.30	0.001
>38	89	3.62 ± 0.35		1.11 ± 0.08		0.3 ± 0.03	

At 99% of confidence limit (according to t test).

<32 weeks and those between 33-37 weeks (*Table III*). *Table IV* shows the mean value of FC, VI and Evans ratio (VI/FC) according to weight. These are significantly (p = 0.001) different for AGA and SGA infant of <32, >33-<37 and >38 weeks gestational age. There is no significant different in VI of Western and Indian infants (*Fig*).

TABLE III—*Temporal View Parameters of the Cohort*

Gestation (wk)	No.	FC mean + SD	p value	VI mean + SD	p value	VI/FC ratio mean + SD	p value
32	21	3.12 ± 0.29	0.001	1.02 ± 0.11	0.001	0.32 ± 0.03	
>33-<37	43	3.37 ± 0.28	0.001	1.06 ± 0.10	0.001	0.31 ± 0.03	0.001
>38	89	3.62 ± 0.35		1.11 ± 0.08		0.3 ± 0.03	

At 99% of confidence limit (according to t test).

TABLE IV—*Temporal View Parameters of the Cohort*

Gestation (wr)		No.	FC mean ± SD	p value	VI mean ± SD	p value	VI/FC ratio mean ± SD	p value
<32	AGA	19	3.16 ± 0.28	0.001	1.04 ± 0.10	0.001	0.33 ± 0.03	0.001
	SGA	2	2.8 ± 0.00		0.9 ± 0.14		0.32 ± 0.04	
>33-<37	AGA	29	3.4 ± 0.29	0.001	1.06 ± 0.09	0.001	0.31 ± 0.02	0.001
	SGA	14	3.3 ± 0.24		1.07 ± 0.08		0.32 ± 0.03	
≥38	AGA	52	3.82 ± 0.25	0.001	1.13 ± 0.08	0.001	0.29 ± 0.02	0.001
	SGA	37	3.35 ± 0.27		1.07 ± 0.07		0.32 ± 0.02	

At 99% of confidence limit (according to t test).

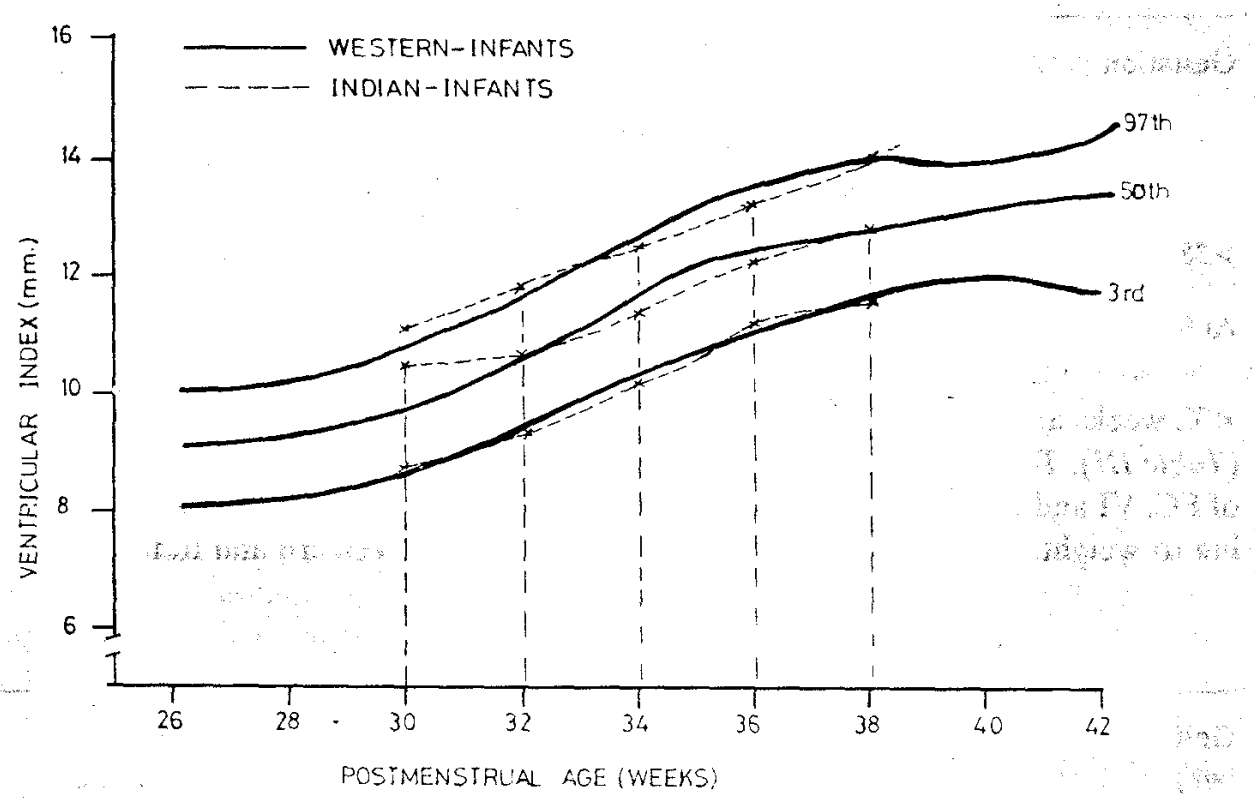

Fig. Comparison of ventricular index of Western and Indian infants.

Discussion

Lombroso *et al.* established the normal values for lateral ventricle, third ventricle, temporal horn and temporal region. Normal value of lateral ventricle according to them is 15-18 mm in newborns and infant upto 12 months. Similarly, normal values of temporal horn is 7-8 mm, temporal trigon 10-12 mm, and third ventricle 4-7 mm. He compared 2D ultrasound size with pneumoencephalogram size of ventricle and found a close correlation between the two(1). Two D (B Mode) echoencephalopgraphy provides better visualization of the lateral margin of the ventricle than CT scan. The large difference in acoustic impedance between brain and cerebrospinal fluid provides a sharp margin on ultrasound while partial volume effect causes some loss of margin of ventricle on CT scan(2). In our study the mean value of FC, VI and Evan's ratio (VI/FC) were 3.29±0.30 cm, 1.05±0.1 cm and 0.32±0.03 (32%±3%), respectively in preterm infants. The mean value of FC, VI and Evans ratio were 3.62±0.35 cm, 1.11±0.08 cm and 0.3±0.03 (30%±3%), respectively in term infants. Jhonson *et al.* also evaluated normal values of FC, VI and Evans ratio in preterm and term infants. The mean value of FC, VI and Evan's ratio were 3.9 cm (3.1 to 4.7), 1.1 cm (0.9 to 1.3 cm), and 0.24 to 0.34 (24 to 30%), respectively in term infants. The mean value of FC, VI and Evan's ratio were 3.1 cm (2.4 to 4.3 cms), 1 cm (0.5 to 1.3) and 0.3±0.03 (30%±3%) in preterm infants(2). Our values are comparable to the values given by Jhonson *et al.* To the best of our knowledge there is no such study in which ventricle size of AGA and SGA infants were compared at differ-

ent gestational ages. We found significant difference in the size of lateral ventricle of (FC, VI, Evans ratio) of AGA and SGA infant of <32, >33 to <37 and >38 weeks gestational age. In our study a cross sectional centile chart of VI shows the smooth 3rd, 50th and 97th centile for this measurement over gestational ages 30 to 38 week (*Fig.*). This is comparable to centile chart given by Levene(5).

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NOTES AND NEWS

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