Archives of Disease in Childhood, 1989, **64,** 730–744

Sonographic finding of ventricular asymmetry in neonatal brain

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SUMMARY One thousand normal Chinese full term neonates underwent prospective ultrasonography examination. Asymmetry of size between the right and left lateral ventricle was observed in a similar proportion of boys: 257/551 (47%) and girls: 183/449 (41%). The mode of delivery did not significantly influence the occurrence of ventricular asymmetry. We propose four different patterns of asymmetry.

It is widely accepted that the cerebral ventricles can be clearly shown by sector ultrasonography and ventricular dilatation can be easily recognised. Several authors have reported that a significant proportion of normal children or neonates had asymmetric lateral ventricles on pneumoencephalography or ultrasonography.[1-3]

Subjects and methods

During a period of 10 months from March to December 1984, 1000 of 3472 (29%) consecutively delivered neonates in this hospital were scanned by sector sonogram after obtaining informed consent from parents. There were 551 boys and 449 girls who ranged from 35 to 43 weeks' gestation. Their birth weight ranged from 2200 to 4650 g with a head circumference ranging from 30·5 to 38·5 cm. A total of 598 infants were born by normal spontaneous delivery; 160 by vacuum extraction; 30 by forceps; and 212 by caesarean section.

The neonates were examined at the bedside from 2 to 5 days of age with a portable, real time sector sonograph (Aloka SSD-720) with a frequency of 5 MHz and visual field of 80°. Coronal and sagittal views of the brain were obtained by placing the transducer over the anterior fontanelle. The coronal plane at the level of foramen of Monro was selected and ventricular width was recorded at the widest distance perpendicular to the long axis of the lateral ventricle. Angled sagittal planes in both hemispheres parallel to the midsagittal section at the level of the widest occipital horn were chosen and the distance from tip of the occipital horn to the most lateral part of thalamus was recorded as occipital horn size. The size of ventricular body was measured as the distance on the line perpendicular to the longitudinal axis of the lateral ventricle at its midpoint (figure). Data from the sagittal planes, where the ventricular body and occipital horn can be well defined, were collected for the present analysis. Asymmetry of ventricles was defined as more than 2 mm in difference in size.

Results

Overall, 257 (47%) of the 551 boys and 183 (41%) of the 449 girls had ventricular asymmetry. There was no significant difference in the frequency of ventricular asymmetry between the neonates born vaginally and those delivered by caesarean section ($\chi^2=0{\cdot}66$, $p>0{\cdot}05$). A total of 332 subject were scanned on the second day of life and 145 (44%) of them had ventricular asymmetry. The corresponding results for the group scanned on the third day were 153 (42%) out of 366; fourth day, 72 (47%) out of 153; and fifth day, 70 (47%) out of 149. All infants were healthy at discharge, and none had periventricular haemorrhage or other lesions detected on ultrasonography.

We observed different patterns of ventricular appearance (figure). Type 1, symmetric ventricles (boys 53%, girls 59%); type 2, wider ventricular body in one ventricle (boys 9%, girls 5%); type 3, longer occipital horn in one ventricle (boys 33%, girls 30%); type 4, both wider ventricular body and longer occipital horn in one ventricle (boys 3%, girls 3%); and type 5, either wider ventricular body with shorter occipital horn in one ventricle or vice versa (boys 2%, girls 3%). Our results are summarised in the table, which also indicates the side (left or right) in which ventricular prominence was observed.

The most common finding of ventricular difference was asymmetry of the occipital horn. A total of 249 cases (25%) (type 3, 4, and 5) showed a prominent right occipital horn, and 119 cases (12%) showed a prominent left occipital horn. In contrast, the right ventricular body was larger in 33 cases (3%) (type 2, 4, and 5), and a larger left ventricular body was noted in 91 cases (9%).

Out of a total of 440 babies with ventricular asymmetry, 428 (97%) had differences in measured

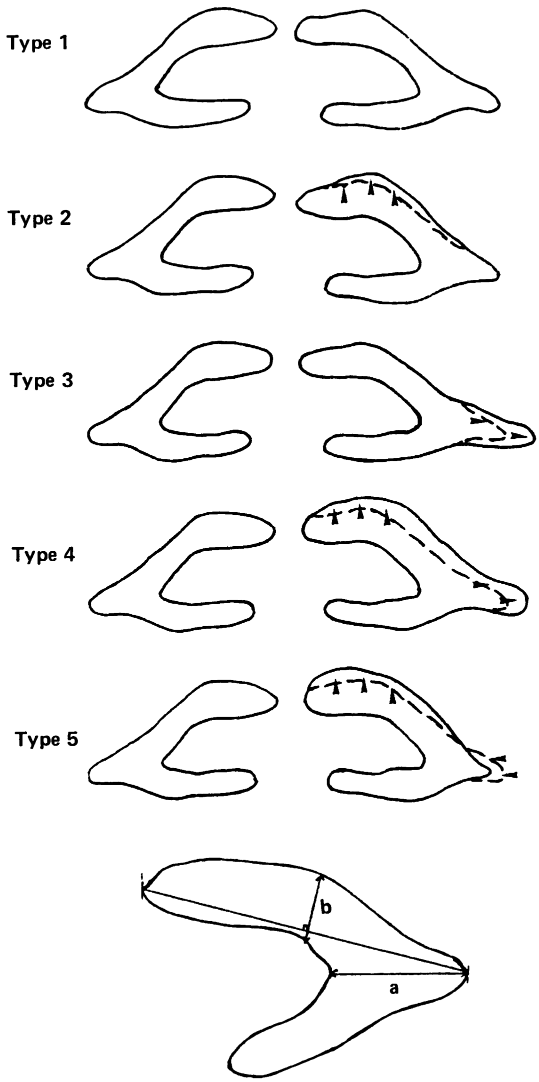

Figure *Size relationship between the lateral ventricles in the sagittal plane. Type 1, symmetric ventricles. Type 2, wider ventricular body in one ventricle. Type 3, longer occipital horn in one vehicle. Type 4, wider ventricular body and longer occipital horn. Type 5, wider ventricular body but shorter occipital horn in one ventricle or vice versa. a=Occipital horn size, b=ventricular body size.*

indices of between 2 and 5 mm, 10 (2%) had differences between 5 and 8 mm, and only two babies (<1%) had greater than 8 mm difference (9 mm and 10 mm respectively). Both these infants had asymmetry of the occipital horn.

Table *Distribution of ventricular asymmetry in normal neonates (n=1000)*

	No (%) of infants	*Group with right > left*	*Group with left > right*
	Boys		
Type 1	294 (53)	—	—
2	49 (9)	13	36
3	180 (33)	123	57
4	15 (3)	5	10
5	13 (2)	2*	11†
Total	551 (100)	143	114
	Girls		
Type 1	266 (59)	—	—
2	23 (5)	6	17
3	136 (30)	94	42
4	11 (3)	5	6
5	13 (3)	2*	11†
Total	449 (100)	107	76

*Wider ventricular body but shorter occipital horn on right ventricle.
†Wider ventricular body but shorter occipital horn on left ventricle.

Discussion

The human brain is unique in the functional asymmetry that exists between its two cerebral hemispheres.[4] Anatomical studies have also shown that hemispheric asymmetry is especially found in several distinct areas.[4 5] The prevalence of ventricular asymmetry in the healthy neonates varied from 16·9% to 37·9% on neurosonography,[1 2] and occipital horn asymmetry in children was noted to be 56% by pneumoencephalography.[3] Clinicians should therefore note that ventricular asymmetry exists in the normal population and is not necessarily a pathological entity.

This study showed 47% of boys and 41% of girls with different types of ventricular asymmetry in the sagittal plane. The figures presented here may serve as a reference for further anatomical study of the brain but do not reflect the true ventricular contours. In five neonates we observed the apparently anomalous combination of a relatively small ventricular body in the sagittal plane without an increased ventricular width in the coronal plane (or the reverse). This indicates that some healthy neonates may have distorted ventricles or 'compressed lateral ventricles'.[3] A three dimensional study of the ventricles warrants further investigation with newer imaging techniques.

Among the 440 neonates with asymmetric ventricles, 341 were delivered vaginally and 99 were born by caesarean section. There was no significant difference between the mode of delivery or the age of the babies at scanning and the incidence of ventricular asymmetry. Asymmetry of brain has been found in all age groups from the fetus to the adult.[4 6] We believe that asymmetry of the lateral ventricles and probably that of the brain is influenced by genetic factors or environmental events that occur during the growth of the brain and not by the pressure effect through the birth canal.

In summary, we report four types of ventricular asymmetry based on the sonographic findings of 1000 normal Chinese neonates. Although our figures do not reflect the true ventricular contours, these findings may have some value for future studies of the neonatal brain.

The authors thank Miss Chiu-Hsiang Hsu for typing the manuscript.

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Accepted 24 November 1988

Plasma vitamin K_1 concentrations in cystic fibrosis

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SUMMARY Plasma concentrations of vitamin K_1 were similar in 37 patients with cystic fibrosis (median 46 ng/l) and 16 controls (49 ng/l). The plasma concentrations were lower than those previously described in adults, but higher than in neonates. There was no association between an increase in prothrombin time and vitamin K_1 plasma concentration.

Children with cystic fibrosis suffer from malabsorption and are, therefore, prone to deficiencies of fat soluble vitamins. Clinical problems secondary to vitamin K deficiency, however, are rare in cystic fibrosis.[1] Komp and Selden reviewed 59 patients and found only four with an increased prothrombin time and possible vitamin K deficiency.[2] A subsequent study, however, measuring factor II antigen and activity suggested that vitamin K_1 deficiency is common in cystic fibrosis.[3]

The measurement of vitamin K_1 is technically difficult and there are no data on plasma concentrations in children. We therefore decided to measure plasma concentrations of vitamin K_1 in children with cystic fibrosis and also a group of control children.

Patients and methods

Blood samples (5 ml) were collected from 37 patients (28 fasting) with cystic fibrosis (mean age 10·6 years, range 2–23 years) and 16 children (controls, all non-fasting) who were having venepunctures at the general outpatients' clinic (mean age 7·6 years, range 3–14 years). The children with cystic fibrosis were attending the Regional Centre at St James's University Hospital where routine annual assessment included the measurement of plasma concentrations of vitamins A and E, faecal fats, liver function tests, and prothrombin time. Plasma concentrations of vitamin K_1 were measured by high performance liquid chromatography coupled to dual cell electrochemical detection.[4] The limit of sensitivity for the assay was 4 ng/l. Statistical anlysis was by Spearman's rank correlation and the Mann-Whitney U Test.

Ethical approval was obtained from the local ethics committee.

Results

The individual plasma concentrations of vitamin K_1 are shown in the figure. Nine children (two controls)