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Planar measurements of foetal lateral ventricles

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To compare the linear dimensions (width) of the foetal atrium and occipital horns to their areas, 31 foetuses (15–24 weeks, C-R 12.5–23.5 mm) from spontaneous abortions were evaluated. Images of the axial sections of the brains were transferred to computer and Scion for Windows 98 software was used for image analysis.
11 brains appeared normal and 20 were abnormal (leukomalacia in 9 cases, periventricular and intraventricular haemorrhage in 6 cases, ventriculomegaly in 3 cases, colpocephaly in 1 case, vascular malformation in 1 case). High-range linear and planar asymmetries in the atrium and occipital horns were observed both in normal and abnormal brains. There was no close correlation between the width and the area of the structures under investigation, although it was stronger in case of the occipital horns. The wider occipital horns and atria often had a smaller area than the narrower ones. Some abnormal cerebral hemispheres had relatively narrow atria and occipital horns in comparison with their large areas.
Further investigation should be carried out to assess the utility and potential superiority of planar measurements over linear in the image diagnosis of foetal ventricles.

key words: foetal lateral ventricles, ventriculomegaly, planar measurements

INTRODUCTION

The cerebral ventricular system arises from cerebral vesicles. At the early stage of cerebral development the wide cerebral ventricles are surrounded by thin nervous tissue (physiological hydrocephalus). The ultimate shape of the lateral ventricles is formed by the rapidly-growing neocortex under pressure from hemispherical rotation [5]. The cerebral hemispheres arch backward and outward (like rams horns) in their early stage of development. The frontal horns occur first and next the temporal and finally the occipital horns are formed [4]. The foetal ventricular system is relatively dilated into the 4th gestational month. After this, the formation of the 4th ventricular outlet, the foramina of Magendie and Luschka, permit the exit and circulation of the cerebrospinal fluid [6]. The width of the lateral ventricular atrium does not vary substantially in size during foetal development and thus becomes a stable marker for the identification of foetal hydrocephalus [3].

The purpose of this study was to evaluate a potential clinical application of ventricular planar analysis in the foetal period. Because of the frequent asymmetry and irregularity of the foetal ventricular contours, we investigated the correlation between the width of the atrium and the occipital horns and their areas.

No data concerning planar analysis of the foetal ventricles are available.

MATERIAL AND METHODS

After obtaining the consent of the Biomedical Ethics Committee, 31 foetuses from spontaneous

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abortions from 15 to 24 gestational weeks (C-R length 12.5–23.5 cm) were collected. The foetuses were stored in 10% formaldehyde solution for 4–8 weeks. Axial sections of the brains were performed. The images of the brains were recorded and transferred to computer.

Scion for Windows 98 software was used for image analysis. Linear measurements of the atria and width of the occipital were taken. The axial sections with the widest atria and occipital horns were chosen for measurement. The planar measurements were taken automatically, after drawing the contours and setting up the scale.

RESULTS

We examined 31 foetal brains, among which 20 were abnormal. There were 9 cases of leucomalacia, 6 cases of peri and inraventricular haemorrhage, 3 cases of ventriculomegaly, 1 case of colpocephaly and 1 case of vascular malformation.

11 foetal brains had no visible abnormality. Among both the normal and abnormal brains we observed asymmetry and a wide variety of lateral ventricle shapes, except for the frontal horns, which were slit-like or coarctated on the axial sections of normal brains. The ventricular atria had triangular contours at the axial sections (ventricular triangles). Both groups of foetuses had variable ventricular triangle width, height and angles. The occipital horns were usually elongated in shape, resembling cucumbers. There was no close correlation between the width and area of the ventricular triangles, although abnormal brains with wide atria (over 10 mm) had significantly greater areas then normal ones (Fig. 1). In 1 case the atria had a width of 8 mm but their areas were comparable to brains with ventriculomegaly. The correlation between the width of the occipital horns and their area was stronger then observed in the atria (Fig. 2). There was asymmetry of the occipital lobes in 1 case of a normal-looking brain, with the area of the larger horn comparable to that of the abnormal brains. In 2 cases of cerebral haemorrhage we observed discrepancies between large areas of the occipital lobes and their normal width range.

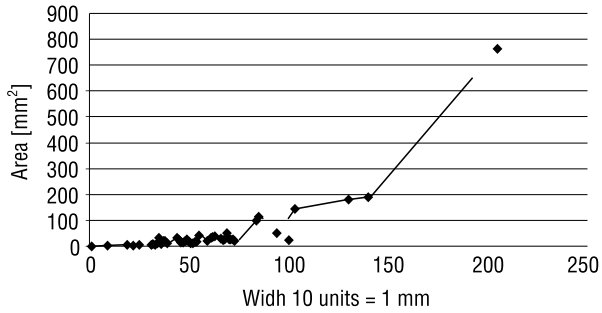

Figure 1. Correlation between width and area of left occipital horns.

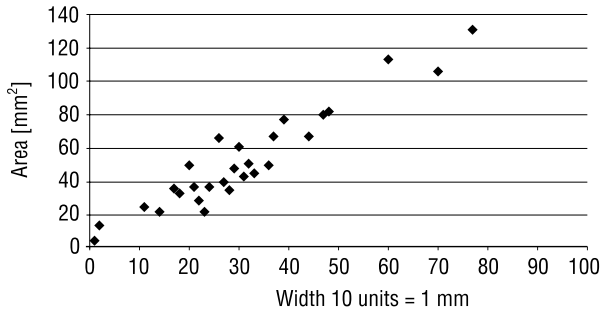

Figure 2. Trend graph between width and area of ventricular atria.

DISCUSSION

The currently accepted upper limit for ventricular width is 10 mm. Ventriculomegaly is associated with many CNS abnormalities. However, certain anomalies, such as agenesis of the corpus callosum, are often not associated with ventriculomegaly but cause an abnormal shape of the lateral ventricles [2]. A recent MRI study shows the important role played by cerebral ventricular morphology assessment [7]. Asymmetry of the cerebral ventricles has been reported both in normal and abnormal foetuses. Serial follow-up examinations are needed to ensure stability and resolution of the finding. Whenever progression is manifested, ventriculomegaly is indicated [1].

The foetal brains investigated had been stored for 4–8 weeks in 10% formaldehyde and no significant shrinkage artifacts were observed. At first we attempted a volumetric analysis of the lateral ventricles but unfortunately we were not able to obtain thin parallel sections of the fragile foetal brains. The material investigated confirms the wide range of asymmetries of the lateral ventricles both in normal and abnormal foetal brains. We have not found any close correlation between the width and the area of the objects investigated.

In some cases planar measurements of lateral ventricles were more sensitive in detecting pathology. Our preliminary data suggest the clinical utility of the planar measurement of lateral ventricles

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