View metadata, citation and similar papers at core.ac.uk
brought to you by CORE
provided by Via Medica Journals

VIA MEDICA

SHORT COMMUNICATION

Vol. 63, No. 2, pp. 241–243
Copyright © 2004 Via Medica
ISSN 0015–5659
www.fm.viamedica.pl

An evaluation of the size of the fourth ventricle in human foetuses

Elżbieta Błaszczyk

Department of Human Anatomy, Medical University, Wrocław, Poland

[Received 1 August 2003; Revised 10 December 2003; Accepted 16 December 2003]

The aim of the study was metric analysis of the fourth ventricle in human foetuses. The study was performed on 117 foetuses aged 4–7 months. The area and four dimensions of the fourth ventricle were obtained and the results analysed statistically. The features of the fourth ventricle studied correlate with foetal age to different degrees. The correlation coefficient is greatest for the upper part of the roof.

Key words: measurement, rhomboid fossa, roof of the fourth ventricle

INTRODUCTION

Ventricular dilatation may be caused by different congenital abnormalities and may be associated with different malformations of the posterior fossa [3, 4]. Modern prenatal diagnosis enables the growth of anatomical structures to be monitored. It is also possible to evaluate foetal maturity and gestational age and to reveal early abnormalities [1, 2]. The aim of this study was to determine the measurement of the fourth ventricle.

MATERIAL AND METHODS

A cross-sectional study was undertaken on 117 normal foetuses aged 4–7 months. The collection of foetuses belongs to the Department of Descriptive Anatomy of the Medical University, Wrocław. A computer-aided system of image processing was used to obtain measurements for the midsagittal sections of the foetal skulls. Four points were determined: the higher and lower points of the rhomboid fossa, the point between the pontine and medullar sections of the rhomboid fossa and the fastigium. Each point was mathematically defined by two co-ordinates (x, y). These points form a polygon. There is a simple relation between the area of this figure and the co-ordinates of these points expressed by the following formula:

$$A = \tfrac{1}{2} \sum_{k=1}^{n} (y_{k+1} + y_k)(x_{k+1} - \times_k)$$

The four dimensions were obtained on the basis of these points, the length of the pontine part and the length of the medullar part of the rhomboid fossa together with the length of the upper part and the length of the lower part of the roof of the fourth ventricle. Mean values (x), standard deviation (SD), ranges, median, confidence interval ± 95% and correlation coefficient (r) were then calculated for the features of the fourth ventricle under examination and the equation of regression (l) was defined for all the parameters in relation to gestational age (GA).

RESULTS AND DISCUSSION

Tables 1–5 show the values of the statistical characteristics of the features studied of the fourth ventricle according to groups composed of 4, 5, 6 and 7-month-old foetuses. The relations between each parameter and gestational age were determined as the regression equations and the correlation coefficient.

The relations observed between all the studied parameters of the structure and gestational ages are linear and positive. The features of the fourth ventricle that were related variously to foetal age, the upper part of the roof having the strongest

Address for correspondence: Elżbieta Błaszczyk, Department of Human Anatomy, Medical University, ul. Chałubińskiego 6a, 50–367 Wrocław, Poland, tel: +48 71 784 13 38, fax: +48 71 784 00 79

Table 1. The statistical characteristics of the length of the pontine part of rhomboid fossa [mm]

Age	Number	Mean	–95%	+95%	Median	Min.	Max.	SD
4 month	19	2.31	2.03	2.59	2.29	1.15	3.27	0.58
5 month	24	2.75	2.48	3.02	2.73	1.75	4.22	0.63
6 month	25	3.69	3.15	4.23	3.75	1.52	8.32	1.31
7 month	31	4.21	3.78	4.64	4.18	1.93	6.40	1.17

$I_1 = 2.1691 + 0.02089 \times GA$; $r = 0.39249$

Table 2. The statistical characteristics of the length of the medullar part of the rhomboid fossa [mm]

Age	Number	Mean	–95%	+95%	Median	Min.	Max.	SD
4 month	19	3.59	3.25	3.92	3.73	2.06	4.86	0.70
5 month	24	4.84	4.35	5.33	4.90	2.61	7.14	1.16
6 month	25	7.26	6.75	7.77	7.34	5.40	9.44	1.23
7 month	31	7.49	6.80	8.18	7.87	1.32	11.10	1.89

$I_2 = 0.49614 + 0.06110 \times GA$; $r = 0.63965$

Table 3. The statistical characteristics of the length of the upper part of roof of the fourth ventricle [mm]

Age	Number	Mean	–95%	+95%	Median	Min.	Max.	SD
4 month	19	2.59	2.30	2.88	2.55	1.53	4.07	0.60
5 month	24	3.80	3.42	4.17	3.81	2.15	5.72	0.89
6 month	26	5.73	5.18	6.28	5.55	2.81	10.20	1.36
7 month	30	6.39	5.89	6.88	6.31	3.70	9.33	1.32

$I_3 = -1.456 + 0.06152 \times GA$; $r = 0.75391$

Table 4. The statistical characteristics of the length of the lower part of roof of fourth ventricle [mm]

Age	Number	Mean	–95%	+95%	Median	Min.	Max.	SD
4 month	19	3.87	3.42	4.32	3.95	2.31	5.27	0.93
5 month	24	4.61	4.16	5.07	4.54	2.49	6.83	1.08
6 month	25	6.00	5.50	6.50	5.93	4.00	7.76	1.23
7 month	30	6.31	5.63	6.99	6.13	1.87	9.07	1.83

$I_4 = 2.8824 + 0.03727 \times GA$; $r = 0.44785$

Table 5. The statistical characteristics of the area (A) of the fourth ventricle [mm^2]

Age	Number	Mean	–95%	+95%	Median	Min.	Max.	SD
4 month	19	6.44	5.64	7.25	6.35	3.19	9.74	1.67
5 month	24	9.13	7.90	10.4	8.31	4.67	15.4	2.92
6 month	25	14.08	11.67	16.50	12.85	1.25	29.24	5.85
7 month	31	18.05	14.77	21.33	16.04	3.33	39.04	8.79

$I_A = -0.2350 + 0.21333 \times GA$; $r = 0.44077$

correlation (r = 0.75), while the lower part of roof, the area of the fourth ventricle and the pontine part of the rhomboid fossa correlated weakly with gestational age (r = 0. 45, 0.44, 0.39). The normal values obtained in this study could be useful for evaluating the size of the fourth ventricle in the prenatal period.

The anatomy of the posterior fossa can be revealed adequately by prenatal sonography and prenatal ultrafast MR images [8]. Measurements of the posterior fossa structures were performed at different periods of human life [5–7].

REFERENCES

1. Abramowicz JS, Jaffe R (1996) Ultrasound detection of fetal abnormalities. Pediatric Ann, 25: 228–238.
2. Bieganowska-Klamut Z, Kostrzewa M, Wieczorek P, Dybiec E (1995) Ultrasonografia i tomografia komputerowa w diagnostyce wrodzonych malformacji tylnej jamy czaszki, opis dwóch przypadków. Ultrason Pol, 5 (2): 61–66.
3. Chapman PH, Swearingen B, Caviness V (1989) Subtorcular occipital encephaloceles. Anatomical considerations relevant to operative management. J Neurosurg, 71: 375–381.
4. Fenstermaker R, Roessmann U, Rekate HL (1984) Fourth ventriculoceles with extracranial extension. J Neurosurg, 61: 348–350.
5. Ichiyama T, Hayashi T (1991) Ultrasonic measurements of the posterior cranial fossa structures in neonates and infant. Eur J Pediatr, 150: 719–721.
6. Kushnir U, Shalev J, Bronstein M, Bider D, Lipitz S, Nebel L, Mashiach S, Ben-Rafael Z (1989) Fetal intracranial anatomy in the first trimester of pregnancy: transvaginal ultrasonographic evaluation, Neuroradiology, 31: 222–225.
7. Niemann K, van den Boom R, Haeselbarth K, Afshar F (1999) A brainstem stereotactic atlas in a three-dimensional magnetic resonance imaging navigation system: first experiences with atlas-to-patien registration. J Neurosurg, 90: 891–901.
8. Stazzone MM, Hubbard AM, Bilaniuk LT, Harty MP, Meyer JS, Zimmerman RA, Mahboubi S (2000) Ultrafast MR imaging of the normal posterior fossa in fetuses. Am J Roentgenol, 175 (3): 835–839.