

EVALUATION OF CEREBROSPINAL FLUID SYSTEM OF THE BRAIN IN HEALTHY CHILDREN UP TO ONE YEAR OLD BY USING OF NEUROSONOGRAPHY

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Neurosonography NSG is one of the most widespread methods for diagnostic of cerebral disorders in young age children. This method is noninvasive, not inexpensive, does not have any complications and therefore is available in most hospitals, it does not require a special preparation of the child before the study and maintenance of anesthesia. The aim of the study was to evaluate the CSF system of the brain of healthy children up to 1 year old and to develop regional indicators for Chernivtsy region. The study involved 67 healthy children up to 1 year old (30 boys and 37 girls) who underwent a complex examination on the base of consultative and diagnostic department of the Chernivtsy Regional Children's Hospital in 2012 year. All patients were full-term children. NSG performed by using the ultrasound diagnostic system DS-6 «Mindray» with convex (2,5-3,5-5,0 MHz) and linear (5,0-7,5-10,0 MHz) sensors. Sonographic parameters of ventricular system of children up to 1 year old, living in Chernivtsy region, were analyzed by standard statistical methods. The width of the anterior horn of the left and right lateral ventricles in all children was the same. The height of the body of lateral ventricles and the third ventricle measured in both sexes were not significantly different. The large tank was measured by the standard method and its size does not exceed 5 mm in all patients, what is considered normal. Have been elaborated regional indicators of neurosonography (NSG) for cerebrospinal fluid (CSF) system of the brain in children up to 1 year old, living in Chernivtsy region. Significant differences of ventricular system indicators of the brain in children up to 1 year old have not been identified, also there was no sex differences observed among them. Have been estimated percentile marks for individual indicators of CSF system that can serve as the standard for specific region and can be used in NSG examination.

Key words: neurosonography, children, cerebrospinal fluid system.

Introduction. NSG is one of the most widespread methods for diagnostic of cerebral disorders in young age children. This method is noninvasive, not inexpensive, does not have any complications and therefore is available in most hospitals, it does not require a special preparation of the child before the study and maintenance of anesthesia (Гаврюшов В.В., Зубарева Е.А. и др., 1990; Lai F.F., Tsou K.Y., 1990). Despite the fact that NSG relates to screening methods of diagnostic, spectrum of pathological cerebral disorders founded by it is not different compared with those obtained by using magnetic resonance (MRI) and computer tomography (CT) (Озерова О.Е., Буркова А.С., и др., 1998; Latchaw R.E., Truwit C.E., 1995). NSG has been successfully used for the diagnostic of urgent states and during dynamic observation of children with perinatal brain damage (PBD) (Озерова О.Е., Кудашов Н.И. и др., 2000; Perlman J.M., 1998). Prospective direction of NSG application is searching of predictors for early forecasting of abnormalities in neuro-psychological development (NPD) of children (Мазурин А.В., Воронцов И.М., 2001; Inder T.E., Anderson N.J. et

al., 2003; Maalouf E.F., Duggan P.J. et al., 2001). Therefore, it is important to develop standard regional neurosonographical indicators of the CSF system of the brain in conditions of the norm.

The aim of the study was to evaluate the CSF system of the brain of healthy children up to 1 year old and to develop regional indicators for Chernivtsy region.

Materials and Methods. The study involved 67 healthy children up to 1 year old (30 boys and 37 girls) who underwent a complex examination on the base of consultative and diagnostic department of the Chernivtsy Regional Children's Hospital in 2012 year. All patients were full-term children. NSG performed by using the ultrasound diagnostic system DS-6 «Mindray» with convex (2,5-3,5-5,0 MHz) and linear (5,0-7,5-10,0 MHz) sensors.

NSG performed through the anterior fontanel in frontal (coronary), sagittal and parasagittal planes. Herewith the state of the CSL system (lateral and the third ventricle, large tank, subarachnoid space) was evaluated.

Results and Discussion. Sonographic parameters of ventricular system of children up to 1 year old,

living in Chernivtsy region, were analyzed by standard statistical methods. The width of the anterior horn of the left and right lateral ventricles in all children was the same. The height of the body of lateral ventricles and the third ventricle measured in both sexes were not significantly different. The large tank was measured by the standard method and its size does not exceed 5 mm in all patients, what is considered normal.

According to E.A. Zubareva, E.A. Ulezko (2004) the most stable sizes have the anterior horn (1-2 mm) and the body of lateral ventricle (width not exceeding 4 mm). The front corners are measured in the coronary plane in cut through the front of horns of lateral ventricles, the body – in cut through the body of lateral ventricles. Posterior horn is often asymmetric, variable by depth and size. The third ventricle is measured in coronary plane in cut through interventricular holes and has 2-4 mm.

Percentile indicators are using for evaluation of ventricular system parameters. Median – is an average value of this indicator, min – is corresponding to the 5th percentile, and max – to the 95th percentile (Table 1).

As the table shows the width of the anterior horn and the height of the lateral ventricle of the body, the width of the third ventricle and the large tank sizes

are not significantly different in both sexes. Also were not founded significant differences between indicators of CSF system in children depending on age.

Estimation of the fourth ventricle size is difficult, so attention is paying to its shape and structure, which can vary significantly in the presence of brain abnormalities.

On coronal sections in the middle is located the interhemispheric fissure as a vertical echogenic strip that separates hemispheres. With its expansion, in the center is visible signal from the brain crescent that is not visualized separately in normal conditions. The width of the interhemispheric fissure between the gyruces is normally not more that 3-4 mm. At the same cut is comfortably to measure the size of subarachnoidal space – between the lateral wall of the upper sagittal sinus and the nearest gyrus (sinocortical width). Normal size of subarachnoidal space in full-term children is up to 3 mm.

A large tank is located under the cerebellum and medulla oblongata on the occipital bone, normally its size on sagittal section is less than 5 mm.

Percentile indicators, used for evaluation of parameters of individual indicators of CSF system are present in table 2.

Table 1

Standard size of the brain ventricles in children up to 1 year old living in Chernivtsy region

Structure	Value	Male (mm)	Female (mm)
The width of the anterior horn of the left lateral ventricle	Min	1,0	1,0
	Median	2,86±0,02	2,94±0,02
	Max	5,0	5,0
The width of the anterior horn of the right lateral ventricle	Min	1,0	1,0
	Median	2,86±0,02	2,94±0,02
	Max	5,0	5,0
The height of the body of lateral ventricle	Min	1,0	1,0
	Median	2,31±0,02	2,56±0,03
	Max	4,0	4,0
The width of the third ventricle	Min	2,0	2,0
	Median	2,86±0,02	2,94±0,02
	Max	5,0	5,0

Table 2

Standard size of cerebrospinal fluid system in children up to 1 year old living in Chernivtsy region

Structure	Value	Male (mm)	Female (mm)
Subarachnoidal space	Min	0	0
	Median	0,61±0,01	0,54±0,02
	Max	3	3
The width of the interhemispheric fissure	Min	1	1
	Median	2,2 ± 0,01	2,2 ± 0,02
	Max	4,5	4
The large tank	Min	2,0	2,0
	Median	2,83±0,01	3,16±0,01
	Max	4,0	4,0

As the table shows subarachnoidal space size, the width of the interhemispheric fissure and the large tank size were not significantly different in both sexes.

Conclusions. Thus significant differences in sizes of individual indicators of CSF system and between sexes were not found. Percentile indexes for individual indicators of CSF system in children up to 1 year old, living in Chernivtsy region, which may become standard for specific region and can be used in NSG examination, were estimated.

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ОЦІНКА ЛІКВОРНОЇ СИСТЕМИ ГОЛОВНОГО МОЗКУ У ЗДОРОВИХ ДІТЕЙ ДО ОДНОГО РОКУ ЗА ДОПОМОГОЮ НЕЙРОСОНОГРАФІЇ

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Нейросонографія (НСГ) — це один із найпоширеніших методів для діагностики захворювань головного мозку в дітей раннього віку. Цей метод неінвазивний, недорогий, не має ускладнень та протипоказів, не вимагає спеціальної підготовки дитини до дослідження та анестезії. Метою дослідження було оцінити за допомогою НСГ лікворну систему головного мозку здорових дітей віком до 1 року і розробити регіональні показники для Чернівецької області. Досліджено 67 здорових дітей віком до 1 року (30 хлопчиків і 37 дівчаток), які пройшли комплексне обстеження на базі консультативно-діагностичної відділу лікарні Чернівецької обласної дитячої в 2012 році. Усі пацієнти були доношеними. НСГ здійснювалося за допомогою ультразвукової діагностичної системи DS-6 «Mindray» з конвексним (2,5-3,5-5,0 МГц) і лінійним (5,0-7,5-10,0 МГц) датчиками. Сонографічні параметри шлуночкової системи дітей до 1 року, які проживають у Чернівецькій області, були проаналізовані за допомогою стандартних статистичних методів. Ширина переднього рога лівого і правого бічних шлуночків у всіх дітей була однаковою. Висота тіла бічних шлуночків і третього шлуночка, виміряної у обох статей суттєво не відрізнялися. Велику цистерну вимірювали стандартним методом, а її розміри не перевищували 5 мм у всіх пацієнтів, що вважається нормою. Були розроблені регіональні показники нейросонографії для лікворної системи мозку в дітей до одного року, які мешкають у Чернівецькій області. Значних відмінностей у показниках у дітей до одного року не виявлено, також не виявлено гендерних відмінностей. Розраховано процентильні значення для окремих показників лікворної системи, які можуть слугувати нормами для даного регіону і використовуватися при НСГ.

Ключові слова: нейросонографія, діти, лікворна система.

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