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CEPHALOHAEMATOMA – POSSIBLE PERINATAL NEURORISK FACTOR

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Original paper

Key words: cephalohaematoma, newborn, birth injuries, perinatal brain damage, neonatal brain ultrasound

Sažetak. Cephalohaematoma is a collection of blood, between the skull bone and periosteum, which according to clinical presentation, could be admitted to perinatal risk factors. The ***aim*** of this paper is to present the most common brain ultrasound (US) change in infants with cephalohaematoma, and assess eventual neurorisk in examined population. ***Methods.*** We retrospectively analyzed the US brain changes in healthy term infants with cephalohaematoma, additionally to anamnesis and other clinical risk factors. We analyzed 2970 participants during one calendar year in the maternity ward of our institution. ***Results***. The frequency of cephalohaematoma is 1.55%. The average birth weight was 3443.26±412.41 g, length 49.69±1.57 cm and head circumference 35.22±0.62 cm. We did not observe any other birth trauma, congenital anomalies, coagulation disorders, or neurological deviations. Normal brain US observed in 67.39% of the respondents. Abnormal US findings had 32.61% of the respondents, of which a significant change in US had three children (6.53%). Cephalohaematoma was the only risk factor in 17 children (36.96%). Low neurorisk factors had five patients (10.87%), and in 24 infants with cephalohaematoma we found factors of high neurorisk (52.17%). The most common additional risk factors are gestational diabetes (19.57%), infections during pregnancy (17.39%) and head circumference above the 95th percentile (17.39%). ***Conclusion***. US of the brain is useful, simple and objective method that is already in the maternity ward may be supplemented by anamnesis and clinical data in order to assess the possible factors of neurorisk in newborns with cephalohaematoma.

Introduction

Cephalohaematoma is subperiostal fluctuation of blood collection between the skull bones and the periosteum, recognizable by a harder, elastic swelling, limited by skull sutures, and usually visible after a latency period of at least 24 hours after birth. In the same newborn two or more cephalohaematoma types can be found, usually parietal, rarely occipital, either on one side or both. Frontal and temporal cephalohaematoma localization has not been described. Clinically, it is evident in 0.4 – 2.5% of newborns.[1]

Bleeding on the scalp can be subperiosteal, subcutaneous and subaponeurotic. Subaponeurotic bleeding is also called »false cephalohaematoma«. It appears in a wide area below the aponeurosis parietal bone and is often associated with massive surrounding or internal bleeding. In addition to birth trauma, literature identifies the following risk factors: higher birth weight, gender, prolonged delivery, presentation at birth, parity and use of instruments by labour.[2] Alongside cephalohaematoma other perinatal complications are more likely to occur: neurological symptomatology (changes in muscle tone change in behaviour of the newborn), bleeding, anaemia, jaundice, cephalohaematoma calcification, localized and/or general infection (meningitis, sepsis, osteomyelitis).[3]

In the late 19th century, English orthopaedist Little first mentioned the possibility of perinatal events influencing the physical and mental development of a child,[4] and in the mid 20th century special attention is paid to neuro risk newborn groups. The first register and monitoring of neurological development in children was introduced in the UK by Sheridan in 1964.[5] Today it is believed that 10–15% of live-born newborns belong to the group of neuro risk newborns. Hospital neonatologists and primary care paediatricians following hospital release carry out classification of newborns into groups of low and high neuro risk. Clinical assessment of neuro risk level is done according to recommended criteria.[6]

Early diagnosis of neuo risk is a prerequisite for successful rehabilitation, whereby the following criteria play an important role the presence of medical history and clinical risk factors and US evaluation of changes in the brain. The existence cephalohaematoma is a medical history risk factor due to the fact that it belongs to the group of delivery injuries, and requires detailed clinical and neurological assessment in newborns In addition, cephalohaematoma can occur as an integral part of clinical coagulopathy, which should be taken into account in differential diagnosis, especially in extensive cephalohaematoma.[7]

Several studies have reported the existence and classification of brain findings found through US imaging in healthy asymptomatic newborns,[8] while we did not find any studies dealing with changes in the brain detected through US imaging in the same group of infants with cephalohaematoma. In a prospective study involving 493 patients, Gover and his colleagues found abnormal brain US findings in 11.2% of healthy term newborns.[9] Of these, 3.8% of the study population had significant brain findings detected by US that did not

clinically manifest. Thus, the implementation of US screening in the healthy newborn population is subject to numerous controversies.[10]

The most common significant brain changes registered by US in healthy term newborns includes: focal echogenicity, corps callosum agenesis, enlarged cisterna magna, medial line cysts, subcortical leukomalacia, perinatal infarction and complicated intracranial haemorrhage (third and fourth degree intraventricular haemorrhage).[11] Non-significant findings in the brain registered by US in term newborns includes uncomplicated intracranial haemorrhage (subependymal bleeding, and first and second grade of intraventricular haemorrhage), persistent cavum vergae, cavum septi pellucidi, choroid plexus cysts, caudothalamic cysts, ventricular asymmetry and a milder ventriculomegalia (0.5–1 cm).[12]

The aim of this study was to investigate the frequency of US brain changes in healthy term newborns with cephalohaematoma, and to classify them into significant and non-significant. Also, the aim of the study is, depending on the existence of other medical history and/or clinical risk factors, as well as changes in brain detected by US, to include examined newborns with cephalohaematoma in the low neuro or high neuro risk group.

Examinees and Methods

We conducted a retrospective analysis of changes in the brain detected by US in newborns with cephalohaematoma from 1 January to 31 December 2010. The study population consisted of 2,970 newborns from a total of 3,262 deliveries during the same year at the maternity ward of our hospital. The analysis included only healthy and term newborns (37^{th} to 42^{nd} week). The following data was recorded during regular routine clinical examination of the newborns: gender, birth weight, birth length, head circumference, delivery mode, vitality assessment according to the Apgar score, age and mother's parity, duration of labour, clinical characteristics of cephalohaematoma, neurological assessment of the newborn, the occurrence of jaundice, the characteristics of brain US findings, mother's illnesses during pregnancy.

The data is presented in tables, graphs and pictures. For anthropometric parameters of newborns percentile values of the test population were calculated. To test the correlation between individual variables the χ^2-test (SPSS version 9.0) was used. The significance level was $P < 0.05$.

Brain US imaging was done during the child's stay in hospital, from the third to fifth day after birth using the Siemens Sonoline G40, with an ultrasonic transducer 5.3 MHz (Acuson). The process was carried out through the large fontanelle, in coronal and sagittal cross-sections. Brain US imaging was performed by neonatologists with a completed course in newborn intracranial echosonography.

Results

On the sample of healthy term newborns, cephalohaematoma was found in 46 infants, and the prevalence of cephalohaematoma in our study was 1.55%. Cephalohaematoma was found in 26 (56.52%) male and in 20 (43.47%) female newborns, with no significant statistical gender differentiation. All children were delivered in the natural head down position, without the use of vacuum extraction and forceps. Only one newborn had cephalohaematoma on the occipital bone, where we used differential analysis and diagnostics to exclude cranial meningocele *(Figure 1)*, in all other newborns the cephalohaematoma was parietal. Cephalohaematoma on the right side was found in 19 (41.31%) newborns, on the left side in 18 (39.13%), and on both sides in nine (19.56%) newborns. Besides cephalohaematoma in the test newborns, we did not find any other delivery injuries or congenital anomalies. We did not observe prolonged duration of labour in respect to mother parity. The average birth weight of the newborns was 3443.26 + 412.41 g. Boys tended to have an average weight of 3537.31 + 401.77 g and girls 3321.17 + 403.24 g (maximum 4150 g, minimal 2620 g, with a 1530 g range). For the test sample, the 95^{th} birth weight percentile was 4050 g. Four children (8.69%) had the same or greater weight – two male and two female newborns. The average length of newborns at delivery was 49.69 + 1.57 cm. In boys, the average length at delivery was 49.92 + 1.57 cm (maximum 53 cm, minimum of 46 cm, with a 7 cm range), and in girls 49.41 + 1.61 cm, with the same maximums and minimums and range as the boys. For the test sample, the 95^{th} percentile birth length was 53 cm. Three newborns (6.12%) had the same or greater length – two male and one female newborn. The average head circumference was 35.22 + 0.62 cm; in boys 35.28 + 0.59 cm, in girls 35.12 + 0.67 cm. The mini-

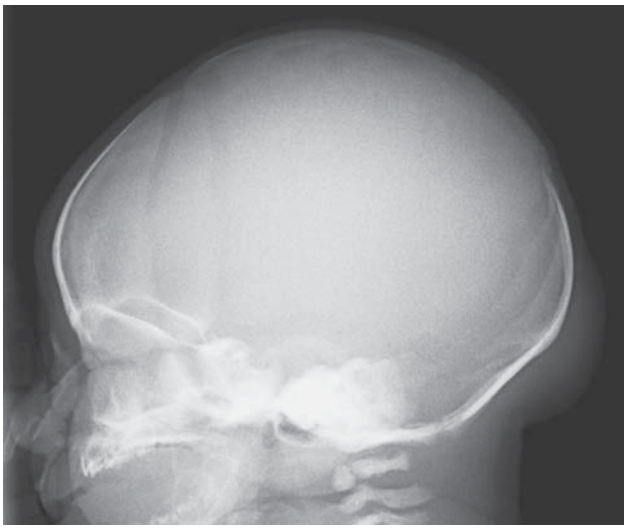

Figure 1. Occipital localisation of cephalohaematoma on craniogram

mum value was 34 cm, the maximum 36 cm, with a 2 cm range, equally for boys and girls. In the population studied (both boys and girls), the 95th percentile head circumference was 36 cm, found in a total of eight infants (17.39%); in 4 boys and 4 girls.

Newborn vitality was assessed using the Apgar score. All children with cephalohaematoma were born as healthy (none had an Apgar score below eight in the first minute, and below 9 in the fifth minute). In newborns with cephalohaematoma, we undertook clinical and laboratory testing for anaemia and clotting disorders, but failed to prove any in a single child. We observed jaundice in 25 newborns with cephalohaematoma (54.38%). Phototherapy to resolve jaundice was conducted in four children (8.69%). Differential diagnosis in respect to cranial meningocele was resolved through craniograms, which proved occipital localization of cephalohaematoma. We found no neurological abnormalities in any newborn with cephalohaematoma during its hospital stay.

Table 1. Brain US findings in healthy term neonates with cephalohaematoma

Brain US findings in healthy term neonates with cephalhematoma	Incidence	
	n	%
Normal findings	31	67.39
Abnormal findings (n=15)		
a) Non-significant findings (n=12)		
Cavum septum pellucidum	4	8.69
Peri-interventricular haemorrhage grade II	3	6.53
Subependimal haemorrhage	3	6.53
Subependimal cysts	1	2.17
Choroid plexus cysts	1	2.17
b) Significant findings (n=3)		
Focal echogenicity	2	4.35
Partial agenesis of corpus callosum	1	2.17
Total	46	100.00

Table 2. Presence of perinatal risk factors in healthy term neonates with cephalohaematoma

Presence of perinatal risk factors in healthy term neonates with cephalohaematoma	Incidence	
	n	%
Without additional risk factors	17	36.96
Low neurorisk factors (≤ 2 risk factors)	5	10.87
High neurorisk factors (≥ 3 risk factors)	24	52.17
Total	46	100.00

Table 3. The most common perinatal risk factors in healthy term neonates with cephalohaematoma

The most common perinatal risk factors in healthy term neonates with cephalohaematoma (n=46)	Incidence	
	n	%
Gestational diabetes	9	19.57
Infections in pregnancy	8	17.39
Eclampsia	4	8.69
Isoimmunization	2	4.35
Mother's chronic disease	2	4.35
Apgar score < 7 in 5. minute	4	8.69
Birth weight > 95. centile	4	8.69
Birth lenght > 95. centile	3	6.53
Head circumference > 95. centile	8	17.39
Severe jaundice	4	8.69

Table 1 shows US imaging of brain changes in healthy term newborns with cephalohaematoma. Normal brain US imaging was observed in 67.39% of the examinees. Abnormal US findings were found in 32.61% of the examinees, of which three children (6.53%) had significant changes.

The occurrence of perinatal risk factors in healthy term infants with cephalohaematoma is shown in *table 2*. Cephalohaematoma was the only perinatal factor in 17 children (36.96%). Low neuro-risk factors were present in five examinees (10.87%), and high risk were present in 24 newborns with cephalohaematoma (52.17%). The most common additional risk factors, shown in *table 3*, are gestational diabetes (19.57%), infections during pregnancy (17.39%) and head circumference above the 95th percentile (17.39%). All healthy term newborns whose US scans showed changes in the brain called for further US monitoring, and monitoring by a neuro paediatrician and physical medicine specialist if necessary.

Discussion

Neurological damage detected after birth or during early childhood, is probably the result of a series of factors, and not just one isolated adverse event during pregnancy, childbirth or during the perinatal period.[13] The accepted indicators of imminent asphyxia in newborns is not linked to subsequent brain damage as cause and effect, and do not necessarily directly reflect peripartum events, but can occur in the early stages of pregnancy due to various reasons, including genetic predisposition.[14]

One of the proven risk factors for possible perinatal brain damage are silent, clinically undiagnosed intrauterine infections that trigger the activation of inflammatory factors, cause early neurological damage and increase sensitivity in the brain of the foetus to hypoxia. In our study, we found infections during pregnancy in 17.39% newborns with cephalohaematoma. Of the possible risk factors, according to our results, only gestational diabetes is more prevalent than infections (19.57%). However, we believe that the number and types of perinatal factors are not perinatal brain damage predictors.[15]

A pre-requisite for high-quality brain US examination is a trained staff, room and equipment. More than two thirds of the examinees (67.39%) in our study had normal brain US scans. Abnormal US scans were found in about one-third (32.61%) of healthy term newborns with cephalohaematoma. Most often, they were insignificant changes in brain US, which would not necessarily affect the child's later neurological development (26.09%).[16]

Among the most commonly observed non-significant changes in brain US was cavum septum pellucidum, which is the normal and expected foetal brain structure, and was found in more than 60% of the term newborn brain US scans.[17] WE can monitor this structure in the first 3–6 months, after which it usually disappears in over 85% of children.[18] The existence of cavum septum pellucidum in adulthood may be associated with some psychopathological entities (schizophrenia, epileptogenesis, chronic headaches, chromosomal abnormalities, behavioural disorders).[19] Uncomplicated peri- and intraventricular haemorrhage was found in three term newborns with cephalohaematoma (6.52%), which is more when compared to a population of healthy newborns where, depending on the authors and population examined, it was approximately 2–4%.[20] Among term newborns with cephalohaematoma we did not find complicated intracranial haemorrhage (III and IV grade). Subependymal cysts and choroid plexus cysts were described in 1–5% of the newborn population,[21] which is consistent with our results.

We found significant findgins in brain US scans in three newborns, focal echogenicity in two, and partial corpus callosum agenesis in one newborn. Corpus callosum agenesis occurs in the general population with a prevalence of 0.03 to 0.7%, and in persons with developmental disabilities in 2.3% of the cases.[22] The authors describe those even significant changes in brain US accidentally diagnosed do not necessarily clinically manifest later in life in about 75–80% of the cases observed.[23] In about 70% of children in the high neuro risk group one can expect significant neurological deviation later in life. As much as 90% of children in the low neuro risk group showed normal development, while only 10% had mild neurological deviation.[24]

A good quality clinical examination supplemented with appropriate diagnostics should be the guideline to the rational approach in diagnosing and monitoring brain injury in the early period of growth and development.[25] Professional societies and leading institutions should develop action protocols for specific clinical situations and child healthcare levels.[26]

This article represents a retrospective analysis of the described clinical entity. In order to assess cephalohaematoma as a possible neuro-risk factor a prospective study with a control group should be conducted and early childhood neural development should be monitored. Children with non-significant changes in brain US should be monitored until the changes have disappeared, and children with significant changes until large fontanelle closure.[27] If cephalohaematoma occurs alongside other perinatal risk factors, it would be advisable to perform brain US imaging in hospital, which is in line with the multietiological concept of possible perinatal brain damage.[28] The advantages and disadvantages of imaging methods should be explained to parents as a useful means and tool for evaluating changes, but not for predicting neurodevelopmental outcome.

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KEFALHEMATOM – MOGUĆI PERINATALNI NEURORIZIČNI ČINITELJ

Izvorni članak

Ključne riječi: kefalhematom, novorođenče, porođajne ozljede, perinatalna oštećenja mozga, ultrazvuk novorođenačkog mozga

Summary. Kefalhematom je nakupina krvi između lubanjske kosti i periosta, i ovisno o svojoj kliničkoj prezentaciji, može pripadati činiteljima perinatalnog rizika. ***Cilj*** ovog rada je prikazati najčešće ultrazvučne (UZV) promjene mozga u novorođenčadi s kefalhematomom i procijeniti eventualni neurorizik u ispitivanoj populaciji. ***Metode***. Retrospektivno su analizirane UZV promjene mozga u zdrave donošene novorođenčadi s kefalhematomom, te pridruženi anamnestički i klinički činitelji rizika. Obuhvaćeno je 2970 ispitanika tijekom jedne kalendarske godine u rodilištu naše ustanove. ***Rezultati.*** Učestalost kefalhematoma je 1,55%. Prosječna porođajna težina je 3443,26±412,41 g, duljina 49,69±1,57 cm i opseg glave 35,22±0,62 cm. U ispitanika nisu uočene druge porođajne ozljede, prirođene anomalije, bolesti zgrušavanja, niti neurološka odstupanja. Uredan UZV nalaz mozga zamijećen je u 67,39% ispitanika. Promijenjen UZV nalaz imalo je 32,61% ispitanika, od čega je značajne UZV promjene imalo 3 djece (6,53%). Kefalhematom je bio jedini činitelj rizika u 17 djece (36,96%). Činitelje niskog neurorizika imalo je 5 ispitanika (10,87%), a visokog 24 novorođenčadi s kefalhematomom (52,17%). Najčešći dodatni činitelji rizika su gestacijski dijabetes (19,57%), infekcija u trudnoći (17,39%) i opseg glave iznad 95. centile (17,39%). ***Zaključak***. UZV mozga je korisna, jednostavna i objektivna metoda kojom se već u rodilištu mogu dopuniti anamnestički i klinički podaci, u cilju procjene eventualnog neurorizika u novorođenčadi s kefalhematomom.