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Application of transient evoked otoacoustic emission in the hearing screening tests in newborns from the risk groups

Specialist neonatal care has reduced perinatal mortality and simultaneously the number of children with central nervous system damage, including hearing organ, has increased (1, 2).

The majority of authors think that intrauterine fetal anoxia is not connected with the risk of the hearing loss development. Also the mechanical ventilation, ischaemic encephalopathy or pulmonary hypertension may cause sensorineural hearing loss.

Apart from perinatal causes of hearing loss there are a lot of factors having harmful effects on newborns. They include cerebrospinal meningitis, viral infections and ototoxic drugs (3, 4).

Experimental studies and clinical observations carried out recently indicate significant influence of sound stimuli on the development and maturation of hearing pathway during the first months of life (5). Hence in the case of hearing organ damage the rehabilitation of hearing should be initiated as soon as possible. It is a prerequisite for correct rehabilitation.

The hearing screening tests are significant in diagnostic examinations. Otoacoustic emission is more and more frequently performed during the hearing screening tests in newborns (3, 4).

The aim of the study was the evaluation of incidence of hearing organ damaging factors in patients treated in the neonatal pathology department and the results of otoacoustic emission in this group.

MATERIAL AND METHODS

Audiological tests were performed in 20 children aged 0–2 months hospitalized in the Department of Neonatal Pathology, Infants and Cardiology of the University Hospital. The following risk factors were evaluated: mother's diseases during the first three months of pregnancy, intrauterine fetal hypoxemia, prematurity, low Apgar score, birth weight, neonatal icterus, ototoxic drugs, pulmonary insufficiency, sepsis, central nervous system diseases, encephalitis.

The screening hearing tests using the otoacoustic emission were performed with the use of ILO88 Otodynamics analyzer, after the otoscopy and tympanometry tests. For Transient Evoked Otoacoustic Emission (TEOAE) non linear click stimulus lasting for 80μs and reaching the intensity of 84 dB SPL in outer ear canal was used. In DPOAE tests there were used 2 pure tones of stimulating intensity 70 dB SPL with the proportion f2/f1=1.22.

Table 1. The risk factors of hearing loss

1	Respiratory insufficiency	15
2	Ototoxic drugs	15
3	Sepsis	10
4	Prematurity	9
5	Low Apgar score	8
6	Low birth Wright	5
7	Mother's diseases in pregnancy	4
8	CNS diseases	3
9	Hyperbilirubinemia	3
10	Interuterine fetal hypoxemia	3
11	Encephalitis	2

Table 2. The analysis of hearing risk factors in children without TEOAE responses

	The casus in sequence / Risk factors	1	2j	3	4	5j	6	7	8	9
1	Ototoxic drugs	✓	✓	✓			✓		✓	✓
2	Sepsis	✓	✓				✓		✓	
3	Respiratory insuffi-ciency	✓	✓	✓	✓		✓	✓	✓	✓
4	Prematurity		✓	✓	✓		✓	✓		
5	Low Apgar score		✓	✓	✓		✓	✓	✓	
6	Mother's diseases In pregnancy			✓		✓				
7	Low birth weight		✓		✓		✓	✓		
8	Hyperbilirubinemia					✓				
9	Encephalitis								✓	✓

RESULTS

On the basis of the audiological tests the normal tympanic membranes and tympanometry type "A", were confirmed in all of the children.

The absence of bilateral otoacoustic tests was confirmed in 7 newborns. Six children were taking ototoxic drugs, including 3 children treated twice with aminoglycosides antibiotics. Pulmonary insufficiency (6 cases), and sepsis (3 cases) was observed. No otoacoustic response was observed in children burdened with at least three risk factors of the hearing organ. In two cases the damage was unilateral. In those children the presence of factors predisposing for hearing loss was noticed.

DISCUSSION

The studies confirmed the need of screening tests in neonatal departments. The hospitalized children are exposed to numerous hearing risk factors. Otoacoustic emission is non-invasive test very useful for screening.The results of screening otoacoustic emission tests were published by Johnson and Ashurst (6). These authors state that this kind of test is reliable in 91%. In our material in as much as 45% of cases we did not observe correct otoacoustic emission results, and this is an indication for monitoring the hearing in this group of patients.

We did not have otoacoustic emission in children with 3 and more etiological risk factors of hearing loss. Most frequently they were: pulmonary insufficiency, sepsis and ototoxic drugs. Simmons (7) noted that perinatal and neonatal hypoxia was observed most often. Despland and Galambos (8) identified hearing loss with perinatal fetal hypoxia as well. Pruszewicz and Pośpiech (9) when examining low-birth-weight children, stated that accumulation of at least three hearing loss risk factors leads to profound sensorineural hearing loss development. According to their studies, hypoxia as the perinatal risk factor was confirmed in 40% of cases.

A high risk of hearing organ damage is noticed in patients of neonatal departments and this results from serious general condition of a child. Our pilot study indicates frequent hearing loss occurrence with high accumulation of risk factors in this group of patients.

REFERENCES

1. Borg E.: Perinatal asphixia, hypoxia, ischemia and hearing loss. An overwiew. Scandinavian Audiology, 26, 2, 77, 1997.
2. Eviatar L.: Evaluation of hearing in the high-risk infant. Clinics in Perinatology, 11, 1, 153, 1984.
3. Mueller-Malesińska M. et al.: Epidemiologia czynników ryzyka uszkodzenia słuchu u noworodków w Polsce. Audiofonologia, 18, II, 15, 2000.
4. Skarżyński H. et al.: Badania przesiewowe noworodków i niemowląt pod kątem uszkodzenia słuchu w Polsce – doniesienia wstępne. Audiofonologia, 18, II, 9, 2000.
5. Kaga M. et al.: Normalisation of poor auditory brainstem response in infants and children. Brain Development, 6, 5, 458,1984.
6. Johnson S. et al.: Prevalence of sensorineural nearing loss in premature and sick term infants with perinatally acquired cytomegalivirus infection. Ear and Hearing, 7, 5, 325, 1986.
7. Simmons F.: Patterns of deafness in newborns. Laryngoscope, 90, 3, 448, 1980.
8. Despland P., Galambos R.: The brainstem auditory evoked potential is a usefull diagnostic tool in evaluating risk factors for hearing loss in neonatology. Advances in Neurology, 32, 241, 1982.
9. Pruszewicz A., Pośpiech I.: Mała masa urodzeniowa jako czynnik ryzyka uszkodzenia narządu słuchu. Rehabilitacja w Otologii, 137, 1999.

SUMMARY

The hearing screening tests in newborns – the patients of the Department of Newborns' Pathology, were carried out using the analyser of otoacoustic emission. Also etiological factors of hearing loss present of this group were analysed. Basing on the performed examinations the absence of otoacoustic emission was confirmed in 45% of the studied patients, and it correlated with three or more hearing loss risk factors.

Otoemisja akustyczna w badaniach skryningowych słuchu u noworodków z grup ryzyka

Badania przesiewowe słuchu u dzieci, pacjentów Kliniki Patologii Noworodków i Niemowląt przeprowadzono przy użyciu analizatora otoemisji akustycznej. Przeanalizowano również czynniki etiologiczne predysponujące do uszkodzenia słuchu, które występowały w tej grupie pacjentów. Na podstawie przeprowadzonych badań stwierdzono brak otoemisji występujący u ok. 45% badanych dzieci. Brak otoemisji wywołanej korelował ze współistnieniem trzech lub większej liczby czynników wpływających na uszkodzenie narządu słuchu.