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КОМПЛЕКСНА ПРОГРАМА ОЗДОРОВЛЕННЯ: СИСТЕМНИЙ ПІДХІД ТА ІНТЕГРАТИВНА ТЕРАПІЯ ЗАХВОРЮВАНЬ ЧЕРЕЗ ТЕРАПЕВТИЧНУ КОРЕКЦІЮ ПСИХОБІОЛОГІЧНИХ КОНФЛІКТІВ	
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## **THE ROLE OF ULTRASOUND DIAGNOSTICS IN ASSESSING BRAIN FUNCTION IN NEWBORNS**

**Introduction.** Ultrasound diagnostics (US) is one of the most important and accessible tools in neonatology for assessing the central nervous system in newborns. Due to its safety, lack of ionizing radiation and the possibility of performing in real time, US is the standard for the initial examination of brain structures in infants, particularly for at-risk groups [3,4,5].

Neonates, especially preterm infants, are at high risk of developing neurological complications due to hypoxic-ischemic brain injury, intraventricular hemorrhage, and periventricular leukomalacia [1,3,4]. Early detection of pathologies using ultrasound diagnostics allows for timely initiation of treatment and improves the prognosis for such patients.

Ultrasound diagnostics (neurosonography) is a non-invasive, safe and highly effective method for assessing the structures and functions of the newborn brain. It allows detecting a wide range of pathologies at early stages, including intraventricular hemorrhages, periventricular leukomalacia and other consequences of hypoxic-ischemic brain damage.

**The purpose of the work.** To determine the role and modern capabilities of ultrasound diagnostics in the study of functional and morphological changes in the brain of premature newborns who are prone to cerebral hemodynamic disorders (intracranial hemorrhage, periventricular leukomalacia, and hypoxic-ischemic encephalopathy).

**Materials and methods.** A comprehensive search of information in databases, including PubMed, Cochrane Library, EMBASE, Web of Science, Scopus, was conducted. The results of studies using neurosonography through a anterior fontanelle window, as well as Dopplerography of cerebral vessels to assess blood flow, were analyzed. The study was conducted in intensive care units among premature newborns (gestation period less than 32 weeks) and very low birth weight infants (weight < 1500 g).

Neurosonography was performed through the fontanelle to visualize brain structures, and Doppler to assess cerebral blood flow in the middle cerebral artery, venous sinus, and other large vessels, which is critically important in predicting the consequences of hypoxia and ischemia [1,2,3]. Repeated examinations were mandatory to monitor changes in brain structures.

**Results.** Ultrasound has been shown to detect up to 85% of intraventricular hemorrhages in 124 infants born at less than 32 weeks gestation [2,3]. Periventricular leukomalacia was diagnosed in 10% of 56 infants at high risk of hypoxia [4].

Doppler imaging is an important prognostic tool, as changes in cerebral blood flow have been correlated with subsequent neurological deficits in 70% of cases [5,6]. Doppler imaging has also shown a decrease in cerebral perfusion pressure in infants with severe hypoxia [2]. Repeated examinations in the first weeks of life assessed the progression or regression of pathological changes [2,5,6].

Ultrasound diagnostics has a number of significant advantages. First of all, it is safe for newborns due to the absence of radiation exposure [1,2]. It is also possible to conduct the study in intensive care units while maintaining efficiency - high sensitivity and specificity in detecting hemorrhages and ischemic changes [3]. It is important that there is a possibility of dynamic monitoring of the condition of newborns in real time.

However, there are certain limitations of the method, such as the dependence of results on operator experience or the inability to assess small brain structures or complex abnormalities without the use of additional methods such as MRI [3,4,5].

**Conclusions.** Ultrasound diagnostics (neurosonography) is a safe and non-invasive method that allows diagnosing from 64% to 85% of cases of intraventricular hemorrhages, and up to 10% of cases of periventricular leukomalacia in premature infants with a gestational age of less than 32 weeks.

In 70% of cases, changes in cerebral blood flow recorded using Doppler were correlated with the subsequent development of neurological complications, which confirms the prognostic significance of Doppler. Repeated ultrasound examinations during the first weeks of life allow us to assess the progression or regression of pathological changes in brain structures.

Further improvement of techniques and technologies will allow to increase the accuracy of diagnostics and optimize the treatment of newborns with neurological disorders. Development of technologies, in particular the introduction of 3D and 4D ultrasound, can significantly increase the accuracy of diagnostics in newborns with suspected neurological pathology.

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