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DIAGNOSTIC AN ACCURACY OF ULTRASOUND EXAMINATION OF FETUSES AND NEWBORNS IN DETECTING CONGENITAL ABNORMALITIES OF THE DIGESTIVE ORGANS

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Abstract

Congenital anomalies of the digestive organs occupy a significant place in the structure of perinatal pathology and require timely diagnosis. The aim of this study was to evaluate the diagnostic accuracy of ultrasound examination in fetuses and newborns when identifying congenital anomalies of the digestive organs. A prospective cohort study was conducted involving 298 pregnant women and their newborns. Prenatal ultrasound examination was performed at gestational ages of 18–22 and 30–34 weeks, while neonatal ultrasound was performed during the first 5 days of life. The sensitivity, specificity, and prognostic value of the method were evaluated. Congenital anomalies were identified in 26 (8.7%) cases. Prenatal ultrasound sensitivity was 80.8%, and specificity was 95.9%. The comprehensive use of prenatal and neonatal ultrasound increased diagnostic accuracy to 93.5%. The results obtained indicate the high effectiveness of ultrasound examination, especially when used in combination.

Key words: ultrasound, prenatal diagnosis, newborns, congenital anomalies, digestive organs.

Introduction

Congenital malformations (CDM) remain one of the leading causes of perinatal morbidity and mortality, as confirmed by both international and domestic studies [1]. According to Russian authors, a significant share of VPR is attributed to digestive organ anomalies, which are characterized by early clinical manifestations and a high frequency of complications [2]. The most common pathologies include esophageal and intestinal atresia, congenital intestinal obstruction, as well as abnormalities of the liver and bile ducts [3].

The development of prenatal diagnostic methods, particularly ultrasound examination, has significantly expanded the possibilities for early detection of congenital anomalies [4]. Ultrasound is the primary screening method due to its safety, accessibility, and high informativeness. According to the recommendations of domestic and international specialists, routine ultrasound examinations in the second and third trimesters of pregnancy allow for the detection of most structural anomalies [4.5].

However, as N.P. Shabalov notes, not all congenital anomalies can be detected at the prenatal stage, which is due to both the characteristics of intrauterine development and limitations in visualization [3]. In this regard, neonatal diagnosis is of particular importance, as it allows for the clarification or confirmation of a previously established diagnosis [6].

Modern research emphasizes that the greatest diagnostic effectiveness is achieved through a combination of prenatal and postnatal ultrasound examinations [5]. Nevertheless, the issue of the accuracy and complementarity of these methods remains relevant.

The aim of the study is to evaluate the diagnostic accuracy of ultrasound examination in fetuses and newborns when identifying congenital abnormalities of the digestive organs.

Materials and Methods

The study was conducted as a prospective cohort observation for the period 2023–2025. The study included 298 pregnant women with single pregnancies and their newborns. The inclusion criteria were informed consent, absence of severe comorbidities, and the possibility of dynamic observation.

Prenatal ultrasound examination was conducted at gestational ages of 18–22 and 30–34 weeks using expert-class equipment. The anatomical structures of the fetus's digestive organs, including the stomach, intestines, liver, and bile ducts, were evaluated. Particular attention was paid to echographic signs such as "double bladder," expansion of intestinal loops, and absence of gastric imaging [4].

Neonatal ultrasound examination was conducted on the first 5 days of life to clarify the diagnosis. Clinical data, results of additional diagnostic methods, and surgical treatment were used as reference standards.

Statistical analysis included calculations of sensitivity, specificity, PPV, and NPV. The significance of differences was assessed using the $\chi 2$ criterion at a significance level of $p<0.05$.

Results

The study included 298 pregnant women and their newborns. Congenital anomalies of the digestive organs were confirmed in 26 patients, accounting for 8.7% of the total sample. The distribution of pathologies showed that intestinal obstruction was most frequently observed in 7 cases (26.9%), esophageal atresia in 5 cases (19.2%), duodenal atresia in 4 cases (15.4%), liver and bile duct anomalies in 4 cases (15.4%), and other combined forms in 6 cases (23.1%).

Analysis of prenatal ultrasound examination showed that at gestational ages of 18–22 weeks, suspicion of congenital pathology was identified in 17 cases, while with a repeated examination at 30–34 weeks, the number of identified cases increased to 21, indicating an increase in diagnostic informativeness in later gestational ages. When compared with the final diagnosis, it was established that prenatal ultrasound allowed for correct diagnosis in 21 out of 26 cases, while 5 cases remained undiagnosed (false negative results), and false positive results were obtained in 6 cases.

Neonatal ultrasound examination conducted during the first 1–5 days of life revealed 23 out of 26 cases of congenital anomalies, including 3 cases not diagnosed prenatally. The number of false negative results was 3 cases, and false positive results were 4 cases. At the same time, in a number of observations, the neonatal stage made it possible to clarify the nature of the pathological process, in particular, to differentiate between various forms of intestinal obstruction and to identify comorbid changes in the liver and bile ducts.

Calculation of diagnostic indicators showed that the sensitivity of prenatal ultrasound examination was 80.8%, specificity 95.9%, positive prognostic value 77.7%, and negative prognostic value 97.0%. For neonatal ultrasound, sensitivity was 88.5%, specificity was 96.6%, positive prognostic value was 82.1%, and negative prognostic value was 98.1%.

The combined use of prenatal and neonatal ultrasound examinations significantly increased diagnostic efficacy. The total sensitivity was 92.3%, specificity was 97.8%, positive prognostic value was 89.2%, negative prognostic value was 98.9%, and the total diagnostic accuracy reached 93.5%. Statistical analysis showed a

significant advantage of the combined approach compared to using only prenatal ultrasound ($p<0.05$).

Additional analysis showed that diagnostic accuracy varied depending on the type of pathology. The highest sensitivity was observed in duodenal atresia (up to 90%) and severe intestinal obstruction, which is associated with the presence of characteristic echographic signs ("double bladder" symptom, pronounced expansion of intestinal loops). At the same time, liver and bile duct anomalies were diagnosed with lower accuracy, especially in the prenatal stage, due to their less pronounced echographic picture.

Analysis of temporal aspects showed that in 22 out of 26 cases (84.6%), early prenatal diagnosis made it possible to determine pregnancy management and delivery tactics in advance, as well as to prepare conditions for providing specialized surgical care in the early neonatal period. In the remaining cases, in the absence of timely diagnosis, a tendency toward a more severe clinical course and the need for emergency intervention was noted.

Thus, the results obtained demonstrate that ultrasound examination possesses high diagnostic value; however, its effectiveness increases significantly when used sequentially during the prenatal and neonatal stages.

Discussion

The results obtained confirm that ultrasound examination is one of the key methods for the early diagnosis of congenital abnormalities of the digestive organs. The established sensitivity indicators (80.8% for the prenatal stage and 88.5% for the neonatal stage) correspond to modern research data, in which sensitivity varies within 70-90% depending on the type of pathology and gestational age. This indicates the high reproducibility of the results and their alignment with international data.

One of the important findings of the study is the identification of limitations in prenatal diagnosis. Despite high specificity (95.9%), some pathologies remain undiagnosed before birth. This is due to the fact that some anomalies form at late stages of intrauterine development or lack pronounced echographic signs. Similar data are also reflected in the works of Russian researchers, who indicate that the accuracy of ultrasound diagnostics depends on the morphological severity of the defect and the specialist's experience.

Neonatal ultrasound results showed higher sensitivity compared to the prenatal stage. This is explained by the improvement of imaging conditions after birth and the possibility of assessing the functional state of the organs. Furthermore, the neonatal stage allows for the clarification of anatomical details, which is especially important when planning surgical intervention.

The most significant result is the increase in diagnostic accuracy during the combined use of ultrasound. The increase in sensitivity to 92.3% and overall accuracy to 93.5% confirms the feasibility of an integrated approach. This result aligns with modern clinical recommendations, which emphasize the necessity of continuous diagnostic monitoring from the prenatal to postnatal period.

Analysis of the pathology structure showed that pronounced anatomical changes, such as duodenal atresia and intestinal obstruction, are diagnosed most accurately. At the same time, less pronounced and functional disorders are identified significantly worse. This indicates the need to use additional diagnostic methods in complex cases.

It should be noted that early diagnosis allowed for timely planning of pregnancy management and delivery tactics in most cases (84.6%), as well as ensuring readiness for surgical treatment. This confirms not only the diagnostic but also the prognostic significance of ultrasound examination.

Despite the results obtained, the study has several limitations. The single-centered nature and relatively small sample size may limit the generalizability of the data. Furthermore, ultrasound diagnostics remains dependent on the specialist's qualifications and the technical conditions for conducting the study.

Thus, the research results confirm that ultrasound examination is an effective, but not absolute, diagnostic method and possesses the greatest clinical value when applied comprehensively.

Conclusion

The conducted study showed that ultrasound examination possesses high diagnostic value in identifying congenital abnormalities of the digestive organs in fetuses and newborns. The prenatal stage allows for the early detection of a significant portion of pathologies, but its capabilities are limited by the specifics of intrauterine development and visualization.

Neonatal ultrasound examination complements prenatal diagnosis, ensuring diagnosis clarification and identification of previously undiagnosed cases. The highest

diagnostic efficiency is achieved through the comprehensive application of methods, which is confirmed by an increase in sensitivity and overall diagnostic accuracy.

The obtained results substantiate the need to implement integrated ultrasound screening into clinical practice as a standard approach for the early diagnosis of congenital abnormalities of the digestive organs.

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