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THE ROLE OF MULTISPIRATE COMPUTED TOMOGRAPHY IN EARLY DIAGNOSIS AND EVALUATION OF NEPHROBLASTOMA IN CHILDREN

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Abstract. Nephroblastoma, also known as Wilms' tumor, is a malignant neoplasm that develops from kidney tissue. This disease is considered the most common form of malignant urinary tract tumor in children. Nephroblastoma occurs equally in boys and girls under 5 years of age. Research shows a correlation between maternal age and the likelihood of having a child with nephroblastoma. Wilms' tumor is a congenital anomaly.

Wilms' tumor is given in honor of the German surgeon Max Wilms (1867–1918), who in 1899 conducted a comprehensive review of the literature on pediatric kidney tumors and scientifically substantiated the origin of this neoplasm. It should be noted that, although nephroblastoma predominantly occurs in young children, in rare cases it can also occur in older children.

Early diagnosis, correct staging of the disease and informed choice of treatment methods play a key role in ensuring the possibility of a full recovery for patients with nephroblastoma.

Key words: Wilms disease, malignant tumors, early diagnosis, multispiral computed tomography (MSCT), pediatric oncology, embryonic tumor.

Relevance. Nephroblastoma (Wilms' tumor) is the second most common intra-abdominal cancer in children and the fifth most common among pediatric malignancies overall. According to the World Health Organization (WHO), nephroblastoma accounts for approximately 95% of all childhood renal malignancies, with approximately 75% of cases occurring in children under 5 years of age, and the peak incidence occurring between 2 and 3 years of age [16]. The overall survival rate for Wilms' tumor, once <30%, currently exceeds 90%, making it one of the real successes of modern medicine. It accounts for approximately 6% of all childhood cancer cases and accounts for more than 95% of all renal tumors in the pediatric age group. In other words, according to statistics, out of a million children under 17 years of age, this disease is diagnosed annually in 8-9 children worldwide [4].

Study Objective: The aim of this research is to improve the early detection of nephroblastoma and explore new perspectives and potential of multislice computed tomography (MSCT) in diagnosing this disease.

For comparative diagnostics, specifically differential diagnosis of Wilms' tumor, it is important to consider various other kidney diseases that can occur in children, such as solitary renal cysts, hydronephrosis, polycystic kidney disease, neuroblastoma, angiolipoma, and many others. Establishing an accurate diagnosis plays a crucial role in choosing the best treatment strategy. In this context, multislice computed tomography (MSCT) is an indispensable tool that provides a more accurate and detailed image of renal structures, allowing physicians to more effectively differentiate and determine the nature of any detected changes [8].

Modern multi-row spiral CT scanners are essential for diagnosis. The scanning protocol includes a series of abdominal and renal scans using contrast media. CT can identify the characteristic features of nephroblastoma, including tumor size, shape, texture, and the presence of calcifications. A more in-depth data analysis and comparative evaluation of the effectiveness of these methods require a computer software package, as well as image enhancement using contrast media. Advanced software should be used for image and data analysis, allowing for more accurate calculations and statistical analysis [15].

The use of contrast media in MSCT (multislice computed tomography) for the diagnosis of nephroblastoma can provide important information for physicians and oncology specialists. Contrast media helps improve the visibility of the tumor and surrounding tissue on images, which can be useful for a more accurate diagnosis.

3D visualization of MSCT images provides a more comprehensive view of the tumor structure and characteristics, which helps physicians make more informed treatment and case management decisions [10]. When a contrast agent is injected into a patient before MSCT, it is typically distributed into the circulatory system. The tumor and the vessels supplying it with blood can be more clearly detected in images due to the contrast between the tumor and surrounding tissue (Fig. 1). This allows physicians to determine the tumor size, structure, shape, and characteristics, as well as assess the blood supply, which can be important when choosing the optimal treatment strategy [11].

However, it should be remembered that the decision to use a contrast agent must be made individually for each patient and depends on their medical history, allergies, and overall health. Physicians also consider the potential risks and benefits of using contrast and may take precautions if necessary [6].

Images before and after contrast are displayed on the CT computer screen. Particular attention is paid to signs of capsule disruption, infiltration of adjacent organs, lymph node involvement, and vascular invasion [9].

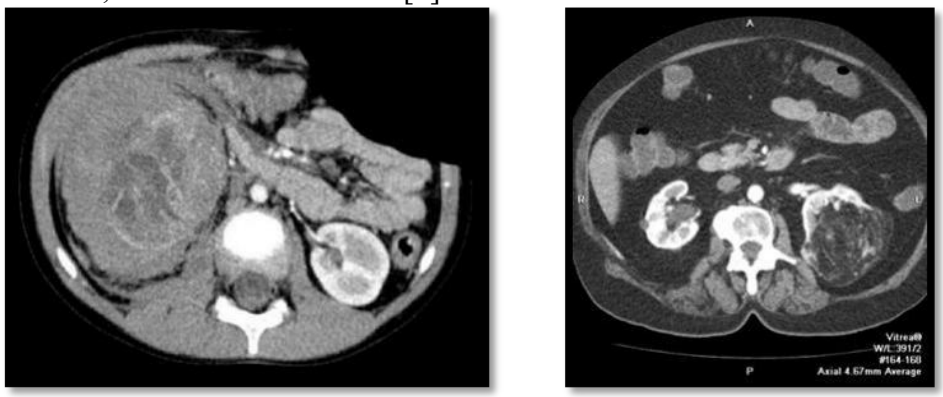

Fig. 1. MSCT of nephroblastoma in children

Capsular disruption was diagnosed radiographically based on the presence of tissue expansion in the perirenal fat, whereas direct infiltration of adjacent organs was diagnosed when tissue planes were lost or irregular borders between the tumor and surrounding tissues were observed.[14] CT diagnosis of lymph node metastases was based on a node enlargement greater than 1 cm in short-axis diameter. Vascular tumor invasion was diagnosed when an intraluminal filling defect was observed in the renal vein, inferior vena cava, or right atrium during the portal venous phase.[7]

Research results. The use of multislice computed tomography (MSCT) has demonstrated impressive results in the early diagnosis and study of this rare pathology. Our study demonstrates that MSCT is of great importance for identifying hidden changes associated with Wilms' disease due to its ability to produce high-resolution images and detailed three-dimensional reconstruction [3].

We have found that MSCT allows for the precise detection of structural abnormalities in vital organs, such as the kidney and its vessels, which is critical for diagnosing Wilms' disease and understanding its impact on the body. This allows physicians to examine even the smallest arterial changes and other signs specific to this pathology [1].

An important aspect of our research was also confirmation that MSCT can serve as a powerful tool for monitoring the condition of patients with Wilms' disease over time. This allows

physicians to more accurately assess the effectiveness of treatment and respond to changes in pathology in real time [12].

Overall, the results of our study highlight the enormous potential of MSCT for the early detection, detailed characterization, and monitoring of Wilms' disease [5]. These findings contribute to improved diagnosis and treatment of patients with this condition and may serve as a starting point for further research in this area. The study results also highlight the need for further research into the development of new treatment methods and therapeutic strategies for more effective management of nephroblastoma [2].

These findings enrich our understanding of nephroblastoma and contribute to improved diagnosis, treatment, and prognosis for patients with this tumor.

The results of our study highlight the importance of MSCT as an innovative method in the fight against Wilms' disease, providing new perspectives for earlier diagnosis, more accurate study of pathology and improved quality of medical care for these patients [14].

Conclusion. The results of this study clearly demonstrate the important role of multislice computed tomography (MSCT) in the diagnosis of nephroblastoma in children. This form of kidney cancer is one of the most common in children and requires early detection for successful treatment.

Our findings highlight that MSCT provides accurate and detailed imaging of renal structures, making it an important tool for distinguishing nephroblastoma from other renal pathologies. This is critical when choosing the optimal treatment strategy. The use of contrast media within MSCT adds valuable data, improving tumor visibility and facilitating a more accurate diagnosis. This is considered an important discovery that could significantly improve the early diagnosis and evaluation of nephroblastoma in children. Staging is a major determinant of therapy for Wilms' tumor. This study assessed whether MSCT can accurately predict the location and stage of disease in patients with Wilms' tumor undergoing primary or delayed nephrectomy. Potential errors are clinically significant, as overstaging can lead to overtreatment, such as excessive radiation exposure, with associated short- and long-term complications.

In conclusion, our study confirms the importance of MSCT in the context of pediatric oncology and raises questions about further improvement of this technique to best care for children with nephroblastoma.

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