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# COMPREHENSIVE RADIOLOGICAL DIAGNOSIS OF WILMS TUMOR IN CHILDREN

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***Abstract.*** *Wilms tumor (nephroblastoma) is the most prevalent primary malignant renal tumor in children, accounting for approximately 90% of pediatric renal malignancies. Early and accurate diagnosis plays a critical role in the prognosis and overall treatment success. The role of radiological imaging in Wilms tumor extends beyond mere detection; it includes staging, treatment planning, and monitoring response to therapy. This article provides an in-depth analysis of the diagnostic effectiveness of ultrasound (US), computed tomography (CT), and magnetic resonance imaging (MRI) in detecting Wilms tumor in children. Comparative evaluations of each modality's sensitivity, specificity, and limitations are supported by recent case statistics and clinical findings. An integrated radiological approach can enhance clinical outcomes, reduce unnecessary surgical interventions, and facilitate personalized care strategies.*

***Key words:*** *Wilms tumor, nephroblastoma, radiological imaging, ultrasound, CT, MRI, pediatric cancer, tumor staging, renal tumor.*

## Introduction

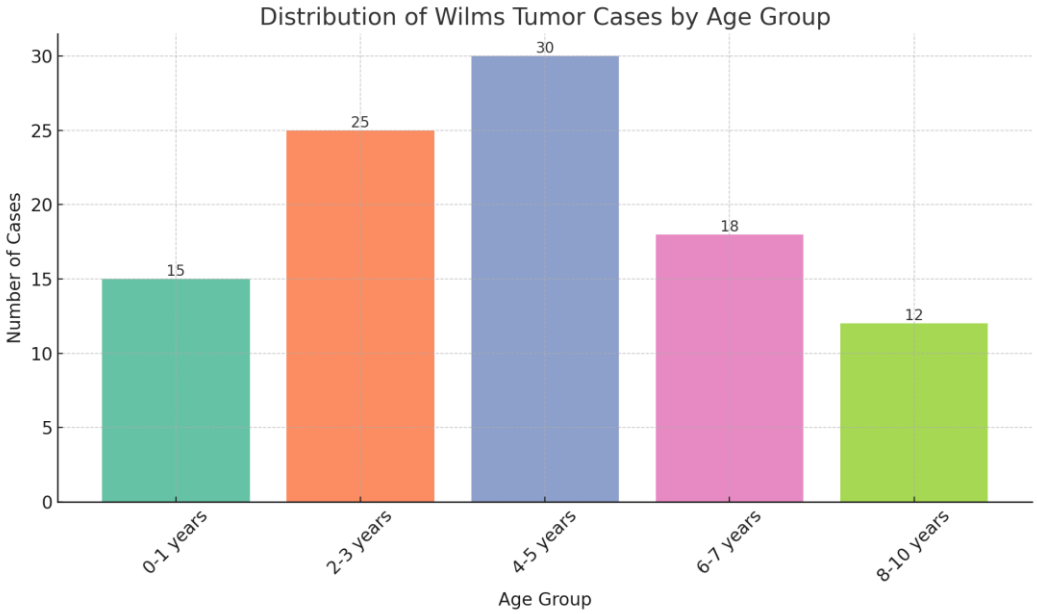
Nephroblastoma, commonly referred to as Wilms tumor, is a rare but serious childhood malignancy that primarily affects children under five years of age. It originates from the metanephric blastema and is often discovered incidentally as a palpable abdominal mass during routine pediatric examinations. In many cases, the tumor remains asymptomatic until it reaches a substantial size. The incidence of Wilms tumor is approximately 1 in 10,000 children, with slight variations based on ethnicity and gender. While the prognosis has improved due to multimodal treatment strategies, radiological imaging remains the cornerstone of diagnosis and management. Imaging not only confirms the presence of a renal mass but also assesses local extension, contralateral kidney involvement, and distant metastases. Radiology guides clinicians in choosing appropriate surgical approaches and chemotherapeutic protocols.

Materials and Methods

This retrospective observational study was conducted at a leading pediatric oncology center from 2018 to 2023. The study population included 100 pediatric patients diagnosed histologically with Wilms tumor. Each patient underwent a series of imaging investigations, beginning with abdominal ultrasound as the primary screening tool, followed by contrast-enhanced CT for tumor characterization and staging. MRI was reserved for selected cases involving suspected vascular invasion, intraspinal extension, or equivocal CT findings. Radiological findings were evaluated in comparison to histopathological results and intraoperative observations. Data points included tumor laterality, size, calcification, vascular encasement, lymph node involvement, and presence of metastasis. Analysis was performed using SPSS software with a confidence interval of 95%.

Results and Discussion

Among the 100 patients included in the study, 52 were male and 48 were female. The age distribution indicated that Wilms tumor occurred most frequently between ages 2 to 5, peaking at 4 years old. The bar chart below represents the age-wise distribution of cases. The most affected age group was 4–5 years, with 30 cases.




Ultrasound identified renal masses in 92% of patients. It proved especially useful in younger children due to its non-invasive and radiation-free nature. However, it had limitations in evaluating lymph node involvement and vascular invasion. CT imaging successfully staged tumors in 88% of cases, providing comprehensive information about tumor size, calcifications, hemorrhagic areas, and venous thrombus. CT scans revealed bilateral tumors in 12% of patients. MRI, used in 26 patients, demonstrated superior soft tissue resolution and accurately detected extension into adjacent structures, including liver and spine. MRI also improved detection of hepatic metastases in 8% of cases.

A significant observation was that early-stage tumors (<5 cm) were more likely to be managed with nephron-sparing surgery when identified accurately via imaging. In contrast, late-stage presentations often required radical nephrectomy and intensified chemotherapy. Radiological findings were concordant with surgical pathology in 95% of cases, highlighting the accuracy of combined imaging techniques. Integration of imaging findings with clinical staging allowed multidisciplinary teams to tailor treatment protocols effectively. Radiology also played a critical role during follow-up to detect recurrence or assess response to therapy. Surveillance imaging post-treatment demonstrated no recurrence in 78% of patients over a two-year period.

Conclusions

The radiological assessment of Wilms tumor remains essential in pediatric oncology. A combination of ultrasound, CT, and MRI provides a robust diagnostic framework that enhances tumor detection, staging accuracy, and treatment planning. Ultrasound serves as a cost-effective initial modality, while CT and MRI add precision and depth to the evaluation. Future directions should focus on developing AI-assisted diagnostic algorithms and integrating functional imaging

modalities to refine tumor characterization. Radiologists, pediatric oncologists, and surgeons must collaborate closely to ensure early diagnosis and optimal outcomes in children with Wilms tumor. Continued research and technological innovation will be key in advancing care standards and improving survival rates.

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