International Journal of Science and Research (IJSR)
ISSN: 2319-7064
Impact Factor 2024: 7.101

Role of Computed Tomography in the Evaluation of Pediatric Abdominal Masses

Dr. Shreya Rathi[1], Dr. Anjali Pawar Dahiphale[2], Dr. Varsha Rote Kaginalkar[3]

[1]Junior Resident, Department of Radiodiagnosis, GMC Aurangabad, Maharashtra, India

[2]Professor, Department of Radiodiagnosis, GMC Aurangabad, Maharashtra, India

[3]HOD and Professor, Department of Radiodiagnosis, GMC Aurangabad, Maharashtra, India

Abstract: ***Objective:*** *This study aims to evaluate the effectiveness of computed tomography (CT) in diagnosing and assessing pediatric abdominal tumors.* ***Methods:*** *A total of 40 pediatric patients, ranging in age from 0 to 12 years, who presented with clinically suspected abdominal masses, underwent CT imaging at the Department of Radiodiagnosis, GMCH, Aurangabad. The study analyzed tumor characteristics, including location, organ of origin, attenuation, enhancement, necrosis, cystic transformation, calcifications, and extent of spread. Diagnoses were made based on patient age and CT findings, providing both preliminary and differential diagnoses.* ***Results:*** *The study found that most cases involved infants under one year of age, followed by children between 1 to 5 years old. Neuroblastomas were the most frequently detected tumors, followed by Wilms' tumors. Malignant tumors were significantly more prevalent than benign ones.* ***Conclusion:*** *CT proved to be a highly sensitive, rapid, and reliable imaging modality for detecting, localizing, and characterizing abdominal tumors in pediatric patients. It played a crucial role in differentiating between tumor types and assisting in treatment planning, making it a valuable diagnostic tool for pediatric oncology.*

Keywords: Pediatric abdominal masses, pediatric abdominal imaging, CT scan diagnosis, CT evaluation, neuroblastoma imaging, Wilm's tumor imaging

1. Introduction

Pediatric abdominal tumors present a wide range of pathologies, originating from various organs and encompassing both benign and malignant growths. The probability of specific tumors occurring is strongly influenced by the child's age, with some tumors being more prevalent in neonates, infants, early childhood or adolescence. Multidetector computed tomography (MDCT) is a highly advanced imaging technique that offers multiplanar reconstruction capabilities, enabling detailed visualization of tumors. This technology aids in precise localization, characterization, and differential diagnosis of abdominal masses based on imaging features and patient demographics.

Objectives

- To analyze the significance of CT in detecting, localizing, and characterizing pediatric abdominal tumors. - To assess the role of CT imaging characteristics (e.g., attenuation, enhancement, necrosis, calcifications, and extensions) in diagnosing tumors.
- To determine the most common pediatric abdominal tumors and their typical presentations on CT scans.
- To evaluate the diagnostic accuracy of CT in differentiating between benign and malignant tumors.

2. Materials and Methods

Study Population

The study included 40 pediatric patients (aged 0 to 12 years) with clinically suspected abdominal masses who underwent CT evaluation at the Department of Radiodiagnosis, GMCH, Aurangabad.

Imaging Protocol:

Each lesion was examined for:

- Location and organ of origin
- Density and attenuation patterns
- Enhancement characteristics
- Presence of necrosis or cystic degeneration
- Calcifications
- Extent of tumor spread to adjacent structures

Diagnosis Approach:

Based on the patient's age and CT findings, provisional and differential diagnoses were formulated.

3. Results and Discussion

Age and Gender Distribution:

- The highest number of cases (18 patients) were infants under one year old, followed by the 1-5-year age group (11 cases).
- The gender distribution was nearly equal, with 22 males and 18 females.

Most Common Tumors Identified:

- Neuroblastoma (11 cases) was the most frequently diagnosed tumor, primarily affecting infants below one year of age.
- Wilms' tumor (8 cases) was the second most common malignancy, predominantly seen in early childhood.
- Renal masses included Wilms' tumors (8 cases) and mesoblastic nephromas (2 cases).
- Liver masses included hemangiomas (5 cases) and hepatoblastomas (4 cases).
- Other tumors detected:
- Extra-adrenal ganglioneuroblastoma (1 case)
- Ovarian teratomas (2 cases)
- Sacrococcygeal teratomas (5 cases)

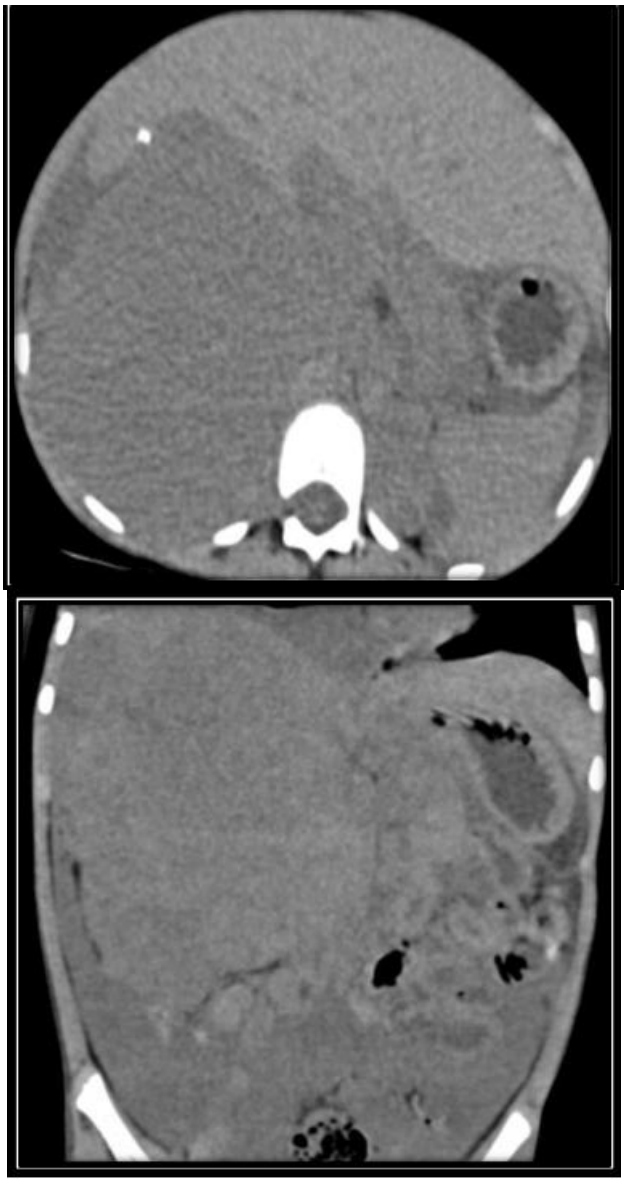
- Splenic hamartomas (2 cases)

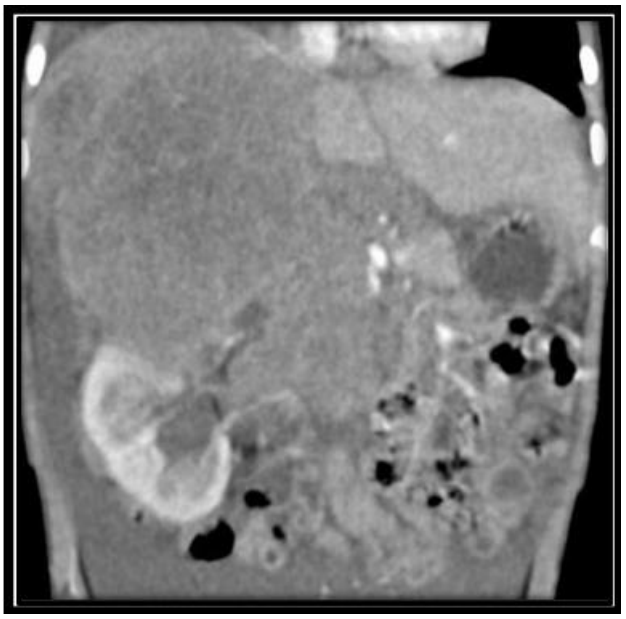
Malignant vs. Benign Tumors:
- A total of 28 cases were malignant, while 12 cases were benign.
- CT demonstrated 100% sensitivity in detecting calcifications, which are crucial in tumor characterization.

CT's Role in Diagnosis:
MDCT with multiplanar reformation (MPR) provided high diagnostic accuracy, particularly in:
- Identifying the tumor's site of origin.
- Differentiating solid from cystic components.
- Assessing vascular involvement and extensions.
- Detecting metastases and lymphadenopathy.

4. Imaging Findings

Case 1
A 3 year old male presented with pain, abdominal lump and distension since 1 year.





Figures 1, 2, 3 & 4: Axial NCCT and arterial phase CECT and coronal arterial

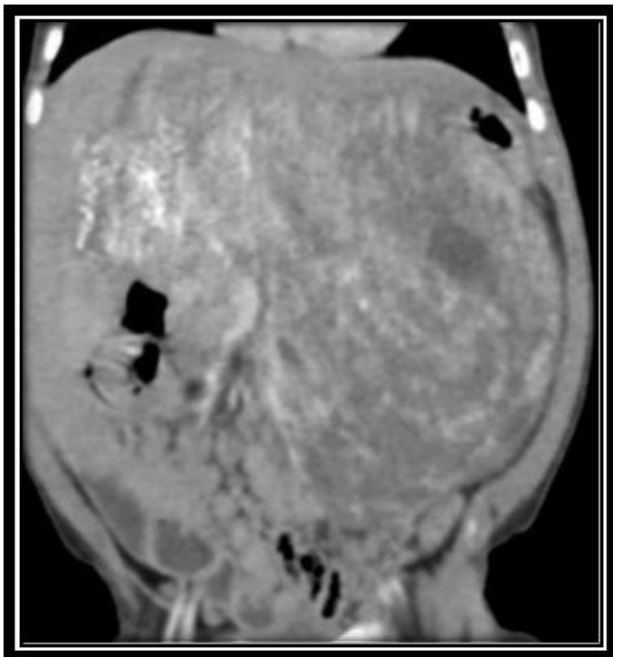
A large heterogeneously enhancing retroperitoneal mass encasing the aorta and lifting it forwards. The kidney is displaced inferiorly and does not demonstrate a claw sign. These features are typical of a large neuroblastoma, which classically envelop and displace vessels

Case 2
A 4-year-old female presented with a painless upper quadrant abdominal mass with intermittent hematuria. since 1 year.

Figures 5 & 6: Axial and coronal CECT scan reveals a large intrarenal mass with heterogeneous contrast enhancement (and no calcification) with displaced collecting system, occupying much of the upper abdomen representing a case of Wilm's tumor (nephroblastoma).

Case 3

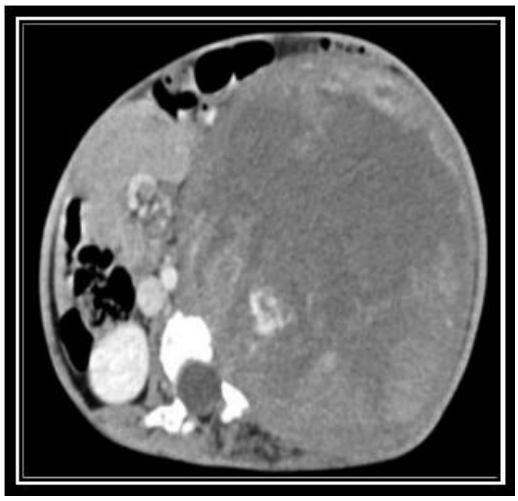
A 4 year old boy presented with abdominal distension and jaundice for 2 years. Patient has raised serum alpha-fetoprotein.

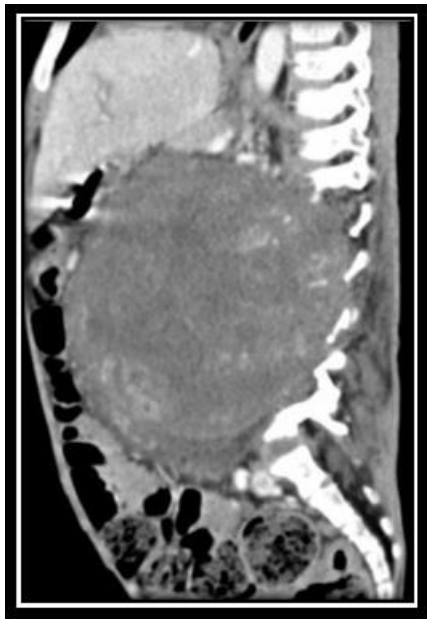


Figures 7 & 8: Axial and coronal CECT shows a large heterogeneous predominantly hypodense mass lesion arising from both lobes of liver with few focal calcifications. Biopsy revealed a hepatoblastoma.

Case 4

A 6 year old male presented with abdominal distension since 8 months.





Figures 9 & 10: Axial and sagittal CECT shows a large heterogeneously enhancing abdominopelvic mass lesion with necrotic areas & few calcific foci within is noted in left side of abdomen, involving left psoas muscle and displacing aorta and SVC towards right side. There is suspicious intra-canalicular extension at L1-L2 vertebral level. It is causing mass effect and displacing lumbar vertebrae towards right side causing erosion of vertebral bodies and transverse process of lumbar vertebra on left side with resultant curvature with convexity towards right side. HP & IHC revealed malignant peripheral nerve sheath tumor.

Advantages of CT in Pediatric Abdominal Tumor Diagnosis

- Rapid Imaging: CT scans provide quick, high-resolution imaging, reducing the need for sedation or anesthesia in young children.
- High Sensitivity in Tumor Characterization: CT is highly effective in identifying tumor location, composition, and extent of spread.
- Multiplanar Reconstruction (MPR): Allows for detailed cross-sectional imaging, improving tumor detection and surgical planning.

Limitations of CT

Radiation Exposure: CT involves ionizing radiation, which may pose long-term risks such as carcinogenesis. However, modern dose optimization techniques significantly reduce radiation exposure.

5. Conclusion

A pediatric patient presenting with an abdominal mass requires prompt evaluation to determine the appropriate clinical and surgical management. The combination of patient age, tumor imaging characteristics, and CT findings plays a pivotal role in narrowing down differential diagnoses. Multidetector computed tomography (MDCT) remains an essential diagnostic tool due to its high accuracy, rapid imaging capabilities, and ability to detect subtle tumor features. Additionally, it provides valuable preoperative information that helps in surgical planning and therapeutic decision-making.

References

[1] Rahhal et al. A Child with an Abdominal Mass. Pediatric Rounds: 37 – 42.
[2] Golden CB, Feusner JH. Malignant abdominal masses in children: quick guide to evaluation and diagnosis. Pediatr Clin North Am 2002; 49: 1369–92, viii.
[3] Chandler JC, Gauderer MW. The neonate with an abdominal mass. Pediatr Clin North Am 2004; 51: 979–97, ix.
[4] Lonergan G F et al. Neuroblastoma, Ganglioneuroblastoma and Ganglioneuroma: Radiologic- Pathologic Correlation. Radio Graphics 2002; 22: 911–934.
[5] Lowe L H et al. Pediatric Renal Masses: Wilms Tumor and Beyond. Radio Graphics 2000; 20: 1585–1603.
[6] Dong Quotient, Chen J. (2011). CT Scan of Pediatric Liver Tumors, CT Scanning - Techniques and Applications, Dr. Karupppasamy Subburaj (Ed.), ISBN: 978953307943-1.
[7] Hirons MP, Owens CM. Radiology of neuroblastoma in children. Eur Radiol 2001; 11: 2071-81.
[8] Fernbach SK, Feinstein KA, Donaldson JS, et al. Nephroblastomatosis: Comparison of CT with US and urography. Radiology 1988; 166: 153.
[9] Remain TAH, Siegel MJ, Shackeyord GD: Wilms' tumor in children: Abdominal CT and US evaluation. Radiology 1986; 160: 501-05.
[10] Amendola MA, Blane CE, Amendola BE, Glazer GM. CT findings in hepatoblastoma. J Comput Assist Tomogr. 1984; 8: 1105-9.
[11] Chung EM et al. Pediatric Liver Masses: Radiologic-Pathologic Correlation Part 2. Malignant Tumors. RadioGraphics 2011; 31: 483–507.
[12] AbramsonSJ, Lack EE, Teele RL. Benign vascular tumors of the liver in infants: Sonogrphic appearance. AJR 1982; 138: 629-32.
[13] Chung EM et al. Pediatric Liver Masses: Radiologic-Pathologic Correlation Part 1. Benign Tumors. RadioGraphics 2010; 30: 801–826.
[14] Smith WL, Franken EA, Mitros FA. Liver tumors in children. Semin Roentgenol 1983; 18: 136- 48.

[15] Wells RG, Sty JR. Imaging of sacrococcygeal germ cell tumors. RadioGraphics 1990; 10: 701- 713.
[16] Leonidas JC, Carter BL, Leape LL, Ramenofsky ML, Schwartz AM. Computed tomography in diagnosis of abdominal masses in infancy and childhood. Comparison with excretory urography. Archives of Disease in Childhood, 1978, 53, 120-125.
[17] Shukla A, Pratap V. Multi-detector computed tomography of renal and adrenal tumours in children. Int J Sci Stud 2014; 2 (8): 70-74.