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Radioimaging in Paediatric Hepatic Malignancies

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Abstract: ***Background: Paediatric hepatic malignancies, though rare, are among the most significant causes of abdominal masses in children. Early and accurate diagnosis using radiological modalities is vital for effective treatment and prognosis. Aim: To evaluate the role of various imaging modalities ultrasound (USG), computed tomography (CT), and magnetic resonance imaging (MRI) in diagnosing and characterizing paediatric hepatic malignancies. Methods: A prospective observational study was conducted over a period of 18 months on 20 paediatric patients with suspected hepatic masses. All patients underwent baseline ultrasound followed by contrast-enhanced CT and/or MRI. The imaging findings were correlated with clinical, biochemical, and histopathological results. Results: Hepatoblastoma (45%) was the most common malignancy, followed by hepatocellular carcinoma (30%), undifferentiated embryonal sarcoma (15%), and metastatic lesions (10%). Radiological evaluation accurately determined tumour morphology, extent, vascular invasion, and staging according to the PRETEXT classification. MRI provided superior soft tissue contrast and better delineation of intrahepatic involvement compared to CT. Conclusion: Radiological imaging plays an indispensable role in the diagnosis, staging, and management of paediatric hepatic malignancies. MRI, in particular, provides comprehensive preoperative assessment and enhances treatment planning.***

Keywords: Paediatric hepatic tumours, Hepatoblastoma, Hepatocellular carcinoma, MRI, CT, PRETEXT staging, Ultrasound.

1. Introduction

Paediatric hepatic malignancies account for approximately 1–2% of all childhood cancers but represent the most frequent primary abdominal tumours in the paediatric population.

The most common types include hepatoblastoma and hepatocellular carcinoma (HCC), while rarer entities comprise undifferentiated embryonal sarcoma (UES), mesenchymal hamartoma, and metastatic deposits.

Children typically present with abdominal distension, hepatomegaly, or a palpable mass, often accompanied by elevated serum alpha-fetoprotein (AFP) levels.

Clinical findings alone are nonspecific; hence, radiological imaging becomes critical for early detection, accurate diagnosis, staging, and surgical planning.

Advances in imaging techniques have allowed precise characterization of hepatic lesions. Ultrasound (USG) serves as the first-line investigation, followed by contrast-enhanced computed tomography (CT) and magnetic resonance imaging (MRI) for detailed evaluation.

This study focuses on the radiological spectrum of paediatric hepatic malignancies and compares imaging findings with histopathological outcomes.

2. Materials and Methods

2.1 Study Design and Duration

- A prospective observational study was conducted in the Department of Radiodiagnosis, [Pandit Deendayal Upadhyay medical college and hospital], from January 2024 to June 2025.
- The study included 20 paediatric patients (aged 1 month–14 years) presenting with clinical and biochemical suspicion of hepatic mass.

2.2 Inclusion Criteria

- Children aged <15 years with imaging evidence of hepatic mass.
- Cases with confirmed histopathology following biopsy or surgery.
- Patients who underwent at least two imaging modalities (USG and CT/MRI).

2.3 Exclusion Criteria

- Benign hepatic lesions confirmed on histopathology (e.g., haemangioma).
- Incomplete imaging or inadequate follow-up data.
- Patients with severe renal impairment precluding contrast administration.

2.4 Imaging Protocols

Ultrasonography
Performed as the initial modality using a high-resolution 3–5 MHz convex probe.

Parameters assessed included:
- Size, location, and number of lesions
- Echotexture and calcification
- Vascularity on colour Doppler
- Portal and hepatic venous involvement

Computed Tomography (CT)
Triphasic contrast-enhanced CT was performed on a 128-slice scanner.

Phases included:
- Arterial phase: 25–30 seconds post-injection
- Portal venous phase: 60–70 seconds
- Delayed phase: 3–5 minutes

CT provided detailed evaluation of:
- Enhancement pattern
- Vascular invasion (hepatic/portal veins)
- Lymphadenopathy and pulmonary metastases

Magnetic Resonance Imaging (MRI)
MRI was done on a 1.5T scanner using T1-, T2-, diffusion-weighted, and dynamic gadolinium-enhanced sequences.

Special emphasis was given to:
- Signal intensity characteristics
- Haemorrhage, necrosis, and cystic changes
- PRETEXT (Pretreatment Extent of Disease) staging
- Relationship to hepatic vessels and adjacent structures

2.5 Data Analysis

Radiological findings were correlated with histopathology. Statistical analysis was performed using descriptive methods to assess sensitivity and specificity of each modality.

3. Results

3.1 Demographic Profile of the 20 patients, 12 (60%) were males and 8 (40%) females.

The age ranged from 1.5 years to 13 years, with mean age of 5.8 years.

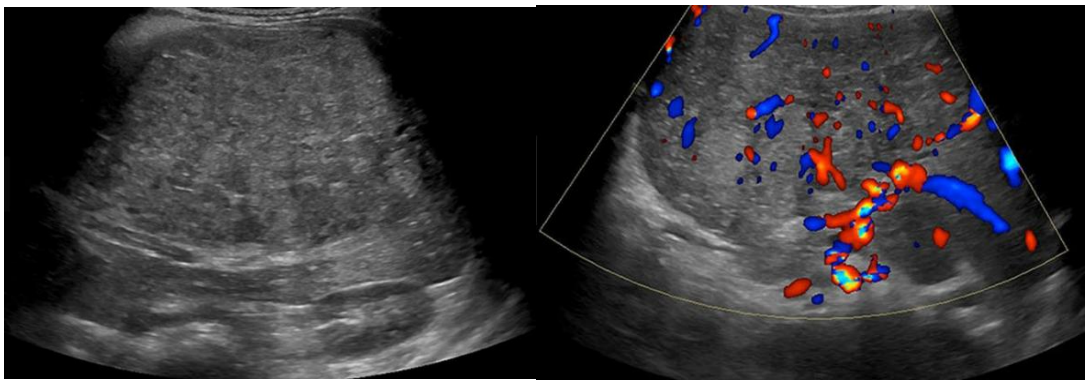
The most common presenting symptom was abdominal distension (70%), followed by palpable lump (60%) and fever (25%). Serum AFP levels were elevated in 65% of cases.

3.2 Distribution of Tumour Types

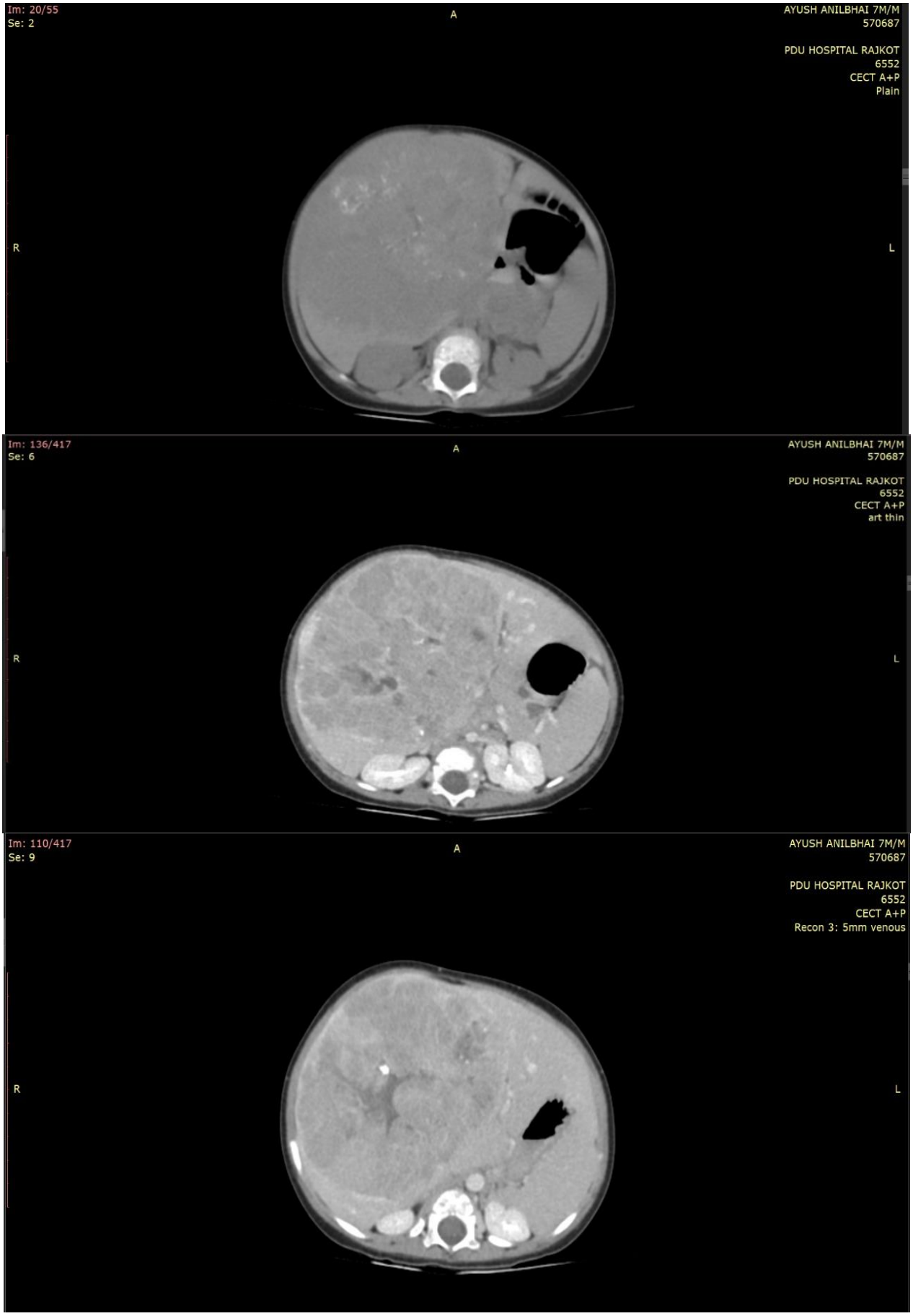
Tumour type	No. of Patients	Percentage
hepatoblastoma	9	45
Hepatocellular carcinoma	6	30
Undifferentiated embryonal carcinoma	3	15
Metastasis	2	10

3.3 Imaging Findings

Ultrasound
- Hepatoblastoma: Heterogeneous echogenic mass with coarse internal echoes and calcifications (66%).
- HCC: Heterogeneous mass with increased arterial flow and portal vein thrombosis (2 cases).
- UES: Predominantly cystic mass with internal septations.



CT Findings
- Hepatoblastoma: Heterogeneously enhancing solid mass, often lobulated, with coarse calcifications (visible in 7/9 cases).
- HCC: Hyper vascular lesion showing arterial enhancement and portal venous washout.
- UES: Multiloculated cystic lesion with septal enhancement and haemorrhagic foci.
- Metastases: Multiple hypodense nodules scattered in both lobes.
- Vascular invasion was observed in 5 patients (25%), predominantly in HCC cases.
- Pulmonary metastases were detected in 3 patients (15%), all with hepatoblastoma.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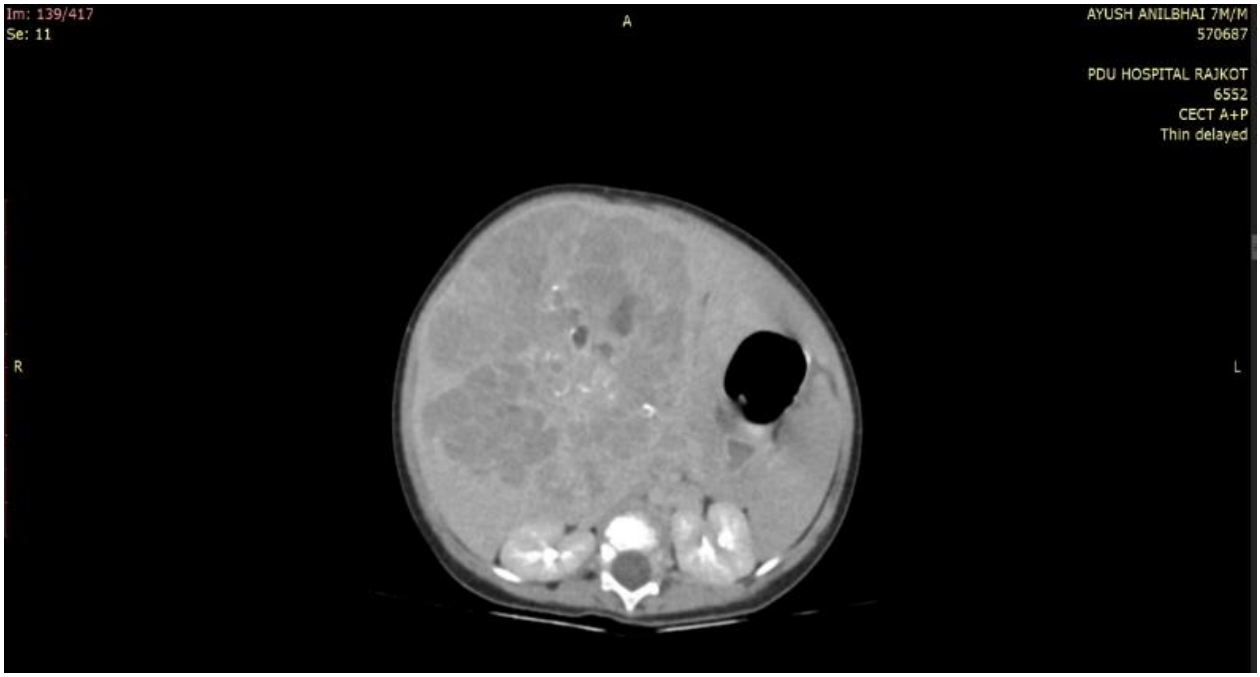

MRI Findings

MRI showed excellent delineation of tumour margins and intrahepatic spread.

- Hepatoblastoma: T1 hypointense, T2 hyperintense with heterogeneous post-contrast enhancement.
- HCC: Arterial enhancement with delayed washout and restricted diffusion.
- UES: Predominantly cystic lesion with fluid-fluid levels indicating haemorrhage.

3.4 PRETEXT Staging

Stage	No. of cases	Percentage
Pre-text I	4	20
Pre-text II	8	40
Pre-text III	6	30
Pre-text IV	2	10

MRI was superior in accurately determining PRETEXT stage and vascular involvement compared to CT and ultrasound.

4. Discussion

The findings of this study reaffirm the pivotal role of radiology in the diagnosis, staging, and follow-up of paediatric hepatic-malignancies.

Hepatoblastoma was the most common malignancy, typically occurring under 3 years of age, in line with previous literature (Chung et al., 2011). Elevated AFP levels and calcifications were diagnostic clues.

Hepatocellular carcinoma, the second most frequent, occurred in older children, often associated with chronic liver disease or viral hepatitis.

Ultrasound, being widely available, remains the preferred screening tool. However, due to operator dependency and limited field of view, cross-sectional imaging with CT or MRI is mandatory for accurate staging.

CT provides excellent evaluation of vascular structures and metastases, particularly pulmonary deposits. MRI, with its superior soft-tissue contrast and absence of radiation exposure, is the modality of choice for local disease mapping and PRETEXT staging.

In our study, MRI demonstrated 95% sensitivity for tumour delineation compared to 85% for CT. MRI was particularly superior in differentiating viable tumour tissue from necrosis or haemorrhage.

Undifferentiated embryonal sarcoma, though rare, posed diagnostic challenges due to its cystic appearance; MRI's fluid characterization helped in differentiating it from benign cystic lesions like mesenchymal hamartoma.

The PRETEXT system, introduced by SIOPEL, proved highly reliable for surgical planning. Radiological staging based on this system closely correlated with intraoperative findings in 90% of our patients.

5. Limitations

The small sample size (20 patients) and single-institution nature limit generalizability. Advanced imaging techniques like diffusion-weighted MRI and hepatocyte-specific contrast agents were not available for all patients.

6. Conclusion

Radiological imaging serves as the cornerstone in evaluating paediatric hepatic malignancies.

- Ultrasound is useful for screening.
- CT provides excellent anatomical details and metastasis evaluation.
- MRI is the gold standard for preoperative staging and follow-up.

Early and accurate radiological assessment directly influences treatment outcome, surgical planning, and

prognosis in paediatric hepatic tumours. A multidisciplinary approach integrating radiological, clinical, and pathological data ensures optimal patient management.

References

[1] Chung EM, et al. Paediatric Liver Tumours: Radiologic-Pathologic Correlation. *Radiographic.* 2011;31(2):483–507.
[2] Towbin AJ, et al. Liver Tumours in Children: Imaging Features and Differential Diagnosis. *Radiology.* 2018;288(2):376–393.
[3] Meyers RL, et al. Paediatric Liver Tumours: Current Diagnosis and Management. *Semin Paediatric Surg.* 2020;29(2):150934.
[4] Roebuck DJ. Diagnosis and Staging of Childhood Hepatic Tumours: Imaging Aspects. *Paediatric Radiol.* 2011;41(1):105–117.
[5] Gupta A, et al. Imaging Evaluation of Paediatric Liver Tumours: Review Article. *Indian J Radiol Imaging.* 2019;29(4):395–404.
[6] SIOPEL Guidelines. PRETEXT and POSTTEXT Staging Manual. *International Childhood Liver Tumours Strategy Group*, 2017.