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Efficacy of MRI and CT in Differentiating Benign From Malignant Liver Lesions

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A B S T R A C T

Liver lesions represent a broad spectrum of pathological entities ranging from benign tumors, such as hemangiomas, to malignant ones like hepatocellular carcinoma (HCC). Accurate differentiation between benign and malignant liver lesions is essential for appropriate clinical management. This study aims to compare the diagnostic efficacy of computed tomography (CT) and magnetic resonance imaging (MRI) in distinguishing benign from malignant liver lesions. Conducted over a two-year period at ShriVasantraoNaik Government Medical College Yavatmal, the study involved 50 patients who underwent both CT and MRI, with histopathological confirmation serving as the gold standard. MRI demonstrated higher sensitivity (90%), specificity (85%), and overall accuracy (88%) compared to CT, which exhibited a sensitivity of 80%, specificity of 75%, and accuracy of 78%. MRI's superior soft-tissue contrast and advanced imaging sequences contributed to better lesion characterization, while CT remained valuable for initial detection and emergencies. The findings suggest that MRI is the preferred modality for differentiating liver lesions, particularly when the precise diagnosis is critical for treatment planning.

Keywords: Liver lesions, CT, MRI.

INTRODUCTION

Liver lesions are a common clinical finding, with the differential diagnosis ranging from benign entities, such as hemangiomas and focal nodular hyperplasia, to malignant lesions like hepatocellular carcinoma and metastases. Accurate differentiation between benign and malignant liver lesions is crucial for appropriate patient management and prognosis. Imaging techniques, particularly magnetic resonance imaging (MRI) and computed tomography (CT), play a vital role in this diagnostic process.

CT has been widely used for liver imaging due to its ability to provide detailed anatomical structures and detect enhancement patterns in various phases after contrast administration [1]. However, despite its effectiveness, CT has limitations in distinguishing certain benign from malignant lesions, especially in cases where enhancement patterns overlap [2]. On the other hand, MRI, with its superior soft-tissue contrast and advanced sequences such as diffusion-weighted imaging (DWI) and dynamic contrast enhancement, has emerged as a more accurate modality for characterizing liver lesions[3, 4].

Previous studies have reported that MRI is particularly effective in identifying malignant features, such as diffusion restriction and capsular retraction, which are less frequently seen in benign lesions [5]. The use of histopathological confirmation as the gold standard remains essential to validate imaging findings [6]. This study aims to evaluate and compare the efficacy of CT and MRI in differentiating benign from malignant liver lesions in a clinical setting.

Materials and Methods

Study Design

This prospective study was conducted over two years at ShriVasantraoNaik Government Medical College Yavatmal. A total of 50 patients with suspected liver lesions were included.

Inclusion Criteria

- Patients aged 18 and above with liver lesions detected on initial ultrasound.
- Patients who underwent both MRI and CT for further evaluation.

Exclusion Criteria

- Patients with contraindications to MRI (e.g., pacemakers, claustrophobia).
- Patients with incomplete imaging or clinical data.

Imaging Protocol

- **CTScan**: Contrast-enhanced computed tomography (CECT) scans were performed on all patients using a multi-slice CT scanner. Both arterial, venous, and delayed phases were captured to assess the lesion characteristics.
- **MRI**: Magnetic resonance imaging (MRI) was performed using a 1.5T MRI scanner. T1- and T2-weighted sequences, diffusion-weighted imaging (DWI), and dynamic contrast enhancement were used to evaluate the lesions.

Diagnostic Criteria

- **Benign Lesions**: Homogeneous enhancement patterns, well-defined margins, lack of diffusion restriction, absence of capsular retraction.
- **Malignant Lesions**: Heterogeneous enhancement, irregular margins, diffusion restriction, capsular retraction, or vascular invasion.

Histopathological Correlation

All patients underwent either biopsy or surgical resection for histopathological confirmation, which was used as the gold standard.

RESULTS AND OBSERVATIONS

Table 1: Patient Demographics for Benign and Malignant Liver Lesions

Demographics	Benign Lesions (n=20)	Malignant Lesions (n=30)	Total (n=50)
Age (mean ± SD)	50 ± 8	54 ± 12	52 ± 10
Gender (M/F)	12/8	18/12	30/20

This table shows the age and gender distribution of patients diagnosed with benign and malignant liver lesions. The mean age of patients with malignant lesions is slightly higher than that of those with benign lesions. Males were more commonly affected in both categories.

Table 2: Sensitivity, Specificity, and Accuracy of CT and MRI in Differentiating Liver Lesions

Modality	Sensitivity (%)	Specificity (%)	Accuracy (%)
CT	80	75	78
MRI	90	85	88

This table compares the performance of CT and MRI in detecting malignant liver lesions. MRI showed superior sensitivity, specificity, and overall accuracy in distinguishing between benign and malignant lesions compared to CT.

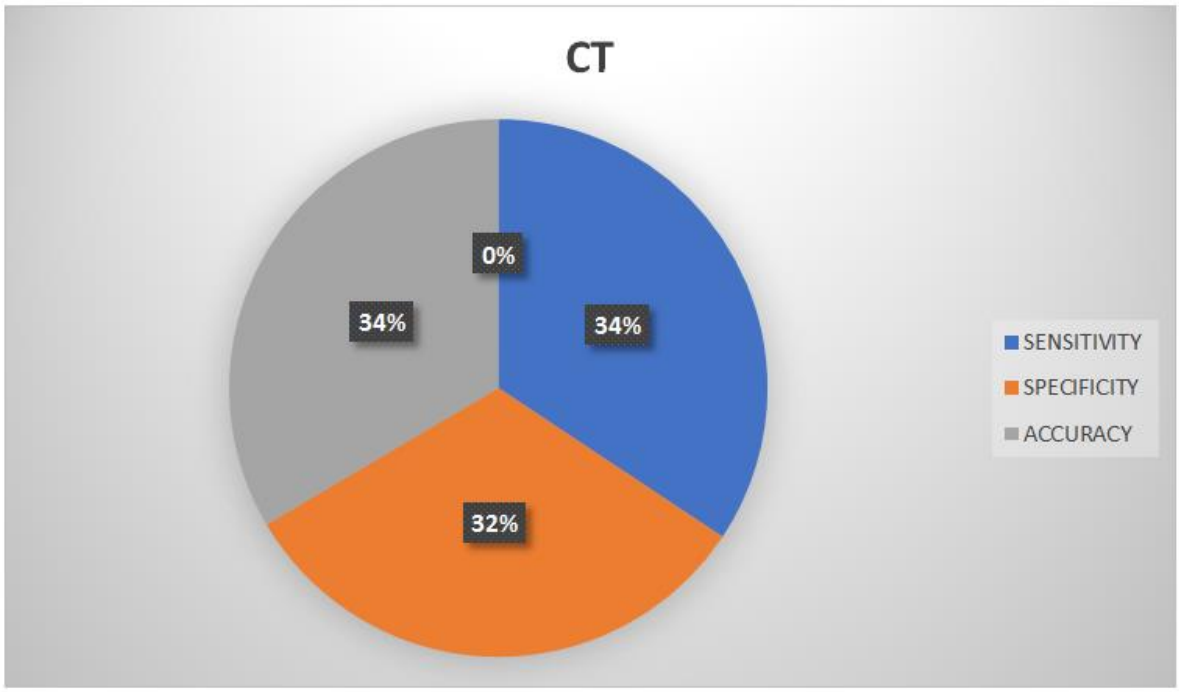

Fig 1: Sensitivity, Specificity, and Accuracy of CTin Differentiating Liver Lesions

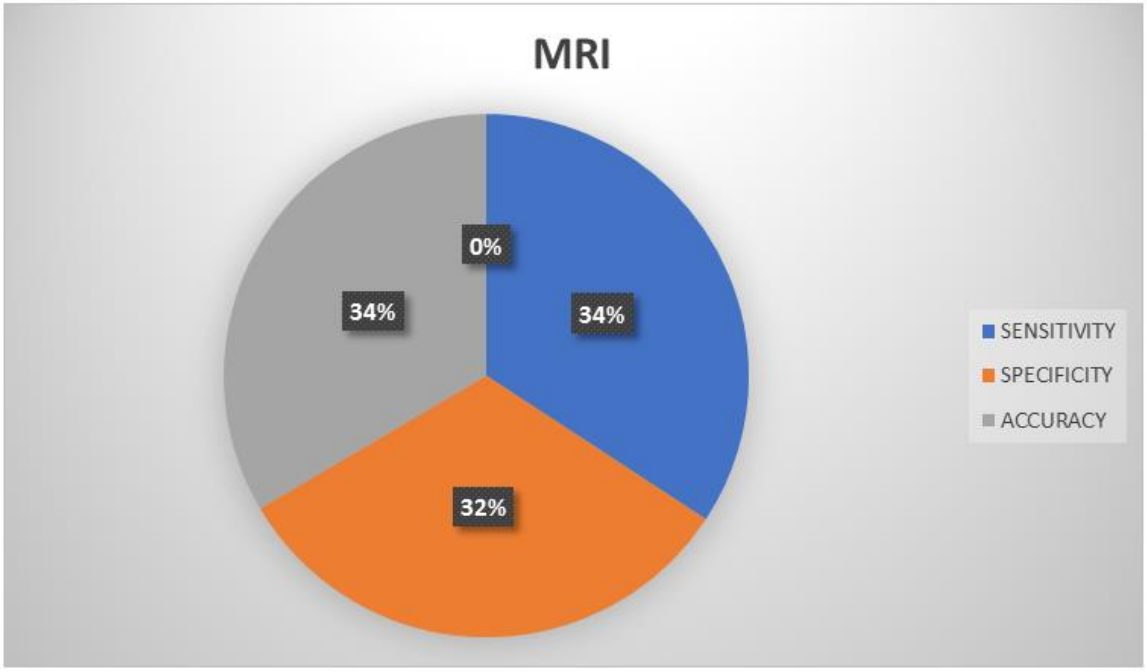

Fig 2: Sensitivity, Specificity, and Accuracy ofMRI in Differentiating Liver Lesions

Table 3: Imaging Findings and Lesion Type Distribution

Lesion Type	BenignLesions (n=20)	MalignantLesions (n=30)
Hemangioma	8	0
Focal Nodular Hyperplasia	6	0
Hepatocellular Carcinoma	0	18
Metastasis	0	12
Hepatic Adenoma	6	0

This table shows the distribution of specific liver lesion types in the study. Benign lesions were predominantly hemangiomas, focal nodular hyperplasia, and hepatic adenomas. Malignant lesions were mainly hepatocellular carcinoma and metastatic tumors.

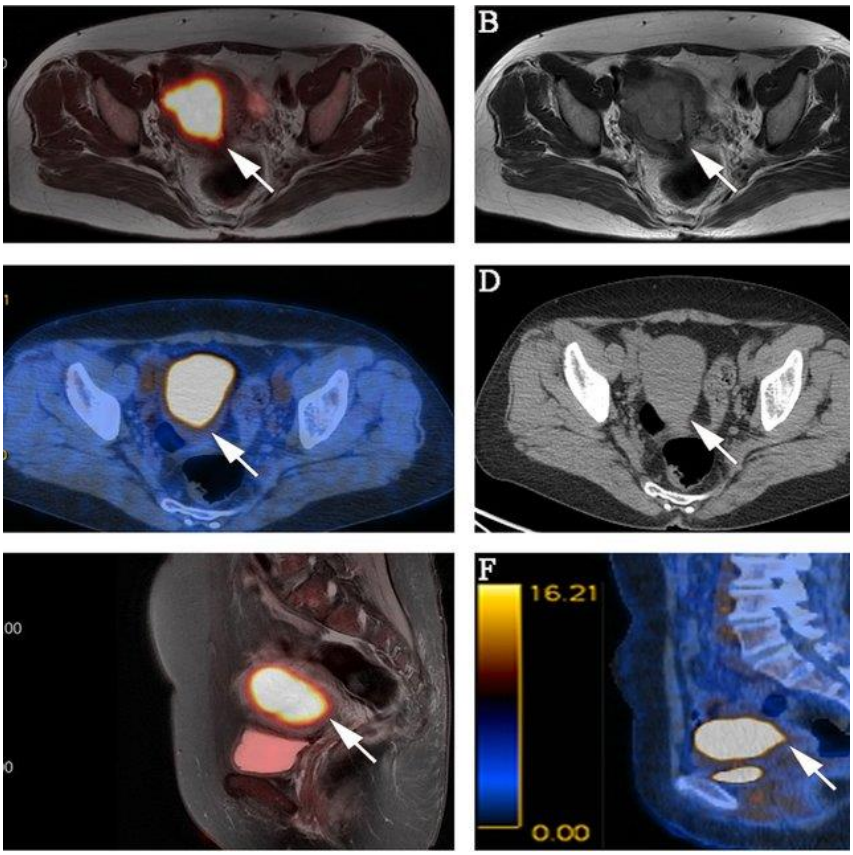

Figure-01

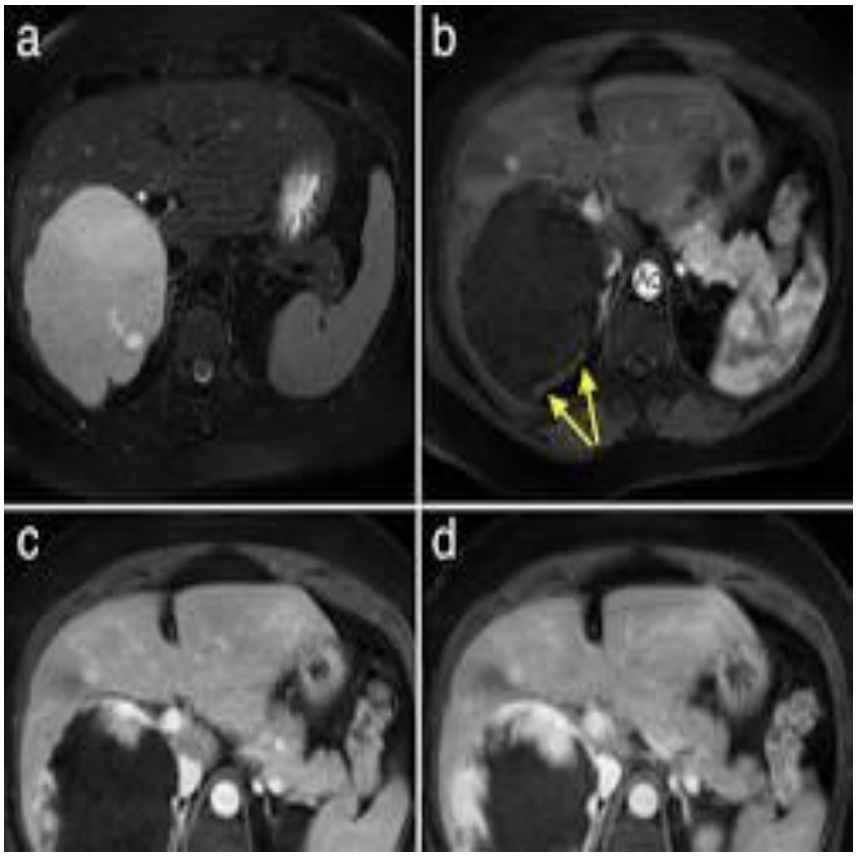

Figure- 02

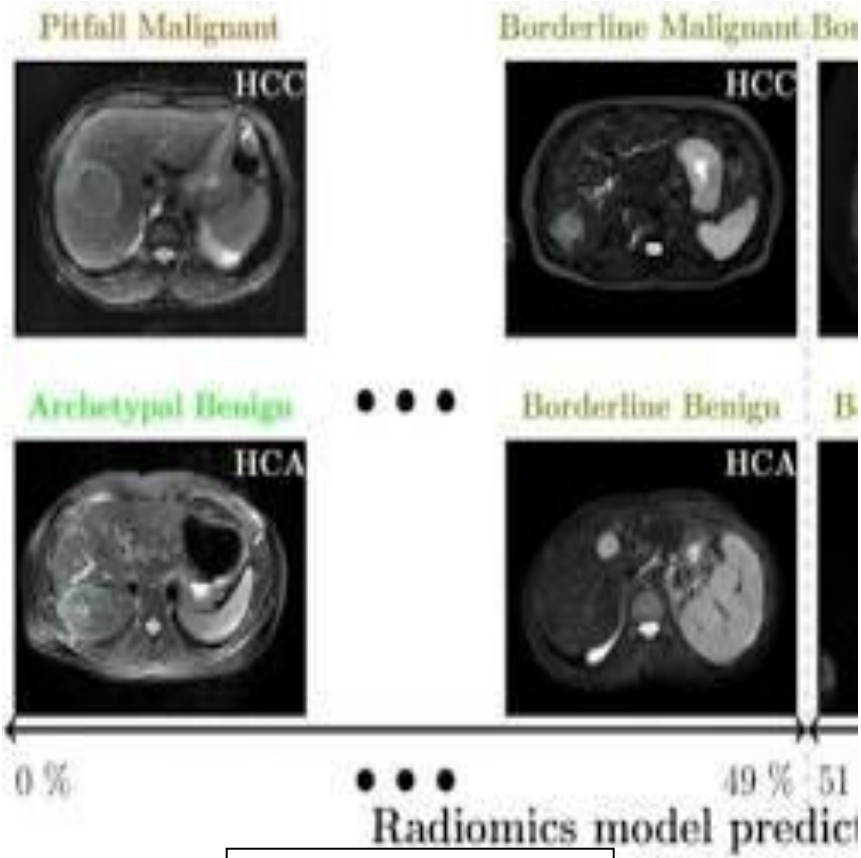

Figure-03

DISCUSSION

The differentiation between benign and malignant liver lesions remains a critical aspect of patient care, particularly in guiding the need for surgical intervention or conservative management. In our study, MRI demonstrated superior diagnostic performance over CT, with a sensitivity of 90%, specificity of 85%, and overall accuracy of 88%. These findings are consistent with existing literature, which highlights MRI's ability to better characterize soft tissues and identify malignant features such as irregular margins, diffusion restriction, and vascular invasion [7, 8].

CT remains a valuable tool, especially in emergency settings and for the initial detection of lesions. However, the sensitivity of CT in this study (80%) was lower than that of MRI, primarily due to the overlapping enhancement patterns seen in benign and malignant lesions during the arterial phase [9]. Our results align with previous reports that suggest MRI is more reliable for differentiating between benign entities, such as hemangiomas, and malignancies like hepatocellular carcinoma [10].

One notable observation in this study was the misclassification of some benign lesions as malignant, particularly with CT imaging. This is likely attributable to the nonspecific enhancement patterns seen in hepatic adenomas and focal nodular hyperplasia, which can mimic malignancies [11]. MRI's ability to incorporate advanced sequences like DWI likely contributed to its higher specificity, allowing for better lesion characterization [12].

Histopathological confirmation, used as the gold standard in this study, remains indispensable for accurate diagnosis, particularly in cases where imaging findings are equivocal [13]. While biopsy and surgical resection provide definitive diagnosis, imaging modalities like MRI and CT play a crucial role in narrowing down the differential diagnosis and guiding further interventions [14].

CONCLUSION

In conclusion, our study reinforces the notion that MRI is superior to CT in differentiating benign from malignant liver lesions. The higher accuracy of MRI makes it a preferred modality, especially when definitive characterization of liver lesions is essential for clinical decision-making.

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