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Role of MRI in Focal Liver Lesions

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Abstract: ***In this research, 42 individuals with focal liver lesions were studied to see how well magnetic resonance imaging (MRI) characterized and diagnosed these conditions. Using diffusion-weighted imaging (DWI), dynamic gadolinium-enhanced sequences, and unenhanced MRI, we examined MRI signal intensity fluctuations affected by lesion histopathology and intracellular substances. The majority of the participants were middle-aged men (68% of the total), and the majority of the lesions were situated in the right lobe of the liver (61% of the total). Hemangiomas, metastases, hepatocellular carcinoma, and cholangiocarcinoma were among the 18 malignant lesions; abscesses, simple cysts, hydatid cysts, and hemangiomas made up the 24 benign lesions. With the exception of a few instances involving metastasis and hepatocellular carcinoma, radiological diagnosis and histological confirmation were quite concordant, with a success rate of 100% for benign lesions and 80-100% for malignant lesions. By accurately identifying benign cysts, hemangiomas, localized nodular hyperplasia, and metastases, MRI was able to anticipate the diagnosis in 90% of malignancies. The research emphasizes the use of magnetic resonance imaging (MRI) as a non-invasive diagnostic tool for liver lesions. Lesion characterisation is done precisely using MRI sequences that include pre-contrast T1 weighted, T2 weighted, in-phase and out-of-phase imaging, echo planar imaging (EPI)-DWI, and gadolinium-enhanced T1 weighted. Clinical decision-making and treatment planning for localized liver lesions are much enhanced by MRI, according to these data.***

Keywords: Magnetic Resonance Imaging (MRI), Focal Liver Lesions, Diffusion-Weighted Imaging (DWI)

1. Introduction

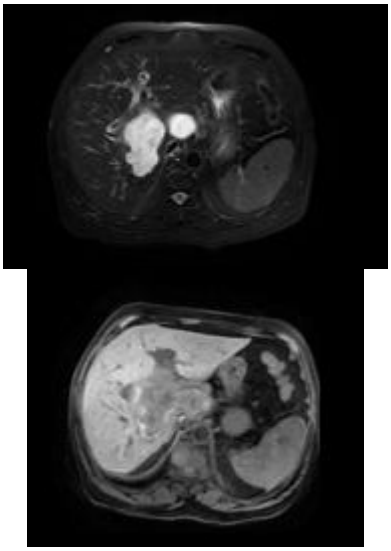
The pathogenic characteristics that impact T1 and T2 relaxation times, such as lesion histology (cellularity, vascularity, stromal components, necrosis, or bleeding), also affect the strength of magnetic resonance signals in localized liver lesions. The behavior of MR signals is also influenced by intracellular materials such as fat, iron, copper, melanin, and glycogen. Some studies indicate that benign liver masses are frequent, however the precise occurrence is unknown. Up to 38% of patients survive when solitary colorectal metastases are removed. When evaluating liver disease, MRI is perfect because it provides contrast for diffuse processes such iron buildup in hemochromatosis, which affects more than 20% of the population, and aberrant fat in nonalcoholic steatohepatitis.

Aims & Objectives

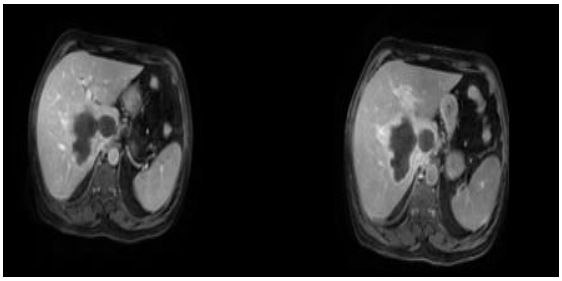
1) To evaluate both unenhanced and dynamic gadolinium enhanced sequences in order to determine the lesion characterisation potential of MRI.
2) To explain the main MRI results by histopathologically correlating the lesions.
3) To assess the lesions using diffusion weighted imaging and look at how the b value helps distinguish between benign and malignant lesions.

2. Materials and Methods

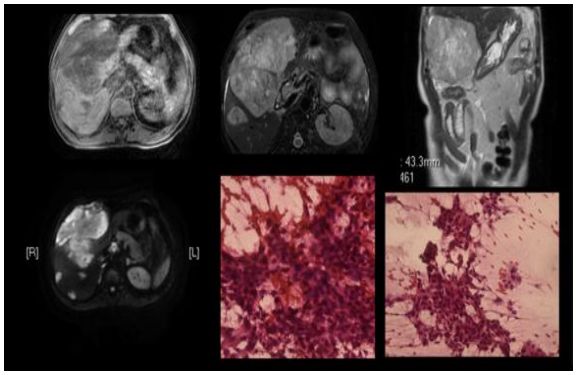
After giving their informed agreement, 42 consecutive patients who were sent to Sri Siddartha Medical College and Hospital's department of radiodiagnosis and who had sonographically been diagnosed with localized liver lesions were included in the research. A specialized phased-array body coil was used.



Axial T2 images show intensely hyperintense lesion in caudate lobe and segment VII of the liver.



Early and delayed stages of axial post-contrast pictures. In delayed stages, there is a ring enhancement remark around the lesion. On delayed pictures, the thick wall and perilesional amplification are seen.



T2, DWI, axial LAVA, and coronal T2. The lesion appears bright on diffusion weighted images, hyperintense on T2 WI, and hypointense on LAVA. A cytosmear reveals sheets of tumor tissue, clusters of round to oval cells, and moderate to sparse cytoplasm, all of which are indicative of poorly differentiated hepatocellular carcinoma.

3. Results

A study analyzing MRI features of 42 individuals with liver lesions found that 18 of the 42 cases had malignant lesions, while 24 were benign. The majority were aged 40-60, with 61% of the lesions in the right lobe.

Table 1: Sex Distribution

Sex	Count of instances	Percentage
Male	28	68%
Female	13	32%

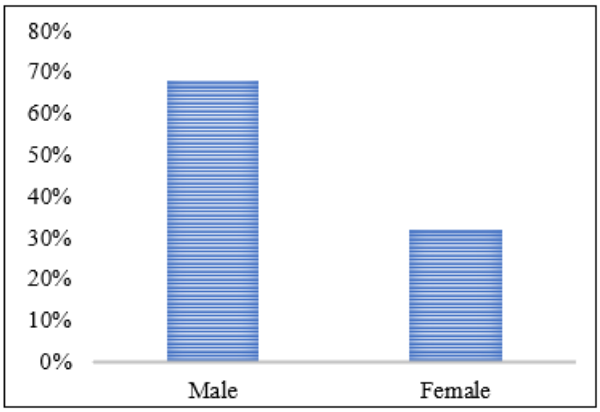


Figure 1: Graphical Representation on the percentage of Sex distribution

Of the 41 cases, 68% were male, with 13 being female. This suggests that liver lesions are more common in men, possibly due to increased exposure to hepatotoxic drugs, viral hepatitis, occupational risks, or lifestyle factors. The study underscores the importance of considering sex-specific risk profiles in diagnosing, preventing, and treating liver disorders.

Table 2: Distribution of Ages

Age (yrs)	No of Patient
10-20	0
20-30	4
30-40	12
40-50	9
50-60	15
60-70	2
>70	0

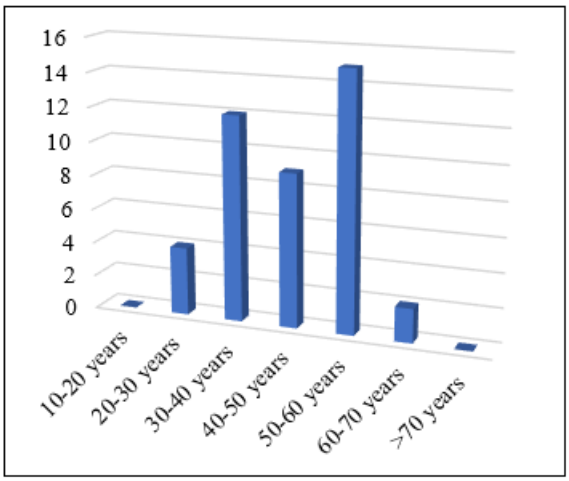


Figure 2: Graphical Interpretation on the percentage of Age Distribution

The study reveals that the majority of hepatic lesion cases are in the middle-aged population, with 15 individuals aged 50-60 being the most common. The 30-40 age group had 12 instances, followed by the 40-50 age group with 9. Liver lesions are more common in people aged 30-60, with only four instances in younger age groups and none in age groups 10-20 or older than 70. The working-age population, particularly those in their fourth to sixth decades, is where liver lesions are most common.

Table 3: Incidence of Benign and Malignant Lesions

Lesions	Benign	Malignant
Hepatic cysts	4	-
Pyogenic liver abscess	7	-
Echinococcal liver cysts	4	-
Cavernous hemangiomas of the liver	4	-
Localized hepatic steatosis sparing	2	-
Mucinous cystic neoplasm of the liver	1	-
Benign hepatic hyperplastic nodule	1	-
Secondary hepatic malignancy	-	9
Primary liver cancer	-	5
Bile duct carcinoma	-	4
Benign post-necrotic hepatic nodules	1	-
Total	**24**	**18**

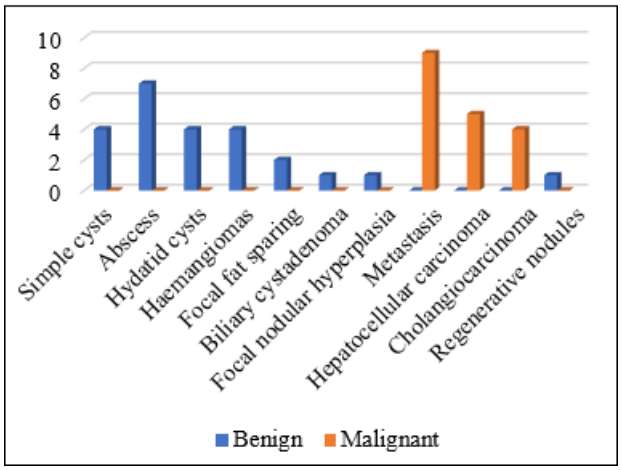


Figure 3: Graphical Representation on Benign and Malignant Lesions

The investigation revealed a diverse range of benign and malignant hepatic lesions, with hepatic abscesses being the most common. Other common benign abnormalities included focusing fat sparing, biliary cystadenoma, localized nodular hyperplasia, and regenerative nodules. On the other hand, 18 malignant lesions were found, with metastatic lesions being the most common. Hepatocellular carcinoma was the second most prevalent malignant lesion. The study underscores the importance of precise diagnostic imaging and clinical assessment in distinguishing between benign and malignant hepatic pathologies.

Table 4: Anatomical Distribution of Hepatic Lesions

Location	Number of Lesions
Right hepatic lobe	26
Left hepatic lobe	7
Bilobar (involving both hepatic lobes)	9

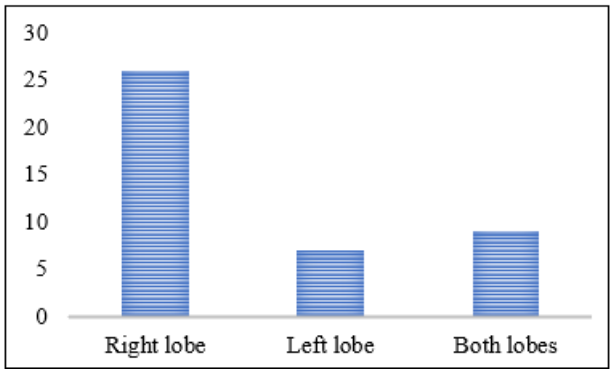


Figure 4: Graphical Representation on Number of Lesions

The anatomical distribution of hepatic lesions according to their position within the liver lobes is shown in Table 4. With 26 cases, the right lobe accounted for the bulk of lesions, indicating a notable prevalence when compared to other locations. This result is consistent with previous research that indicates the right lobe is more often impacted because of its bigger size and more extensive vascular supply. Conversely, the left lobe had a comparatively lower incidence, with just 7 lesions found there. Furthermore, nine lesions were found to include both lobes, indicating a more widespread or diffuse disease process in these instances. When contemplating lesion excision or focused treatment, the overall distribution emphasizes the propensity of hepatic lesions to locate mostly in the right lobe, which has significant clinical consequences for diagnosis, imaging emphasis, and surgical planning.

Table 5: Diagnostic Accuracy of Benign Liver Lesions

Bening lesion	Radiologically diagnosed cases	Confirmed by HPE/ Followup	Percentage
Hepatic cyst	4	4	100%
Pyogenic liver abscess	5	5	100%
Echinococcal liver cyst	4	4	100%
Cavernous hepatic hemangioma	5	5	100%
Localized sparing in hepatic steatosis	2	2	100%
Mucinous cystic neoplasm of the liver	1	1	100%
Benign hepatic hyperplastic lesion	1	1	100%

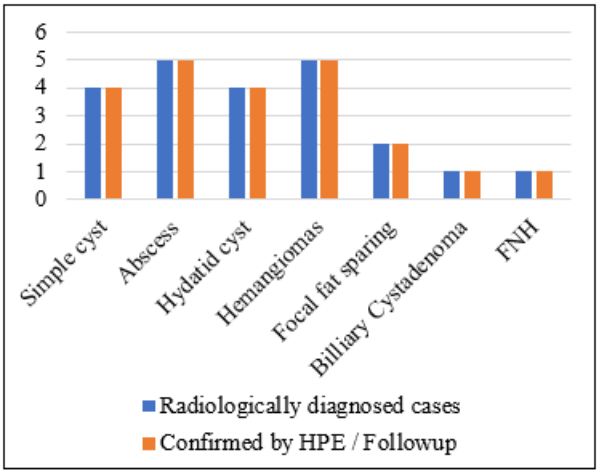


Figure 5: Graphical Representation on

The study demonstrates a 100% concordance rate between radiological diagnosis of benign liver lesions and their confirmation by histological testing or clinical follow-up. This confirms the high diagnostic accuracy of radiological imaging in detecting benign liver disorders. The study also found that imaging reliably identified less common lesions, such as localized fat sparing, biliary cystadenoma, and focal nodular hyperplasia. This highlights the importance of radiological techniques, particularly ultrasonography, CT, and MRI, in distinguishing benign liver lesions and guiding therapeutic choices.

Table 6: Diagnostic Confirmation of Malignant Liver Lesions

Malignant lesions	Radiologically Diagnosed cases	Confirmed by HPE/Follow-up	Percentage
Metastasis	11	9	82%
HCC	5	4	80%
Cholangiocarcinoma	4	4	100%

Table 6 compares radiologically diagnosed cases with confirmations from histopathological investigation (HPE) or clinical follow-up to analyze the diagnosis accuracy of radiological imaging for malignant hepatic lesions. With 9 of the 11 instances that were first identified as metastases being confirmed, the accuracy rate was 82%. Likewise, an 80% confirmation rate was achieved, with 4 of 5 patients classified

as hepatocellular carcinoma (HCC) being confirmed. Notably, a 100% diagnostic concordance was shown by the precise identification and confirmation of all four cholangiocarcinoma cases. Despite the fact that radiological imaging is a very useful method for identifying malignant liver lesions, particularly cholangiocarcinoma, these results imply that there is still a small chance of diagnostic error in instances of metastasis and HCC. To guarantee an accurate diagnosis and suitable treatment planning, this highlights the ongoing significance of histopathological confirmation, especially for cancers with overlapping imaging features.

4. Conclusion

In 38 out of 42 tumors, MRI was able to predict the diagnosis. Depending on the case, it may reveal the nature of benign cysts, hemangiomas, localized nodular hyperplasia, or metastases. The final diagnosis could not be reached in two cases of early abscesses, one case of multifocal hepatocellular carcinoma, and one case of regenerative nodules. For ninety percent of the detections, this was the culprit. So, magnetic resonance imaging (MR) is a good way to evaluate small liver lesions. Imaging techniques such as in-phase and out-of-phase imaging, gadolinium enhanced T1 weighted images, pre-contrast T1 weighted gradient echo pictures, and T2 weighted images may help precisely describe the lesions.

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