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Evaluation of localized liver lesions using magnetic resonance imaging association with histopathology

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Abstract
Background: There has been a rise in the number of focal liver lesions that are inadvertently found due to the widespread use of cross-sectional imaging. Having a reliable approach for detecting and characterizing FLL is crucial for optimal patient therapy.
Materials and Methods: This study was conducted in the Department of Radio Diagnosis, Madha Medical College and Research Institute, Chennai, Tamil Nadu, India, from August 2016 to September 2017. Patients who exhibited clinical, biochemical, ultrasound, and CT signs of liver pathology were referred to the Department of Radio Diagnosis, Madha Medical College and Research Institute, Chennai, Tamil Nadu, India for diagnosis. Initially, a minimum of 50 instances are selected. However, it is possible to increase the number of cases if they are available during the study time.
Results: Within the realm of FLL, attaining the maximal level of imaging precision is crucial in order to avoid unnecessary biopsies, which may result in post-procedural complications. The magnetic resonance imaging approach has the capacity to provide comprehensive and highly precise diagnostic information, while also avoiding the use of any potentially hazardous ionizing radiation. This article provides a comprehensive analysis of the imaging features of both benign and malignant focal liver lesions.
Conclusion: It includes that a diagrammatic representation of a practical approach employing magnetic resonance imaging.

Keywords: Benign, malignant, liver, lesions, magnetic resonance imaging

Introduction
An increase in the rate of incidentally identified focal liver lesions (FLL) has been documented due to the widespread use of cross-sectional imaging. An accurate identification and description of FLL is crucial for the most effective patient care. Most cases of Focal Liver Lesions (FLL) that occur in noncirrhotic liver are not cancerous, even in patients who already have other types of cancer outside the liver. The most frequently observed benign lesions are cysts, hemangiomas, localized nodular hyperplasia, and hepatocellular adenomas. Metastases are the most often observed malignant lesions in noncirrhotic liver [1-3].
Hepatocellular carcinomas, as well as intrahepatic cholangiocarcinomas to a lesser degree, primarily develop in individuals with chronic liver illness. These types of cancer are the most frequently occurring primary liver malignancies. Significant advancements in imaging technology have occurred in recent years. Ensuring the highest level of precision in imaging is crucial in the context of FLL to prevent needless biopsies, which can lead to post procedural complications of up to 6.4% and mortality rates of up to 0.1%. Currently, magnetic resonance imaging (MRI) is crucial in the treatment of liver lesions, utilizing a technology that does not include radiation and a contrast agent that is safe. Magnetic resonance imaging (MRI) is an excellent technique for fully defining focal liver lesions (FLL) due to its enhanced soft-tissue resolution and sensitivity to intravenous contrast agents [4-6].
Prior research has determined that the sensitivity and specificity of MRI in diagnosing FLL are expected to be 94% and 82%-89%, respectively. This review specifically examines the diagnostic accuracy of MRI in assessing the most prevalent non-cancerous and cancerous liver lesions. In summary, this paper also presents a practical educational method to FLL on MRI. Magnetic Resonance Imaging (MRI) Protocol Magnets with field strengths of 1.5 Tesla

(T) and 3T are currently considered the benchmark in technology for producing high-quality and consistent MR pictures [3-5]. Significant progress has been made in the field of MRI over the past decade, particularly in terms of hardware, software, and contrast agents, which have greatly improved liver imaging. From our viewpoint, a suitable imaging technique must be concise, thorough, and standardized in order to ensure the ability to reproduce and maintain consistent image quality and diagnostic accuracy. An extensive procedure enables the assessment of the parenchyma, vascular, and biliary system. This can be achieved through the utilization of either breathing-independent sequences or breath-hold sequences that effectively reduce motion artifact and spatial misregistration [7-9].

Gradient-echo sequences are typically employed in T1-weighted sequences, while fast spinecho sequences are utilized in T2-weighted sequences. Advanced MRI methods utilize a mixture of fat-suppressed and non-fat-suppressed T2-weighted pictures, in- and opposed-phase T1-weighted images, and dynamic pre- and post-contrast fat-suppressed T1-weighted images. T2-weighted imaging primarily provides information regarding the presence of fluid, fibrotic tissue, and iron content. Fat suppression is typically employed for at least one series of photos to enhance the visibility of lesions. Pre-contrast T1-weighted images (T1-WIs) play a crucial role in accurately identifying and describing lesions [10-12].

Noninvasive methods, however, could be valuable in identifying and characterizing these abnormalities. Transabdominal sonography, contrast-enhanced computed tomography, and magnetic resonance imaging are commonly employed to noninvasively diagnose liver problems. Dynamic three-dimensional gradient-recalled-echo MR imaging provides a precise assessment of different localized hepatic lesions by producing thin-section pictures with fat saturation and a high signal-to-noise ratio, increased by dynamic contrast [11-13].

Materials and Methods

This study was conducted in the Department of Radio Diagnosis, Madha Medical College and Research Institute, Chennai, Tamil Nadu, India, from August 2016 to September 2017. Patients who exhibited clinical, biochemical, ultrasound, and CT signs of liver pathology were referred to the Department of Radio Diagnosis, Madha Medical College and Research Institute, Chennai, Tamil Nadu, for diagnosis. Initially, a minimum of 50 instances are selected. However, it is possible to increase the number of cases if they are available during the study time.

Inclusion Criteria

- Patients presenting with focal hepatic lesions was suspected clinically.
- Patients who had hepatic abnormalities on earlier imaging studies
- Patients who are otherwise healthy yet have abnormal hepatic imaging etc.
- Patients with indeterminate liver lesions detected on USG or CT.

Exclusion Criteria

- All patients having cardiac pacemakers, prosthetic heart valves
- Patient having history of claustrophobia
- All patients who do not consent to be a part of the study
- Renal dysfunction stage 4 & 5 CKD.

Results

The current investigation was carried out in the Department of Radiodiagnosis of GGH, Medical College. The study population consisted of all individuals who exhibited signs of hepatic masses based on clinical and/or Ultrasonography results. An MRI was used to analyze a total of 50 individuals with liver lesions. The distribution of instances is illustrated in the subsequent table.

Table 1: Distribution of cases

LESION	Patients	%
Benign Focaliver Lesions		
Haemangioma	6	12
Hydatid cyst	7	14
Abscess	5	10
Simple hepatic cyst	4	8
Focal fatty infiltration	1	2
Hepatic adenoma	2	4
Poly cystic liver disease	1	2
Kochs granuloma	1	2
Biliary hamartoma	1	2
Regenerative nodule	1	2
Malignant Focaliver Lesions		
Metastases	9	18
Hepatocellular carcinoma	6	12
Cholangio carcinoma	4	8
Lymohoma	2	4
Total	50	100

Among the 50 instances, there were 29 masses that were determined to be benign and 21 masses that were determined to be malignant. Hemangiomas were the most prevalent benign hepatic tumor, while metastases were the most prevalent malignant hepatic tumor.

Table 2: Age distribution of patients with focal liver lesions

Age distribution (years)	Number of patients	%
<20	2	4
21-30	2	4
31-40	6	16
41-50	11	22
51-60	16	32
>60	13	26
Total	50	100

The age range of cases spanned from 2 years to 70 years, with the highest number of patients falling between the ages of 51 and 60 years.

Table 3: Age distribution in hepatic lesions

Lesion	Number of Cases	Age group (In Years)					
Benign lesions		**<20**	**21-30**	**31-40**	**41-50**	**51-60**	**>60**
Haemangioma	6	-	1	1	1	2	1
Hydatid cyst	7	-	1	1	2	2	1
Abscess	5	-	-	-	3	1	1
Simple hepatic cyst	4	-	-	-	-	2	2
Focal fatty infiltration	1	-	-	1	-	-	
Hepatic adenoma	2	-	-	2	-	-	
Polycystic liver disease	2	-	-	-	-	-	2
Kochs granuloma	1	1	-	-	-	-	
Biliary hamartoma	1	-	-	1	-	-	
Regenerative nodule	1	-	-	-	1	-	
Malignant Lesions							
Metastases	8	-	1	1	-	5	3
Hepatocellular carcinoma	7	-	-	-	1	5	1
Cholangio carcinoma	4	-	-	-		2	1
Lymohoma	1	-	-	-	1	-	
Total	50	1	3	7	9	19	12

The data indicates that 36% of the instances occurred in individuals in their sixth decade of life. Hepatocellular carcinoma (HCC) and metastases were primarily observed in patients over the age of 40 years. Metastases were observed in 10 instances, with the majority occurring in individuals between the ages of 50 and 69.

Table 4: Distribution of sexes among patients with isolated liver lesions

Sr. No.	Gender	Number of patients
1.	Male	32
2.	Female	18

The table above indicates that 66% of the cases analyzed in the study were males, whereas 17% were females.

Table 5: Patients with benign localized liver lesions: A breakdown of sex

Sr. No.	Gender	Number of patients
1.	Male	16
2.	Female	2

Table 6: Patients with malignant localized liver lesions: A distribution of sexes

Sr. No.	Gender	Number of patients
1.	Male	15
2.	Female	06

The predominant symptom observed in instances with hepatic masses was abdominal pain, with the presence of an abdominal mass being the second most often reported symptom. Abdominal pain was the predominant symptom observed in instances of haemangioma. Abdominal pain was the predominant symptom observed in instances of hepatocellular carcinoma (HCC). 4 out of 7 cases of hepatocellular carcinoma (HCC) were attributed to alcohol consumption. The most commonly seen symptoms in metastases were pain and weight loss.

Discussion

The present investigation was conducted in the Department of Radiodiagnosis of GGH, Kurnool Medical College. The study population consisted of patients who were referred to the department of Radio-diagnostic and imaging at Kurnool Medical College and GGH for diagnosis. These patients had clinical, biochemical, ultrasound, and CT evidence indicating liver pathology. Among the 61 patients referred by various clinical departments, 4 individuals with advanced metastasis received palliative chemotherapy. Unfortunately, 3 of these metastasis patients passed away before fine needle aspiration cytology could be performed. Additionally, 4 patients who were suspected of having hepatocellular carcinoma were lost to follow-up, preventing FNAC from being conducted. The study comprised a total of 50 incidents. This investigation includes 50 patients with localized hepatic lesions. The study group consisted of 17 women and 33 males, representing 66% of the total participants. 57% of the patients fell between the age range of 31-60. According to the present investigation, 42% of the lesions were determined to be malignant [12-14].

The most prevalent malignant primary hepatic tumor examined was metastases, which were detected in 20% of cases and were present in 80% of patients aged 8 or older. Matsui *et al.* (2005) and Silverman *et al.* (2005) reported congruent results in 2009. When hepatic masses were present, the most commonly reported symptom was abdominal pain (82%), followed by the presence of an abdominal mass (32%). The two most prevalent symptoms shared by metastases are pain and weight loss, accounting for 70% of cases. Abdominal discomfort was the most common symptom of HCC, with a prevalence of 71.42%. The most prevalent clinical symptom was hepatomegaly, which refers to an enlarged liver or a mass felt in the right hypochondrium, observed in 36% of patients. An accurate diagnosis may be determined solely based on the clinical characteristics in 38% of instances. Imaging plays a crucial role in diagnosing, identifying, and accurately outlining different types of lesions [15-17].

The hepatic mass lesions consisted of 40% non-tumorous lesions, 18% benign hepatic tumors, and 42% malignant lesions. Within our series, the prevalence of metastatic disease was observed in 20% of the total patient population. Accounting for 47.61% of all malignant cases, it held the highest prevalence among malignant lesions. MRI exhibits a sensitivity of 100% and a specificity of 93.55% for malignant mass lesions, whereas it demonstrates a sensitivity of 93.55% and a specificity of 100% for benign disorders. A simple cyst on Doppler imaging appears as a clearly defined area without echoes, with increased sound

transmission behind it, but without any blood flow. The diagnosis can be confirmed by analyzing the results of the USG and CT scans. However, the utilization of multiple MRI sequences yielded further information regarding the internal composition of the cyst [16-18].

The distinctive characteristics of hydatid sand and floating membrane can be utilized to confirm the diagnosis of a hydatid cyst directly on the ultrasound examination. A low intensity rim was observed surrounding the lesion on the T1W and T2W images of the MRI, which is a distinctive observation. Differentiating between amoebic and pyogenic abscesses with sonography is often straightforward. Amoebic abscesses typically appear as solitary, well-defined, hypoechoic lesions with accentuated posterior features. Perilesional edema was identified on an MRI scan as being specific to an amoebic liver abscess. On ultrasonography (USG), hemangiomas are clearly characterized and show increased echogenicity in small lesions. However, lesions larger than 6 cm may have a varied pattern [17-19].

In T1-weighted images of the magnetic resonance (MR), there is a decrease in signal intensity. However, in T2-weighted imaging, there is a significant increase in signal intensity. Additionally, there is a distinct peripheral nodular enhancement with delayed centripetal filling. Due to their bright appearance on T2WI, haemangiomas can be effectively distinguished from small hepatocellular carcinoma using MRI. Consequently, MR data are regarded as diagnostic [20, 21]. MRI is valuable for distinguishing between benign nodules and dysplastic nodules, which may include a malignant HCC center. Hepatocellular carcinoma appears as a solid mass with different echogenicity from the surrounding tissue, with poorly defined boundaries and widespread blood vessel formation. Metastatic lesions exhibited a varied appearance on USG. The predominant sonographic pattern exhibited multiple distinct, solid hypoechoic liver lesions. The vascularity of the metastatic lesions is a direct reflection of the initial tumor's vascularity. Unlike hepatocellular carcinomas, which have a scattered distribution of blood vessels, hypervascular metastasis displays a peripheral arrangement [21].

Conclusion

A comprehensive examination was conducted on a group of 50 persons who had hepatic lesions. The age of these individuals ranged from 2 to 70 years, with the highest percentage falling within the 51 to 60 year age bracket. The male patients accounted for 66% of the total, with a male to female ratio of 2:1. The findings of the magnetic resonance scan are ambiguous. USG is unable to differentiate between focal fatty infiltration and hepatic lesions, whereas MRI has the capability to do so. Ultrasonography is a useful screening tool for detecting liver abnormalities. Ultrasonography should be employed for all persons with suspected hepatic lesions to initially detect and locate the lesion. Magnetic Resonance Imaging, with a sensitivity rate of 92%, is a dependable diagnostic technique for detecting hepatic masses. The study findings highlight the advantages of utilizing multiplanar imaging and MRI with notable differentiation of soft tissues for identifying and describing various liver diseases. When a patient is suspected of having a hepatic lesion, it is recommended to conduct an ultrasound as the primary screening method. CT and MRI should be used to further describe the lesion and determine the stage of any malignant abnormalities.

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Done.

Conflict of Interest
None.

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