Original Research Article

Comparison and correlation of CT scan and MRI for focal liver lesion detection and characterization

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Abstract

Background: Liver diseases create diagnostic challenge for attending clinicians. Role of radiological imaging, particularly newer modalities like Ultrasound, Color Doppler, CT scan, MRI, DSA, are highly reliable. Early identification of liver lesions provides the opportunity for the success of therapeutic approach. Contrast enhanced CT scan and contrast enhanced MRI are most advanced and appropriate modalities to detect and characterize liver focal lesions. In present study we tried to compare and correlate findings of both modalities. **Methodology:** We evaluated 40 cases of liver pathologies which are suspected in sonography examination. All patients were undergone contrast enhanced CT scan as well as MRI evaluation. Various radiological findings are recorded in standard format. **Result:** In total 40 patients of focal liver pathology all age groups are included. Male: female ratio is 70:30.Patients are presented with various clinical symptoms like right hypochondriac pain, fever, lump, jaundice, weight loss etc. Benign lesions are found in 40% of cases and malignant lesions are found in 60 % of cases. Most common pathology is liver metastatic lesions which are picked up by MRI with 100% accuracy. CT is able to characterize only 10 out of 13 metastatic cases(77%). Few other cases of benign lesions like hemangioma, hamartoam ,adenoma and FNH are also remained indeterminate in CT scan which all are accurately diagnosed and characterized by MRI and confirmed in histopathology. A case of HCC, lymphoma and nodular dysplasia also remained indeterminate in CT scan and further diagnosed and characterized by MRI.

Key Words: CT Scan, Focal liver lesions, MRI.

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INTRODUCTION

Liver is a common target for various primary as well as secondary malignancies. Deciding patient's eligibility for either invasive procedure or palliative therapy requires accurate assessment of liver tumours, liver parenchyma and the extent of the disease. Differentiation between hemangiomas and other focal liver lesions, such as liver metastases, is also of high clinical importance, especially in the case of patients with a history of a malignancy [3].CT scan can detect actual density and contrast enhancement pattern of various lesions during various phases[4]. MRI plays an important role in evaluation of wide range of benign and malignant focal liver lesions with help of its basic sequences and special sequences like 3 dimensional (3D) gradient recalled echo(GRE) sequences such as volumetric interpolated breath hold examination(VIBE). Various studies suggested there is large potential of non-invasive non ionizing MRI technique in liver focal lesion imaging specially after scanner hardware improvement and fast imaging technique with motion artifact

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suppression[5]. Aim of this study is to compare and correlate CT scan and MRI techniques in detection and characterization of focal liver lesions.

MATERIALS AND METHODS

The present study was carried out in 40 patients at the department of radio-diagnosis in M P Shah Govt.Medical College and G G Hospital Jamnagar. All patients were referred from surgical and medical department to Radio diagnosis department for investigations of liver pathology. The study was performed on 16 slice CT SCAN machine of GE BRIGHT SPEED healthcare with pre contrast and triple phase post-contrast 5mm axial sections. A 120-140 kV tube voltage and 300-380 mAs current were used. After contrast agent injection at 3-4 ml/s, bolus-triggered scans in the arterial, portal venous and equilibrium phases were acquired (approximately 25-35 seconds, 50-70 seconds and 10 minutes after injection). A collimation of 5 mm was used in the arterial phases of imaging, and a collimation of 2.5 and 5mm in the portal venous phase scanning. All phases of imaging were performed with a 0.8 sec gantry rotation, a pitch of 6 and a 15 mm table feed with each gantry rotation. Triple phase Computed Tomography has gained acceptance as the preferred technique for the valuation of wide range of focal liver lesions, because it provides image acquisition at peak enhancement of liver parenchyma in a single breath hold, reducing the chances of missing small lesions[6]. In this study MRI imaging was performed with 1.5 TESLA 8 channel MRI of SIEMENS MAGNETON ESSENZA machine. A dedicated phased-array body coil was used. Pre contrast T1 –weighted, fat suppressed 3D GRE VIBE 3-5mm axial sections, Fat-suppressed coronal T2-weighted HASTE , Fat-suppressed T1-weighted fast low angle shot and True FISP/ dual excitation T2W sequence (T2+T2), axial in-phase and out-phase chemical shift GRE T1-weighted[7] images were acquired . Image contrast is related to the T2*/T1 ratio. Acquisition time is approximately 10 seconds, allowing scanning to be performed during breath-hold. Dynamic fat suppressed Gd-enhanced T1-weighted MR imaging VIBE 3DGRE sequence subsequently performed in the arterial, portal-venous and equilibrium phases. The imaging parameters were kept identical. A power-injector was used for the gadolinium injections (Magnilek, gadopentetate dimeglumine, USP, dose 0.1 mmol/kg body weight; injection rate 2 ml/s).Three-dimensional GRE imaging has several advantages over two-dimensional dynamic imaging[8,9]: (a) 3D images can be reformatted in any plane, (b) high-quality thin-section images with no gaps can be obtained, and (c) the detection and localization of small focal hepatic lesions is superior. In addition, the same data set can be used to generate high-quality images depicting the vasculature. A comprehensive liver protocol evaluates the parenchyma, vasculature, and biliary system. High-quality images require compromise between achievable resolution and the need for breath-holding, which limits each sequence to 20 seconds or less. Breath-holding is not always possible in sick patients. As a result, modifications to the basic protocol may include the addition of free-breathing sequences, respiratory-trigger and gating, motion correction techniques.

RESULTS AND DISCUSSION

In present study focal liver lesions are found in all age groups with largest number (45%) in age group of 51-70 years. Maximum numbers of cases are among male gender(70%) as compared to female gender having 30% cases. Patients are presented with various clinical symptoms like pain and lump in right hypochondrium, fever, jaundice and weight loss. Out of 40 cases 60 %(24 cases) are of malignant lesions and 40% (16 cases) are of benign lesions.

TABLE 1

Benign lesions 16 cases (40%)			Malignant lesions24 cases (60%)		
Lesions	No of cases	%	Lesions	No of cases	%
Liver abscess	4	10	Hepatocellular carcinoma	7	17.5
Benign adenoma	1	2.5	Liver metastasis	13	32.5
Hemangioma	7	17.5	Cholangiocarcinoma	2	5
Focal nodular hyperplasia	1	2.5	Lymphoma	1	2.5
Hydatid cyst	2	5	Dysplastic nodule	1	2.5
Biliary hamartoma	1	2.5			

We have compared and correlated ability of CT scan and MRI for lesion characterization and diagnosis against gold standard diagnostic methods histopathology/surgical findings.

TABLE 2: COMPARATIVE ABILITY OF CT SCAN AND MRI FOR FOCAL LIVER LESION CHARACTERISATION AGAINST HISTOPATHOLOGY/SURGICAL FINDINGS

Confirmed diagnosis of liver lesions on histopathology/surgery	CT Scan		MRI	
	Confirmed lesion	Indeterminate lesions	Confirmed lesion	Indeterminate lesions
Abscess	4	0	4	0
Benign adenoma	0	1	1	0
Hemangioma	6	1	7	0
Hepatocellular carcinoma	6	1	7	0
Liver metastasis	10	3	13	0
Focal nodular hyperplasia	0	1	1	0
Hydatid cyst	2	0	2	0
Biliary hamartoma	0	1	1	0
Cholangiocarcinoma	2	0	2	0
Lymphoma	0	1	1	0
Dysplastic nodule	0	1	1	0
Total lesions n=40	30	10	40	0

and diagnosis while CT scan is having 100% sensitivity for focal liver lesions detection with 30/40 =75% specificity for lesion characterization and diagnosis. Above comparative study suggests that MRI is able to well characterized hemangioma, benign adenoma, metastasis, focal nodular hyperplasia, lymphoma, dysplastic nodule and hepatocellular carcinoma and hamartoma more precisely and accurately compared to CT scan. All 40 cases are identified by both techniques, however CT scan is unable to characterize and diagnose 10 cases while MRI can characterize and diagnose all 40 cases. So we can say MRI is having 100% sensitivity and specificity for focal liver lesion detection, characterization

TABLE 3: CORRELATION OF CT AND MRI ON BASIS OF CORRECTLY CHARACTERIZATION NUMBERS OF LIVER LESIONS (N=40)

Characterization of number on liver lesions	More than CT	Same as CT	Less than CT
MRI (number of patients)	10(25%)	30 (75%)	0

In this study of 40 patients of focal liver lesions, MRI had diagnosed more number of liver lesions as comparison to CT in 25% patients (10 patients) and similar number of lesions in 75% patients (30 patients) and there was no any patient in which MRI show less number of liver lesion as comparison to CT.

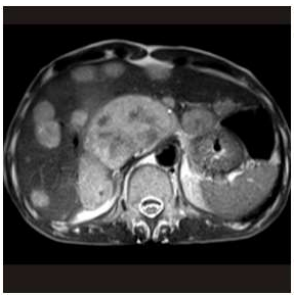


Figure 1

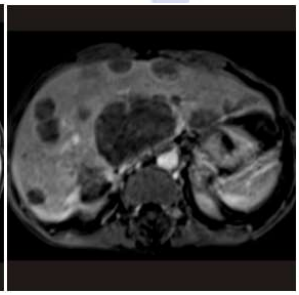
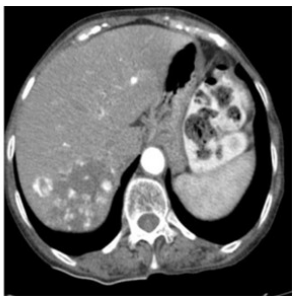


Figure 2



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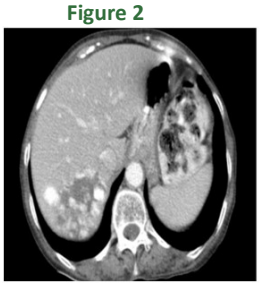

Figure 4

Figure 1: Liver Metastasis T2 HASTE AXIAL; **Figure 3:** Liver Metastasis T1 VIBE FS portal venous phase; **Figure 4:** Plain and arterial phase of contrast CT scan of a case of hemangioma; **Figure 5:** Portal venous phase and equilibrium phase of CT scan in a case of hemangioma

CONCLUSSION

In present study, Majority of patients of focal liver lesions are from the age group of 51-70 years (45%).Present Study reveals male predominance in focal liver lesions with male female ratio of 2.33. Focal liver lesions in present study show Malignant lesions are more (60%) as compared to benign lesions (40%).Most common malignant lesions was metastasis (32.5%) followed by hepatocellular carcinoma (17.5%) and most common benign lesion being hemangioma (17.5%) followed by liver abscess (10%).Based on symptomatic distribution majority of the patients presented with complain of weight loss followed by pain and lump in right hypochondriac. In present study, largest number of indeterminate lesions on CT was found in hemangiomas (7.5%) .In Present study, MRI is equal to CT in detection of number of liver lesions but superior to CT in well characterization of liver lesions (in 25% more patients than on CT) with specificity of 100% and sensitivity of 100%.In overall focal liver lesions CT was correctly able to diagnose in 75% patients, while MRI diagnosed 100% patients correctly. CT and MRI are useful to identify the lesion, extent of lesion, grading and staging of lesion and characteristic enhancement of focal liver lesions. MRI is investigation of choice in focal liver lesions over CT due to lack of radiation hazard (can be used in pregnant females), differentiation between benign and malignant lesions and better detection and well characterization of liver lesion as compared to CT. So, Main conclusions from the present study depicts, MRI imaging is an excellent technique for the detection of number of lesions and characterization of focal liver lesions accurately and differentiation of malignant versus benign lesions which obviates need for unnecessary biopsy/surgery for particular benign lesions. The true FISP/ Dual excitation T2W sequence (T2+T2) is capable to differentiate between hemangiomas and malignant lesions[10]. Although the primary modalities for liver imaging are ultrasound and computed tomography but MRI is the most sensitive method for detecting small liver metastatic lesions, and MRI is the pre-operative standard method for diagnosis.

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