Original Article

Role of MRI in Characterization of Focal Liver Lesions

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ABSTRACT

Introduction: The increasing and widespread use of imaging studies has led to an increase in detection of incidental Focal Liver Lesions. It is important to diagnose not only malignant liver lesions, but also benign solid and cystic liver lesions.

Objectives: Role of MRI imaging in characterization of various focal liver lesions detected incidentally on Ultrasonography.

Methods: The present study included 50 patients with various focal Liver Lesions detected incidentally on Ultrasonography. MRI Liver of the patients having incidentally detected Focal Liver Lesions on Ultrasonography and Inconclusive Ultrasonography findings was done to characterize the various focal liver lesions. Biopsy was done in patients with findings raising a possibility of a malignant lesion.

Result: Of the 50 patients, 30 patients were male and 20 were female. Age of patients ranged from 1 year to 79 years. Spectrum of diseases based on imaging findings includes: Simple hepatic cyst (5/50, 10%), Hemangioma(5/50, 10%) , Focal nodular hyperplasia(2/50, 4%), Hydatid cyst(4/50, 8%), abscess(3/50, 6%), hepatocellular carcinoma(9/50, 18%), metastases(12/50, 24%) and indeterminate radiological diagnosis(10/50, 20%). USG guided liver biopsy was done in 31 patients revealed Hepatocellular carcinoma in 7, Cholangiocarcinoma in 2, metastases in 20 patients and Hepatic adenoma in 2 patients.

Conclusion: MRI has an excellent lesion detection rate. Nearly all the lesions detected on Ultrasonography were detected on MRI imaging. MRI is excellent for the characterization of various Focal Liver Lesions. It was possible to reach to a specific radiological diagnosis in most of the patients.

Keywords: Focal Liver Lesions, characterization, MRI

INTRODUCTION

Hepatocellular carcinoma - Risk factors Hepatitis B and C virus infection, Cirrhosis of liver, MRI Appearance - HCC shows typical hypervascularity in the arterial phase and washout in the portal venous and/or equilibrium phase[1].

Cholangiocarcinoma - Risk factors Primary sclerosing cholangitis, liver fluke infestation, Caroli's disease, Choledochal cyst, cirrhosis, a typical intrahepatic cholangiocarcinoma is hyperintense on T2w images and often obstruct vessels and bile ducts, with upstream ductal dilatation, in affected segment(s), there is a volume loss with capsular retraction, after contrast, the enhancement is delayed, starting in the periphery, resembling hemangioma, however, the enhancement of cholangiocarcinoma is not isointense to vessels[2,3].

Hepatic metastases - The most common primary malignancy that metastasize to the liver are gasto-intestinal, breast cancer, lung cancer, renal cell carcinoma, bladder carcinoma, melanoma, sarcomas, may be hypo- or hypervascular, most hypovascular metastases are multiple, hypointense on T1 and hyperintense on T2 and hypovascular in dynamic contrast imaging, cystic metastases may be intensely bright on T2, there is contrast enhancement in the periphery but the center is hypointense. Hypervascular liver metastases are hyperintense in late arterial phase imaging, they are often multiple and do not follow the SI of vessels, on T2, the SI of hypervascular metastases is usually moderately elevated, and on T1 hypointense.[4,5]

Hepatocellular adenoma is a benign neoplasm that arises de novo, risk factors for hepatocellular adenoma - Women taking oral contraceptives, Anabolic androgen steroids, Glycogen storage disease (GSD) Ia and III. A typical adenoma has heterogeneous SI on both T1 and T2 weighted sequences due to hemorrhage, necrosis and/or steatosis. The enhancement is after Gd-contrast heterogeneous in the arterial phase and hypointense in the hepatobiliary phase. [6,7]

Hepatic hemangiomas are benign vascular liver lesions of unknown etiology. Alternatively, hepatic hemangiomas could result from dilation of existing blood vessels in tissues that developed normally. A typical hemangioma is well delineated and hypointense as blood on T1w images and clearly hyperintense on T2w images. The contrast enhancement is peripheral and nodular in early phases, followed by progressive centripetal filling in late and delayed phases. The SI is similar to blood.[8,9]

Focal nodular hyperplasia is a benign hepatic lesion. The development of focal nodular hyperplasia is caused by an injury to the portal tract resulting in the formation and enlargement of arterial to venous shunts. A typical FNH is hyperintense in the arterial phase, and isointense before

contrast and in the venous phase. Thin radiating septa divide the tumor, but there is no capsule. A majority of FNH (89%) is before contrast hyper- to isointense on T2 and iso- to hypointense on T1. After gadolinium administration, 98% of FNH show a rapid and intense enhancement during the arterial phase, followed by a hyper- to isointensity in portal venous and equilibrium phases. FNH has a central scar, slightly hyperintense on T2 and with late Gd-contrast enhancement (in contrast to fibrolamellar HCC with hypointense scar without contrast enhancement).[10,11]

Simple hepatic cysts are postulated to be congenital exclusions of hyperplasic bile duct rests that lack a communication with biliary ducts. MRI shows a well-defined, homogeneous lesion with low signal intensity on T1 weighting, and high intensity on T2, without contrast enhancement. [12]

Hydatid cysts are due to Echinococcus granulosus infection in which humans serve as accidental intermediate hosts when they eat food contaminated with echinococcus eggs or eat organ meat from infected animals such as sheep or cows. In echinococcosis, there is a large cystic mass with numerous peripheral daughter cysts. Calcifications, if present, are hard to see on MRI. Cyst wall and septa enhances after Gd-contrast injection.[13]

Liver Abscess. Most liver abscesses are pyogenic and can be portal or biliary in origin. Typically, cluster of small abscesses coalesce into a large cavity with air or fluid level and is surrounded by an enhancing capsule. [14,15]

METHODOLOGY

The present study included 50 patients with various incidentally detected focal Liver Lesions on Ultrasonography. MRI Liver of these patients was done to characterize the various FLL. Biopsy was done in patients with findings raising a possibility of a malignant lesion.

Table 1: MRI PROTOCOL

Scanner	SIEMENS MAGNETOM Essenza 1.5 T' machine
Minimum sequences	Precontrast and dynamic post gadolinium T1-weighted gradient echo sequence, T2 (with and without FAT SAT), and T1w in – and out-of-phase imaging. Arterial phase – Artery fully enhanced, beginning enhancement of portal vein. Portal venous phase. Portal vein enhanced, peak liver parenchymal enhancement, beginning enhancement of hepatic veins (35-55s after the injection of a late arterial phase scan) Delayed phase, 120s after the initial injection of contrast

Non Liver Specific, Gadolinium Enhanced MRI

There are several gadolinium, Gd, based extracellular contrast agents, without liver specific enhancement. These were used for dynamic MRI. Patients having incidentally detected Focal Liver Lesions on Ultrasonography and Inconclusive Ultrasonography findings were included in the study. Patient with traumatic liver lesions, already diagnosed cases and patients with metallic implants, pace makers, cochlear implants etc. were excluded from the study.

RESULTS

Of the 50 patients, 30 patients were male and 20 were female. Age of patients ranged from 1 year to 79 years. Spectrum of diseases includes: Simple hepatic cyst (5/50, 10%), Hemangioma (5/50, 10%), Focal nodular hyperplasia(2/50, 4%), Hydatid cyst(4/50, 8%), abscess(3/50, 6%), hepatocellular carcinoma(9/50, 18%), metastases(12/50, 24%) and indeterminate radiological diagnosis(10/50, 20%). MRI findings were indeterminate for (10/50, 20%) of the patients and required further evaluation. USG guided liver biopsy was done in 31 patients revealed Hepatocellular carcinoma in 7, Cholangiocarcinoma in 2, metastases in 20 patients and Hepatic adenoma in 2 patients.

Table 2: Imaging characteristics of cystic liver lesions

Lesion	MRI
Simple hepatic cyst	Well defined T1 hypointense, T2 hyperintense with no post contrast enhancement.
Hydatid cyst	T1 hypointense, T2 hyperintense (cyst contents), hypointense rim T2, daughter cysts in periphery, membrane seen as floating linear structures in cyst. Cyst wall and septa enhance.
Liver abscess	T1 hypointense, T2 hyperintense, enhancing capsule

Table 3: Imaging characteristics of malignant liver lesions

Lesion	MRI
Hepatocellular carcinoma	Typical hypervascularity in the arterial phase and washout in the portal venous and/or equilibrium phase.
Cholangiocarcinoma	Hyperintense on T2w images, volume loss with capsular retraction, delayed enhancement, starting in the periphery, however, the enhancement of cholangiocarcinoma is not isointense to vessels.
Hypovascular metastases	Hypointense on T1 and hyperintense on T2 and hypovascular in dynamic contrast imaging. There is contrast enhancement in the periphery but the center is hypointense.
Hypervascular metastases	Hyperintense in late arterial phase imaging. They are often multiple.

Table 4: Imaging characteristics of benign solid liver lesions

Lesion	MRI
Hepatocellular adenoma	Moderate arterial enhancement without persistent enhancement during delayed phase
Hemangioma	Discontinuous peripheral enhancement with central fill in.
FNH	T1 isointense or hypointense, early arterial phase enhancement with central scar enhancement in delayed phase

DISCUSSION

Incidentally detected Focal Liver Lesions still pose a diagnostic dilemma. MRI appears to be a useful imaging modality in these situations. Most of the focal liver lesions have a characteristic pattern on various MRI sequences. Hepatocellular carcinoma show enhancement in arterial phase with early washout. Cholangiocarcinomas show volume loss and capsular retraction in the affected segments while the enhancement is delayed and starts in the periphery (similar to hemangiomas). Hypovascular metastases show peripheral enhancement with non-enhancing central component. Hypervascular metastases show enhancement in the late arterial phase but do not follow the signal intensity of vessels.

These findings thus raise the possibility of a malignant lesion and needs a tissue diagnosis. Hepatic adenomas show moderate arterial phase enhancement without persistence in the delayed phase and thus may be difficult to differentiate for hepatocellular carcinoma.

CONCLUSION

Contrast enhanced MRI can be performed to characterize focal liver lesions detected incidentally on various diagnostic imaging studies before subjecting the patient to more invasive diagnostic procedures. A specific diagnosis could be made in most of the patients. Biopsy can then be performed in doubtful cases and whenever a malignant lesion in suspected.

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