Original Research

STUDYING THE IMAGING PROPERTIES OF LIVER TUMORS ON MAGNETIC RESONANCE IMAGING WITH PRIMOVIST - A HEPATOSPECIFIC PARAMAGNETIC GADOLINIUM-BASED CONTRAST AGENT

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ABSTRACT

The study was performed on 25 patients diagnosed with liver tumors, assigned magnetic resonance imaging (MRI) with Primovist - a hepatospecific paramagnetic gadolinium-based contrast agent at the International Medical Center of Hue Central Hospital. The result is as followed: 11 HCCs, 1 biliary tract malignant tumor, 1 hepatic adenoma, 6 metastates, 2 FNH, 1 hepatic AML, 3 hemangiomas. 47 lesions in total, including 9 lesions smaller than 1cm, 12 lesions 1-2 cm, 26 lesions larger than 2 cm. All 11 HCCs are hypointense on T1W, hyperintense on T2W, intratumoral high signal on DWI, 9 cases have typical enhancement pattern on Dynamic phase (arterial enhancement with washout assessed on the portal venous phase), 10 cases have no enhancement on Hepatocellular phase. Metastasis lesions have peripheral enhancement on both arterial and venous phases, no enhancement on delayed phase due to not having hepatic cells. The the biliary tract tumor is pathologically correct, with minor peripheral enhancement 30 seconds after injection, gradual centripetal enhancement after 60 and 90 seconds, no enhancement on delayed phase due to not having hepatic cells. 3 cases with hemangiomas are hyperintense on T2WI, similar to blood vessels, hypointense on T1WI, pheripherally enhanced 30 seconds after injection, fully centripetal fill-in after 90 seconds, non-enhanced on delayed phase (20 minutes) due to not having hepatic cells. 2 cases with FNH have iso- or mildly hyperintense on T1W, isointense on T2W and hypointense on DWI, isointense on hepatocellular phase due to the reservation of hepatic cells.

Liver MRI with Primovist is specific for Hepatic cells, playing a critical role in detecting small lesions and differentiating benign and malignant lesions of the liver, especially those without typical enhancement pattern on Dynamic phase.

Keywords: *magnetic resonance imaging, liver tumors, Primovist*

I. INTRODUCTION

Common liver tumors include hepato-cellular carcinoma (HCC), biliary tract cancer and metastases [1]. Differentiating benign and malignant lesions is significant in prognosis and treatment [2]. Liver magnetic resonance imaging (MRI) with liver-specific contrast agent (Primovist) is a new method popular in big hospitals in recent years, to detect liver lesions and help diagnose whether

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those lesions are benign or malignant, especially lesions smaller than 1cm [3,4]. In addition, it has the potential to assess the morphology and function of the biliary tract and evaluate the remaining liver function prior to hepatectomy in patients with liver tumors [5]. At Hue Central Hospital, MRI with liver-specific contrast agent (Primovist) has just been implemented. Therefore, we conducted the project "Studying the imaging properties of liver tumors on magnetic resonance imaging with primovist – a hepatospecific paramagnetic gadolinium-based contrast agent" with the objective: assessing advantages on hepatic cellular phase and identifying specific imaging features of liver lesions.

II. MATERIALS AND METHODS

Study polulation

Twenty-five patients with liver tumors were enrolled in a cross-sectional descriptive study. They were indicated liver MRI scans with Primovist on the Phillips' 1.5T Achieva MRI machine at the International Medical Center – Hue Central Hospital from 09/2019 to 06/2020.

Imanging technique

Facility: 3T MRI machine at Department of Diagnostic Imaging – International Medical Center - Hue Central Hospital.

- Patients are instructed on how to breathe in accordance with the request of a technician in order to avoid artifacts, creating more accurate diagnosis.

- Total survey time is about 25 minutes.

- The usual pulse sequences are axial and coronal SE, STIR T2W, T1W prior to contrast injection.

- Dynamic survey after contrast injection at different phases: arterial, portalvenous, equilibrium and 20 minutes delayed.

- GRE in-phase and out-phase pulse sequences for fat detection were used before injection. Diffusion technique (DWI) is currently being studied and applied in oncology to evaluate tumor stage and response to treatment.

Image analysis

MRI results are interpreted by Radiologists to evaluate: (1) The tumor size; (2) Dynamic phase signal; (3) Hepatocellular phase signal; (4) Diagnosis

Statistical analysis

The data were analyzed using SPSS version 20.0. The categorical variables were presented in frequency and percentage.

III. RESULTS

In the study, 25 patients with liver tumors were assigned liver MRI with liver-specific contrast. Age in the study ranges from 37 to 76, concentrated in the age group 40 to 60, in which men accounted for 19/25 (76%) and women accounted for 6/25 (24%).

47 lesions were detected on 25 cases with liver MRI.

More than a half of the tumors have the size more then 2 cm (Table 1). Most liver tumors are hypointense on T1W, hyperintense on T2W and have restricted diffusion (Table 2). Lesions enhanced on arterial phase are accounted for high percentage (Table 3). 82,89% of tumors are non-enhanced on hepatocellular phase (Table 4). HCCs are accounted for 44%, no FNH cases were detected in the study (Table 5).

Table 1: Tumor size

Tumor property (n=47)		Number of tumors	Percentage
Tumor size	< 1 cm	9	19.2
	1-2 cm	12	25.5
	>2 cm	26	55.3

Table 2: Tumor signal before injection

Tumor signal (n=47)	Before injection		GRE		Restricted diffusion
	Hypointense on T1W	Hyperintense on STIR T2W	In-phase	Out-phase	
n	41	45	1	1	35
%	87,23	95,7	2,1	2,1	74,5

Table 3: Tumor signal after injection (Dynamic phase)

Phase	n	Percentage
Arterial	39/47	82,98
Venous	15/47	31,9
Delayed	8/47	17,02

Table 4: Tumor signal after injection (Hepatocellular phase)

Tumor (n=47)	n	Percentage
Enhanced	8	17,02
Non-enhanced	39	82,98
Total	47	

Table 5: Diagnosis (n=25)

Tumor	n	%
HCC	11	44
Biliary tract malignant tumor	1	4
Adenoma	1	4
FNH	0	0
Metastases	6	24
FNH	2	8
AML	1	4
Hemangioma	3	12
Total	25	100

IV. DISCUSION

Twenty-five cases of MRI scan with Primovist contrast agent showed the results of imaging diagnosis: 11 HCC, 1 biliary tract malignant tumor, 1 adenoma, 6 metastases, 2 FNH, 1 AML, 3 hemangiomas. The results show a total of 47 lesions, including 9 smaller than 1cm; 12 from 1 to 2cm; 26 larger than 2cm. In 25 cases in our study, lesions were mostly detectable on ultrasound and CT scan images because the majority of tumors were big. However, these tumors were atypical so the diagnosis has not been determined, only after Primovist injection that more information were shown visually. The minor lesions in our study were mainly metastatic (often multifocal) lesions and neoplasms. A number of minor lesions have been detected on ultrasound and CT scan. However, liver MRI with Primovist helps with further detection of very small liver lesions, neoplastic nodules as well as satellite nodules in HCC [6]. In the study, there was 1 case of HCC, re-examined 6 months after RFA, in which new minor lesions were found that were ignored on ultrasound images.

In 11 cases with diagnosed HCC, all were hypointense on T1W, hyperintense on T2W, restricted diffusion, on Dynamic Phase, 9 cases had typical enhancing pattern (arterial enhancement with washout assessed on the portal venous phase), 10 cases were non-enhanced on hepatocellular phase due to damaged liver cells, 1 case still enhanced, possibly a well differentiated HCC. In 6 cases of liver metastases, lesions were enhanced peripherally on arterial and portal venous phase, non-enhanced on delayed phase due to not having hepatic cells; The case with biliary tract tumor was pathologically proper, with minor peripheral enhancement 30 seconds after injection, gradual centripetal enhancement after 60 and 90 seconds, no enhancement on delayed phase due to not having hepatic cells. The case with adenoma (this case does not have surgery or biopsy, so there is no pathology), is monitored for more than 3 months and re-check with ultrasound, no changes in tumor size. In the study, 3 cases with hemangiomas are

hyperintense on T2WI, similar to blood vessels, hypointense on T1WI, pheripherally enhanced 30 seconds after injection, fully centripetal fill-in after 90 seconds, non-enhanced on delayed phase (20 minutes) due to not having hepatic cells. 2 cases with FNH have iso- or mildly hyperintense on T1W, isointense on T2W and hypointense on DWI, isointense on hepatocellular phase due to the reservation of hepatic cells. 1 case with AML, the signal on T1W in-phase and out-of-phase shows that there is fat signal, heterogenously hyperintense on T2W, Dynamic images show enhancement on arterial phase, lower on venous phase, prolonged enhancement in the hepatocellular phase [7].

Our study is limited by the small sample size, because this is a very expensive technique, so our subjects are patients who have conditions to perform the technique. There are people with lesions easily seen on CT scan as well as Dynamic MRI who still want to perform MRI with liver-specific contrast. While there were minor lesions, atypical enhancement properties on CT scan as well as Dynamic MRI but were not eligible for this technique [8]. Therefore, the study did not highlight the value of liver-specific MRI with hepatocellular phase, but only stopped at characterizing liver tumors. In the cases of HCC detected in the study, only 2 surgical cases and 2 biopsy cases had pathological results, the remaining 7 cases were treated with RFA and TOCE resulting in no gold standard in diagnosing HCC. This is a newly implemented technique so our experience is not abundant, there are still errors in diagnosis.

IV. CONCLUSION

Liver MRI with Primovist is specific for Hepatic cells, playing a critical role in detecting small lesions and differentiating benign and malignant lesions of the liver, especially those without typical enhancement patterns on Dynamic phase.

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