ORIGINAL ARTICLE

SENSITIVITY OF DIFFUSION WEIGHTED IMAGES IN DETECTION OF SMALL HEPATOCELLULAR CARCINOMA IN PATIENTS WITH CIRRHOSIS LIVER

Hina Gul, Adnan Ahmed

Department of Radiology, Khyber Teaching Hospital, Peshawar - Pakistan

ABSTRACT

Objective: To find out the sensitivity of adding diffusion weighted images(DWI) to a standard contrast enhanced MRI in detection of small hepatocellular carcinoma HCC (≤ 2cm) in patients with cirrhosis liver.

Material and Methods: The study was conducted at the Radiology Department of Khyber Teaching Hospital, Peshawar from July 2015 to June 2017. A total of 85 known cirrhotic patients with suspicion of hepatocellular carcinoma on ultrasound or dynamic contrast enhanced CT scan were included in the study. Patient with known malignancy, hepatic metastasis or radiological imaging characteristics of benign hepatic lesions (like hemangioma, adenomas and focal nodular hyperplasia) and patient with pace makers or suffering from claustrophobia were excluded from the study. Contrast enhanced MRI with diffusion weighted sequences on 1.5 Tesla MR scanner (Achieva, Phillips) were obtained in all patients.The observations were compared with histopathological findings and follow up imaging.

Results: Diffusion weighted MR imaging was found to be 95% sensitive in lesions measuring 5-20mm in size and showed 92-93% sensitivity in lesions measuring >21mm in size.

Conclusion: diffusion weighted images (DWI) is non-invasive, fast and accurate method to detect small hepatocellular carcinoma (HCC) in cirrhosis liver.

Keywords: Hepatocellular,Carcinoma, cirrhosis liver, DWI, MRI.

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INTRODUCTION

Cirrhosis liver is imposing a serious health care burden in Pakistan[1]. One of the serious complication of cirrhosis liver is hepatocellaular carcinoma (HCC), which is one of the leading causeof cancer deaths worldwide[2]. Although its prognosis is poor, early detection of small HCC (≤ 2cm) in cirrhosis liver can improve prognosis in these patients with a 5 years survival rate of >70%[3]. With recent advances in imaging techniques like dynamic CT scan and MRI, hepatocellular carcinoma can be diagnosed confidently almost replacing the need for biopsy[4].

The European and American Associations for the study of liver disease have made imaging criteria for the diagnosis of HCC comprising on characteristic early arterial enhancement and washout in portal venous phase[5]. However most of the times smaller lesions (≤2cm) do not follow the characteristic enhancement pattern[6,7,8]. New technical improvements in MRI like diffusion weighted imaging offers promising results in detection and characterization of hepatic lesions[9]. Several studies showed that DWI improves the detection of HCC especially in cirrhotic liver[6,10]. The purpose of our study is to evaluate sensitivity of diffusion weighted imaging in detection of small hepatocellular carcinoma(≤ 2cm)and to compare our results with other local and international studies.

Dr. Hina Gul (Corresponding Author)
Associate Professor
Department of Radiology, Khyber Teaching Hospital, Peshawar - Pakistan
Cell: +92-305-9481111
Email: hinagulrad@yahoo.co.uk
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MATERIAL AND METHODS

This cross-sectional validation study was conducted at the Radiology Department of Khyber Teaching Hospital, Peshawar from July 2015 to June 2017. Known cirrhotic patients with radiological suspicion of hepatomas on ultrasound or dynamic CT scan were included in the study.Patient with known malignancy,hepatic metastasis or radiological imaging characteristics of benign hepatic lesions (like hemangioma, adenomas

and focal nodular hyperplasia) and patient with pace makers or suffering from claustrophobia were excluded from the study. All patients were scanned in 1.5 Tesla MRI machine(Achieva, Phillips). Conventional MR sequences of liver (axial T1 and T2, coronal T2, sagittal T2, fat saturationT2 axial), gadolinium enhanced axial and coronal fat saturated and spin echo diffusion weighted axial images were undertaken at 'b value' of 1000. These images were interpreted by two consultant radiologists with more than 10 years experience in hepatic imaging. The hepatic lesions were analyzed as high signal intensities on DWIcompared to normal hepatic parenchyma and measurement of longest dimensions of lesion noted. Lesions measuring ≤ 2cm were considered to be small hepatomas. Results were calculated via SPSS – version 20 software. Final diagnosis was confirmed by histopathological findings (n = 48) and follow – up imaging (n=58).

RESULTS

A total of 85 known cirrhotic patients were included in the study. Mean age was 53 years with a range of 37-70 years. 58% were male and 42% were female. A total 106 hepatic lesions were found in both lobes of liver in 85 cirrhotic patients. These lesion were finally diagnosed as HCC histologically (n = 48) or through follow up imaging (n = 58). Table 1 shows imaging characteristics of these lesions on T2 weighted images (T2WI), venous washout on contrast enhanced (CE) dynamic MRI and diffusion weighted images (DWI) on basis of sizes of the lesions.

Table 1: Number of lesions showing hyperintensity on T2WIs and DWI and portal venous washout on dynamic contrast enhancedMRI according to size of hepatocellular CA.

Lesion size	Hyperintense on T2WIs	Venous washout or capsule enhancement on dynamic MRI	Hyperintensity on DWI	Sensitivity of DWI
(TP/TP+FN)	14	8	19	19/19+1= 95%
21– 30mm (n – 38)	36	37	35	35/35+3= 92%
>30mm (n = 48)	46	48	45	45/45+3= 93%

DISCUSSION

Early detection of small sized hepatocellular carcinoma is always challenging and decisive for determining the prognosis and planning of future treatment of patients with cirrhosis liver[13]. Dynamic contrast enhanced (CE) CT scan and MRI are the mainstay imaging modalities used for diagnosing HCC, with the typical early arterial phase enhancement and rapid washout on portal venous phase and enhancing capsule on delayed interstitial phase images[14]. However smaller lesions (≤ 2cm) do not usually show rapid washout in portal venous phase[15]. In addition, dysplastic/regenerative nodules in cirrhotic liver also offer a diagnostic challenge. Therefore with advances in hardware and coil systems newer techniques like DWI are used in MRI for early detection and characterization of nodular lesions in cirrhotic liver[16]. Diffusion weighted images enable qualitative and quantitative analysis of tissue diffusivity relying upon movement of water molecules in a tissue, without use of gadolinium chelates. This is particularity useful in patients with renal problems[17]. We found out in our study that for detection of hepatocellular CA ≤ 2cm, the sensitivity of early venous wash-out sign in post – gadolinium MR sequences was quiet low (40%) as compared to larger HCC lesion> 3cm showing 97–100% sensitivity. This result was comparable to Park etal[16]. On the other hand, small HCC lesion (≤ 2cm in size) showed greater diffusion weighted sensitivity (95%) compared to larger lesion (92%). These results were comparable to Chen J etal[18]. In our study larger lesion were hyperintense on T2WIs (95%) and showed early venous wash-out in dynamic contrast enhanced study (97 – 100%). Baliyan V et al[17] reported that contrast enhanced MRI, added with DWI sequences showed 97% sensitivity in detection of HCC lesions as compared to MRI alone (85%). These results were comparable to our study regardless of sizes of the lesions.(Chen J,[18] and Arif-Tiwari H[19] also observed that adding diffusion weighted sequences to the routine contrast enhanced MRI can significantly increasethe detection rate of HCC in cirrhotic liver and especially smaller lesions having ≤ 2cm in size. Chundru S,[20] showed in his study that tumors showing high signals on DWI and low values on apparent diffusion co-efficients (ADC), tend to have worse histological grades. So in this study we concluded that smaller HCC lesions ≤2cm showed hyperintensity on DWI (95%),while larger HCC lesions >2cm showed hyperintensity on T2 weighted images (95%) and early venous wash-out on post contrast dynamic sequences (97-100%).

LIMITATIONS

Small sample size and inclusion of only cirrhotic patients.

CONCLUSION

DWI is a non invasive useful diagnostic tool for detecting small hepatocellular carcinoma.

RECOMMENDATIONS

DWI should be included in MRI protocol of hepatic

imaging. Further research is recommended for evaluating the role of apparent diffusion co-efficient(ADC) values in prediction of histological grade of hepatocellular carcinoma.

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AUTHOR'S CONTRIBUTION

Following authors have made substantial contributions to the manuscript as under:

Gul H: Main idea, Planned the study, Data collection.
Ahmed A: Bibliograophy and drafting of manuscript.
Authors agree to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.