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Diagnostic Accuracy of DWI in Malignant LiverLesions

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ABSTRACT
Background: Liver is a common target for primary malignancies. Early detection of liver malignancies provide the opportunity for the success of liver surgery as a therapeutic approach. Diffusion MRI is used recently as a tool for further characterization of hepatic focal lesions. This is available through measurement of ADC. This study aims to study the diagnostic accuracy of DWI in diagnosing malignant liver lesions.
Methodology: My study group comprised of 30 patients, who were referred to Department of Radiodiagnosis for MRI abdomen for evaluating HPR proven malignant liver lesions, for follow up and treatment purpose.
Patients were selected according to inclusion criteria , consent obtained and consecutively sampled for MRI using 1.5 Telsa MR unit after getting clinical data, HPR reports and biochemical parameters. Conventional MRI and DWI was performed. After blind characterization and detection of lesions, diffusion images with ADC values were reviewed. Imaging was done using non enhanced T1 and T2 weighted and DWI. ADC values were noted for each lesion. Histopathological finding is taken as gold standard.
Results:DWI had an accuracy of 99.8 % in detecting malignant liver lesions. The mean ADC value for malignant liver lesions was obtained as $1.24 \pm 0.34 \times 10^{-3}$ mm²/s.
Conclusions: The results of this study show that DWI-MRI is a reliable noninvasive diagnostic technique to detect malignant liver lesions with high accuracy using ADC valuesgenerated.
Keywords: Malignant liver lesions, DWI-MRI, ADC, Diffusion restriction

I. BACKGROUND AND RATIONALE

- Liver is a common target for primary malignancies.
- Early detection of liver malignancies provide the opportunity for the success of liver surgery as a therapeutic approach.
- MRI plays an increasingly important role in the non invasive characterization of focal liver lesions because of its high contrast resolution, lack of ionizing radiation, and the possibility of performing functional imaging sequences.
- Diffusion MRI which is based on the diffusion of water molecules throughthe tissue of interest, is used recently as a tool for further characterization of hepatic focal lesions. This is available through measurement of ADC. The diffusion of water molecules in malignant tumors is restricted which results in decreased apparent diffusion coefficient(ADC).
- Previous studies have aimed to examine the efficacy of DW MRI in diagnosing liver masses, but no consensus exists regarding the routine use of DWI in detecting neoplastic lesions, as no definite cutoff point is set for values generated by DWI imaging, such as apparent diffusion coefficient (ADC) which is used for quantitative analysis of hepatic lesion.
- This study aims to study the diagnostic accuracy of DWI in diagnosing malignant liver lesions.

II. METHODOLOGY

- My study group comprised of 30 patients, who were referred for MRI abdomen for evaluating HPR proven malignant liver lesions, for follow upand treatment purpose.
- Patients were selected according to the inclusion criteria , consent obtained and consecutively sampled for MRI using 1.5 Telsa MR unit after getting clinical data, HPR reports and biochemical parameters.
- Conventional MRI and DWI was performed.
- After blind characterization and detection of lesions, diffusion images with ADC values were reviewed.
- All patients were subjected to T1 and T2 weighted MR imaging and Diffusion weighted MR imaging and ADC values were calculated. HPR was taken as gold standard and the results obtained according to ADC values were compared with HPR results.

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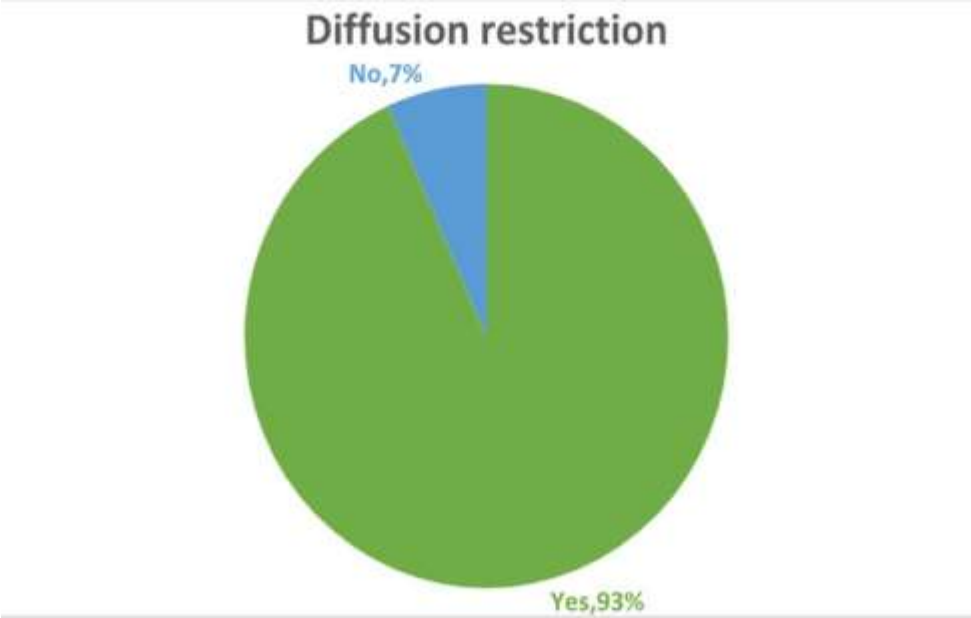
III. OBSERVATION

- Out of the 30 patients included in my study, 19 were males (63.3%) and 11 were females (36.6%).
- Alcoholism was an associated risk factor in 40 % of patients.
- Cirrhosis, other primary malignancy and chronic hepatitis B or C were the associated comorbid illnesses, of which cirrhosis was most common (33.3%)
- 93% of the lesions showed restricted diffusion with low ADC values on DWI. Two HPR proven cases of well differentiated hepatocellular carcinoma showed absent diffusion restriction.



PHOTOGRAPHS

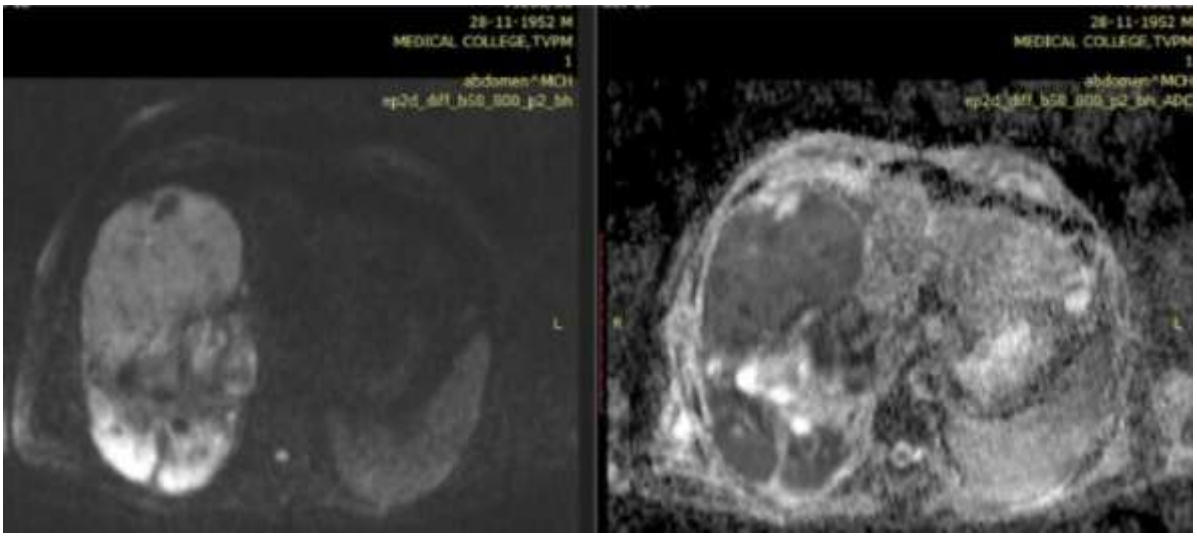


FIGURE 1- A well defined irregular shaped T2 heterogeneously hyperintenselesion involving segments 6,7 and 8 of right lobe of liver. Patchy areas of diffusion restriction noted with low ADC values . This is an HPR proven case of hepatocellular carcinoma. ADC value for this lesion was obtained as 0.95x10^{-3}mm^2/s

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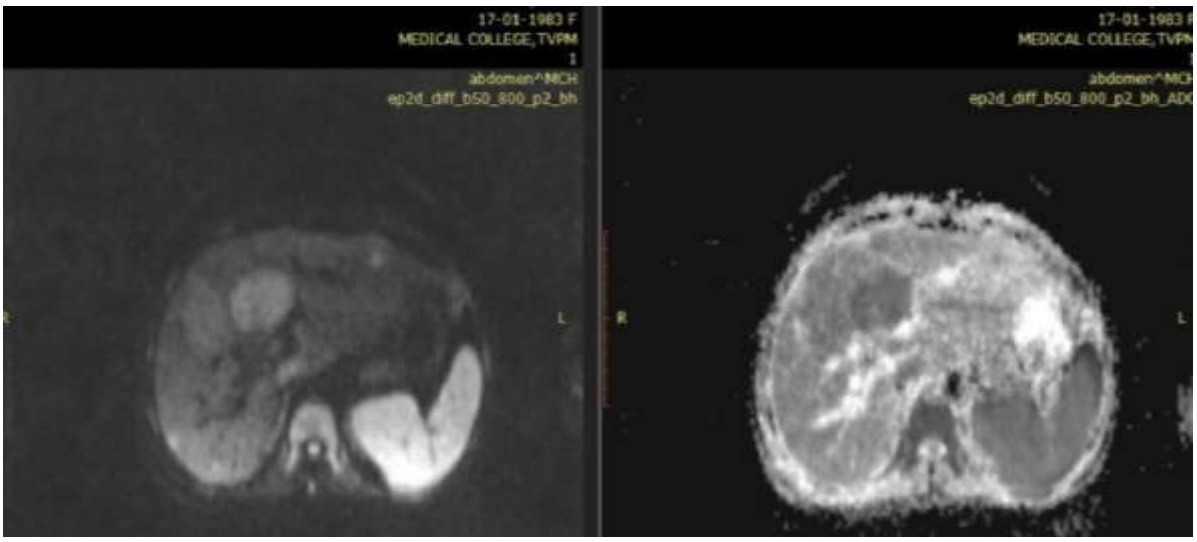

FIGURE 2- K/C/O carcinoma rectum with liver metastasis. Multiple well defined T2 hyperintense lesions of varying sizes with diffusion restriction andlow ADC values noted involving both lobes of liver. ADC value for the largest lesion was obtained as 0.8 $x10^{-3}mm^2/s$

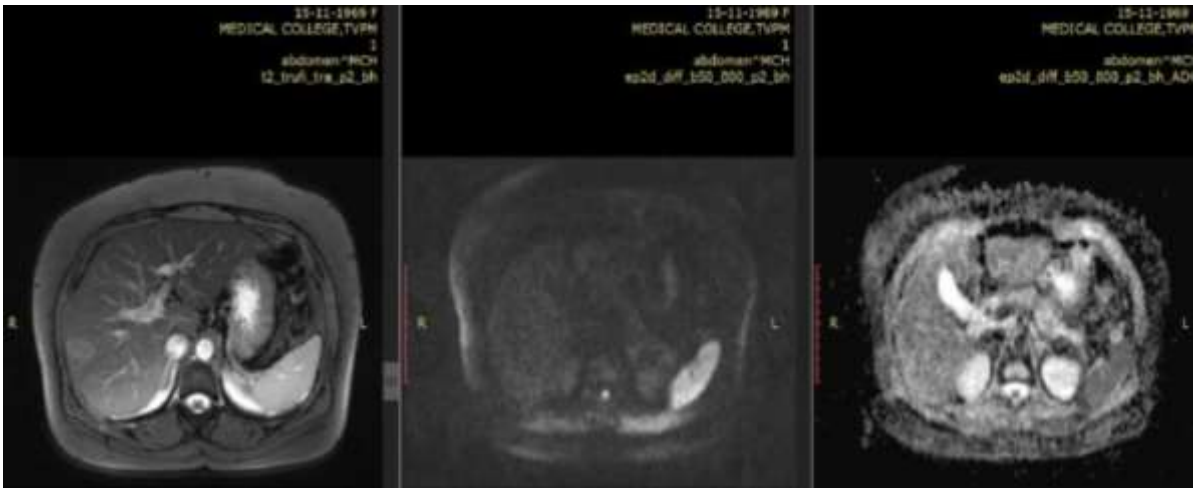

FIGURE 3- T2 hyperintense lesion involving segments 6 and 7 of liver in subcapsular location showing no diffusion restriction. This is an HPR provencase of well differentiated hepatocellular carcinoma. ADC vale of this lesionwas obtained as 1.06 $x10^{-3}mm^2/s$

IV. RESULTS

- The mean ADC value of the HPR proven malignant liver lesions was obtained as 0.94± 0.08$x10^{-3}$ mm^2/s.
- The lowest mean ADC value among all the lesions was obtained for hepatic metastasis and it measured 0.88 ± 0.06 $x10^{-3}mm^2/s$.
- The highest mean ADC value among all the lesions was obtained for intrahepatic cholangiocarcinoma and it measured 1.10 ± 0.03 $x10^{-3}mm^2/s$.
- The mean ADC value of HCC was obtained as 0.96± 0.05 $x10^{-3}mm^2/s$.

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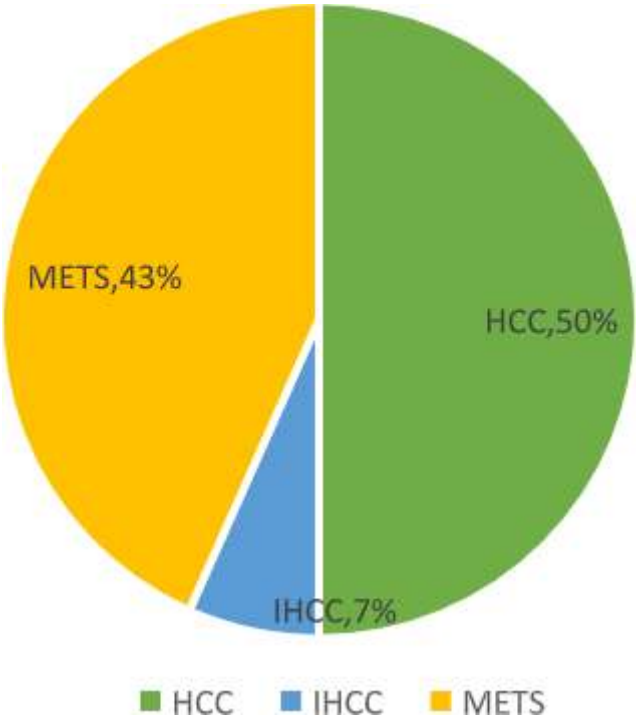

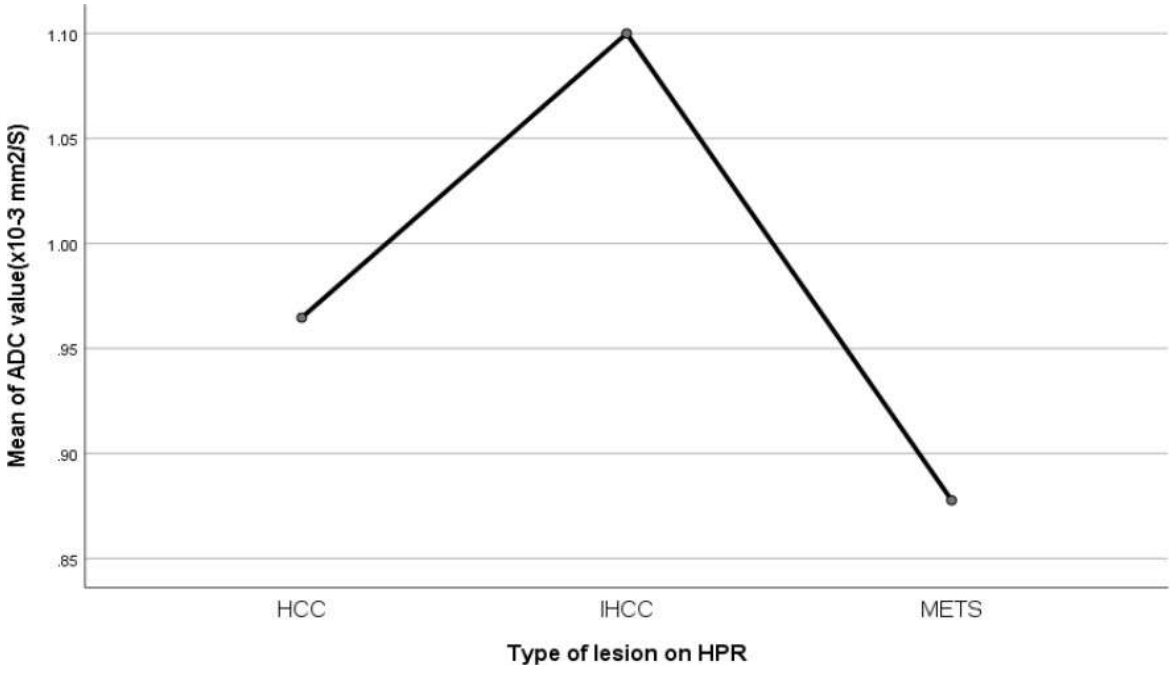

V. DISCUSSION

- DWI is an imaging technique that allows the mapping of free diffusion of water molecules that reflects the structural differences in disease by restricting diffusion. DWI has a good ability to detect liver lesions, and quantitative evaluation can be achieved without the use of contrast media which is an advantage of DWI.
- The degree of restriction to diffusion of water in biologic tissue is inversely correlated to the tissue cellularity and the integrity of cell membranes. The motion of water molecules is more restricted in tissues with a high cellular density. In hypercellular tissue, extracellular water cannot diffuse which results in a

reduction in ADC.

- Previous studies have concluded DWI to have a higher detection rate of liver tumors than T2WI, particularly in detecting malignant lesions. Malignant lesions usually have high signal intensity on diffusion images and low ADC values.
- In my study two HPR proven cases of well differentiated HCC did not show diffusion restriction. This is possibly due to minimal difference in the cellularity of these well differentiated HCCs and the background liver parenchyma, as stated in previous studies. Another cause for false negative DWI is cirrhosis. Cirrhotic hepatic parenchyma causes restricted diffusion of water molecules compared to normal parenchyma. In a fibrotic liver, HCC will have decreased lesion to liver contrast on DWI. Therefore, if a lesion is suspicious for HCC on conventional MR sequences, the absence of restricted diffusion does not necessarily exclude HCC, especially if the background parenchyma is fibrotic

VI. CONCLUSION

- The results of this study show that DWI-MRI seems to be a reliable noninvasive diagnostic technique to detect malignant liver lesions, with the help of ADC values calculated in various b values, especially high b values.
- More so, different hepatic lesions have a distinct mean ADC profile which can be used for further differentiation of different subgroups of malignantlesions.
- DWI seems to have the potential to be of great value as a diagnostic tool in addition to ultrasonography and CT for characterization of focal liver lesions, however, further studies are required, including a larger number of patients, to confirm our results.

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