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CORRELATION OF APPARENT DIFFUSION COEFFICIENT WITH HISTOPATHOLOGY OF FOCAL LESION IN LIVER

Neurology

Dr. Apar Mathur MBBS, M.D Radiodiagnsis (Command Hospital Airforce, Bangalore)

Air CMDE (Dr) Hirdesh Sahni MBBS, MD, DM (Intervention And Neuroradiology)

Dr. Shuchi Mathur MBBS, M.D Anesthesia (Senior Resident, St. Johns's Medical College, Bangalore)

Dr. Vaibhav Mathur* MBBS, M.D Medicine, D.M Neurology (S.M.S Medical College, Jaipur)*Corresponding Author

ABSTRACT

AIMS: To determine if Apparent Diffusion Coefficient (ADC) values of focal lesions of liver can give a definitive diagnosis, differentiate between inflammatory and non-inflammatory and differentiate between benign and malignant lesions.

METHODS: a)Diffusion weighted (DW) sequence, followed by ADC mapping was performed on a 1.5 T MRI Seimens machine. The diagnosis was confirmed on histopathology or from other parameters. A total of 50 cases were included.

b)The MR parameters of the DW sequence were:

- TE of 96 msec
- TR of 4700 msec
- FOV of 320 mm
- B values 0, 400 and 800 sec/mm2

RESULTS: The range of ADC value of normal liver ranged from 1.176 x 0.001 to 1.929 x 0.001, with a mean of 1.491 x 0.001.
The range of ADC value of solid part of benign lesions was 1.251 x 0.001 - 2.31 x 0.001, with a mean of 1.432 x 0.001.
The range of ADC value of solid part of malignant lesions was 0.859 x 0.001 to 1.159 x 0.001 with a mean of 0.988 x 0.001.
The ADC of cystic lesions varied significantly from the solid parts of the liver. However none of the malignant lesions had a necrotic area. The difference between cystic areas of inflammatory and non-inflammatory lesions was not significantly different.
The sample size of the study was too small to give a definitive diagnosis of the lesion based on the ADC value.
The AUC in the ROC is 0.888 (0.798-0.977) proving the ADC score had good predictive validity in predicting malignancy (P value <0.001). Our results show that using ADC score had a sensitivity of 82% and specificity of 79% to differentiate benign from malignant lesions. Cut off ADC value for differentiation the malignant from benign lesions was 1.2165.

CONCLUSION: ADC score on DWI MR sequence can be used as an additional imaging tool to differentiate between benign and malignant lesion.

KEYWORDS

Focal Liver Lesion, Diffusion weighted image, Apparent diffusion coefficient.

INTRODUCTION

Liver masses are broadly classified into benign or malignant. This is essential and needs to be done accurately as the management and prognosis of these two broad groups varies significantly.

The diagnosis and management of liver masses requires a multidisciplinary team work involving the gastroenterologist/ hepatologist, radiologist, pathologist, hepatobiliary or transplant surgeon, and medical oncologist [1].

There is a wide variety of differential diagnosis on imaging (USG, CT and MRI) of a space occupying lesion of liver. To get a definitive diagnosis of the same, a biopsy of the lesion is often required.

Attempts have been made to explore the use of Diffusion Weighted Imaging, using Magnetic Resonance Imaging for organs other than the brain, like Liver. This sequence gives the ADC value of the imaged parts of the body. ADC value may help in narrowing the differential diagnosis of various focal lesions of liver. This by and large may thus reduce the requirement of an invasive procedure like biopsy.

There is scarcity of literature about the ADC value of a space occupying lesion of the liver. This study will help in further determining the diagnostic value of ADC in space occupying lesions of liver.

RESULTS

Table 1: Descriptive analysis of histopathological diagnosis in the study population (N=50)

Histopathological Diagnosis	Frequency	Percentages
Hcc	19	38.00%
Matastasis	14	28.00%
Pyogenic Liver Abscess	10	20.00%
Simple Cyst	3	6.00%
Amoebic Liver Abscess	2	4.00%
Atypical Hemanigioma	1	2.00%
Adeno Ca Of Liver	1	2.00%

Table 2: Descriptive analysis of histopathology diagnosis new in the study population (N=50)

Histopathology Diagnosis new	Frequency	Percentages
Malignant	33	66.00%
Benign	17	34.00%

Table 3: Descriptive analysis of ADC lesion in study population (N= 50)

Parameter	Mean ± SD	Median	Minimum	Maximum	95% C.I	
					Lower	Upper
ADC Value lesion (X103)	1.37 ± 0.74	1.12	0.69	3.90	1.16	1.58

Table 4: Comparison of ADC lesion between histopathology (N= 50)

Parameter	Histopathology		P value (Mann - Whitney U test)
	Malignant (N=33) Median (IQR)	Benign (N=17) Median (IQR)	
ADC lesion	0.988 (0.859, 1.159)	1.432(1.251, 2.31)	<0.001

Table 5: Comparison of mean of ADC between the malignant Lesions (N=33)

Parameter	Malignant lesion (Mean± SD)		P value
	HCC (N=19)	Matastasis (N=14)	
ADC lesion	1.02 ± 0.27	1.18 ± 0.48	0.224

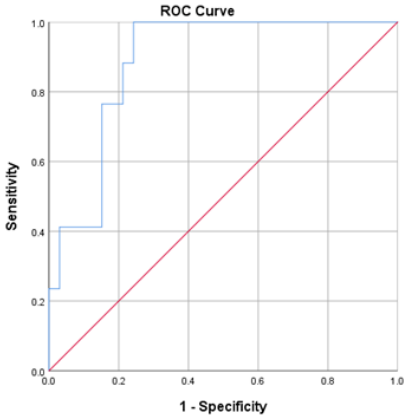

Figure 1: Predictive validity of ADC lesion in predicting malignant (N=50)

Table 6: Predictive validity of ADC lesion in predicting malignant

Test Result Variable(s): ADC lesion				
Area Under the Curve	Std. Error	95% Confidence Interval of AUC		P value
		Lower Bound	Upper Bound	<0.001
.888	.046	0.798	.977	

The ADC lesion had good predictive validity in predicting malignant, as indicated by area under the curve of 0.888 (95% CI 0.798 to 0.977, P value <0.001)

Table 7: We concluded the ADC score of various focal lesions of liver as follows:

Final diagnosis	ADC lesion Mean ± SD
HCC	1.02 ± 0.27
MATASTASIS	1.18 ± 0.48
ADENO CA OF LIVER	1.22 ± 0
PYOGENIC LIVER ABSCESS (Base line)	1.38 ± 0.25
AMOEBIC LIVER ABSCESS	1.74 ± 0
ATYPICAL HEMANIGIOMA	2.6 ± 0
SIMPLE CYST	3.77 ± 0.11

DISCUSSON

Our study was conducted in a tertiary care hospital, located in Banglore. A 1.5 T machine was used and DWI imaging was done of 50 focal lesions in 50 patients using a b values of 0,400 and 800 (sec/ mm sq). The lesions examined were correlated with the histopathological diagnosis, leaving to no ambiguity as to the ADC value reaching an accurate diagnosis. In almost 100 % cases, the ADC value of these histopathologically diagnosed lesions gave the value as predicted in our hypothesis and are in concurrence with the findings of the previously concluded studies. However, if minor discrepancies have occurred from the ADC values as predicted in previous studies, could be because most of these previous studies are done with a higher b value (1400 sec/mm sq).

Characterization of a hepatic lesion relies on morphologic imaging features primarily, which can be supplemented with ADC measurements. Specifically, for malignant lesions, DWI is useful in distinguishing the different components of tumors (cystic and/or necrotic vs solid components). False negative may arise from mucinous tumors, which can mimic the appearance of a cyst, well-differentiated tumors, necrotic lesions (either primarily necrotic or secondary), and image artifacts, which could obscure visualization of the lesion. (6). However, in our study, we did not have significant number of lesions with such solid/cystic/necrotic components, to provide a significant ADC value to these components separately.

Benign hepatic lesions have generally higher ADC values compared with malignant lesions, with some overlap. The variation in ADC cutoffs values may occur due to differences in techniques of image acquisition, the choice of b values, and the liver lesions in question. (2,3,4,5,6,7,8,9,10,11). The most important source of variability in ADC measurement is the b value used. As the DWI imaging is a marker of cellularity, hence, some benign solid lesions (like focal nodular hyperplasia and adenomas) may display restriction on DWI, which is primarily a feature of malignancy/infective lesions. On the other hand, necrotic malignant lesions can demonstrate high ADC values like benign lesions (12).

Inflammatory lesions such as abscesses (amoebic/pyogenic/fungal), are ambiguous as their ADC value is higher than malignant lesions, but lower than benign lesions. The contents of such lesions in long standing cases can become purely cystic. In early stages, these lesions may also show restriction on DWI. The solid/pus/cystic components of such lesions may also show different ADC values. In our study we figured that we can give a different ADC values to such components. We however, still could not reach a definitive value of these components as the number of these cases was not statistically significant.

SUMMARY

Focal lesions in the liver have a wide aetiology. The non-invasive pre-operative diagnosis of focal lesions of liver has taken a great leap forward with the available imaging modalities of Ultrasound, CT and MRI. However, to conclusively diagnose and plan a treatment plan for a lesion, biopsy of the lesion is often required. In this pilot study we have tried to compare the ADC score on DWI MRI sequence, with the final diagnosis. A total of 50 cases were included in this study. The ADC values and the final diagnosis is as follows:

Table 8: ADC score of various focal lesions of liver as per our study:

Final diagnosis	ADC lesion Mean ± SD
HCC	1.02 ± 0.27
MATASTASIS	1.18 ± 0.48
ADENO CA OF LIVER	1.22 ± 0
PYOGENIC LIVER ABSCESS (Base line)	1.38 ± 0.25
AMOEBIC LIVER ABSCESS	1.74 ± 0
ATYPICAL HEMANIGIOMA	2.6 ± 0
SIMPLE CYST	3.77 ± 0.11

We also looked at the difference in the ADC values of benign vs malignant lesions. In this study the ADC scores had a good predictive (AUC 0.88) value in differentiating malignant and being liver lesions, with a sensitivity of 82 % and specificity of 79 %. The benign lesions had a ADC value greater than 1.2165. The range of ADC of benign lesions was 1.251- 2.31, while that of malignant lesions was 0.859 - 1.159.

The differentiation between inflammatory and non-inflammatory lesions, was not significant.

It is thus suggested that ADC values could help in determining the requirement of a biopsy.

CONCLUSION

ADC value of a focal lesion of liver could help differentiate between a benign and a malignant aetiology. The higher the ADC score of a lesion, the chances of the lesion being benign are more. The cut off ADC value for differentiation the malignant lesions from the benign lesions is 1.2165.

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