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Role of Dynamic Contrast Enhanced MRI and Diffusion Weighted Imaging in Evaluation of H.C.C after Chemo-Embolization

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Abstract

Background: Hepatocellular Carcinoma (HCC) is the most common primary malignant disease of the liver and is the third leading cause of death from cancer worldwide. Dynamic Contrast-Enhanced MRI (DCE MRI) can play a significant role as an imaging of H.C.C, especially in the detection of viable tumor foci, the differentiation between necrosis and viable tumor after TACE and early prediction of response. Diffusion-weighted MRI shall be more frequently used for tumor response evaluation to TACE because they provide detailed anatomic and functional or metabolic change information during tumor treatment, particularly during targeted chemotherapy.

Aim of Study: Detection of the value of DCE (Dynamic contrast enhanced) MRI and DWI (Diffusion Weighted Imaging) in evaluation of HCC (Hepatocellular Carcinoma) necrosis after TACE (Trans-Arterial Chemo-Embolization).

Material and Methods: Pre-contrast T1 and T2 WIs followed by diffusion weighted MR images (several b factors 20, 500, 800s/mm^2) then DCE MRI study using a 3 Telsa scanner followed by measuring different ADC values obtained in 30 patients underwent TACE for treatment of 40 HCC lesions for assessment of tumoral necrosis. ADC cut-off number was estimated using the ROC curve after measuring ADC values for all cases.

Results: Statistical analysis demonstrated that Dynamic MRI had sensitivity of about 100% and 95.24% for specificity, While DWI has level of sensitivity of about 52.63% and 90.5% as a degree of specificity.

The difference between well-ablated and residual/newly developed groups'.

ADC values was found to be significant statistically (*p*-value <0.001) and best cut-off variable that maximize specificity and sensitivity is 1.35, where sensitivity level reaches about 78.9% and specificity level reaches about 85.7%.

Conclusions: Depending on our study, dynamic MRI showed very high sensitivity while DWI with ADC mapping series alone have low level of sensitivity so it promotes reader confidence and might be used in case of gadolinium contra-indications or in case of incapability of breath holding adequately.

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Key Words: *HCC – TACE – Dynamic MRI – DWI – ADC.*

Introduction

DURING 2018, hepatocellular carcinoma was considered as the most common primary liver neoplasm and as the sixth most common malignancy and also the fourth leading cause of cancer-related mortalities **[1]**. The sure diagnosis of malignancy usually necessitates tissue biopsy before treatment plan establishment. Yet, HCC is considered an exception owing to its non-invasive diagnosis through imaging in relatively high risk populations **[2]**. Also difficultness and lack of accuracy in liver biopsies (in focal hepatic lesions <2cm, it has about 40% false-negative biopsy results) **[3]**.

Dynamic MRI as an imaging modality is subjected to profound improvement through advances in software and hardware as well as contrast agent development **[4]**. It has a significant role in assessment of tissue characteristics via its multi-sequences capabilities, supplying exact qualitative and quantitative data **[5]**.

Barcelona Clinic Liver Cancer (BCLC) classification system showed that Trans-Arterial Chemoembolization (TACE) should be the first-line for HCC treatment in case intermediate stage, also in case of with sizable or multi-centric HCC as well as in case of patients with intact hepatic function with no radiological evidence of either vascular infiltration nor extra-hepatic metastatic spread **[6]**.

Effectiveness of TACE is followed-up via imaging modalities is crucial in assessing its outcome and planning the next steps in the patient future treatment strategy plan **[7]**.

CT-scan studies assess lipidol droplets applied to the detected focal hepatic mass lesions. Assessment of contrast enhancement is often hard in

treated hepatic lesions with incomplete retention of hyper-dense lipidol droplets owing to the beam hardening imaging artifacts caused lipidol droplets. fortunately, MRI signals are not affected/degraded by lipidol; subsequently, Dynamic MRI study better detect residual/newly developed focal lesions. Therefore, Dynamic MRI is considered now as the chosen diagnostic imaging modality for the hepatic lesions [7].

Image subtraction is beneficial in evaluation of post TACE treatment response in HCC lesions as the high signals lipidol droplet in T1 WIs leading to difficulties in evaluation of sure pathological tumoral post contrast enhancement without subtraction [9].

Transcatheter loco-regional therapies result in few different degrees and patterns of treatment response. In general, in residual/newly developed response after TACE, DCE MRI show areas of pathological arterial enhancement mixed within ablated necrotic regions. Detected peri-lesional post contrast arterial enhancement is not necessarily a sign for recurrence [10], yet it may constitute regional adjacent inflammatory process caused by infiltrate or other non-malignant arterio-portal shunts due to direct arterio-portal fistula or diminished portal blood flow after iatrogenic portal tract post procedural injuries in the vicinity of the TACE procedure, however it resolves with time and follow-up [11].

Diffusion weighted imaging gives idea about tumoral cellularity and viability degree. Well ablated hepatic lesions show less facilitated signals in DWI accompanied by increase in ADC value due to cell membrane destruction, While, residual/ newly developed hepatic focal lesions remain restricted in DWI with relatively low ADC mapping series value. ADC series give thought regarding water molecule movement in and outside cell membrane in biological tissue and that gives suggestive data about the tumor cells microenvironment [10].

DWI plays a great role in diagnosis of residual mass lesions with tumoral viability; yet, DWI couldn't substitute dynamic study in its identification of enhancement patterns for residual lesions [12].

Patients and Methods

Patients:

This study is a retrospective study carried out on 30 patients with 40 HCC lesions who were treated by TACE procedure. The study was conducted in El-Maadi Military Compound Hospital. The patients were referred from the Tropical Department to the Radiology Department over a period of 32 months (between June 2016 to February 2019). The patients' age ranged from 40 and 79 years of age (median 60); 27 patients were males and 3 were females. All patients signed written consents.

This study was approved by the Research Committee of Faculty of Medicine, Ain Shams University and informed consent was obtained from patients or their authorized representatives.

Inclusion criteria:

All patients underwent session of TACE referred from the Gastroenterology Department to the Radio-Diagnosis Department (between June 2016 to February 2019). All patients had cirrhotic liver due to chronic viral hepatitis.

All cases underwent the following:

- Clinical assessment.
- Revision of each patient's blood urea and creatinine tests.
- Revision of each patient's previous old prior radiological investigations for the patients.

Exclusion criteria:

- Systemic chemotherapy for HCC.
- Other hepatic mass lesions different from than hepatocellular carcinoma.
- All MRI contraindications as for example claustrophobia and electronic cardiac pacemakers.
- Contraindications for administration of gadolinium.

Image acquisition:

Magnetic resonance imaging:

Dynamic MRI with DWI was done over GE 3 T. MRI machine (Discovery 750) using torso surface phased-array coil.

Protocol of MRI:

A- Conventional pre-contrast MR imaging included: Axial and coronal T 1 WI, Dual Gradient-Echo In-Phase and Opposed-Phase, T2 WI and axial STIR weighted images.

B- Diffusion study: It was performed before or after DCE MRI by applying different b-values of 20, 500, and 800s/mm2.

C- Dynamic study:

- DCE MRI study was carried out following injection of the amount of 0.1mmol/kg body of Gd-DTPA at the rate of 2ml/sec followed by flushing with sterile saline solution (20ml) through power injector connected to IV line along the antecubital vein.

- Dynamic phases were taken using 3D T1 LAVA (liver acquisition with volume acceleration) technique performed in multi-phasic way; where dynamic series consisted of one pre contrast series followed by four successive post contrast series including early and late arterial then portal venous phase imaging with 20-22s intervals (18-21s) for image acquisition according to hepatic size with breath-holding technique and 1 second for re-breathing before each phase imaging and finally a 3-5-min delayed phase. All patient candidates were imaged at time of end expiration to minimize the risk of imaging misregistration.

Analysis of MR images was divided to:

Dynamic MRI analysis:

- Recording morphological features for each lesion including its size, MR signal characteristics in T1, IP/OP, T2 and fat-sat sequences and borders.
- Pattern of enhancement through dynamic study and in post processed subtracted images where, for interpretation of the DCE MRI study, arterial hyper-vascularity and subsequent washout appearance were regarded as suggestive findings of residual/recurrent HCC as in Fig. (1). Meanwhile well ablated conditions were considered when progressive or persistent enhancement was detected on dynamic images as in Figs. (2,3).

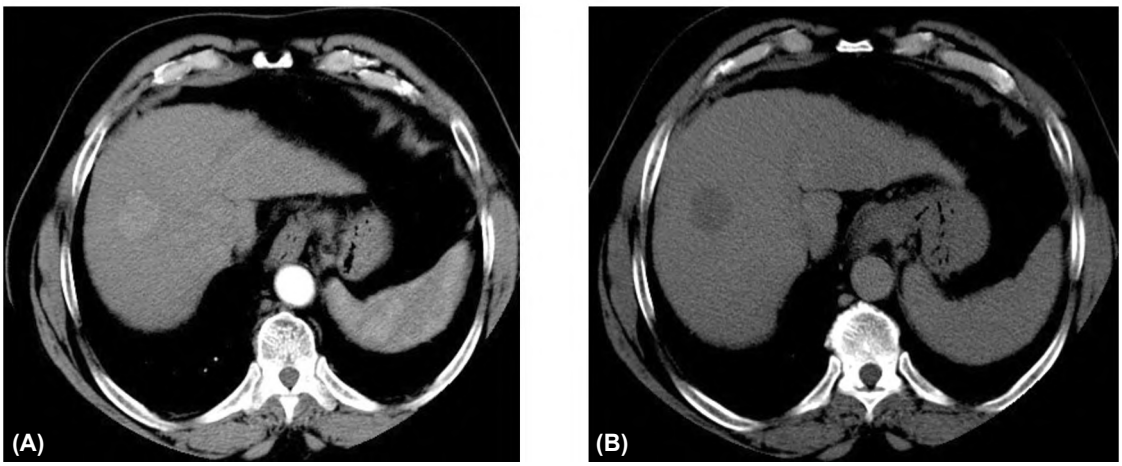


Fig. (1): (A, B): A 66-year-old male patient with hepatitis C diagnosed as HCC involving right hepatic lobe segment VIII shown in pre-treatment triphasic CT-scan. (A) Arterial phase image showed right hepatic lobe segment VIII enhancing focal lesion, measuring about 2.8cm in maximum diameter. (B) Delayed phase image showed corresponding washout, suggestive of HCC.

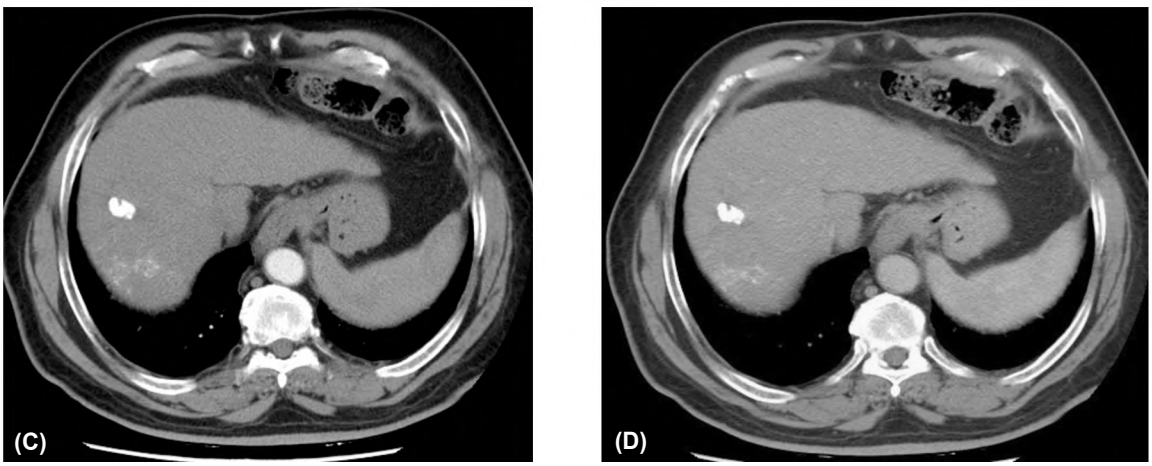
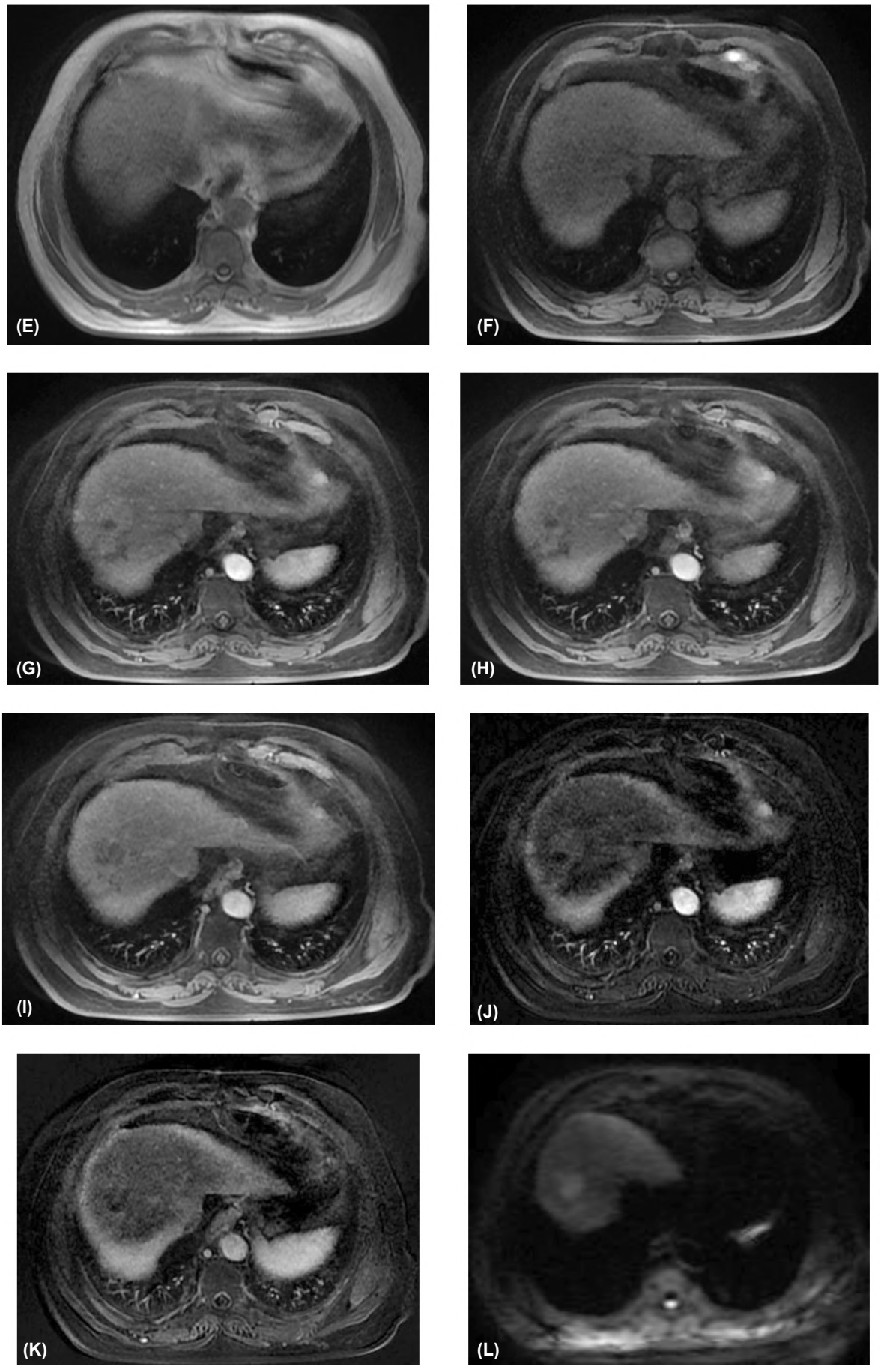


Fig. (1): (C, D): Follow-up by triphasic CT-scan after one month following TACE. (C, D) Arterial & delayed phase images showed hyper-dense lipidol homogenous uptake along the right hepatic lobe segment VIII focal lesion without post contrast arterial enhancement nor contrast washout at delayed phase.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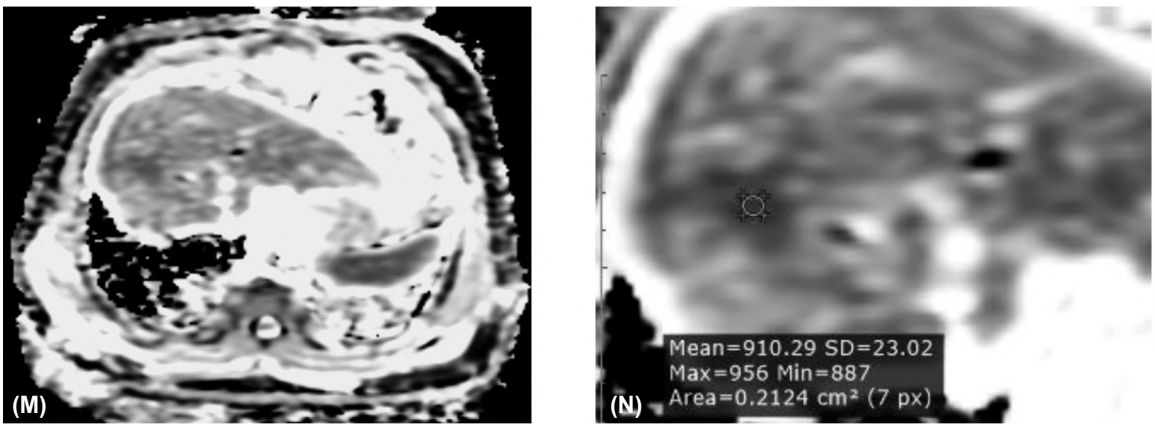
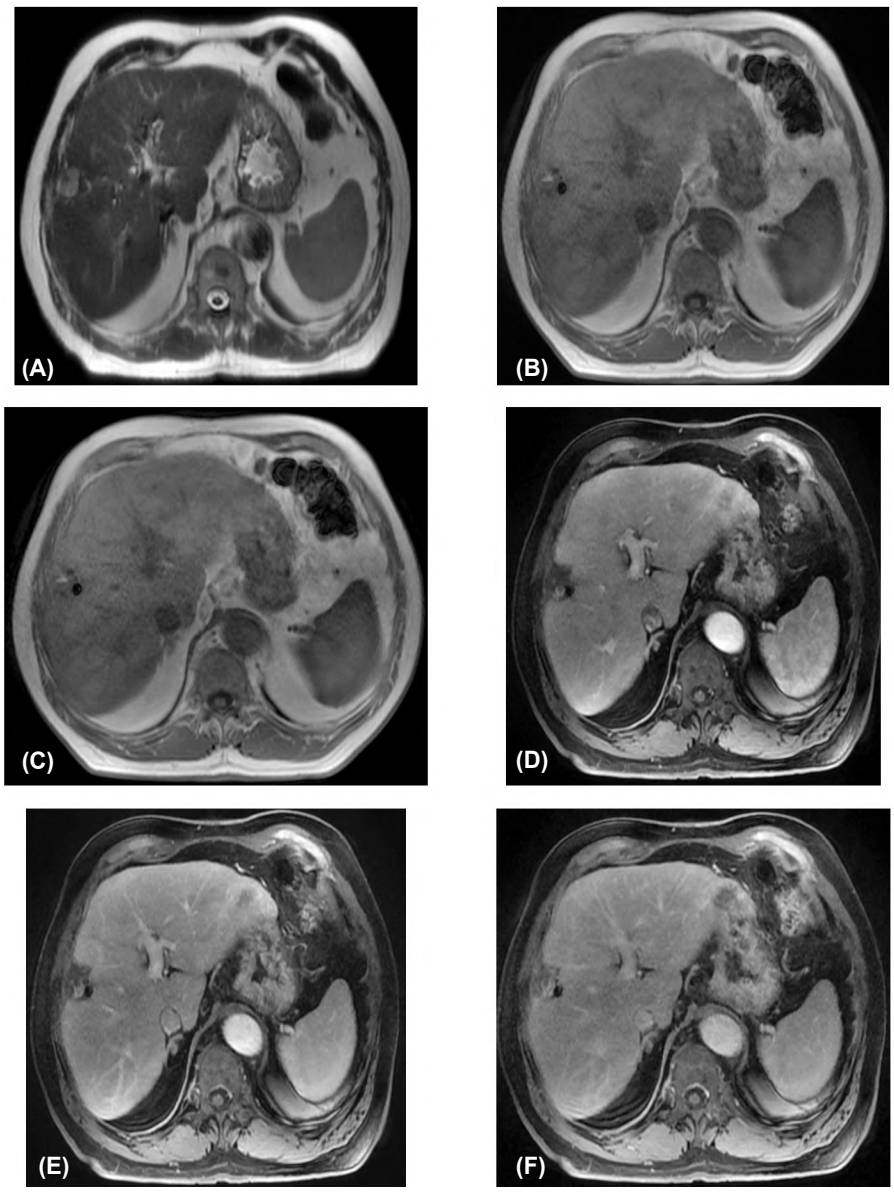


Fig. (1): (E to N) Post-treatment DCE MRI with DWI following one month from TACE. (E, F) Axial and pre-contrast T1 images revealed faint dark signals of the chemo-embolized segment VIII lesion. (G) Late arterial phases of T1 image showed pathological arterial enhancement in most of its portions. (H, I) Porto-venous & delayed phases of T 1 showed evident washout of the previously arterial enhancement. (J, K) Late arterial & delayed phases of T1 LAVA with subtraction confirmed arterial enhancement with washout. (L, M, N) DWI (b-value 800) & corresponding ADC map images showed true diffusion restriction of the chemo-embolized lesion with ADC value of 0.91 X 10^{-3} s/mm^2. Final diagnosis: Residual/recurrent H.C.C.



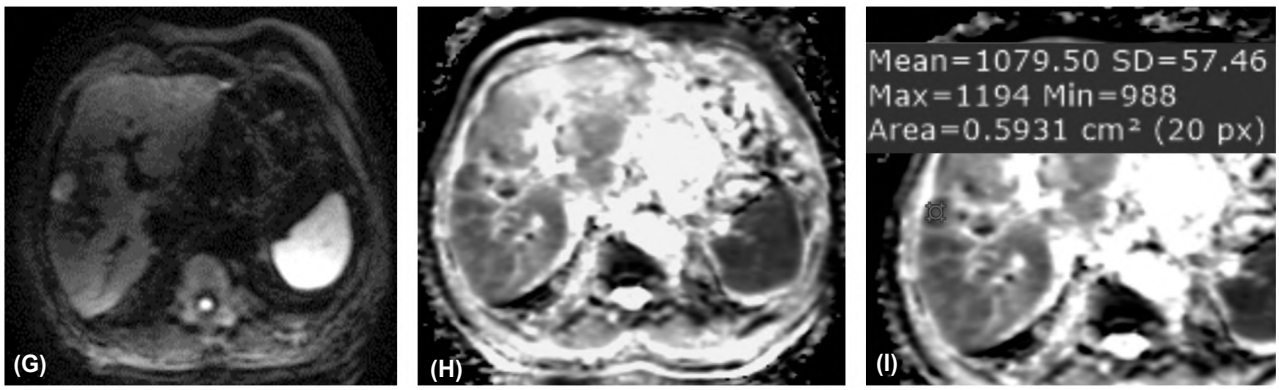


Fig. (2): A 70-year-old male patient with chronic viral hepatitis C with elevated AFP (1000), diagnosed as HCC involving right hepatic lobe segment V underwent TACE ablation with reduced AFP (200), followed up by DCE MRI with DWI for assessment of treatment response after 1 and 3 months following chemo-embolization showed tumoral non-viability. (From "a" to "i" images) 1 st follow-up post-treatment DCE MRI with DWI. (A, B) Axial T2 & T1 WIs images revealed heterogeneous signals (predominantly bright in T2 and iso-intense in T1 with hyper-intense and hypo-intense foci seen within of the chemo-embolized segment V treated lesion. (C, D) Axial T 1 LAVA pre-contrast & late arterial phase images show small non-rim APHE in the posterior portion of the treated focal lesion. (E, F) Porto-venous & delayed phases of T 1 LAVA images show small area of progressive enhancement along the postero-medial portion of the treated hepatic focal lesion representing granulation tissue (expected post TACE response). (G, H, I) DWI (b-value 800) and corresponding ADC map images show restricted diffusion manifested by bright signals in DWI and corresponding dark signals in ADC mapping series with ADC value = 1.07 X 10^{-3} s/mm^2. Diagnosis: Well ablated H.C.C.

Diffusion sequence interpretation:

- Recording signal intensity on diffusion images with reporting ADC values using a commercially windows workstation (GE). The pattern of diffusion restriction was classified into three categories:

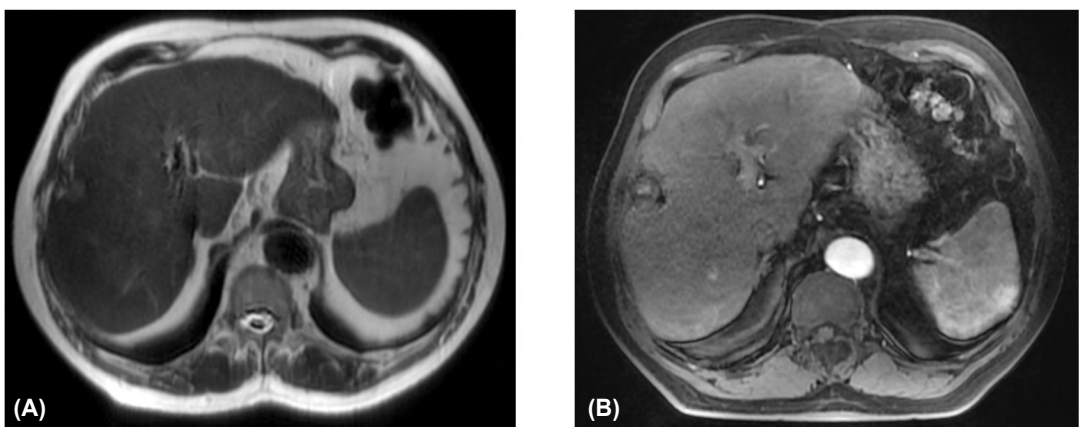
1- Well ablated: Was considered when no lesional hyper-intensity in on diffusion images or mild sustained hyper-intensity with high signals in ADC mapping series (shine through effect) is noted.

2- Viable tumor portion was identified by persistent high signals in the diffusion images accompanied with signal drop of background parenchyma with increasing b values with corresponding dark signals in ADC mapping series.

3- Uncertain cases were considered when persistent faint or moderate high signals seen on diffusion images with corresponding iso-intensity in ADC mapping series.

ADC measurement:

- ADC maps were generated on GE workstation where the three used b values (20, 500, and 800 s/mm^2) were used for ADC calculation.
- A region of interest was drawn over any sustaining hyper-intensity areas on diffusion images, and if no high signal can be identified, the whole lesion was measured. The ADC was measured three times and the three measurements were averaged.
- The standard of reference in our study: It was hard having histopathologic reports in our patients and suitable choice for their treatment was not surgery. In addition, biopsy may result in sampling error.



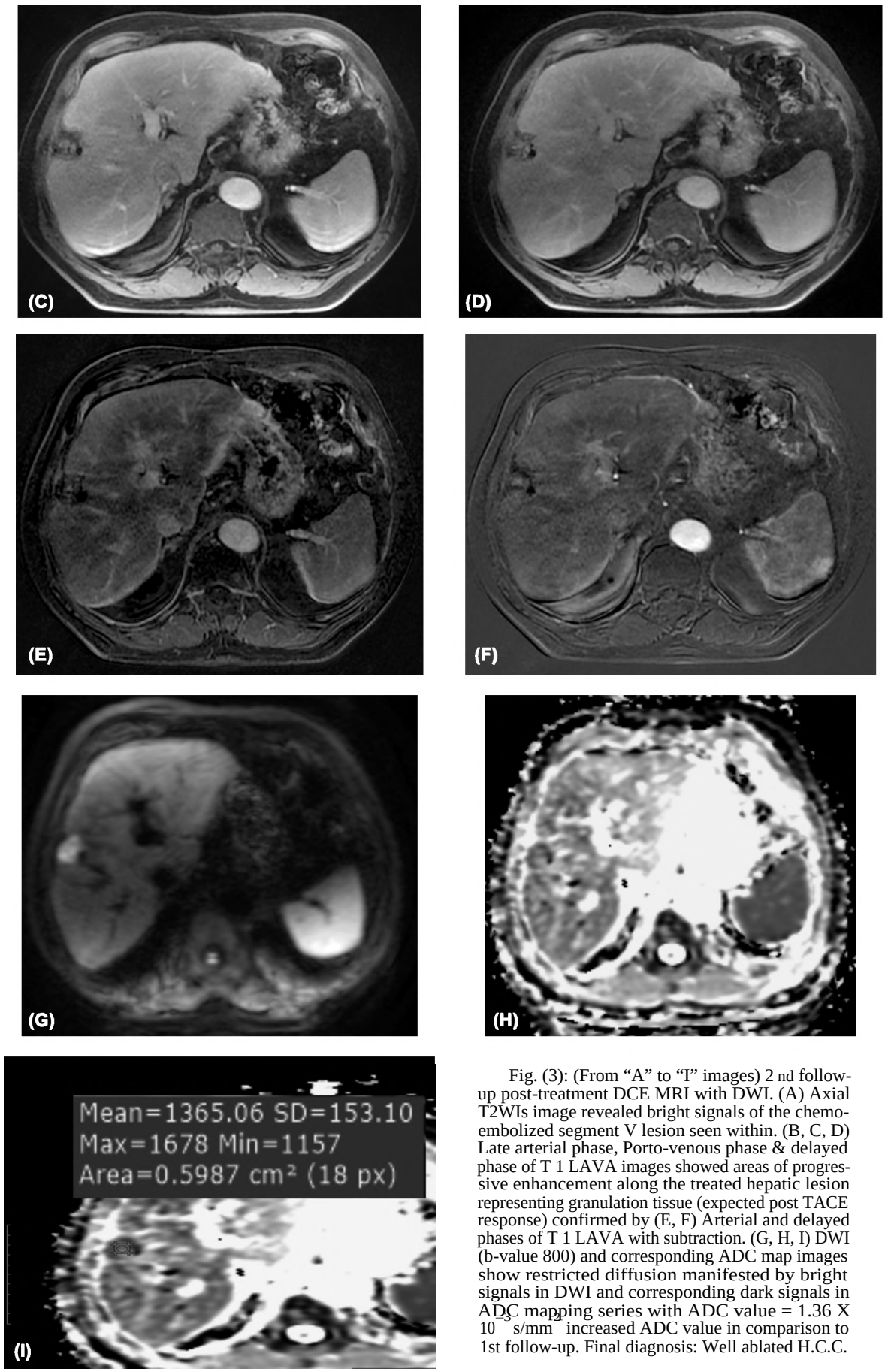


Fig. (3): (From “A” to “I” images) 2 nd follow-up post-treatment DCE MRI with DWI. (A) Axial T2WIs image revealed bright signals of the chemo-embolized segment V lesion seen within. (B, C, D) Late arterial phase, Porto-venous phase & delayed phase of T 1 LAVA images showed areas of progressive enhancement along the treated hepatic lesion representing granulation tissue (expected post TACE response) confirmed by (E, F) Arterial and delayed phases of T 1 LAVA with subtraction. (G, H, I) DWI (b-value 800) and corresponding ADC map images show restricted diffusion manifested by bright signals in DWI and corresponding dark signals in ADC mapping series with ADC value = 1.36 X 10^{-3} s/mm^2 increased ADC value in comparison to 1st follow-up. Final diagnosis: Well ablated H.C.C.

- Residual/recurrent HCC lesions as in Fig. (1) were finally diagnosed in our study depending on the follow-up imaging findings including absence of pathological arterial enhancement, absence of wash-out or sustained iodized-oil accumulations in the hyper-vascular area on the hepatic arteriography with repeated TACE.
- In the benign well ablated category as in Figs. (2,3), accepted perilesional hepatic parenchymal changes could be seen such as inflammatory, ischemic changes, or pseudo-lesions. The perilesional abnormal signal intensity area should disappear or decrease in size on DCE MRI in 3-month duration follow-up.
- Lesional diffusion restriction was considered as a sign of residual/recurrence detection and it can promote reader confidence together dynamic imaging findings.

Statistical analysis:

- The statistical package SPSS version 25 was used in data coding and entry.
- Then summarized using mean, standard deviation, median, minimum and maximum in quantitative data and using frequency (count) and relative frequency (percentage) for categorical data.
- Standard diagnostic indices including sensitivity, specificity, Positive Predictive Value (PPV), Negative Predictive Value (NPV) and diagnostic efficacy were calculated.
- A ROC (Receiver Operating Characteristic) curve was constructed and the area below the ROC curve was used to represent prediction precision.
- p-values less than 0.05 were considered as statistically significant.

Results

This study was retrospectively carried out on 30 patients (3 females and 27 males) with 40 treated lesions, the mean age for all patients was 60 years (age range, 40-79 years).

Nineteen from the 40 HCC treated lesions showed radiological features suggestive of residual/recurrence post TACE response while 21 lesions were considered as well-ablated lesions due to effective tumoral chemo-embolization as show in Fig. (4).

Well-ablated hepatic lesions' size ranged from 1cm to 4.5cm and residual/recurrent HCC lesions' ranged between 1.2cm to 7.3cm.

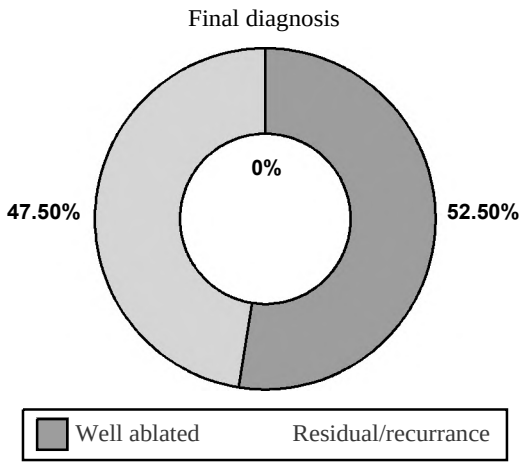


Fig. (4): Distribution of treated lesions into well ablated and residual/recurrence categories.

Table (1): The mean and standard deviation of well ablated and residual/recurrent categories. (40 treated lesions).

	Residual/recurrent					Well-ablated				
	Mean	SD	Median	Min	Max	Mean	SD	Median	Min	Max
Size (cm)	3.7	1.42	4	1.2	7.3	2.5	1.03	2.4	1	4.5

In our study among 40 lesions, heterogeneous T2 signal intensity constitutes about 45% of all lesions and about 61% of them showed T1 WI heterogeneous intensity making the tumoral evaluation after TACE on conventional pre-contrast signal intensity a matter of difference.

Table (3) shows how the lack of pathological arterial enhancement represents excellent post TACE response in about 95.2% of well ablated study category (i.e. true negative) in Dynamic MRI study, while its presence accompanied with/or evident delayed contrast washout represents viability in about 100% of the residual/recurrence category. In our study, we faced no false negative cases among residual/recurrent category.

Table (3): Correlation between dynamic MRI and final diagnosis in the research group.

	Residual/recurrence		Well-ablated		Total	
	No.	%	No.	%	No.	%
Dynamic MRI results:						
TP	19	100			19	47.5
FN	–	–			0	0
FP	–	–	1	4.7	1	2.5
TN	–	–	20	95.3	20	50
Total	19	100.0	21	100.0	40	100

Table (4) shows how lack of diffusion restriction on DWI and ADC mapping series represent excellent therapeutic response in about 90.5% of well ablated category lesions, while on the other hand about 47.4% of the residual/recurrent lesions showed facilitated diffusion (i.e. false negative results). Around 52.6% of the residual/recurrent lesions showed restricted diffusion while with only 9.5% of well ablated lesions showed diffusion restriction (i.e. false positive).

Table (4): Correlating diffusion MRI results to the final diagnosis in the studied group.

	Residual/recurrence		Well-ablated		Total	
	No.	%	No.	%	No.	%
Uncertainty in DWI as positive interpretation:						
TP	9	52.6	–	–	19	22.5
FN	10	47.4			10	25
FP			2	9.5	2	5
TN	–	–	19	90.5	19	47.5
Total	19	100	21	100	40	100

The difference between residual/recurrence after TACE and well ablated study groups ADC values was found to be statistically significant with p-value of <0.001.

The ROC curve created by plot at different cut off values is shown in Fig. (5). The best-cut off value that augments sensitivity and specificity is 1.35. At this ADC value, the sensitivity is around 78.9% and with specificity of about 85.7%. Statistical software showed that the area below the curve is C=0.861 with SE=0.064 and 95% CI from 0.735 to 0.987 as shown in (Table 5).

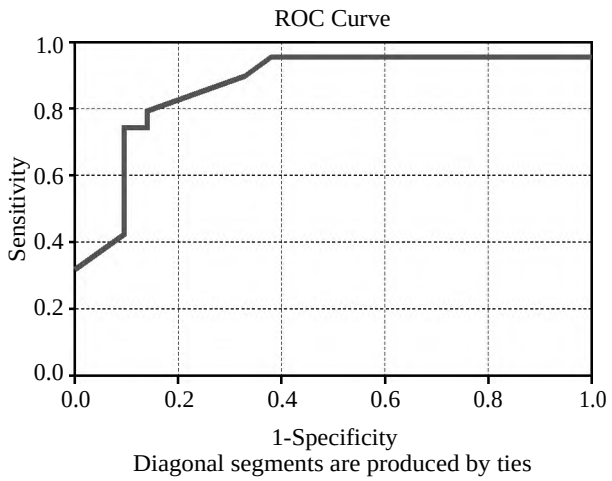


Fig. (5): Results of ROC (Receiver Operating Curves) for ADC mapping series values in distinguishing well-ablated and residual lesions.

The ROC curve showed that ADC variable is a good indicator to differentiate tumoral viability for HCC from perilesional pseudo-or non-viable treated lesions.

Table (5): ROC curve analysis revealed that ADC value was a significant discriminant factor in predicting well ablated from residual/recurrent hepatic lesions.

SE	p-value	95% Conf. Interval		Cut off	Sens.	Spec.	Overall accuracy
		Lower Bound	Upper Bound				
0.861 0.064	<0.001	0.735	0.987	1.35	78.9%	85.7%	82.50%

According to (Table 6) DWI MRI had a sensitivity of 52.6%, a specificity of 90.5%, PPV of 83.3%, NPV of 67.9% and an overall agreement of 72.5% compared to 100%, 95.2%, 95%, 100% and 97.5% respectively in case of dynamic MRI.

Table (6): Showing statistical indices of the dynamic MRI and diffusion weighted imaging.

	Dynamic MRI results	Uncertainty in DWI as a positive interpretation
Sensitivity (%)	100	52.63
Specificity (%)	95.24	90.48
PPV (%)	95	83.33
NPV (%)	100	67.86
Accuracy (%)	97.5	72.5

Discussion

We carried out our study for detection of the value of DCE MRI and DWI in evaluation of HCC necrosis after TACE.

Dynamic MRI study is the corner stone nowadays in evaluation of HCC necrosis after TACE through non-contrast conventional MRI sequences interpretation showing morphological and fluid content changes as well as fibrosis, while DCE study vividly shows perfusional criteria through different vascular phases **[7]**.

(Afifi et al., 2016) and (Ebeed et al., 2017) stated that hepatic lesions after TACE show high signals on pre-contrast T1 WIs and dark signal intensity on T2-WIs images while T2 high intensity signals in case of tumoral viability. High signal intensity on T2 WIs not only represents viability but it may be seen in case of post procedural lesional inflammation, hemorrhage or cystic necrosis **[7,16]**.

Among our 40 hepatic focal lesions included in our research, around 61 % of focal lesions elicit MRI signal heterogeneity in T1 WIs and around

46% showed in signal heterogeneity T2 WIs that makes evaluation of post TACE response depending on non-contrast conventional MRI signal intensity basis only a conflict issue.

Depending on our study, we had higher sensitivity level for Dynamic MRI compared to other studies done by (Goshima et al., 2008), (Yu et al., 2009), (Osama et al., 2013) and (Ebeed et al., 2017), this occurs because in all other researches in-appropriate breath holding led to motion artifacts with subsequent false negative interpretation by the viewer, however in our study we had strict rules in accepting level of images quality, therefore no false negative results in our study. We also had one false positive case due to false misinterpretation of peri-lesional arterioportal enhancement **[7, 17-19]**.

(Afifi et al., 2016) showed that the rise in false positive findings from DWI is from perilesional parenchymal insults that showed persistent high signals on DWI with different b factor values. They also stated that hyper cellular tissues mixed with fibrotic components in case of post procedural inflammatory granulation could also results in diffusion restriction **[16]**.

In the experiences of (Osama et al., 2013) and (Ebeed et al., 2017) liquefactive central breaking down as well as post procedural intra-lesional necrosis considered to be the cause for high signals in DWI images of post TACE well ablated lesions **[7,19]**.

In our research study, two false positive results out of 40 hepatic lesions were falsely misdiagnosed on DWI. We also considered that false positive results in our statistics is also likely originating from post procedural hemorrhage or due to liquefactive tumoral breaking down that leads to lack of diffusion facilitation.

(Tantawy and Mohamed, 2016) showed that there is a difference in ADC mapping series values in HCC focal lesions in cases done pre and post TACE application. Where, the mean ADC value for lesions pre-TACE was about 1.28 ± 0.22 X 10^{-3} s/mm^2, and elevated after TACE in responding lesions to reach 1.58 ± 0.25 X 110^{-3} s/mm^2 with a significant statistical difference (p=0.002) **[20]**.

Based on our study, the difference between ADC variables between the residual/recurrent and well ablated groups is statistically significant with p-value <0.001. The best-cut off value that sensitivity and specificity levels are augmented is 1.35. At this ADC value, the sensitivity value is around 78% and specificity level is around 85%. We also found from the ROC that ADC value is a good indicator to distinguish residual/recurrent activity of HCC from post-TACE expected findings seen in well ablated lesions.

(Kamel et al., 2006), (Ebeed et al., 2017) and (Tantawy and Mohamed, 2016) have done studies that proved that ADC values elevated in well ablated lesions following TACE than in residual/ recurrent lesions **[7,20,21]**.

Realistically speaking, to show post TACE viability whether residual/recurrent or not is far more significant than recording ADC values pre and post TACE. In the study of (Yu et al., 2009), ADC mapping series value was utilized to detect the peripheral viable tumoral recurrence for HCC lesions from benign expected lesional or peri-lesional findings. Their study showed that results were not with statistically significant differences; ADC values broadly differed for the well ablated lesions and profoundly overlapped with the residual/recurrent tumoral lesions and therefore establishing cutoff value was impossible **[18]**.

Our results agrees with the results of (Goshima et al., 2008), (Ebeed et al., 2017) and (Osama et al., 2013) where they show that Dynamic MRI is superior to DWI in evaluation of post TACE tumoral activity and diffusion weighted imaging should be continuously considered as a solid indicator of HCC viability after TACE in comparison to Dynamic MRI, where sensitivity level of Dynamic MRI study is about 100% with specificity level of around 95.25%, positive predictive value percent of around 95 %, a negative predictive value percent of around 100% and overall agreement of 97.5%. While diffusion weighted imaging's statistics values are around 52.6%, 90.5%, 83.3%, 67.9% and 72.5% respectively **[7,17,19]**.

(Yousef et al., 2017) agreed with our study that DWI got some advantages compared to DCE MRI study. For example, in case of contrast agent IV administration contra-indication and also that it has a relatively shorter time in examination. Also, DWI is simpler to be repeated, permitting short interval follow-up during and after treatment. Furthermore, shorter time is taken in DWI images and their post-processing compared to Dynamic MRI. Lastly, DWI is of benefit in cases of heterogeneity that may happen within treated tumors, where it allows easy assessment of different tumoral portions **[22]**.

We reached in our study also to the conclusion that DWI is of significant value in case of IV

contrast contra-indication. Yet, it cannot replace dynamic MRI study evaluation and final diagnosis should depend on combination of conventional sequences hand in hand with dynamic MRI study.

Few limitations were conducted during our study. As for instance, having histo-pathology reports for patients underwent TACE wasn't easy because these patients were not selected for lesional resection or hepatic transplantation.

Another limitation was conducted in our study that relatively small sized sample decreased our statistical analysis power. However, this small sized sample could be attributed to the strict inclusion and exclusion criteria carried out for this research.

Also, few technical difficulties were faced in diffusion weighted imaging in our study in number of hepatic treated lesions situated along the most upper portions of superior hepatic segments closely related to the diaphragmatic copula where DWI is very sensitive to motion (respiratory) and also pulsatile movement artifacts arising from cardiac motion causing relatively diminished signal-to-noise ratio and spatial resolution degradation. While measuring ADC mapping values, we also faced averaging partial-volume artifacts and inevitable imaging noise causing ADC values calculation errors. We done our best to overcome these technical difficulties via having several measurements as well as placing the smallest possible accepted ROI. So, our recommendation in more future dynamic MRI and DWI studies with strong magnetic gradient systems as well as new technical improvements to increase the sensitivity of DWI as well as promote image quality.

Finally, DCE MRI with post processed subtracted images have to be used in conjugation with DWI for accurate imaging interpretation in evaluation of HCC tumoral activity after TACE.

Conclusion:

Depending on our study, Dynamic MRI showed very high sensitivity while DWI with ADC mapping series alone have low level of sensitivity so it promotes reader confidence and might be used in case of gadolinium contra-indications or in case of incapability of breath holding adequately.

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دور الرنين المغناطيسى الديناميكى بالصبغة والرنين بطريقة الإنتشار فى تقييم آورام الكبد الآولية الخبيثة للعلاج بالحقن الكيميائى

آصبح الحقن الكيميائى عن طريق الشرايين من آهم الطرق الشائع إستخدامها فى جميع آنحاء العالم لعلاج آورام الآولية الخبيثة وآحد آسباب الرئيسية فى ذلك هو آنه فى حالة تدهور وظائف الكبد الناجم من تليفه قد آدى إلى تقليص إستخدام الخيارات الجراحية.

وبناءاً عليه فإن تشخيص الآورام المتبقية آو المتكررة عن طريق المتابعة بشتى طرق التصوير الطبى المختلفة بعد الحقن الكيميائى يعتبر آمر مصيرى فى هذه الحالات حيث آنه يسهل التدخل الناجح فى مراحل المرض المبكره من مما يؤدى إلى تجنب الوصول إلى مراحل المتقدمه.

توفر الآشعة المقطعية الديناميكية متعددة المراحل تقييم حالة توزيع ودرجة إمتصاص "الليبيودول" داخل الورم الدور العلاجى للحقن ممن يعطى معلومات قيمة عن درجة تنقرز الورم. ولكن نقص تراكم الليبيودول مازال يمثل مشكلة يواجهها آطباء الآشعة إضافة إلى تآثر صور الفحص سلبياً بالكثافة العالية لليبيودول المتراكم.

إن التصوير بالرنين المغناطيسى يقوم بتقييم النواحى التشريحية والوظيفية والجزيئية للآنسجة وذلك يؤدى إلى تقييم الإستجابة للحقن الكيمائى وعلاوة على تقديمه لمعلومات عن التغيرات الشكلية والتغيرات فى محتوى السوائل والتليف لنسيج الكبد.

ولقد وجدنا آن تقييم الآورام المتبقية بعد الحقن الكيمائى يعد آمر صعب بواسطة فحص الرنين التقليدى وإن فحص الرنين المغناطيسى بالصبغة يعتبر هو الطريقة الدقيقة المثلى لتحديد التغيرات المرتبطة بالعلاج متمثلة فى حجم الدم ونفاذية الآوعية الدموية إضافة إلى آن فحص الرنين المغناطيسى بطريقة الإنتشار جنب إلى جنب تقييم معامل الإنتشار من ما يؤدى إلى تكوين فكرة عن حركة الماء داخل الورم ويقييم آجزاء الورم غير المتنقرزه. إن الخلايا السرطانية التى لديها آغشية سليمة تسبب إعاقة لحركة الماء فى الورم بينما الآورام النخريه تسبب سيوله فى حركة الماء نتيجة لتلف الآغشية.

حيث آن الآورام غير المتنقرزه تتكون من عديد من الخلايا التى لها آغشية سليمة تسبب إعاقة لحركة الماء وبالتالى تعطى معامل إنتشار منخفض بينما تنقرز الخلايا يزيد من نفاذيه الآغشية مما يتيح التنقل الحر لجزيئات الماء وبالتالى تؤدى فى زيادة معامل الإنتشار.

وقد قمنا فى هذه الدراسة بعرض الدور الذى يلعبه التصوير بالرنين المغناطيسى فى تقييم الآورام الكبدية الآولية بعد الحقن الكيمائى وتم تقييم ثلاثين مريضاً بفحص الرنين التقليدى والرنين الديناميكى بالصبغة والرنين بطريقة الإنتشار وتمت دراسة نتائج هذه الحالات.

آظهرت نتائج هذه الدراسة إرتفاع آداء التشخيص بفحص الرنين المغناطيسى الديناميكى مقارنة مع الرنين بطريقة الإنتشار حيث كانت له حسا سية ١٠٠٪، وخصوصية ٩٥.٢٪، قيمة تنبؤية إيجابية ٩٥٪، قيمة تنبؤية سلبية ١٠٠٪ والتوافق العام ٩٧.٥٪ مقارنة ب ٥٢.٦٪، ٩٠.٥٪، ٨٣.٣٪ و٦٧.٩٪ و٧٢.٥٪ على التوالى للرنين بطريقة الإنتشار.

لقد وجدنا آن فحص الرنين المغناطيسى بطريقة الإنتشار يعضد حساسية فحوص الرنين لإكتشاف آورام الكبد الآولية ولكن على حساب خصوصية الفحص نتيجة لتسببه فى زيادة عدد النتائج الإيجابية الخاطئة التى قد يكون سببها نزيف بداخل الورم آو التنقرز السائلى اللذين يؤديان إلى إعاقة إنتشار جزيئات الماء.

وقد وجدنا فى هذا البحث آن متغير معامل الإنتشار يعتبر مؤشراً جيد للتفرقة بين الإرتداد الجديد لآورام الكبد الخبيثة الآولية والآفات الزائفة آو الحميدة المحيطة بالورم.

ونستخلص من هذه الدراسة آن الرنين المغناطيسى بالصبغة وبطريقة الإنتشار معاً من الممكن آن يحققوا مراقبة فعالة لإستجابة الورم للعلاج ويعد الرنين المغناطيسى بطريقة الإنتشار طريقة سريعة وواعدة لتقييم إستجابة الورم للعلاج خاصة فى الحالات التى يكون إستخدام الصبغة مستبعداً آو عندما يكون المريض غير قادر على حبس النفس آثناء الفحص.