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ROLE OF CARDIAC MAGNATIC RESONANCE TISSUE MAPPING IMAGING IN ISCHEMIC HEART DISEASE

By

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ABSTRACT

Background: The magnetic resonance imaging of the heart provides the distinctive opportunity to non-invasively evaluating the myocardium, and has become the gold standard for the assessment of viability.

Objective: To examine the clinical application of cardiac magnetic resonance imaging (CMRI) native and post-contrast T1 map, as extensively as the T2 map, in ischemic heart disease in the form of diagnosis of myocardial edema and necrosis in cases of acute myocardial infarction post percutaneous coronary intervention (PCI), and to evaluate their prognostic value.

Patients and methods: A total number of 80 patients were scheduled for elective CMRI between December 2019 and April 2021. Our patients came to Al-Hussein Hospital, Cardiology Department with a clinical picture of an acute myocardial infarction subjected for PCI. They were referred to the CMRI unit at Al-Hussein Hospital one to two days post PCI for CMRI as a part of a research project. Follow up magnetic resonance imaging (MRI) was performed three to four months later.

Results: This study involved 59 males and 21 females with a mean age of 53 (± 12) years. In our study, different tissue mapping values showed marked statistically difference between hyper enhanced (HE) and remote segments with P value <0.001. We detected microvascular obstruction in 50 patients (62.5%). In patients with microvascular obstruction (MVO), there was a difference (yet non statistically significant) in tissue mapping values between segments of MVO and hyper enhanced segments, with no MVO with tendency towards pseudo normalization of tissue mapping values of the MVO segments. The suggested cut off value of T2 map was 53.2ms with 80% sensitivity, 71% specificity, 74% positive predictive value, 78% negative predictive value, and 76% accuracy. There were two suggested cut off value of native T1 map:

1. The first one was 1076.9 ms with 68% sensitivity, 80% specificity, 77% positive predictive value, 71% negative predictive value, and 74% accuracy.
2. The second one was 1069 ms with 75% sensitivity, 73% specificity, 73% positive predictive value, 74% negative predictive value, and 74% accuracy. The suggested cut off value of the extra cellular volume (ECV) showed 78% sensitivity, 89% specificity, 88% positive predictive value, 80% negative predictive value, and 84% accuracy.

Conclusion: The area at risk in cases of an acute coronary syndrome and suggested cut off values were with reasonable sensitivity, specificity and accuracy.

Keywords: Cardiac magnetic resonance tissue mapping.

INTRODUCTION

Coronary artery disease (CAD) represents an important cause of mortality. Cardiac magnetic resonance (CMR) imaging offers the unique opportunity to non-invasively asses the myocardium and has become the gold standard for the assessment of viability *(Doesch and Papavassiliu., 2014)*. Current Cardiac magnetic resonance imaging (CMR) methods, like late gadolinium enhancement (LGE) and edema imaging (T2W) used to detect myocardial ischemia, have restriction *(Dall'Armellina et al., 2012)*.

T1 and T2 mapping techniques are emerging as useful tools for the evaluation of (acute myocardial infarction) AMI *(Kim et al., 2017)*. Quantitative T2 mapping increase sensitivity and specificity in diagnosis of myocardial edema and overcomes the notable issues related with T2W imaging of the heart *(Kim et al., 2017)*. T1 & ECV values could delineate the severity of the extent myocardial injury and predict functional recovery at 6 months *(Dall'Armellina et al., 2012)*.

The aim of our study was to evaluate the clinical application of CMRI native and post-contrast T1 map and the T2 map in ischemic heart disease in the form of diagnosis of myocardial edema and myocardial necrosis in cases of an acute myocardial infarct post PCI and to evaluate their prognostic value.

PATIENTS AND METHODS

A total number of 80 patients (59 males and 21 females) were scheduled for elective CMRI between December 2019 and April 2021.

Our patients came to Al-Hussein Hospital, Cardiology Department with clinical picture of an acute myocardial infarction eligible for PCI. They were referred to the CMRI unit at Al-Hussein Hospital one to two days post PCI for CMRI as a part of a research project. Follow up MRI study was performed three to four months later (mean follow up interval 3.6 ± 0.8 months).

Inclusion criteria: Patients with picture of an acute myocardial infarction as diagnosed clinically, by ECG and cardiac biomarkers according to European Society of Cardiology (ESC) guidelines *(Ibanez et al., 2018)*. Those patients were treated accordingly, and they were recruited into our study when clinically stable.

Exclusion criteria: Patients with cardiac pacemakers, implantable hearing aids, intracranial metal clips, metallic bodies in the eye, insulin pumps, extreme claustrophobia, irregular heart rate, renal insufficiency (GFR< 30 ml/min/1.73 m2), inability to sustain a breath hold, and clinically unstable patients.

All patients were subjected to the history including history of systemic hypertension, diabetes mellitus, ischemic heart disease (IHD), dyslipidemia, metallic implants application, and history of smoking and family history of IHD, or sudden cardiac death. Revision of previous laboratory including recent complete blood count (CBC), renal functions, lipid profile, blood glucose and troponin peak level. Weight and height were measured. A written consent was taken from every patient. Angiography: All patients were exposed to coronary angiography to restore patency of infarct related artery (IRA). Affected vessel, site

of occlusion, complete revascularization, and number of vessels affected, syntax score, and residual syntax score were recorded.

Contrast material: Injection of 0.15 mmol/Kg body weight gadolinium based contrast agent.

Scanner: All examinations were performed using 1.5-T scanner (Philips Achieva, Netherland) with a master gradient system (45 mT/mpeak gradient amplitude, 200 m/T/s slew rate) and an eighteen element array body surface coil and thirty two element spine coil. All the MRI images were transferred to a commercial off-line workstation for further analysis. The software we used for post-processing was Philips intellispace Portal version 8.0.

ECG leads positioning

ECG pads were placed on the anterior chest wall.

Image acquisition: Scout: To delineate the acquisition's field of view (FOV) through obtaining images of the heart in the three orthogonal orientations for planning of the subsequent images. **Cine images:** Cine images using the bright blood steady state free precession (SSFP) sequences were acquired in the horizontal long axis (4 chamber), vertical long axis (2 chamber), short axis (SAX), 3 chamber and (left ventricular outflow tract) LVOT planes. All MRI imaging was ECG gated using retrospective gating during a gentle expiratory breath-hold. SAX stack of cine images was acquired from the mitral valve plane through the apex covering the entire ventricles. The basal cuts are identified from the long axis views at the level of the atrioventricular (AV) junction during end-diastole. SAX stack is acquired through a plane perpendicular to the (interventricular septum) IVS in both the 2 chamber and 4 chamber views or parallel to the mitral valve. Parallel imaging was used with slice thickness 8 mm and interslice gaps 0 mm. This allowed detection and accurate measurement of the thinned out segments, ejection fraction and LV volumes with semi-automated post processing software. **T1 mapping:** T1 quantification was performed with modified Look-Locker Inversion recovery (MOLLI) sequence prior and after injection of contrast material in short-axis images (Basal, midventricular and apical cuts) with variable inversion preparation time. The whole MRI studies were acquired during the same cardiac phase at late diastole using the same imaging parameters.

T2 mapping: T2 quantification was performed with gradient based sequence acquired pre contrast administration in short-axis images (Basal, midventricular & apical cuts). All images were acquired during the same cardiac phase at late diastole using the same imaging parameters.

Late gadolinium enhancement (LGE): Delayed enhancement images for detection of hyper-enhancement (fibrosis) were obtained 6-10 minutes after injection of 0.15 mmol/Kg body weight gadolinium contrast material on inversion recovery prepared fast gradient echo sequence. After five minutes of contrast injection, a cine multi-inversion time inversion recovery sequence (Cine IR) (TI scout) was used to choose the optimum inversion time for the delayed enhancement imaging. Short axis late gadolinium

enhancement images were performed covering the whole ventricle as well as two, three and four chamber images.

Post processing:

Evaluation of LV Function and Wall Thickness: Using Philips intellispace Portal (version 8.0.) workstation, LV short-axis endocardial borders were manually contoured at end-diastole and end-systole for determining end-diastolic volume (EDV), end-systolic volumes (ESV), stroke volume (SV), ejection fraction (EF).

Disease characterization: Images were assessed to identify the hyper enhanced segments and segments of MVO.

Evaluation of Myocardial ECV and T2 map: Short-axis tissue map (native T1, post contrast T1 & T2 map) images at the basal, apical & mid ventricular levels were manually assessed being divided into 16 segments based on the 17 cardiac segments' model (excluding the true apex). For ECV calculation ROI was also drawn in the blood pool in the prior and after contrast T1 map images in order to obtain the signal shortening of the blood. ECV then was calculated.

Follow up: MRI examination that included CINE images for assessment of the volumes and functions and the wall thickness. Complications in our study were expressed in terms of: myocardial thinning, which was defined as decrease in myocardial thickness > 50% of that of the first study. LV remodeling defined as based on EDV change: >20% increase in baseline EDV, based on ESV change: >15% increase in baseline ESV, and based on EF change: >5% drop in baseline EF.

Statistical analysis Data were analyzed using R statistical package version 3.5.1 and SPSS version 25, with two-tailed p-value < 0.05 indicating statistical significance.

Quantitative variables were tested for normality using histograms, quantile plots, and Shapiro-Wilk tests. Normally distributed quantitative variables were expressed as mean ± standard deviation (SD); skewed variables were presented as median and inter-quartile range. Qualitative variables were presented as counts and percentages. The tests were used independent sample t-test or its non-parametric alternative, Wilcoxon rank sum test, for quantitative variables, or Chi-square test or Fisher's test for qualitative variables.

RESULTS

A total number of 80 patients diagnosed with an acute myocardial infarction & underwent primary PCI were scheduled for elective CMRI between December 2019 and April 2021.

Patient characteristics:

This study involved a total of 80 patients; 59 males and 21 females with a mean age of 53 (± 12) years.

Primary PCI data:

Left anterior descending (LAD) was the main vessel in 50 (62.5%) patients. While right coronary artery (RCA) was the main vessel in 20 (25%) patient and left circumflex (LCX) was the main vessel in 12 (15%) patients.

The site of vessel affection was proximal in 46 patients (57.3%) and in the mid segment in 32 patients (40%).

Thrombectomy was performed in 34 patients. PCI related complications were reported in two patients. The number of diseased vessels ranged from a single vessel to three vessels. The Syntax score was 22 ± 7.9 while the mean residual Syntax score was 5.2 ± 8.7.

LAD was the main vessels affected especially at the proximal part **(Table 1)**.

Table (1): PCI data

Parameters		Count	%
Main vessel	**LAD**	50	62.5%
	LCx	20	25%
	RCA	12	15%
Lesion site	**Proximal**	46	57.5%
	Mid	22	40 %
Thrombectomy	**Thrombus aspiration**	34	43.6%
	Conventional angiography	44	56.4%
Complication	**Complicated**	2	2.9%
	No complications	68	97.1%

Complications in the second visit:

In our study, about 40 patients (50%) were complicated by myocardial thinning, 38 patients (47.5%) were complicated by left ventricular (LV) remodeling (ESV change definition), 36 patients (45%) were complicated by LV remodeling (EDV change definition) & only 12 patients (15%) were complicated by LV remodeling (EF drop definition) **(Figure1)**.

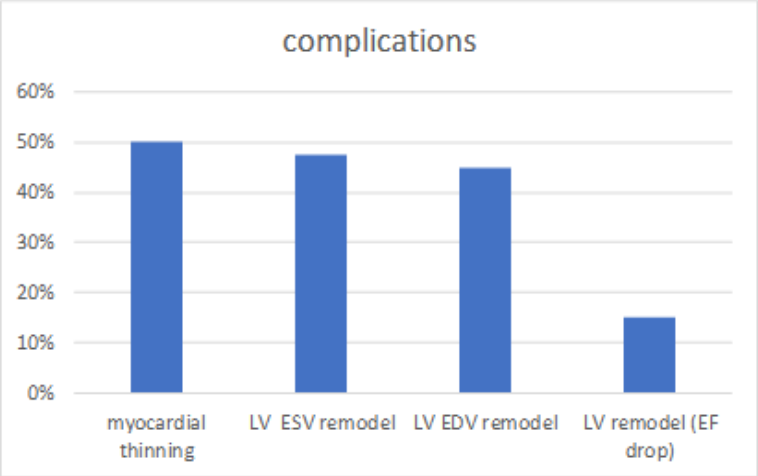

Figure (1): Percentage of complications in the second visit

Tissue mapping in the hyperenhanced versus remote segments:

In our study, different tissue mapping values showed marked statistically difference between hyperenhanced (HE) and remote segments with P value <0.001 **(Table 2)**.

Table (2): Tissue mapping in the hyperenhanced VS remote segments.

Area / Characteristics	HE area	Remote area	P value
T2	56.8 ± 5.7	51.3 ± 4.5	<0.001
Native T1	1107 ± 103	1046 ± 58.3	<0.001
Post contrast T1	325.7 ± 87.6	379.1 ± 66.7	<0.001
ECV	44.1 ± 17.6	31.5 ± 3.5	<0.001

Tissue mapping in hyperenhanced segments and microvascular obstruction:

We detected Microvascular obstruction in 50 patients (62.5%).In patients with MVO, there was a difference (yet non statistically significant) in tissue mapping values between segments of MVO & hyperenhanced segments with no MVO with tendency towards pseudonormalization of tissue mapping values of the MVO segments **(Table 3)**.

Table (3): Tissue mapping in the hyperenhanced VS segments with MVO

Segment / Characteristics	HE segments with MVO (N =50)	HE segments with no MVO (N=30)	P value
T2	56.2 ± 7.6	58.6 ± 6.3	0.137
Native T1	1055.1 ± 105	1074.6 ± 97.5	0.508
Postcontrast T1	314.8 ± 71.6	293.6 ± 68.5	0.275
ECV	41.3 ± 39.6	42.8 ± 4.2	0.616

Suggested cut off value for diagnosis of myocardial edema/ hyperenhancement:

A. T2 map suggested cut off value: In our study the suggested cut off value of T2 map is 53.2ms with 80% sensitivity, 71% specificity, 74% positive predictive value, 78% negative predictive value, and 76% accuracy with the area under the curve (AUC) is 0.796 **(Table 4)**.

Table (4): Suggested T2 map cut off value for diagnosis of myocardial edema

Patients / T2 map	All patients (N = 80)	Patients with MVO (N = 50)	Patients with no MVO (N = 30)
Cut off value	**53.2**	**53.7**	**53.2**
Sensitivity	0.80	0.67	1.00
Specificity	0.71	0.77	0.71
Ppv	0.74	0.64	0.58
Npv	0.78	0.79	1.00
Accuracy	0.76	0.73	0.80

B. Native T1 map suggested cut off value:

In our study there are two suggested cut off value of native T1 map:

1. The first one is 1076.9ms with 68% sensitivity, 80% specificity, 77% positive predictive value, 71% negative predictive value, and 74% accuracy with the AUC is 0.744 (Table 5).
2. The second one is 1069ms with 75% sensitivity, 73% specificity, 73% positive predictive value, 74% negative predictive value & 74% accuracy with the AUC is 0.744 (Table 5).

Table (5): Suggested T1 map cut off value for diagnosis of myocardial edema

Patients / Native T1	All patients (N = 80)	Patients with MVO (N = 50)		Patients with no MVO (N = 30)
Cut off value	**1076.9**	**1069.3**	**1069.3**	**1088.4**
Sensitivity	0.68	0.75	0.68	0.87
Specificity	0.80	0.73	0.73	0.83
Ppv	0.77	0.73	0.61	0.65
Npv	0.71	0.74	0.78	0.94
Accuracy	0.74	0.74	0.71	0.84

C. ECV suggested cut off value:

In our study the suggested cut off value of the ECV shows 78% sensitivity, 89% specificity, 88% positive predictive value, 80% negative predictive value, and 84% accuracy with the AUC is 0.859. The suggested ECV cut off value shows the highest specificity, positive predictive value, negative predictive value & accuracy as compared to that of T2 and native T1 map (even in patients with MVO) **(Table 6)**.

Table (6): Suggested ECV cut off value for diagnosis of myocardial edema

Patients / ECV	All patients (N = 80)	Patients with MVO (N = 50)	Patients with no MVO (N = 30)
Cut off value	**36.4**	**36.6**	**36.4**
Sensitivity	0.78	0.70	0.93
Specificity	0.89	0.89	0.89
Ppv	0.88	0.80	0.76
Npv	0.80	0.83	0.97
Accuracy	0.84	0.82	0.90

Relationships between mapping readings and PCI data:

A. Relation between tissue mapping and infarct related artery (IRA):

There was marked statistically difference in T1 hyperenhanced area readings regarding the main vessel **(Table 7)**.

Table (7): Correlation between tissue mapping readings and infarct related artery (IRA)

IRA / Parameters	LAD (N = 50)	LCx (N = 20)	RCA (N = 12)	P value
T2 hyperenhanced area	57.1 ±6.7	54.8± 2.4	57.1± 3.6	0.817
T2 remote	51 ± 5.1	50.9± 4	52.87± 2.23	0.319
T1 hyperenhanced area	1078.2±105.5	1125.7± 70.3	1190.9± 76.5	0.029
T1 remote	1058.3±63.82	1017.3 ± 48.4	1028 ± 35.7	0.328
Postcontrast T1 hyperenhanced area	344.9 ±94.7	304± 60.8	278.8 ± 74.5	0.109
Postcontrast T1 remote area	385.4 ±66.3	368.6± 71.9	350.9±53.4	0.413

B. Relation between tissue mapping and site of vessel affection:

There was marked statistically difference in post contrast T1 & ECV hyperenhanced area readings with the site of the vascular lesion (whether proximal or mid) **(Table 8)**.

Table (8): Correlation between tissue mapping readings and site of vessel affection.

Lesions / Parameters	Proximal lesions (N = 46)	Mid lesions (N = 22)	P-value
T2 hyperenhanced area	56.3 ±46.9	57.4± 3.8	0.33
T2 remote	51.5±5.4	51.1 ± 3	0.93
STIR hyperenhanced area	76.4 ± 35.5	73.9± 23.5	0.84
STIR remote	60.5 ± 25.3	60.4± 16.7	0.73
T1 hyperenhanced area	1078.8±116.7	1144.5± 68.4	0.069
T1 remote	1043.5± 67.7	1051± 45.5	0.58
Postcontrast T1 hyperenhanced area	351±94.00	289± 68.5	0.04
Postcontrast T1 remote	384± 64.3	364.4±65.7	0.465
ECV hyperenhanced area	42.1± 22.4	45.7± 6.9	0.015
ECV remote	31.5± 3.8	31.4 ± 3.2	0.975

Cases

Case 1:

Clinical history: 45 year old male patient came with an acute myocardial infarction eligible for primary PCI. He is smoker. Not known to be hypertensive or diabetic. Negative family history of ischemic heart disease. ECG: Acute anterior STEMI. Primary PCI: proximal LAD lesion. Stenting was performed. MRI findings (first visit): Hyperenhanced segments: segments 7, 8, 13 & 14. MVO: segments 0 **(Table 9 & 10 and Figures 2, 3, 4 & 5)**.

Table (9): Tissue mapping values in case 1

	S1	S2	S3	S4	S5	S6	S7	S8	S9	S10	S11	S12	S13	S14	S15	S16
T2 map	45	48	45	46	46	47	65	68	66	53	56	63	72	70	59	54
Native T1	987	1023	980	1011	1008	959	1081	1080	1086	990	954	949	1124	1102	1212	1035
Post C T1	337	298	303	321	299	334	65	80	225	342	335	294	64	240	229	246
ECV	24	30	28	27	29	24	171	138	43	23	23	28	181	40	43	38

MRI findings (2nd visit) **(Table 10)**:
LV remodeling (EDV definition): No affection.
LV remodeling (ESV definition): No affection.
LV remodeling (EF definition): No affection.

Table (10): Case 1 LV volumes and functions in the first and second visit

Volumes / Visits	EF	EDV	ESV	SV
1st Visit	47	128	68	60
2nd Visit	52	137	67	71

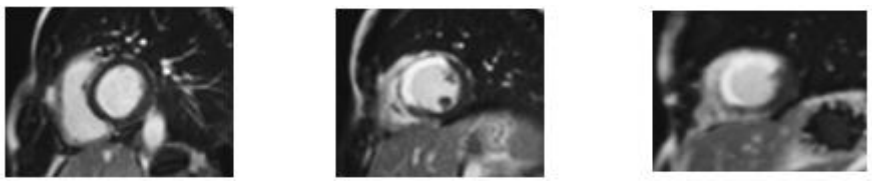

Figure (2): LGE images at basal, midventricular and apical levels

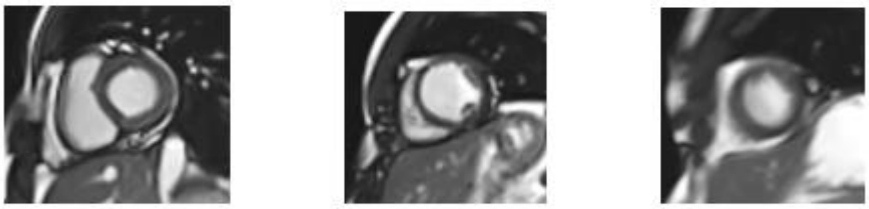

Figure (3): CINE images at basal, midventricular and apical levels (first visit)

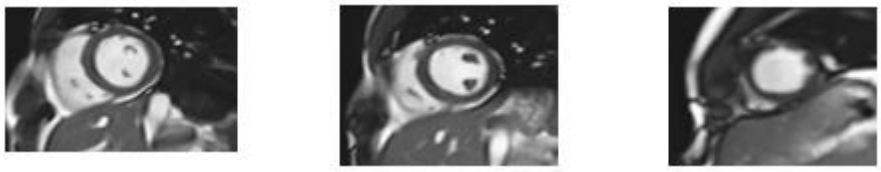

Figure (4): CINE images at basal, midventricular and apical levels (2nd visit)

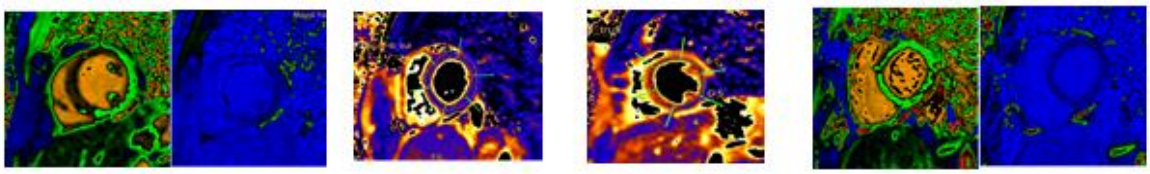

Figure (5): T2 map images at basal, midventricular and apical levels.

Case 2:
Clinical history: 49 year old male patient came with an acute myocardial infarction eligible for primary PCI. He is smoker. Not known to be hypertensive or diabetic. He is dyslipidemic. Negative family history of ischemic heart disease. ECG: Acute inferior STEMI.

Primary PCI: Mid RCA lesion. Thrombectomy & stenting was performed. MRI findings (first visit): Hyperenhanced segments: segments 3, 4, 9, 10 and 15. MVO:3, 4, 9 and 10 **(Table 11 and Figures 6, 7, 8 & 9)**.

Table (11): Tissue mapping values in case 2

	S1	S2	S3	S4	S5	S6	S7	S8	S9	S10	S11	S12	S13	S14	S15	S16
T2 map	47	49	56	54	47	50	54	49	53	50	49	50	62	62	62	64
Native T1	1020	1017	1108	1062	1033	1000	1023	1069	1063	1059	1007	1017	909	1118	1077	903
Post C T1	411	322	268	306	357	388	298	349	356	312	410	428	384	340	320	364
ECV	25	36	48	39	31	27	41	33	32	39	25	23	28	39	41	31

MRI findings (2nd visit) **(Table12)**: Thinned out segments: No affection.
LV remodeling (EDV definition): No affection.
LV remodeling (ESV definition): No affection.
LV remodeling (EF definition): No affection.

Table (12): Case 2 LV volumes and functions in the first and second visits

Volumes / Visits	EF	EDV	ESV	SV
1st Visit	44	196	111	85
2nd Visit	45	211	116	96

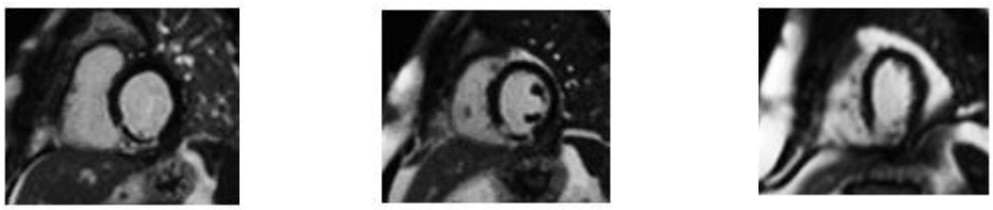

Figure (6): LGE images at basal, midventricular and apical levels.

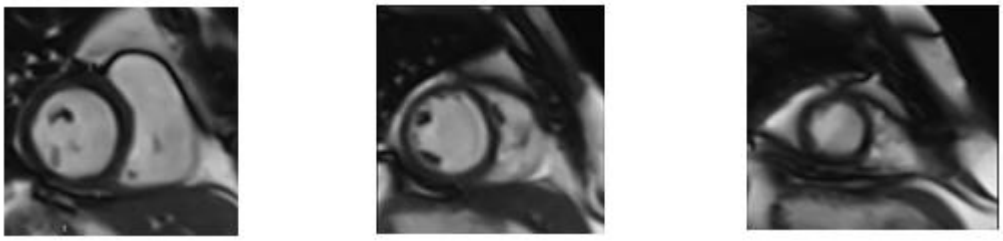

Figure (7): CINE images at basal, midventricular and apical levels (first visit)

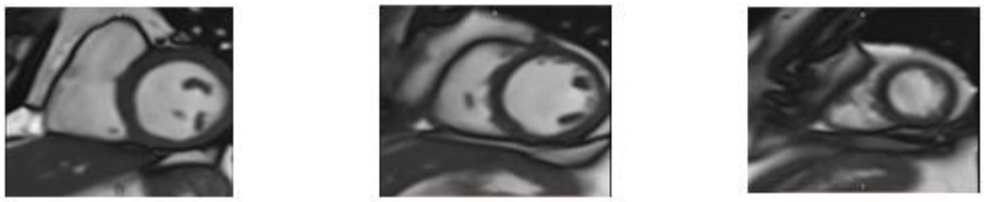

Figure (8): CINE images at basal, midventricular and apical levels (2nd visit)

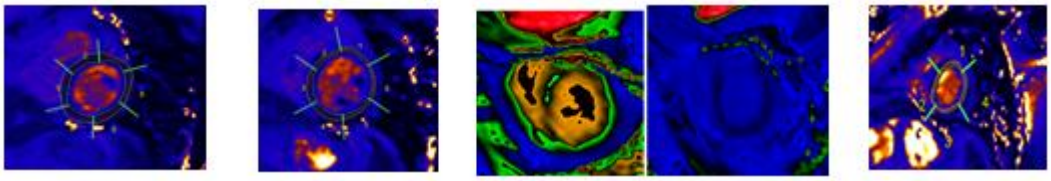

Figure (9): T2 map images at basal, midventricular and apical levels

DISCUSSION

Diagnosis of acute coronary syndrome usually relies on clinical history, electrocardiographic changes and cardiac enzymes level, while imaging, mainly trans-thoracic echocardiography (TTE), is usually deferred Baritussio et al. (2018). Even in successful early revascularization, the extent of the salvaged area at risk contains prognostic information and may serve as a therapeutic target *Eitel et al. (2011).*

T2WI CMR imagings have been used to utilized myocardial edema and discriminate between acute and chronic myocardial infarction. There were some limitation using the T2 sequences include the variability of signal intensity due to phased array coils, slow moving chamber blood that interrupt T2 in sub-endocardial, motion artifact and subjective interpretation of T2 image. T2 mapping overcome the limitation associated with T2W imaging of the heart and provides the solution for increased accuracy in the detection of myocardial edema *(Kim et al., 2017).*

Kim et al. (2017) highlighted the role of T2 map in detection of myocardial edema. Furthermore, it allows quantitative assessment of the myocardium enabling accurate monitoring of the treatment and/or progression of disease. They stated that the T2 of human myocardium was found to be 52.18 ± 3.4 ms (range: 48.96 ms to 55.67 ms).

In our study, we suggested T2 map cut off value of 53.2 ms. Such value showed a reasonable sensitivity (about 80% & reached 100% in patients with no MVO),

specificity (71%), positive predictive value (74%), negative predictive value (78%) and accuracy (76%).

The suggested T2 map cut off value in our study approaches the cut off value of *Bulluck et al. (2015)* (52 ms) that showed 82% sensitivity and 85% specificity.

It was noted in our study that MVO decreased the sensitivity, positive predictive value and accuracy of the T2 map. We agreed with *Dall'Armellina et al. (2012)* in statistically significant difference of native T1 values between the remote and hyper enhanced segments .

In our study, the mean native T1 value of the hyper enhanced segments was 1107 ± 103 ms compared to 1046 ± 58.3ms in the remote segments with P value < 0.001. while *Dall'Armellina et al. (2012)* showed mean native T1 value of the hyper enhanced segments of about 1257 ± 97 ms compared to 1196 ± 56 ms in the remote segments with P value < 0.01.Their study used a 3T CMR.

Another study was conducted by *Bulluck et al. (2015)* using a 3 T CMR set a T1 cut off value of areas of myocardial necrosis with 83% sensitivity and 80% specificity. In our study, the suggested cut off value showed 75% sensitivity and 73% specificity.

Though we agreed with *Dall'Armellina et al. (2012)* that the T1 value of the segment with MVO showed a T1 value higher than the remote myocardium and lower than the hyper enhanced segments with no MVO, yet we did not show marked statistically difference between MVO segments and hyper enhanced segments with no MVO. This was due to using the segmental method of measurement that we used in our study that included the area of MVO with a hyper enhanced area as well as a non-enhanced area in the same segment. This was in contrast to the ROI method of measurement that included the MVO area only.

In our study, post contrast T1 and ECV showed marked statically difference between hyper enhanced and remote segments.

Garg et al. (2018) set a cut off value for ECV of 33% to detect the area at risk. This approaches the suggested cut off value for ECV in our study (36.4%) which showed 78% sensitivity, 89% specificity, 88% positive predictive value, 80% negative predictive value and 84% accuracy.

We also agreed with *Garg et al. (2018)* in the fact that MVO causes low ECV versus the hyper enhanced area. Though we didn't show marked statistically difference yet our ECV and post contrast T1 values in the segments of the MVO showed pseudo normalization of the ECV and post contrast T1 values. They showed that an infarct ECV of <50% had 81% sensitivity and 65% specificity for the follow up the improvement in segmental function.

Our study showed that MVO decreased the sensitivity, positive predictive value and accuracy of the native T1 and ECV. This agreed with *Garg et al. (2018)* that considered MVO stand against T1 mapping as it results in a pseudo-normalization of T1 values in this area.

CONCLUSION

The area at risk in patients diagnosed with myocardial infarction and suggested

cut off values with reasonable sensitivity, specificity and accuracy.

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دور الرنين المغناطيسي في رسم خرائط نسيج القلب في أمراض القلب الإقفارية

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خلفيـــة البحـــث: أصـــبح التصـــوير بـــالرنين المغناطيســـي للقلـــب المعيـــار الذهبي للتقييم الغير جراحي لنسيج القلب في أمراض القلب الإقفارية.

الهـدف مـن البحـث: فحـص المرضـي الـذين يعـانون مـن إحتشـاء عضـلة القلـب الحـاد عـن طريـق رسـم خـرائط نسـيج القلـب مسـتخدما T1 وT1 مـا بعـد الصـبغة و T2 وECV بعـد التـدخل والعـلاج عـن طريـق القسـطرة القلبية.

المرضـى وطـرق البحـث: هـذه الدراسـة تمـت علـى 80 مـن المرضـى فـي الفتـرة مـن ديسـمبر 2019 و ابريـل 2021، حيـث حضـر المرضـى إلـى قسـم القلـب والاوعيـة الدموبـة باحتشـاء عضـلة القلـب الحـاد، وتـم خضـوعهم للقسـطرة العلاجيـة، ومـن ثـم إحـالتهم إلـى قسـم الأشـعة بمستشـفى الحسـين بعـد يـومين مـن إجـراء القسـطرة كمشـروع بحثـي، وتـم تصـوير الـرنين المغناطيسي على فترات خلال أربعة أشهر.

نتـائج البحـث: شـملت هـذه الدراسـة 59 مـن الـذكور و 21 مـن الإنـاث بمتوسـط عمـر 53 (± 12) سـنة. وقـد اظهـرت قـيم مختلفـة لرسـم خـرائط الأنسـجة ذات دلالـة إحصـائية بـين الأنسـجة عاليـة الصـبغة الأنسـجة التـي لـم تتـأثر. وقـد لـوحظ إنسـداد الأوعيـة الدمويـة الدقيقـة فـي 50 مريضًـا (62.5٪). أيضـا فـي المرضـى الـذين يعـانون مـن انسـداد الأوعيـة الدمويـة

، كـــان هنـــاك إختلافـــاً (لكنـــه غيـــر مهـــم إحصـــائيًا) فـــي قـــيم رســـم خـــرائط الأنســـجة بـــين الأنســـجة التـــى بهـــا إنســـداد الأوعيـــة الدمويـــة والأنســـجة الطبيعيـــة. وبلغـــت القيمـــة المحـــددة المقترحـــة لخريطـــة T2 35.2 ملـــي ثانيـــة مـــع حساســـية 80٪، ونوعيـــة 71٪، وقيمـــة تنبؤيـــة إيجابيـــة 74٪، وقيمـــة تنبؤيـــة ســـلبية 78٪، ودقـــة 76٪. أيضـــا كـــان هنـــاك نوعـــان مـــن القيمـــة المحددة المقترحة لخريطة T1 الأصلية:

1. الأول 1076.9 ملـــي ثانيـــة مـــع حساســـية 68٪، ونوعيـــة 80٪، وقيمـــة تنبؤية إيجابية 77٪، وقيمة تنبؤية سلبية 71٪، ودقة 74٪.
2. الثانيـــة 1069 ملـــي ثانيـــة مـــع حساســـية 75٪، ونوعيـــة 73٪، وقيمـــة تنبؤيـــة إيجابيـــة 73٪، وقيمـــة تنبؤيـــة ســـلبية 74٪، ودقـــة 74٪. وتُظهـــر القيمـــة المحـــددة المقترحـــة لـــ ECV حساســـية 78٪، ونوعيـــة 89٪، وقيمة تنبؤية إيجابية 88٪، وقيمة تنبؤية سلبية 80٪، و 84% دقة.

الاســـتنتاج: الـــدور الطـــارئ لرســـم خـــرائط الأنســـجة يكشـــف عـــن المنطقـــة المعرضـــة للخطـــر فـــي مرضـــى متلازمـــة الشـــريان التـــاجي الحـــادة، واقترحت قيمًا محددة بحساسية ونوعية ودقة معقولة.

الكلمات الدالة: رسم خرائط الأنسجة بالرنين المغناطيسي للقلب.