



Speckle tracking versus tissue Doppler assessment of Right ventricular function in inferior wall myocardial infarction and angiographic correlation to proximal right coronary artery stenosis

Mohamed Mahmoud*, Mohamed Salah A. Elsalam**, Hatem A. elrahman***
and Tarek A.M. Khalifa****

Al-Azhar University Faculty of Medicine Cardiology Department

**Assiut, Assiut University Faculty of Medicine Cardiology Department

***Assiut, Sohag General Hospital Cardiology Department

**** Sohag, Egypt

*Corresponding Author

Abstract

Right ventricular (RV) function, has not been widely studied after acute myocardial infarction (MI). The current study describes the use of recent modalities of echocardiography (Echo) to provide a simple accurate diagnosis of ventricular functions post acute inferior MI.

Aims of the study: The assessment of the RV functions in acute inferior wall MI using ventricular strain assessed by 2D longitudinal speckle tracking in comparison to tissue Doppler imaging (TDI) as well as correlation of the results of RV function with the angiographic data of right coronary artery (RCA) stenosis in the first episode of acute inferior wall MI.

Patients & methods. In The patient group composed of 45 patients with first episode of acute inferior MI, twenty patients were selected for the control group. All 65 patients underwent echo assessment indices of dimensions, ventricular function (EF, FS and TAPSE), ventricular myocardial velocities by TDI and global longitudinal strain of both ventricle by speckle tracking. Patients were then divided into two groups A and B according to the presence or absence of significant proximal RCA stenosis.

Results: The study included 45 patients with first episode of IWMI underwent coronary angiography (group2) and 20 persons as control (group1). TAPSE, TDI derived systolic and early diastolic velocities as well as global longitudinal strain assessed by 2D- speckle tracking all were significantly reduced in patients versus control group. On the other hand, patients with proximal RCA stenosis (group A, 17 patients) compared to non-proximal RCA lesions(group B,28 patients) had significantly lower EF, FS, TAPSE, impaired both systolic and diastolic function of RV including TDI derived velocities and global longitudinal strain which assessed by 2D- speckle tracking.

Conclusion: RV functions may be globally significantly reduced in those with first attack of inferior wall MI particularly those with proximal RCA lesions detected by recent modalities of echo even in those with apparently normal traditional echo parameters.

Keywords: inferior myocardial infarction, RV function, echocardiography, TDI Tissue Doppler imaging, speckle tracking, and Two-dimensional strain.

Introduction

In recent years, RV infarction seems to be under diagnosed in most cases of acute myocardial ischemia despite its frequent association with inferior-wall and, occasionally, anterior wall MI. However, its initial management is drastically different from that of left ventricular (LV) MI, and studies have indicated that RV infarction remains associated with significant morbidity and mortality (*Inohara et al., 2013*)(1).

Furthermore, echo evaluation of RV function has been more challenging than that of LV mainly because of the complex structure and asymmetrical shape of the RV. The recent introduction of speckle-tracking echo provides objective measures to quantify segmental and global ventricular function independently of angle of incidence, chamber translation, cardiac rotation, and ventricular size (*Takamura et al., 2010*)(2).

The recent advances in non-invasive modalities, provide a more accurate diagnosis of RV infarction (*Inohara et al., 2013*) (3).

Strain and strain rate (SR) are measures of deformation that are basic descriptors of both the nature and the function of cardiac tissue. These properties may now be measured using either Doppler or two-dimensional ultrasound techniques. Although these measurements are feasible in routine clinical echo, their acquisition and analysis nonetheless presents a number of technical challenges and complexities (*Marwick et al., 2006*) (4).

Patients and Methods

Patient selection: All selected patients were admitted to the coronary care unit, department of cardiology, faculty of medicine, Assiut University from March 2015 to January 2016 with first episode of acute inferior MI recruited for this study and sixty (60) patients from them were selected.

Control group: Twenty age and sex matched persons who were apparently healthy subjects were enrolled in the study as the control group. The following was done for All patients, **1. Informed consent, 2. Full history taking, 3. Complete general and local examination, 4. Total lab investigations 5. Full echocardiographic study** including conventional echo (M-mode, Doppler, 2D) & tissue Doppler image and speckle tracking for assessment of a- Ventricular dimensions (left atrial (LA) diameter, aortic root diameter, LVEDD, LVESD).

b- Ventricular functions: EF, FS, Tricuspid annular peak systolic excursion (TAPSE), TDI assessment of peak systolic velocity of both ventricles (Sm), diastolic atrial peak velocity (Am), early diastolic peak velocity (Em), E/A ratio and global longitudinal strain of both ventricles. **6. Coronary angiography** within one month from the first episode of acute inferior MI in cardiac catheterization unit using device of Siemens Biplane Axiom Artes Zee VC14 with the following views, A-P, RAO, A-P caudal, LAO caudal and cranial views for the left system, RAO and LAO for the right coronary artery and they were classified into group A and group B based on the presence or absence, respectively, of a significant proximal RCA stenosis.

-Statistical analysis: Data was analyzed using STATA intercooled version 12.1. Quantitative data was represented as mean, standard deviation, median and range. Data was analyzed using student t-test to compare means of two groups. When the data was not normally distributed Mann-Whitney test was used. Qualitative data was presented as number and percentage and compared using either Chi square test or fisher exact test. ROC curves were constructed to obtain optimal cut off value of different parameters to predict proximal RCA stenosis. Data were analyzed by sensitivity, specificity, positive, and negative predictive value derived from the receiver operating characteristic (ROC) curve. Graphs were produced by using Excel or STATA program. P value was considered significant if it was less than 0.05.

Results

A total of 65 persons, 45 in the patient group and 20 in the control group, were enrolled in the study.

❖ **Group 1(patients group)** had 45 patients suffering of acute inferior MI, with a mean age of 55.42 ± 9.77 years. There were 37 males (82.22%) and 8 females (17.78%).

❖ **Group 2 (control group)** had 20 populations, with a mean age of 51.5 ± 7.86 years. There were 12 males (60%) and 8 females (40%) were enrolled in the study.

a) Two groups matching together according to age and gender in the following table (1).

b) General Echo findings:-

1- Echo dimensions: LV dimensions (LVEDD & LVESD) are significantly larger in the patients group compared to control group, Mean \pm SD of the LVEDD is 54.46 ± 6.16 in patient group compared to Mean \pm SD of the LVEDD is 49.6 ± 1.95 in control group, Mean \pm SD of the LVESD is 37.13 ± 6.53 in patient group compared to Mean \pm SD of the LVESD is 27.65 ± 2.72 in control group.

In the other hand there is no significant difference in other dimensions (Lt. atrial & aortic root diameters) between two groups as shown in the table (2)

2- Echo findings according to ventricular function:

i. LV function (EF&FS) was significantly lower in patients group than control one as the following: EF% were (Mean \pm SD 58.02 ± 8.47) in

ii. Patients group compared to (Mean \pm SD 64.65 ± 4.97) in control group, FS in group (1) were (Mean \pm SD 31.2 ± 5.98) compared to (Mean \pm SD 35.7 ± 3.97) in group (2).

iii. RV function: RV systolic function which assessed by TAPSE was better in control group than patients group that were (Mean \pm SD 22.4 ± 2.6) in group (1) compared to (Mean \pm SD 24.1 ± 2.6) in group (2), All these findings are shown in table (3).

c) TDI by echo:

Both systolic and diastolic functions of the RV were significantly lower in patients group compared to control group regarding peak early diastolic velocity (Em), E/A ratio and peak systolic velocities (Sm) of the free wall of the RV. On the contrary, there were no significant differences between two groups as regard peak atrial diastolic velocity (Am) of the free wall of the RV.

All of these data shown in the table (4) .

d) **speckle tracking by 2D- echo:** The RV systolic function was significantly better in control group(2) than patients group according to global longitudinal strain of RV, Mean \pm SD of the RV global strain of patients group was $[-12.60] \pm 2.17$ compared to $[-19.77] \pm 2.29$ of control group.

All these data was shown in the following table (5) and figure (1).

Table (1): demographic data of both cases and control group.

Variables	Cases	Controls	P value
Age			
Mean ± SD	55.42 ± 9.77	51.5 ± 7.86	0.12
Median (range)	57 (35-75)	50(35-67)	
Gender			
Females	8 (17.78%)	8 (40.00%)	0.07
Males	37 (82.22%)	12 (60.00%)	

Table 2: comparison between two group according Echo dimensions

Variables	Cases	Controls	P value
LA Diameter			
Mean ± SD	37.35±3.59	38.35±6.29	0.06
Median (range)	36.5(32-43)	39 (22-52)	
Aortic root diameter			
Mean ± SD	28.45±4.93	31.56±3.21	0.08
Median (range)	27 (22-38)	31 (23-37)	
LVEDD			
Mean ± SD	49.6±1.95	54.46±6.16	0.004
Median (range)	49 (47-53)	54 (43-71)	
LVESD			
Mean ± SD	27.65±2.72	37.13±6.53	0.001
Median (range)	27 (24-34)	37 (26-58)	

Table (3): Comparison of cases and control as regards EF, FS, and TAPSE

Variables	Cases	Controls	P value
EF			
Mean ± SD	58.02±8.47	64.65±4.97	0.003
Median (range)	58 (39-75)	64 (58-74)	
FS			
Mean ± SD	31.2±5.98	35.7±3.97	0.003
Median (range)	30 (18-45)	34.5 (31-43)	
TAPSE			
Mean ± SD	22.4±2.6	24.1±0.26	0.02
Median (range)	22 (16-28)	24.5 (1.9-2.8)	

Table (4): Comparison of cases and control groups as regard TDI.

Variables	Cases	Controls	P value
Left ventricular later wall			
LV lat. wall Em Mean \pm SD Median (range)	9.66 \pm 3.11 9.65 (2.83-17.6)	12.72 \pm 3.48 12.87 (6.35-17.4)	0.0008
LV lat. wall Am Mean \pm SD Median (range)	8.62 \pm 3.03 8.09 (3.8-16.2)	8.18 \pm 2.69 7.51 (4.29-15.7)	0.71
LV lat. wall E/A ratio Mean \pm SD Median (range)	1.28 \pm 0.74 1.04 (0.43-4.63)	1.69 \pm 0.72 1.46 (0.74-3.22)	0.009
LV lat. wall Sm Mean \pm SD Median (range)	7.75 \pm 1.53 7.7 (5.07-10.8)	8.88 \pm 2.05 8.14 (6.24-12.7)	0.02
Left ventricular septal wall			
LV Septal wall Em Mean \pm SD Median (range)	6.26 \pm 1.89 5.75 (2.83-12.3)	11.95 \pm 2.94 11 (8.4-16.9)	<0.0001
LV Septal wall Am Mean \pm SD Median (range)	8.45 \pm 1.95 8.09 (4.8-12.9)	7.73 \pm 1.38 7.74 (5.26-11.1)	0.15
LV Septal wall E/A ratio Mean \pm SD Median (range)	0.76 \pm 0.26 0.69 (0.40-1.57)	1.62 \pm 0.62 1.31 (0.98-3.12)	<0.0001
LV Septal wall Sm Mean \pm SD Median (range)	7.16 \pm 1.17 7.2 (5.17-9.3)	8.99 \pm 1.83 8.53 (6.5-12.5)	<0.0001
Right ventricular free wall			
RV free wall Em Mean \pm SD Median (range)	9.08 \pm 3.99 8.36 (5.17-30.1)	13.35 \pm 4.81 11.75 (7.85-28.5)	0.0004
RV free wall Am Mean \pm SD Median (range)	13.64 \pm 4.15 12.8 (6.34-31.4)	12.70 \pm 4.07 11.55 (8.09-24.6)	0.40
RV free wall E/A ratio Mean \pm SD Median (range)	0.67 \pm 0.20 0.65 (0.39-1.72)	1.15 \pm 0.51 1.04 (0.37-2.26)	<0.0001
RV free wall Sm Mean \pm SD Median (range)	11.34 \pm (1.80) 11.1 (7.3-15)	13.63 \pm 1.32 13.4 (11.8-16.9)	<0.0001

Table (5): Comparison of cases and control groups as regard global longitudinal strain of Speckle tracking

Variables	Cases	Controls	P value
LV G.L. strain			
Mean ± SD	[-12.59]±2.94	[-19.91]±2.04	<0.0001
Median (range)	[-12.21] ([-19.32]:[-6.2])	[-19.62] ([-23.7]:[-16.34])	
RV G.L. strain			
Mean ± SD	[-12.22]±2.04	[-19.77]±2.29	<0.0001
Median (range)	[-11.8] ([-17.88]:[-8.26])	[-19.23] ([-24.2]:[-16.9])	

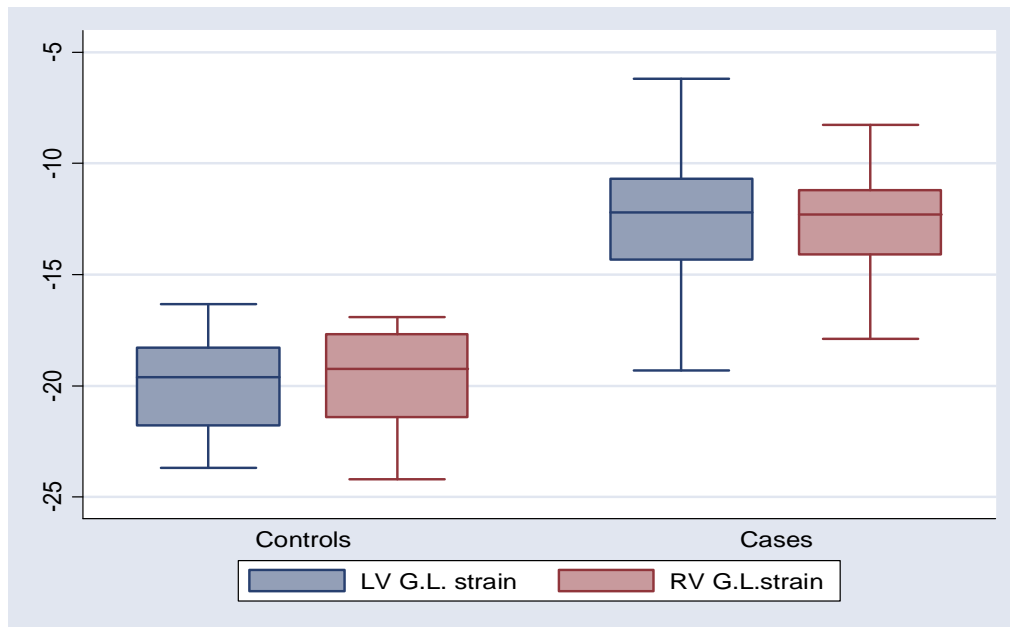


Fig (1) Global RV and LV strain of patients versus control group

1- According the presence or absence of significant proximal RCA stenosis the patients were divided into two sub group :-

-Group (A) which represents 17 patients with proximal RCA stenosis, one female and 16 males with Mean age 56±10.55 years.

-Group (B) which represents 28 patients without proximal RCA stenosis, 7 female and 21 males with Mean age 55.07±9.44 years.

a) Two groups matching together according to demographic data (age, sex), history of DM and hypertension, and all this data of both two groups were shown in table (6).

b) General Echo findings:-

1-Echo dimensions: LV dimensions (LVEDD &LVESD) are significantly larger in patients with proximal RCA stenosis (group A) compared to group (B), Mean ± SD of the LVEDD is 55.88± 5.26 in group (A) compared to Mean ± SD of the LVEDD is 53.6± 5.04 in group (B), Mean ± SD of the LVESD is 38.7±4.94 in group (A) compared to Mean ± SD of the LVESD is 36.17±4.2 in group (B).

On the other hand there is no significant difference between two groups as regards LA & aortic root diameters, all of this diameters showing in the following table (7).

2– Echo findings according to ventricular function:

i. LV function (EF&FS) was impaired in patients with proximal RCA (group A) than patients without proximal RCA (group B) as the following: EF% were (Mean ± SD 54.88±5.99) in group (A) compared to (Mean ± SD 59.9±9.25) in group (B), FS in group A were (Mean ± SD 28.41±3.54) compared to (Mean ± SD 32.89±6.55) in group B.

ii. RV function: RV systolic function which assessed by TAPSE was significantly better in patients without proximal RCA compared to patients with proximal RCA (group A) (Mean ± SD 2.34±0.22) in group (B) compared to (Mean ± 2.06±0.24) in group (A), All these findings are shown in table (8).

c) **TDI by echo:** Systolic and diastolic functions of the RV were significantly lower in patients with proximal RCA stenosis (group A) compared to patients without proximal RCA (group B)

according to atrial diastolic velocity (Am), E/A ratio and peak systolic velocity (Sm) of the RV free wall, also there significant increase of peak early diastolic velocity (Em) of lateral wall of LV in group (A) more than group (B).

On the contrary, there were no significant differences between two groups as regards, RV free wall (Em). All of these data shown in the table (9).

d) **Speckle tracking by 2D- echo:** The RV systolic function was significantly better in patients without proximal RCA stenosis (group B) than patients with proximal RCA stenosis (group A) according to global longitudinal strain of RV, Mean ± SD of the RV global strain of group (B) was [-13.08] ±2.03 compared to [-10.8724] ±2.23 of group(A).

All of these data shown in the table (10) and figure (2).

Table (6) Comparison between patients with and without proximal RCA as regard demographic data, DM and HTN.

Variables	Proximal RCA	No proximal RCA	P value
Age			
Mean ± SD	56±10.55	55.07±9.44	0.76
Median (range)	56 (40-75)	57.5 (35-72)	
Gender			
Females	1 (5.88%)	7 (25.00%)	0.13
Males	16 (94.12%)	21 (75.00%)	
History of hypertension			
No	9 (52.94%)	14 (50.00%)	0.85
Yes	8 (47.06%)	14 (50.00%)	
History of DM			
No	10 (58.82%)	19 (67.86%)	0.54
Yes	7 (41.18%)	9 (32.14%)	

Table (7): comparison between two groups as regards Echo diameters.

Variables	With proximal RCA	Without proximal RCA	P value
Left atrial Diameter Mean ± SD Median (range)	37.9±3.99 37(32-46)	38.6±7.4 39 (22-52)	0.06
Aortic root diameter Mean ± SD Median (range)	31.6±2.51 31(28-37)	31.5±3.57 31 (23-37)	0.08
LVEDD Mean ± SD Median (range)	55.88± 5.26 55(45-71)	53.6± 5.04 52.5 (43-67)	0.01
LVESD Mean ± SD Median (range)	38.7±4.94 38 (29-58)	36.17±4.2 33 (26-50)	0.04

Table (8) Comparison between group (A) and group (B) as regard EF, FS and TAPSE.

Variables	Proximal RCA	No proximal RCA	P value
EF Mean ± SD Median (range)	54.88 ±5.9 57 (39-61)	59.93±9.25 59 (40-75)	0.03
FS Mean ± SD Median (range)	28.41±3.54 29 (18-32)	32.89±6.55 31.5 (22-45)	0.01
TAPSE Mean ± SD Median (range)	2.06±0.24 2.1 (1.6-2.46)	2.34±0.22 2.31 (1.9-2.8)	0.0002

Table (9) comparison between group (A) and group (B) as regard TDI Echo data.

Variables	proximal RCA	No Proximal RCA	P value
Left ventricular later wall			
LV lat. wall Em Mean \pm SD Median (range)	11.13 \pm 2.77 10.6 (6.1-17.6)	8.77 \pm 2.99 8.98 (2.83-16.7)	0.01
LV lat. wall Am Mean \pm SD Median (range)	8.99 \pm 3.73 7.51 (3.8-16.2)	8.39 \pm 2.56 8.15 (4.19-13.5)	0.87
LV lat. wall E/A ratio Mean \pm SD Median (range)	1.51 \pm 0.98 1.23 (0.63-4.63)	1.13 \pm 0.53 0.94 (0.43-2.33)	0.18
LV lat. wall Sm Mean \pm SD Median (range)	7.90 \pm 1.43 8.38 (5.8-10.3)	7.67 \pm 1.60 7.46 (5.07-10.8)	0.63
Left ventricular septal wall			
LV Septal wall Em Mean \pm SD Median (range)	6.69 \pm 2.17 5.75 (4.09-12.3)	5.99 \pm 1.69 5.7 (2.83-9.65)	0.23
LV Septal wall Am Mean \pm SD Median (range)	8.59 \pm 2.15 8.09 (4.8-12.9)	8.36 \pm 1.84 8.05 (5.85-12.5)	0.71
LV Septal wall E/A ratio Mean \pm SD Median (range)	0.80 \pm 0.27 0.70 (0.49-1.57)	0.74 \pm 0.25 0.68 (0.40-1.35)	0.58
LV Septal wall Sm Mean \pm SD Median (range)	7.11 \pm 1.20 7.05 (5.17-9.2)	7.19 \pm 1.17 7.21 (5.17-9.3)	0.82
Right ventricular free wall			
RV free wall Em Mean \pm SD Median (range)	8.42 \pm 2.34 7.85 (5.56-13.5)	9.49 \pm 4.71 8.53 (5.17-30.1)	0.39
RV free wall Am Mean \pm SD Median (range)	11.90 \pm 2.86 11.2 (6.34-17.3)	14.70 \pm 4.49 14.35 (9.52-31.4)	0.03
RV free wall E/A ratio Mean \pm SD Median (range)	0.71 \pm 0.10 0.68 (0.59-0.89)	0.65 \pm 0.25 0.61 (0.39-1.72)	0.02
RV free wall Sm Mean \pm SD Median (range)	10.41 \pm 1.60 10.5 (7.3-12.8)	11.91 \pm 1.70 11.85 (9-15)	0.005

Table(10) : comparison between two groups as regard global longitudinal strain of Speckle tracking.

Variables	Proximal RCA	No proximal RCA	P value
LV G.L. strain			0.33
Mean ± SD	[-13.14]±3.09	[-12.26]±2.85	
Median (range)	[-13.41] ([-19.32]:[-8.3])	[-12.17] ([-17.11]:[-6.2])	
RV G.L. strain			0.05
Mean ± SD	[-10.8724]±2.23	[-13.08]±2.03	
Median (range)	[-11.34] ([-16.61]:[-8.26])	[-13.31] ([-17.88]:[-9.33])	

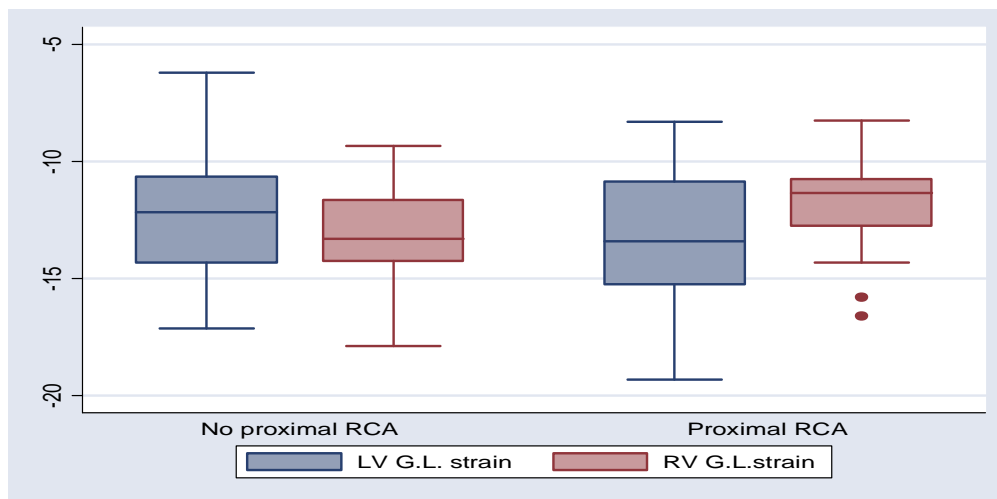


Figure (2): comparison between two groups as regard global longitudinal strain of Speckle tracking by 2D-echo

Discussion

Echo assessment of the right side of the heart is gaining importance in current clinical practice and research with guidelines published specifically to address this purpose (5). This is because of growing evidence of its effects on clinical outcome, morbidity and mortality of several cardiac conditions (6). Evaluation of the RV function has a very significant role in the outcome of patients with MI, especially in those with RVMI. Imaging of the RV is difficult due to its complex crescent-shaped structure, trabeculation. TDI are gaining importance in the assessment of RV performance (7). The main findings of present study were that patients with acute inferior wall MI had significantly lower values of RV systolic and diastolic function (manifested by significant reduction of TAPSE, TDI velocities, global longitudinal strain by speckle tracking) in patients compared to control persons. As regard

the RV systolic function which assessed by TAPSE, The current study was concordant with **Katsuhisa, et al**, who Quantifying longitudinal RV dysfunction in patients with old MI by using speckle-tracking strain echo (8) and **Gorter et al**, who assessed the Right ventricular function after acute myocardial infarction treated with primary percutaneous coronary intervention (from the glycometabolic intervention as adjunct to primary percutaneous coronary intervention in ST-segment elevation myocardial infarction III trial and concluded that TAPSE was reduced in patients with acute inferior wall MI compared to control group (9). On the other hand the present study disagreed with **Lang et al**, who reported the Recommendations for Cardiac Chamber Quantification by Echo in Adults, and concluded that the cut off value for TAPSE is ≤ 17 mm in RV dysfunction, our study concluded the cut off

values was ≤ 22 mm, that contrary may be explained by some of our patients undergone to reperfusion therapy as there is a possibility of recovery of RV function that before echo assessment and also delayed echo examination for some cases after spontaneous recanalization of affected coronary artery (10). According to assessment of RV systolic function by pulsed wave TDI the present study agreed with **Witt and colleague**, who investigated the tricuspid annular velocity assessed by TDI as a marker of RV involvement in the acute and late phase after a first ST elevation MI, and showed a similar diagnostic accuracy of TDI Sm wave of tricuspid annulus in prediction of RV dysfunction, and significantly impaired in patients group compared to control persons (11). The present study was also concordant with **Martin et al** who studied the Echo assessment of global longitudinal RV function in patients with an acute inferior ST elevation MI and proximal RCA occlusion, and reported a significant decrease in TDI-based myocardial velocities of the RV has a global effect following acute MI (12). Our study demonstrated that a cut-off value of TDI systolic velocity Sm =11.34 cm/s, this is concordant with **Zabroska et al**, who studied the diagnostic and prognostic value of right ventricular velocities in inferior myocardial infarction treated with primary PCI, they reported that cut-off values of TDI Sm indicating a functional RV impairment < 12 cm/s in different clinical situations (13). On the other hand our study disagreed with **Lang et al**, who reported the Recommendations for Cardiac Chamber Quantification by Echo in Adults, and concluded that the cut off value for Sm is 9.5 cm/s in RV dysfunction, our study concluded the cut off value was 11.34cm/s, that contrary may be explained by some of our patients undergone to reperfusion therapy as there is a possibility of recovery of RV function before echo assessment and also delayed echo examination for some cases after spontaneous recanalization of affected coronary artery (14).

As regard diastolic dysfunction of RV which demonstrated by the current study based on TDI, the early diastolic annular velocities (Em), showed significant decrease in patients with acute inferior wall MI compared to control subjects,

with no significant difference between two groups according to late diastolic velocity(Am). This finding was agreed with the study of **Nicholaos et al**, who assessed the TDI of the Tricuspid Annulus and Myocardial Performance Index in the Evaluation of RV Involvement in the Acute and Late Phase of a First Inferior MI and demonstrated significant decrease of systolic and diastolic velocity in patients group compared to control persons, with no significant difference as regard late diastolic velocity (Am) (15). Again the present study also agreed with **Kidawa et al**, who investigated the Real-time 3D echo and TDI in the assessment of RV systolic function in patients with RV MI, they had reported that patients with diastolic dysfunction on TDI has significant reduction of Em in patients group compared to control group but the late peak diastolic velocity (Am) was insignificantly reduced (16).

As regard global longitudinal strain for assessment of RV function by 2D speckle tracking, the current study concordant with **Horton et al**, who studied the Assessment of the RV by echo: a primer for cardiac sonographers (17) and **Kossaify et al**, who studied the echocardiographic assessment of the right ventricle, from the conventional approach to speckle tracking and three dimensional imaging, and insights into the "Right Way" to explore the forgotten chamber and they found significant decrease of global longitudinal ventricular strain in patients group compared to control group (18). The current study also agreed with **Katsuhisa et al**, who Quantifying longitudinal RV dysfunction in patients with old MI by using speckle-tracking strain echo, and concluded that global longitudinal RV strain was reduced in patients with acute inferior wall MI and longitudinal function mainly reflects global RV systolic function (19). Again The present study was also concordant with **Martin et al**, who studied the Echo assessment of global longitudinal RV function in patients with an acute inferior ST elevation MI and proximal RCA occlusion, and they demonstrated that a significant decrease in strain/strain rate values of the RV has a global effect following acute MI (20). Our study also agreed with **Lang et al**, who reported the Recommendations for Cardiac Chamber

Quantification by Echo in Adults, and concluded that global longitudinal strain lower than -20 indicates RV systolic dysfunction (21). As regard comparison between patients with proximal RCA lesion and patients without proximal RCA lesion, the present study agreed with **Alam et al**, who studied the RV function in patients with first inferior MI: assessment by tricuspid annular motion and tricuspid annular velocity, they found there is significant impairment of TAPSE in patients with proximal RCA lesion more than patients without proximal RCA lesion (22). Our study also was concordant with **Gopalan et al**, who studied the echo assessment of RV function in inferior wall MI and angiographic correlation to proximal RCA stenosis, and concluded that TAPSE was significantly lower in patients with proximal RCA lesion and both two groups of patients according to presence or absence of proximal RCA stenosis had no significant differences in baseline variables like age, sex, prevalence of hypertension and diabetes (23). On the other hand the present study disagreed with **Rudski et al**, who demonstrated the guidelines for the Echo Assessment of the Right Heart in Adults, they concluded that cut off value of TAPSE was less than 17 mm indicate RV dysfunction, but our study demonstrate ≤ 20 mm cut off value of TAPSE was predicted proximal RCA lesion (24), and disagreed with **El Sebaie et al**, who assessed the right ventricular echocardiographic parameters for prediction of proximal right coronary artery lesion in patients with inferior wall myocardial infarction who found that there is no significant difference according to right ventricular function which assessed by TAPSE in patients with or without proximal RCA lesion that may be due to echo assessment of RV function in both two previous study was done before reperfusion therapy but in our study some of our patients undergone to reperfusion therapy as there is a possibility of recovery of RV function that before echo assessment (25). According to TDI assessment of RV function for patients with or without proximal RCA lesion the present study agreed with **Ozdemir et al**, who studied the new parameters in identification of RV MI and proximal RCA lesion, they concluded that peak velocity of RV free wall (S_m) is ≤ 10.41 cm/s predicted proximal

RCA lesion with 64.7%, 75%, 77.8% and 61.1% sensitivity and specificity, negative predictive value and positive predictive value respectively (26). Current study was also concordant with **Mukhaini et al**, who studied the Assessment of RV diastolic function by TDI in patients with acute RV MI, and proved that RV diastolic function was significantly lower in patients with proximal RCA lesion compared to patients without proximal RCA lesion (27). Again the present study also was agreed with **Kakouros et al**, who studied the Tissue Doppler imaging of the tricuspid annulus and myocardial performance index in the evaluation of right ventricular involvement in the acute and late phase of a first inferior myocardial infarction, how found that the peak systolic velocity (S') of the tricuspid annulus was significantly lower in patients with proximal RCA lesion (28). As regard global longitudinal strain of RV in patients with or without proximal RCA lesion, the current study agreed with **Chang et al**, who study the changes in right ventricular free wall strain in patients with CAD involving the RCA, they demonstrated global longitudinal strain of patients with proximal RCA versus non proximal RCA are $-13.65 \pm 3.83\%$ versus $-15.69 \pm 4.37\%$ respectively, and proved that the systolic function of the RV which assessed by global longitudinal strain was decreased significantly in patients with proximal RCA stenosis compared to non proximal RCA stenosis (29).

Limitations: This study involved a relatively small number of patients at a single center, so future studies of larger numbers of patients are required to determine the actual usability echocardiography of ventricular dysfunction and prediction of proximal RCA stenosis.

Before and after the reperfusion therapy was unclear, Echocardiographic assessment should ideally be performed before any reperfusion strategy as there is a possibility of recovery of RV function. But it was considered unethical to delay reperfusion for echocardiographic assessment.

the pre-existing RV systolic dysfunction could not be excluded. Because RV systolic function can be affected by various conditions, there might be the possibility of the presence of RV systolic

dysfunction by other causes than the occlusion of RV branches. However, in the current study we tried to avoid this limitation by choose patients with first episode of acute inferior wall infarction and exclude all patients suffering of any causes of RV dysfunction as COPD.

A prospective study with a larger number of patients and a well-designed protocol will be needed to confirm the correlation and the clinical impact of impaired RV function in patients with acute inferior MI.

Conclusion

Tissue Doppler and strain echocardiography provides additional information to conventional echocardiography.

The reduced peak systolic velocity and reduced peak early diastolic velocity and GLS seems to be an expression of globally reduced ventricular systolic and diastolic functions in patients with acute inferior myocardial infarction.

Echocardiographic assessment of various parameters of RV function showed significant difference between groups with or without proximal RCA lesion.

Tissue Doppler systolic annular velocity and global longitudinal strain by 2D-speckle tracking are easy to perform and useful in predicting proximal RCA as infarct related artery.

Recommendation: Assessment of ventricular function specially right ventricle is complex but is an essential component of every echocardiographic examination.

RV assessment adds important diagnostic and prognostic information.

Further study focusing on echocardiographic measurements after reperfusion treatment to investigate speed of recovery.

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