Assessment of Right Ventricular Strain by Speckle Tracking Echocardiography for Prediction of Proximal Right Coronary Artery Lesion in Patients with Acute Inferior Wall Myocardial Infarction

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Abstract

An ultrasound technique known as speckle-tracking imaging may be used to objectively and quantitatively analyse the overall and localised heart functions (STI). In patients with acute inferior myocardial infarction, we used speckle-tracking and conventional echocardiography to study the connection between echocardiographic characteristics and the prediction of proximal RCA lesions. This study has a total of 77 participants. Group 1 was given an RCA occlusion in the right ventricle's proximal branch, whereas Group 2 was given an RCA occlusion in the right ventricle's distal branch.

Keywords: Acute myocardial infarction of the inferior wall, speckle tracking echocardiography, and RV infarction are all possible diagnoses in this case.

1. Introduction

In about one-third of patients, the right ventricular function is affected by the inferior myocardial infarction [MI]. Right ventricular involvement in individuals with inferior MI has a strong connection with death and long-term complications [1].

Since the right ventricle is so complicated, non-invasive testing may be challenging. Either from the American Society of Echocardiography (ASE) and/or from the European Association of Cardiovascular Imaging (EACI), an echocardiographic parameter should be used to evaluate a patient's right ventricular function, and these parameters include fractional area change, TAPSE (tricuspid annular plane systolic movement), TDI (tissue Doppler imaging), and a systolic Sm velocity.

Right and left ventricular function in a number of illnesses has been assessed using speckle-tracking echocardiography since its invention. Research shows that the strain's advantages in the delicate RV evaluation of conditions such pulmonary arterial hypertension and congenital heart disease [4] were established mainly for inspection of the left ventricle [LV].

2. Material and methods

Benha University's Department of Cardiology conducted this prospective cohort research over the course of one year, from March 2021 to March 2022.

All participants were given the opportunity to provide their informed permission.

In order to identify the 77 patients with inferior STEMI who satisfied the registration criteria, purposive sampling was performed.

In individuals with suspected inferior STEMI, angiography indicated a blockage of the right coronary artery (RCA) and an ST-segment elevation of at least one millimetre on the electrocardiogram (ECG).

After performing coronary angiography on all patients, we excluded those with significant co-morbid conditions such as LCX dominance, previous documented RV dysfunction and greater than 50% LCX or LAD artery lesions from the experiment.

Patients' medical histories and clinical exams were gathered, and BMI, ECG, coronary angiography, echocardiograms, and speckle-tracking echocardiography were done on all of them.

All echocardiographic studies were conducted within 24 hours following PTCA, which was employed to treat the inferior MI.

It was done in accordance with American Society of Echocardiography [2] recommendations for 2D echocardiographic tests. Measurements of the left ventricle, interventricular septum, posterior wall, and left atrium were required. The LVEF was determined using Simpson's biplaning approach [3]. The wall motion score index [WMSI] is calculated using the 16-segment LV model. [5]

In the event of an inferior myocardial infarction, patients underwent PTCA (primary percutaneous transluminal coronary angioplasty). Distal LCX or LAD lesions that were demonstrated to be angiographically responsible were eliminated from the study. Patients with RCA lesions and thrombus distal to the right ventricular branch were divided into two groups: Group I, which included those with both lesions and thrombus, and Group II, which included only patients with lesions.

3. Results and discussion

The research involved 77 patients. There was a wide range in the age of the patients. Males comprised 76.6 percent of the sample. There were 49 diabetes individuals (63.36 percent) in the study. Patients' systolic and diastolic blood pressure and heart rate were 129.54 23.18 mmHg and 87.7 15.82 mmHg, respectively. Fourty-one patients from Group 1 and 36 patients from Group 2 had RCA lesions that were distal to the right ventricular branch, both of which were associated with an occlusion lesion. There were a variety of results from the patients that were collected and described in Table 1.

Table 2 shows that Group 1 had lower values for RV TAPSE, RV TDI Sm, FAC, RV-FW Strain (both 11.57 and 16.16 percent), RV-FW Strain (both 0.81 and 1.16 percent), RV-FW Strain (both 0.88 and 0.18 percent), and RV-FW Strain (both 0.88 and 0.18 percent) than Group 2 (p 0.001 for the latter two) [Table 2].

This is the first figure.

We found that RV-FW strain > 14.75% predicted proximal coronary aneurysms with an AUC of 0.81, a statistically significant result.

Table (1) Characteristics of the research population in terms of health, demographics, and laboratory findings

Variable	All patients n = 77	Group 1 n = 41	Group 2 n = 36	P
Age [years]	59 ± 6.19	58.3 ± 6.8	60.04 ± 5.35	0.524
Sex male [%]	59 [76.6%]	30 [73.1%]	29 [80.5]	0.387
Diabetes Mellitus	49 [63.36%]	29 [70.7%]	20 [55.5%]	0.358
BMI [kg/m^2]	26.7 ± 3.51	26.41 ± 3.94	27 ± 2.9	0.47
Door to reperfusion [min]	30 [15–45]	30 [15–45]	30 [15–45]	0.137
Systolic blood pressure [mm Hg]	129.54 ± 23.18	131.85 ± 24.06	127.2 ± 22.24	0.81
Diastolic blood pressure [mm Hg]	87.7 ± 15.82	86.85 ± 16.02	88.05 ± 15.77	0.42
Heart rate [bpm]	81.75 ± 12.63	81.07 ± 12.08	82.52 ± 12.53	0.124
Glucose [mg/dl]	151.9 [95-215]	150.95[100–210]	152.97 [95–215]	0.976
Creatinine [mg/dl]	0.97 ± 0.17	0.96 ± 0.17	0.98 ± 0.17	0.498
LDL [mg/dl]	109.54 ± 28.47	108.9 ± 30	110.27 ± 26.84	0.454
Hemoglobin [mg/dl]	14.0 ± 1.29	14.0 ± 1.38	14.0 ± 1.24	0.561
High sensitive troponin [ng/ml]	3.81 [0.6–6.9]	4.19 [0.5–10]	3.38 [0.5–8.6]	0.782

Table (2) Conventional and speckle tracking echocardiographic characteristics of the study population.

|	All patients n = 77	Group 1 n = 41	Group 2 n = 36	P
EDD [cm]	4.7 [3.9–5.7]	4.71 [3.9–5.7]	4.69 [3.9–5.4]	0.463
ESD [cm]	3.09 [2.7–3.1]	3.15 [2.6–3.8]	3.03 [2.6-3.8]	0.122
IVS [cm]	0.97 [0.82–1.05]	0.98 [0.76–1.4]	0.97 [0.76–1.4]	0.094
Posterior wall [cm]	0.97 [0.9–1.1]	0.96 [0.9–1.1]	0.98 [0.9–1.1]	0.796
LA diamater [cm]	3.59 ± 0.29	3.76 ± 0.23	3.5 ± 0.33	0.534
EF [%]	50.88 [35–64]	50.9 [35–64]	50.8 [36–64]	0.489
LV E/A	0.89 [0.65–0.85]	0.9 [0.6–1.5]	0.88 [0.6–1.5]	0.755
LV E/Em	7.93 [6.3–9.6]	7.91 [6.3–9.2]	7.96 [6.4–9.6]	0.605
LV WMSI	1.40 [1.16–1.94]	1.45 [1.16-1.94]	1.35 [1.19–1.7]	0.297
LV GLS [%]	− 15.01 ± 1.5	− 14.98 ± .51	− 15.0 ± 1.52	0.853
RV TAPSE [cm]	1.9 ± 0.25	1.77 ± 0.20	2.04 ± 0.22	< 0.001
RV TDI Sm [cm/s]	11.38 [9.5–13.5]	10.8 [9.5–12.5]	12.04 [10.5-13.5]	0.001
RV TDI MPI	0.55 [0.45–0.65]	0.55 [0.45–0.65]	0.54 [0.45–0.6]	0.482
FAC [%]	38.5 [30–46]	33.7 [30–45]	44 [42–46]	< 0.001
RV-FW strain [%]	− 13.71 ± 4.20	− 11.57 ± 2.85	− 16.16 ± 4.15	< 0.001
RV-FW SRS′ [s^{-1}]	− 0.79 [0.8 to − 0.65]	− 0.74 [− .86 to − 0.63]	− 0.81 [− 1.5 to − 0.75]	0.068
RV-FW SRE′ [s^{-1}]	0.78 [0.65–0.95]	0.69 [0.62–0.85]	0.81 [0.75–1.4]	0.002
RV-FW SRA′ [s^{-1}]	0.79 ± 0.19	0.73 ± 0.145	0.88 ± 0.18	0.001
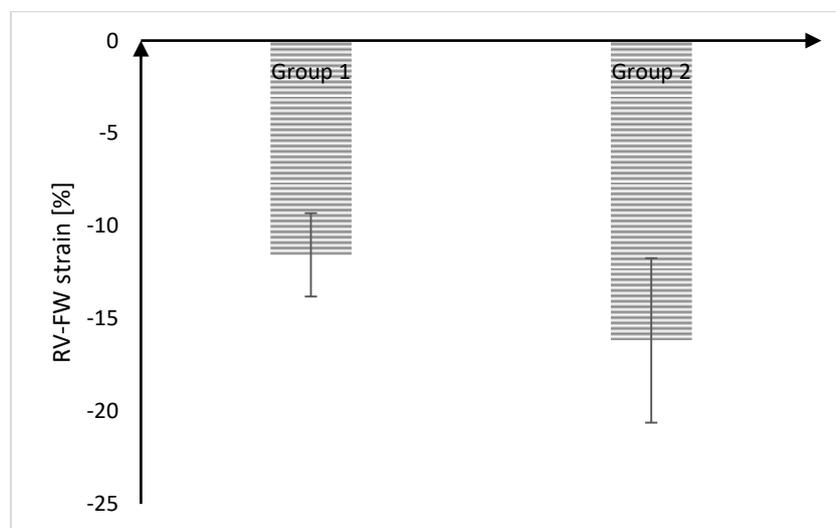
Fig. (1) RV FW strain in both groups
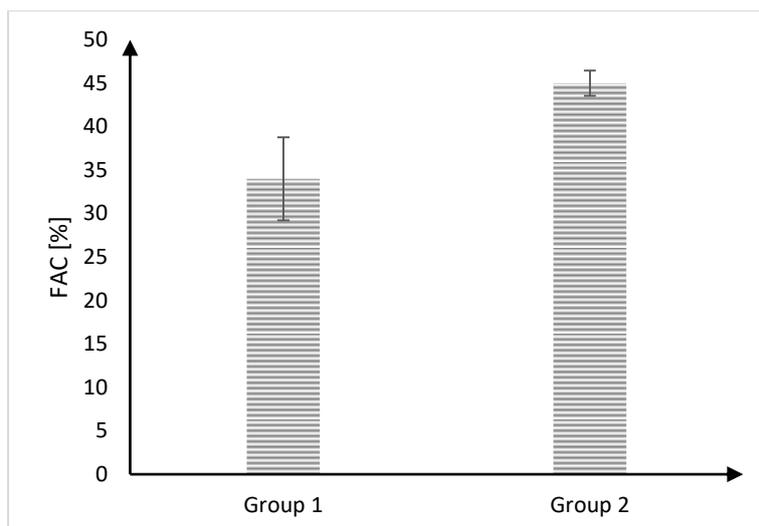
Fig. (2) RV FAC in both groups.

When an RCA occlusion was the origin of an acute inferior MI, RV-FW strain was an indicative of the lesion's proximity. A correlation between FAC and RV EF (MRI) was found [r = 0.80, p = 0.01] in preliminary studies .001] There are seven of them.

Patients with proximal RCA blockage had a lower FAC than those in the control group, according to our study. However, the proximal RCA blockage was not a significant predictor of this outcome.. Due to the emphasis on global functions of the RV rather than segmental functions, FAC may fall short in RCA occlusion prediction. MRI-measured EF was shown to be the most closely connected parameter to the Sm value in patients with inferior MI (figure 2). [10]

There was an 81% and an 82% specificity in the diagnosis of RV MI, as well as an excellent ability to identify the infarct-related vascular route among 60 patients with acute inferior MI who had pulsed wave TDI assessment at peak S′ 12 cm/s. [8]. RV TDI Sm decreased in patients with proximal RCA obstruction, which is similar with previous results.

In order to compare cardiac MRI findings of RV scar and stunning to the speckle-tracking echocardiography data, we employed speckle-tracking.

This study found that the RV peak long strain value revealed the scar better than either TAPSE or TDI. Chang and colleagues found that individuals with proximal and distal coronary aneurysms had lower free strain and GLS than patients with stable coronary disease who were treated for RCA lesions. In addition, the RV free strain was demonstrated to be able to predict the presence of an RCA proximal lesion. During our study, the right ventricular strain value was shown to be a predictor of RCA-proximal obstructions.

Previous studies have found RV diastolic dysfunction in patients with inferior MI. Using TDI, Mukhaini et al. investigated RV diastolic dysfunction in individuals with a reduced ejection fraction. Those with right ventricular MI and an inferior MI were separated into two groups, while those without right ventricular MI were put in a control group. Diastolic values for RV TDI diastolic features were lower in patients with right ventricular MI who had lowered values for the TDI Sm, Em, and Em/Am indices.

4. Conclusion

As a result of the above, we may state Patients with proximal RCA lesions showed lower TAPSE, FAC and TDI sm and RV lateral strain than those with distant RCA lesions.

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