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Detection of Coronary Artery Disease Using 2D-Speckle tracking Comparing with Coronary Angiography in Patient with Acute Coronary Syndrome in Baghdad Teaching Hospital

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ABSTRACT

Background: Speckle-tracking echocardiography is a noninvasive ultrasound imaging technique that allows for an objective and quantitative evaluation of global and regional myocardial function.

Objective: To evaluate the accuracy of 2D speckle tracking trans thoracic echocardiography for detection of culprit coronary artery lesion severity confirmed by coronary angiography in patients with acute coronary syndrome.

Patients and Methods: A cross sectional study was held in Baghdad teaching hospital from March 2017 to March 2018, consisted of patients with acute coronary syndrome ,underwent 2D speckle tracking TTE for left ventricular immediately before invasive coronary angiography.

Results: Fifty patients who fulfilled the inclusive criteria were enrolled in the current study. The mean age 57.2 (± 7.9) years; and male:female ratio 1.9:1.For the stenosis in LAD, the current study showed that the Regional longitudinal strain was a good predictor with a sensitivity of 69 %, specificity 76.2 % and accuracy 72 % compared with coronary angiography, with good performance of the test between tests, good predictive value and accuracy of the test. The performance and validity of 2D LV longitudinal strain in detection of RCA stenosis in comparison with angiography, it had a sensitivity of 72.4 %, specificity of 71.4 % and accuracy of 72 %.

Conclusion: The current study revealed that (RLS) Speckle-tracking echocardiography technique has high sensitivity but with low specificity in diagnosis of culprit of coronary artery disease.

Keywords: Coronary Artery Disease, Speckle-tracking echocardiography, coronary angiograph

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INTRODUCTION

Atherosclerotic plaques, the hallmark of atherosclerosis (1).This is the most common cause of a heart attack. (2). Coronary arteriography: It may be indicated when non-invasive tests have failed to elucidate the cause of atypical chest pain but is usually performed with a view to revascularization (3). Regional wall motion abnormality is a term commonly used in transthoracic echocardiography (TTE) (4). Speckle-tracking echocardiography allows for an objective and quantitative evaluation of global and regional myocardial function (5). Global longitudinal strain recently has been validated as a quantitative index for global LV function (6).

AIM

To assess the value and accuracy of regional (segmental) longitudinal strain versus coronary angiography in detection of coronary artery disease in patients with acute coronary syndrome.

PATIENTS & METHODS

Across section hospital based study was conducted from March 2017 to March 2018, which was held in Baghdad Teaching Hospital. This study included Patients with history suggestive of ischemic heart disease who planned for coronary angiography proceeded by transthoracic echocardiographic examination. Exclude those Patients with poor endocardia border visualization on TTE examination. Patients with history of previous PCI, Severe valvular heart disease, Decompensated heart failure, Severe LV. Hypertrophy and Advanced renal failure. Institutional ethics committee approval was obtained. The personal and clinical data were collected. The following echocardiography data were collected by 2D and M-mode echocardiography , Simpson's method and 2D Speckle tracking (Bull's eye model measuring peak regional and global LV longitudinal strain of 17 segments was calculated. Given the average value of (-17 ± 0.1%) for normal. GLS, any value assessed by AFI < 16 % was considered as impaired GLS) .Coronary angiography was done using standard protocol (7).

Statistical Analysis: The Data were analyzed using SPSS software version 21. The best cutoff value was determined by the highest sum of sensitivity and specificity. A P - value of < 0.05 was considered statistically significant.

RESULTS

A total of 50 patients with coronary artery disease (CAD) were included in this study with mean age of 57.2 ± 7.9 years. Male patients were more than females with ratio as 1.9:1. Mean BMI was 27.9±4.8 Kg/m2;. As shown in table 1

Table 1: Baseline Characteristics of CAD Patients.

Variable	Patient NO.	%
Age	Mean Age ± SD (57.2 ± 7.9 Years)	
< 50 Years	10	20 %
50-59Years	23	46 %
60-69Years	14	28 %
≥ 70 Years	3	6 %
Gender		
Male	33	66 %
Female	17	34 %
BMI	Mean BMI ± SD (27.9 ± 4.8 Kg / m2)	
Normal	21	42 %
Overweight	10	20 %
Obese	19	38 %

Younger age, male and obese have A significant association with Critical angiography lesions as in table 2

Table 2: Baseline Characteristics According to Angiography Findings.

Variable	No Critical Lesion		Critical Lesion		P
No.	%		No.	%	
Age					0.001* S
< 50 Years	4	19 %	6	20.7 %	
50 - 59 Years	14	66.7 %	9	31 %	
60 - 69 Years	0	-	14	48.3 %	
≥ 70 Years	3	14.3%	0	-	
Gender					0.003**S
Male	9	42.9 %	24	82.8%	
Female	12	57.1 %	5	17.2 %	
BMI					< 0.001**S
Normal	15	71.4 %	6	20.7 %	
Overweight	4	19 %	6	20.7 %	
Obese	2	9.5 %	17	58.6 %	

There was a significant association between smoking, Diabetes Mellitus (DM) and Hypertensive (HTN) patients and critical angiography lesions. as found in table 3

Table 3: clinical risk factors according to angiography findings.

Variable	No Critical Lesion		Critical Lesion		P
No.	%		No.	%	
Smoking					<0.001*S
Yes	2	9.5 %	20	69 %	
No	19	90.5 %	9	31 %	
DM					0.02* S
Yes	5	23.9 %	16	55.2 %	
No	16	76. 2%	13	44. 8%	
HT					<0.001**S
Yes	21	100 %	9	31 %	
No	0	-	20	69 %	
Dyslipidaemia					0.1** NS
Yes	2	9.5 %	8	27.6 %	
No	19	90.5 %	21	72.4 %	
Alcoholics					0.1** NS

Yes	0	-	3	10.3%	
No	21	100 %	26	89.7 %	
Family history					0.4** NS
Positive	2	9.5 %	5	17.2 %	
Negative	19	90.5 %	24	82.8 %	

Typical chest pain, abnormal ECG, abnormal EF, abnormal 2D-RWMA, abnormal LVEDD and LVESD have a significant association with critical angiography lesions, as shown in table 4

Table 4: Examination and Investigations Findings According to Angiography Findings.

Variable	No Critical Lesion		Critical Lesion		P
	No.	%	No.	%	
Typical chest pain					<0.001*S
Yes (42p.)	13	61.9 %	29	100 %	
Atypical chest pain					<0.001*S
Yes (8p.)	8	38.1 %	0	-	
ECG					<0.001**S
Normal (15p.)	12	57.1 %	3	10.3 %	
Abnormal (35p.)	9	42.9 %	26	89.7 %	
EF					0.005* S
Abnormal (9p.)	0	-	9	31 %	
Normal (41p.)	21	100 %	20	69 %	
2D-RWM					<0.001**S
Normal (21p.)	16	76.2 %	5	17.2%	
Abnormal(29p.)	5	23.8 %	24	82.8 %	
LVEDD/LVESD					0.001*S
Normal (39p.)	21	100 %	18	62.1 %	
Dilated (11p.)	0	-	11	37.9 %	

Abnormal regional longitudinal strain (RLS) findings of CAD patients were significantly associated with critical angiography lesions., shown in table 5

Table 5: Echocardiography Findings According to Angiography Findings.

Variable	No Critical Lesion		Critical Lesion		p
	No.	%	No.	%	
ST-GLS					0.001* S
Normal (16p.)	12	57.1 %	4	13.8%	
Abnormal (34p.)	9	42.9 %	25	86.2%	
LAD-Related Segments					0.002* S
Normal (25p,)	16	76.2 %	9	31%	
Ischemic lesions (25p.)	5	23.8 %	20	69%	
LCX- Related Segments					<0.001* S
Normal (12p.)	12	57.1 %	0	-	
Ischemic lesion (38p.) (38p.)	9	42.9 %	29	100%	
RCA-related segments					0.002* S
Normal (23p.)	15	71.4 %	8	27.6%	
Ischemic lesion (27p.)	6	28.6 %	21	72.4%	
Speckle RLS findings in general					<0.001* S
Normal (12p.)	12	57.1 %	0	-	
Abnormal (38p.)	9	42.9 %	29	100%	

The validity results of ST-GLS were (sensitivity 86.2 %, specificity 57.1 %, PPV 73.5 %, NPV 75 % and accuracy 74 %). The validity results of LAD examined with echo were (sensitivity 6 9%, specificity 76.2 %, PPV 80 %, NPV 64 % and accuracy 72 %). The validity results of LCX examined with echo were (sensitivity 100 %, specificity 57.1 %, PPV 76.3 %, NPV 100 % and accuracy 82 %). The validity results of RCA / PDA examined with echo were (sensitivity 72.4 %, specificity 71.4 %, PPV 77.8 %, NPV 65.2 % and accuracy 72 %). In general, echo speckling had validity results of

(sensitivity 100%, specificity 57.1 %, PPV 76.3 %, NPV 100 % and accuracy 82 %). The validity results of LAD examined with angiography were (sensitivity 58.6 %, specificity 100 %, PPV 100 %, NPV 63.6 % and accuracy 76 %). The validity results of LCX examined with angiography were (sensitivity 48.3%, specificity 100 %, PPV 100 %, NPV 58.3 % and accuracy 70 %). The validity results of RCA / PDA examined with angiography were (sensitivity 55.2 %, specificity 100%, PPV 100 %, NPV 61.8 % and accuracy 74 %). As shown in table 6.

Table 6: Validity Results of Echocardiography and Coronary Angiographic Indices Regarding Confirmed Critical Coronary Lesions.

Variable	Sensitivity	Specificity	PPV	NPV	Accuracy
ST-GLS	86.2 %	57.1 %	73.5 %	75 %	74 %
LAD-strain	69 %	76.2 %	80 %	64 %	72 %
LCX-strain	100 %	57.1 %	76.3 %	100 %	82 %
RCA strain	72.4 %	71.4 %	77.8 %	65.2 %	72 %
(RLS) in General	100 %	57.1 %	76.3 %	100 %	82 %
LAD-angiography Angiography	58.6 %	100 %	100 %	63.6 %	76 %
LCX-Angiography	48.3 %	100 %	100 %	58.3 %	70 %
RCA-Angiography	55.2 %	100 %	100 %	61.8 %	74 %

DISCUSSION

The echocardiography is characterized by high accuracy and non-invasiveness in diagnosis of coronary artery diseases (8). The speckle tracking echocardiography is new diagnostic tool used mainly for checking the heart functions and detecting the deformities of myocardial activity (9). Present study showed that the validity findings of speckle tracking echocardiography in comparison to coronary angiography were sensitivity 100%, specificity 57.1 %, PPV 76.3 %, NPV 100 % and accuracy 82 %. These findings are close to results of Aggeli et al (8) study. Hubbard et al (10) study and Mabjoob et al (11). In Australia stated that uniting abnormal wall motion analysis and longitudinal strain with dobutamine stress is very helpful in early detection of coronary artery disease (12). The speckle tacking by echocardiography could be achieved easily with low time waste as compared to magnetic resonance imaging (13). The negative predictive value of 100% in our study for speckle echocardiography is in prediction of coronary artery diseases is very important for excluding suspected cases with no coronary artery lesions, that will be helpful for medical staff in emergency units. The explanation of low specificity of speckling echocardiography is related to reduced strain of speckle tracking caused by microvascular dysfunction without significant stenosis of coronary artery disease (14,15). The validity results of speckle tracking by echocardiography for LCX were better than validity results for assessment of LAD and RCA/PDA in comparison to coronary angiography. This finding is consistent with results of Anwar study in Saudi Arabia (16). In Iran A study included 37 patients with acute coronary syndrome and found that speckle tracking echocardiography is effective in diagnosis of non ST segment elevation acute coronary syndrome (17). Despite that, Mondillo et al (18) study recommended the use of speckle tracking echocardiography as adjunct diagnostic method in assessment of coronary artery diseases. Current study showed a significant association between younger age CAD patients and critical angiography lesions (P=0.001). This finding is similar to results of Al-Koubaisy et al (19) study in Iraq and Suresh et al(20) study in India Regarding the gender, our study found a significant association was observed between male CAD patients and critical angiography lesions (P=0.001). This finding is in agreement with results of Mohammad et al(21) study in Iraq and Maroszyńska - Dmoch et al(22) study in Poland.Obesity of patients with coronary artery diseases in present study was significantly associated with critical angiography lesions (P < 0.001). This is consistent with results of Emre et al (23) study in Turkey while Inconsistently with Khan et al(24) study in Pakistan stated that obesity was associated with low severity of coronary artery diseases in women population. This inconsistency might be attributed to fact that the Pakistani study included women only and female gender is less likely to develop critical coronary artery lesions than male gender. Smoking of patients in present study is significantly associated with critical lesions of coronary arteries (P < 0.001). This finding coincides with results of Koju et al (25) study in Nepal. In current study, there was a significant association between DM history and critical angiography lesions (P=0.02). This finding is consistent with results of Albarazani et al(26) in Iraq .Our study showed that HT history of CAD patients was significantly associated with critical angiography lesions (P < 0.001). This is similar to results of Zhang et al (27) study in China.

CONCLUSIONS

The speckle tracking echocardiography has high sensitivity but with low specificity in diagnosis of critical lesions of coronary arteries.

CONFLICT OF INTEREST

None

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