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Dobutamine stress echocardiography combined with two-dimensional speckle tracking echocardiography in late presenters of STEMI patients in a tertiary care hospital in eastern India

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ABSTRACT

INTRODUCTION

Identification of viable myocardium following STEMI has gained crucial importance with the recent step up in myocardial revascularization techniques. The amount of viable myocardium is a "surrogate" of future improvement of LV systolic function: the most powerful single predictor of long term prognosis. Traditionally, evaluation of regional myocardial function was performed by visual assessment of thickening and inward displacement of individual myocardial segments.

AIMS AND OBJECTIVE

The sensitivity and specificity of dobutamine stress ECHO combined with speckle tracking imagining in detecting viable myocardium in patients with late presentation of the STEMI. Two types imaging in predicting coronary artery involvement (according to coronary angiographic findings) among the study subjects. The parameters of conventional ECHO among the study subjects.

METHODOLOGY

This study was an institution based, cross sectional study we take data from Male and female wards of Department of Cardiology, Medical College and Hospital, Kolkata.

Total One & half years, starting from ethical clearance time take to complete this study.

We used all patients with STEMI who have presented after 12hours after the onset of symptoms.

RESULT & DISCUSSION

Also we found that majority of patients had [17 (85.0%)] Grade 1 ECHO D/D compared to [3 (15.0%)] Grade 2 ECHO D/D. In ECHO D/D we found majority of patients had Grade 1 [17(85.0%)] and this was not statistically significant(p=0.3891).

We observed in ECG higher patients had [13 (65.0%)] AWMI compared to [7 (35.0%)] IWMI. More patients had [13(65.0%)] AWMI ECG compared to [7(35.0%)] IWMI ECG and which was statistically significant (p=0.0142). In our study showed that, [9 (45.0%)] patients had Diabetes, Majority of diabetic patients were found in [2 (100.0%)] DV-CAD(LAD, LCx) and [3 (100.0%)] TV-CAD(LAD, LCx, RCA) group. This was statistically significant (p=0.0397).

SUMMARY AND CONCLUSION

We found that LAD Speckle Traking hypokinesia territory/GLS was more in SV-CAD(LAD) CAG and RCA Speckle Traking hypokinesia territory/GLS was more in SV-CAD(RCA). This was statistically significant. DSE LV territory LAD was significantly high in SV-CAD(LAD)

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CAG compared to DV-CAD (LAD, LCx), DV-CAD (LAD, RCA), SV-CAD(RCA) and TV-CAD (LAD, LCx, RCA) CAG types. In our study Speckle Traking hypokinesia territory LAD, LCx was more significant with LAD, LCx DSE LV territory compared to LAD, LAD, RCA and RCA DSE LV territory.

INTRODUCTION

Identification of viable myocardium following STEMI has gained crucial importance with the recent step up in myocardial revascularization techniques. The amount of viable myocardium is a "surrogate" of future improvement of LV systolic function: the most powerful single predictor of long term prognosis. Traditionally, evaluation of regional myocardial function was performed by visual assessment of thickening and inward displacement of individual myocardial segments. Limited by operator dependency and poor visualization of some myocardial segments, it was largely supplanted by estimation of tissue velocities, using TDI. However, this technique is influenced by whole heart translation and tethering movement from adjacent myocardial segments.

In fact, speckle tracking analysis is capable to assess typical ischemic subendocardial damage through several parameters: longitudinal strain (LS), which is the most used STE parameter to assess the early affection of subendocardial fibers of all cardiac chambers; bull's eye representation of left ventricular global LS (LVGLS) that provides a regional evaluation of LV injury according to coronary vascularization territories and the specific analysis of endocardial wall deformation properties with the three-layer analysis [1]. These tools could be useful to promptly guide diagnosis in uncertain cases of ACS and to provide early detection of CCS. Moreover, speckle tracking analysis could be performed on stress echocardiography (SE) images to assess subtle myocardial damage in case of doubtful stress test results or to assess myocardial viability [2]. STE was also shown to be a marker of myocardial fibrosis [3]; therefore, it could represent a noninvasive marker of myocardial postischemic scar.

Traditionally, evaluation of regional myocardial function was performed by visual assessment of thickening and inward displacement of individual myocardial segments. Limited by operator dependency and poor visualization of some myocardial segments, it was largely supplanted by estimation of tissue velocities, using tissue Doppler imaging (TDI). However, this technique is influenced by whole heart translation and tethering movement from adjacent myocardial segments [4]. Eventually, assessment of myocardial deformation indices circumvented these limitations. Evidence supports the superiority of strain (S) and strain rate (SR) measurement over tissue velocity by TDI for the evaluation of regional myocardial function [5].

Low-dose dobutamine stress echocardiography (DSE) is well-acknowledged for identifying viable myocardium. Dobutamine-induced wall motion improvement is specific for predicting reversible contractile dysfunction; however, its sensitivity is suboptimal [6]. Yet, the value of dobutamine-induced myocardial deformation indices (S and SR) for detection of myocardial viability remains unclear. Therefore, we explored whether dobutamine-induced S and SR can

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identify myocardial viability following fibrinolytic therapy for ST-segment-elevation myocardial infarction, taking 99mTc-sestamibi scintigraphy as the "gold standard" for diagnosis.

AIMS AND OBJECTIVE

General: To ascertain the ability and value of a combination of dobutamine stress ECHO with speckle tracking ECHO for the evaluation of viable myocardium in late presents of STEMI patients.

Specific:

i. To assess the sensitivity and specificity of dobutamine stress ECHO combined with speckle tracking imagining in detecting viable myocardium in patients with late presentation of the STEMI.
ii. To compare the findings from two types imaging in predicting coronary artery involvement (according to coronary angiographic findings) among the study subjects.
iii. To find out the parameters of conventional ECHO among the study subjects.

METHODOLOGY

Study design/ Experiment design: This study was an institution based, cross sectional study.

Place of study: Male and female wards of Department of Cardiology, Medical College and Hospital, Kolkata.

Period of study: One & half years, starting from ethical clearance.

Study population: STEMI patients with late presentation, getting admitted in Male and Female wards of department of Cardiology, Medical College, Kolkata.

Sample size/ Design: Sample size (n) = approximately 100 STEMI patients with late presentation, as per the formula $4pq/d^2$, p is the prevalence of abnormal strain, taken as 50%, q = 100-p, d = relative precision taken as 20% of prevalence i.e. 10

Case and control requirement: No controls required, only cases studied

Inclusion/ Exclusion criteria:

Inclusion criteria:

- All patients with STEMI who have presented after 12hours after the onset of symptoms.

Study variables:

- 2D and M mode ECHO:
  - Left ventricular internal diameter diastole:
  - Left ventricular internal diameter systole:
  - Inter ventricular septum diameter diastole:
  - LV posterior wall thickness during diastole:
  - Ejection fraction:
  - Whether any RWMA is present:
  - Any valvular regurgitation:
  - Any pericardial effusion:
  - Diastolic dysfunction:

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RESULT & DISCUSSION

This study was an institution based, cross sectional study conducted at Male and female wards of Department of Cardiology, Medical College and Hospital, Kolkata. Total taken One & half years, starting from ethical clearance for completed the study.

We take data from STEMI patients with late presentation, getting admitted in Male and Female wards of department of Cardiology, Medical College, Kolkata.

We include all patients with STEMI who have presented after 12hours after the onset of symptoms.

Total 20 patients were taken in our study.

In fact, speckle tracking analysis is capable to assess typical ischemic subendocardial damage through several parameters: longitudinal strain (LS), which is the most used STE parameter to assess the early affection of subendocardial fibers of all cardiac chambers; bull's eye representation of left ventricular global LS (LVGLS) that provides a regional evaluation of LV injury according to coronary vascularization territories and the specific analysis of endocardial wall deformation properties with the three-layer analysis.

Geyer H et al [7](2010) found that the authors summarize the recent developments in speckle-tracking echocardiography (STE), a relatively new technique that can be used in conjunction with two-dimensional or three-dimensional echocardiography for resolving the multidirectional components of left ventricular (LV) deformation.

We observed that hypokinesia [7 (35.0%)] were more showed in ECHO RWMA/ territory rest of [Akinesia (LAD) 5(25.0%), hypokinesia(LAD, LCx) 1 (5.0%), hypokinesia(RCA) 4 (20.0%), Hypokinesia (RCA, LCx) 1 (5.0%)]. Higher Akinesia (LAD) were observed in TV-CAD(LAD, LCx, RCA) [3 (100.0%)], more Hypokinesia (LAD) were found in 4 (100.0%), Hypokinesia (LAD, LCx) is showed in DV-CAD(LAD, LCx) [1 (50.0%)], Hypokinesia (RCA) is more showed in [2 (50.0%)], majority Hypokinesia (RCA,LCx) [1 (14.3%)]. This was statistically significant (p=0.0045).

Also we found that majority of patients had [17 (85.0%)] Grade 1 ECHO D/D compared to [3 (15.0%)] Grade 2 ECHO D/D. In ECHO D/D we found majority of patients had Grade 1 [17(85.0%)] and this was not statistically significant(p=0.3891).

We observed in ECG higher patients had [13 (65.0%)] AWMI compared to [7 (35.0%)] IWMI. More patients had [13(65.0%)] AWMI ECG compared to [7(35.0%)] IWMI ECG and which was statistically significant (p=0.0142). In our study showed that, [9 (45.0%)] patients had Diabetes, Majority of diabetic patients were found in [2 (100.0%)] DV-CAD(LAD, LCx) and [3 (100.0%)] TV-CAD(LAD, LCx, RCA) group. This was statistically significant (p=0.0397).

Allman KC et al [8](2002) showed that this study pools data from published series examining late survival with revascularization versus medical therapy after myocardial viability testing in patients with severe coronary artery disease (CAD) and left ventricular (LV) dysfunction. This meta-analysis demonstrates a strong association between myocardial viability on noninvasive testing and improved survival after revascularization in patients with chronic CAD and LV dysfunction.

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Skulstad H et al [9](2006) found that the aim of the study was to compare the ability of the tissue Doppler echocardiographic imaging (TDI) modalities velocity, strain, and displacement to quantify systolic myocardial function. In 10 anesthetized dogs they measured left ventricular pressure, longitudinal myocardial velocity, strain, and displacement by TDI at baseline and during left anterior descending coronary artery (LAD) stenosis and occlusion. Reference methods were segmental shortening by sonomicrometry and segmental work. In 10 patients with acute anterior wall infarction (LAD occlusion) and 15 control subjects, velocity, strain, and displacement measurements were performed.

More patients had DV-CAD (LAD, RCA) in CAG compared to others [2 (10.0%) DV-CAD (LAD, LCx), 4 (20.0%) SV-CAD (LAD) CAG, 4 (20.0%) SV-CAD (RCA) CAG and 3 (15.0%) TV-CAD (LAD, LCx, RCA) CAG]. In DSE LV territory lower patients were observed in LAD, LCx [2(10.0%)] and this was statistically significant (p=0.0067). In DSE LV territory higher patients had LAD and RCA [7(35.0%)] compared to [2(10.0%) LAD, LCx, 4(20.0%) LAD, RCA]. In Speckle Traking hypokinesia territory more patients had [7(100.0%)] RCA and this was statistically significant (p<0.0001).

Renkin J et al [10](1990) found that to evaluate the significance of persistent negative T waves during severe ischemia, A critical stenosis on the left anterior descending coronary artery (LAD), considered as the culprit lesion, was successfully treated by percutaneous transluminal coronary angioplasty (PTCA).

ECHO LVID (d) was 47.4500± 4.9575, DV-CAD(LAD, RCA) group we observed more [48.2857± 4.9570] ECHO LVID (d) compared to others and this was not statistically significant (p=0.1009). ECHO LVID (s) was 36.5500± 6.1342. In ECHO LVID(s) were higher found in [43.6667± 8.1445] TV-CAD(LAD, LCx, RCA) group and which was not statistically significant (p=0.0509). GLS was -15.4000± 1.5355. We found more GLS in [-13.6667± .5774] TV-CAD(LAD, LCx, RCA) group and this was statistically significant (p=0.0177).

In our study the positive correlation (.747) was found between GLS vs NYHA at baseline which was statistically significant (p <0.0001). The value of Pearson Correlation Coefficient (r) was -.873. The negative correlation (-.873) was found between GLS vs ECHO EF and this was statistically significant (p <0.0001). The positive correlation (.689) was found between GLS vs ECHO LVID(d) which was statistically significant (p <0.0001). The positive correlation (.796) was found between GLS vs ECHO LVID(s) and this was also statistically significant (p <0.0001).

SUMMARY AND CONCLUSION

In our study, out of 20 patients, 5 patients were ≤50 years of age, 8 patients were 51-60 years of age and 7 patients were >61 years of age. The mean Age of patients was 57.8000 years and male population was higher than the female population.

We observed that Akinesia (LAD) was significantly higher in TV-CAD (LAD, LCx, RCA) and Hypokinesia (LAD) was also significantly higher SV-CAD(LAD) compared to other CAG types.

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We found that Grade 2 ECHO D/D was less observed in SV-CAD(LAD) and SV-CAD(RCA) CAG type but this was not statistically significant.

Our study showed that AWMI ECG was more significant with DV-CAD (LAD, LCx), SV-CAD(LAD) and TV-CAD (LAD, LCx, RCA) CAG compared to DV-CAD (LAD, RCA) and SV-CAD(RCA) CAG types.

Present study showed that Diabetes was significantly high in patients with DV CAD (LAD, LCx) and TV-CAD (LAD, LCx, RCA) CAG compared to DV-CAD (LAD, RCA), SV-CAD(LAD) and SV-CAD(RCA) CAG. We also found that DYSLIPIDEMIA had no significant relation with CAG types.

Increased DSE LV contractility was significantly less observed in TV-CAD (LAD, LCx, RCA) CAG compared to DV-CAD (LAD, LCx), DV-CAD (LAD, RCA), SV-CAD(LAD) and SV-CAD(RCA).

We found that LAD Speckle Traking hypokinesia territory/GLS was more in SV-CAD(LAD) CAG and RCA Speckle Traking hypokinesia territory/GLS was more in SV-CAD(RCA). This was statistically significant.

DSE LV territory LAD was significantly high in SV-CAD(LAD) CAG compared to DV-CAD (LAD, LCx), DV-CAD (LAD, RCA), SV-CAD(RCA) and TV-CAD (LAD, LCx, RCA) CAG types.

In our study Speckle Traking hypokinesia territory LAD, LCx was more significant with LAD, LCx DSE LV territory compared to LAD, LAD, RCA and RCA DSE LV territory.

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Table: Association between DSE LV/territory and Speckle Traking hypokinesia territory/GLS: CAG

		CAG					
		DV-CAD(LAD, LCx)	**DV-CAD(LAD, RCA)**	**SV-CAD(LAD)**	**SV-CAD(RCA)**	**TV-CAD(LAD, LCx, RCA)**	**TOTAL**
DSE LV territory	**LAD**	1	2	4	0	0	7
	Row %	14.3	28.6	57.1	0.0	0.0	100.0
	Col %	50.0	28.6	100.0	0.0	0.0	35.0
	LAD, LCx	1	0	0	0	1	2
	Row %	50.0	0.0	0.0	0.0	50.0	100.0
	Col %	50.0	0.0	0.0	0.0	33.3	10.0
	LAD, RCA	0	2	0	0	2	4
	Row %	0.0	50.0	0.0	0.0	50.0	100.0
	Col %	0.0	28.6	0.0	0.0	66.7	20.0
	RCA	0	3	0	4	0	7
	Row %	0.0	42.9	0.0	57.1	0.0	100.0
	Col %	0.0	42.9	0.0	100.0	0.0	35.0
	TOTAL	2	7	4	4	3	20

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	Row % Col %	10.0 100.0	35.0 100.0	20.0 100.0	20.0 100.0	15.0 100.0	100.0 100.0
Speckle Traking hypokinesia territory/GLS	**LAD** Row % Col %	0 0.0 0.0	1 20.0 14.3	4 80.0 100.0	0 0.0 0.0	0 0.0 0.0	5 100.0 25.0
	LAD, LCx Row % Col %	2 66.7 100.0	0 0.0 0.0	0 0.0 0.0	0 0.0 0.0	1 33.3 33.3	3 100.0 15.0
	LAD, RCA Row % Col %	0 0.0 0.0	3 60.0 42.9	0 0.0 0.0	0 0.0 0.0	2 40.0 66.7	5 100.0 25.0
	RCA Row % Col %	0 0.0 0.0	3 42.9 42.9	0 0.0 0.0	4 57.1 100.0	0 0.0 0.0	7 100.0 35.0
	TOTAL Row % Col %	2 10.0 100.0	7 35.0 100.0	4 20.0 100.0	4 20.0 100.0	3 15.0 100.0	20 100.0 100.0