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ORIGINAL ARTICLE

Early left ventricular dyssynchrony in acute ST elevation myocardial infarction: A gated single photon emission computed tomography study

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KEYWORDS

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Abstract *Introduction:* The resulting left ventricular (LV) dysfunction in acute STEMI is definitely secondary to loss of myocardial muscle mass (Krumholz et al., 2009; Guerchicoff et al., 2014) but may have an additional component of LV dyssynchrony.

Aim: Detection of LV dyssynchrony in acute STEMI patients and its relation to LV dysfunction in these patients.

Patients and methods: 60 patients presenting with acute STEMI were injected with 25 mCi of Tc^{99m} SestaMIBI prior to primary PCI. Acquisition was deferred after the procedure within 6 h of injection. Images were analyzed using QGS Cedars Sinai software to measure the histogram bandwidth, standard deviation and entropy using GSPECT phase analysis. The results were compared to 60 patients with negative perfusion scans upon maximal exercise imaged using the same protocol during rest.

Results: Our study included a total number of 60 acute STEMI patients, 54 males, mean age 54.8 ± 10.38 years, Compared to 60 controls mean age 50.7 + 20.3 years. Risk factors for CAD were smoking in 41 patients, hypertension in 17, dyslipidemia in 7, diabetes in 15, and positive family history of CAD in 21. 30 patients had acute anterior STEMI and 30 had inferior. LVEDV and LVESV were larger compared to controls; 133.0 ± 88.7 vs. 62.0 ± 19.2 ml and 89.7 ± 82.1 vs.

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19.9 ± 12.3 ml respectively, $p < 0.001$, and lower LVEF 39.0 ± 16.8 vs. 71.1 ± 10.4%, $p < 0.001$. Histogram bandwidth (BW), standard deviation (SD) and entropy (E) values were significantly higher in patients when compared to controls; 76.2 ± 54.7 vs. 17.8 ± 5.3, 20.7 ± 15.2 vs. 4.1 ± 2.0 and 51.1 ± 18.6 vs. 21.8 ± 7.1 degrees respectively, $p < 0.001$. BW, SD and E significantly negatively correlated with LVEF in acute STEMI cases; $r = -.733$, $p < 0.001$, $r = -.75$, $p < 0.001$, and $r = -.858$, $p < 0.001$ respectively.

Conclusion: LV dyssynchrony may be acquired acutely very early in STEMI and may have a negative impact on LV ejection fraction.

1. Introduction

Acute myocardial infarction is a devastating condition carrying high incidence of morbidity and mortality despite considerable advances in lines of therapy over years [1]. The resulting left ventricular (LV) dysfunction is definitely secondary to loss of myocardial muscle mass [1,2] but may have an additional component of LV dyssynchrony. All the efforts in the last decade focused mainly on decreasing infarction size through early reperfusion and adjunctive medical therapy [1–3]. Several studies could find some relation between LV dyssynchrony and acute myocardial infarction, however in these studies modest duration of time elapsed between the incidence of STEMI and imaging used [4–6]. In addition to date there is no evidence that early LV dyssynchrony can affect acutely the LV function. With the advances, ease and popularity in resynchronization therapy positive modification of dyssynchrony toward synchrony may be of value in the acute phase of STEMI. Gated SPECT was studied as a valuable tool to evaluate dyssyn-

Table 1 Risk factors for coronary artery disease.

Risk factors	Frequency	Percentage (%)
Smoking	41	68
F.H of CAD	21	35
Hypertension	17	28
Diabetes	15	25
Dyslipidemia	7	12

Table 2 The demographic data for controls.

	Control (N. 60)
Age	50.9 ± 10.4
Gender (Male)	28 (46.7%)
Diabetes	17 (28.3%)
Hypertension	33 (55.0%)
FH of CAD	13 (21.7%)
Smoking	15 (25.0%)
Dyslipidemia	15 (25.0%)

Table 3 Comparison between the case and controls.

	Control (N. 60)	Case (N. 60)	*p* value
Age	50.9 ± 10.4	54.0 ± 10.4	.104
Gender (Male)	28 (46.7%)	54 (90.0%)	.001
Diabetes	17 (28.3%)	15 (25.0%)	.541
Hypertension	33 (55.0%)	17 (28.3%)	.003
FH of CAD	13 (21.7%)	21 (35.0%)	.156
Smoking	15 (25.0%)	41 (68.3%)	.001
Dyslipidemia	15 (25.0%)	7 (11.7%)	.097

Table 4 Comparison between both groups as regards Left Ventricle gated SPECT and phase analysis results for left ventricle end systolic volume (LVESV), left ventricle end diastolic volume (LVEDV), left ventricle ejection fraction (LVEF), Histogram Bandwidth (BW), Standard Deviation (SD),and Entropy (E) in (degree, millisecond).

Gated SPECT	Controls	Cases	*p* value
LVEDv (ml)	62.0 ± 19.2	133.0 ± 88.7	< .001
LVESv (ml)	19.9 ± 12.3	89.7 ± 82.1	< .001
LV EF%	71.1 ± 10.4	39.0 ± 16.8	< .001
Histogram bandwidth (millisecond)	37.3 ± 11.9	152.4 ± 110.9	< .001
Histogram SD (millisecond)	9.2 ± 4.2	40.4 ± 36.3	< .001
Histogram bandwidth (degree)	17.8 ± 5.3	76.2 ± 54.7°	< .001
Histogram SD (degree)	4.1 ± 2.0	20.7 ± 15.2°	< .001
Histogram entropy (%)	21.8 ± 7.1	51.1 ± 18.6%	< .001

Table 5 Range of Histogram band width and standard deviation and entropy values in STEMI cases.

Case	Range	Mean	Std. deviation
Histogram BW	12–234	76.2	54.7
Histogram SD	1.6–60.8	20.7	15.2
Histogram entropy	6–85	51.1	18.6

Table 6 Range of Histogram band width and standard deviation and entropy values in normal (control) subject.

Control	Range	Mean	Std. deviation
Histogram BW	6–30	17.8	5.3
Histogram SD	0.6–13.5	4.1	2.0
Histogram entropy	1–39	21.8	7.1