Prognostic Value of Left Ventricular Dyssynchrony by Phase Analysis of Gated SPECT in Patients Undergoing Myocardial Perfusion Imaging

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No disclosure

Background

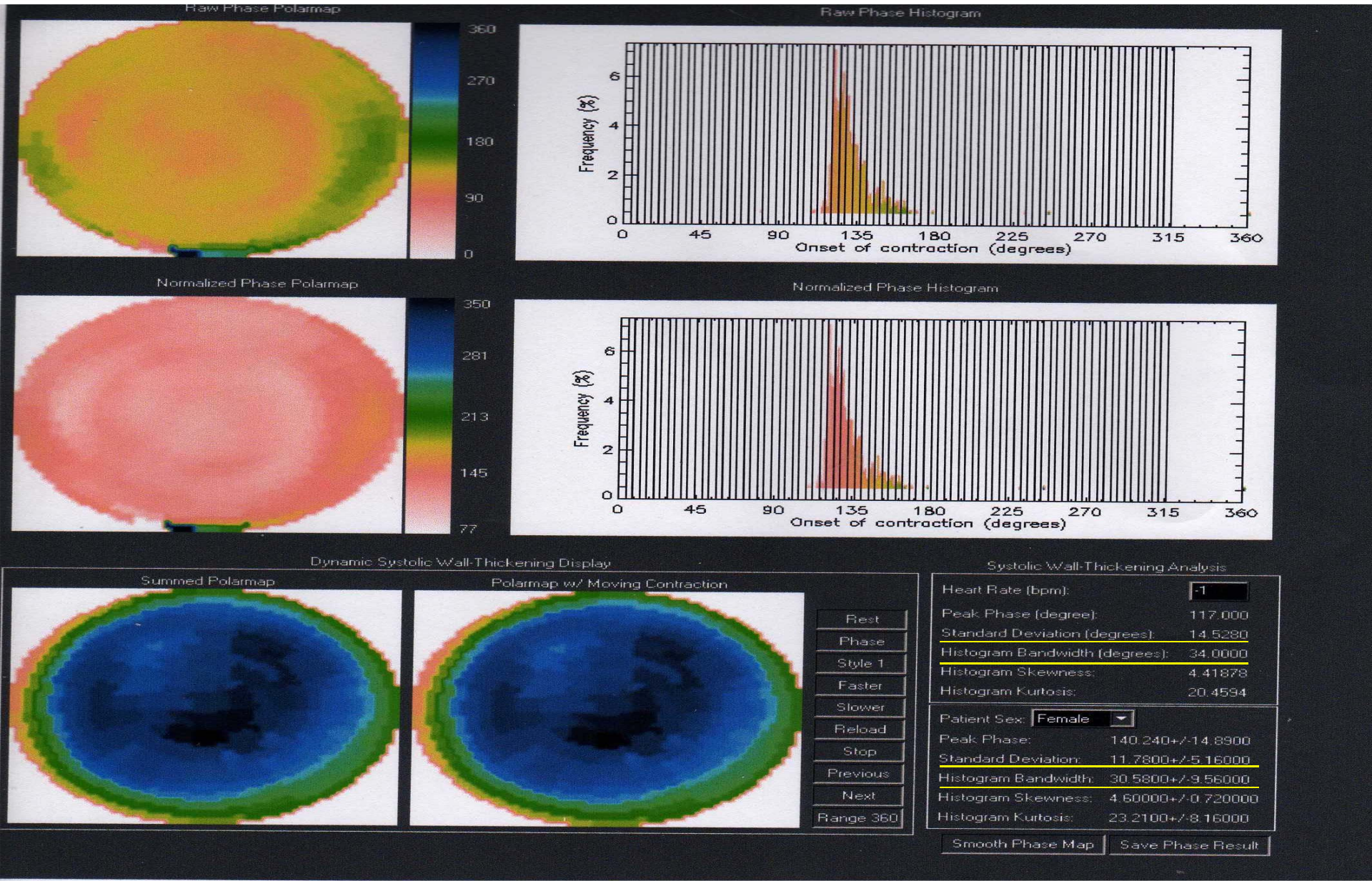
- Left ventricular mechanical dyssynchrony assessed by phase analysis from gated SPECT myocardial perfusion imaging (MPI) has been studied in patients with left ventricular dysfunction with various clinical settings

- Recent data have indicated that LV mechanical dyssynchrony may be mandatory for prediction of CRT responses
- Aljaroudi et al reported on relation of LV dyssynchrony by phase analysis of gated SPECT images and cardiovascular events in heart failure patients with ICD (JNC 2010)

Background

- LVMD by Gated SPECT studies has been validated for measuring by phase analysis based on the first harmonic approximation.
- This technique performed with Emory Cardiac Toolbox software (SyncTool) is fully automated and processed data obtained during routine gated SPECT imaging.
- There are two parameters related with LV dyssynchrony: phase standard deviation (PSD) and histogram bandwidth (PBW).

Normal phase histogram



Patient Name: *****

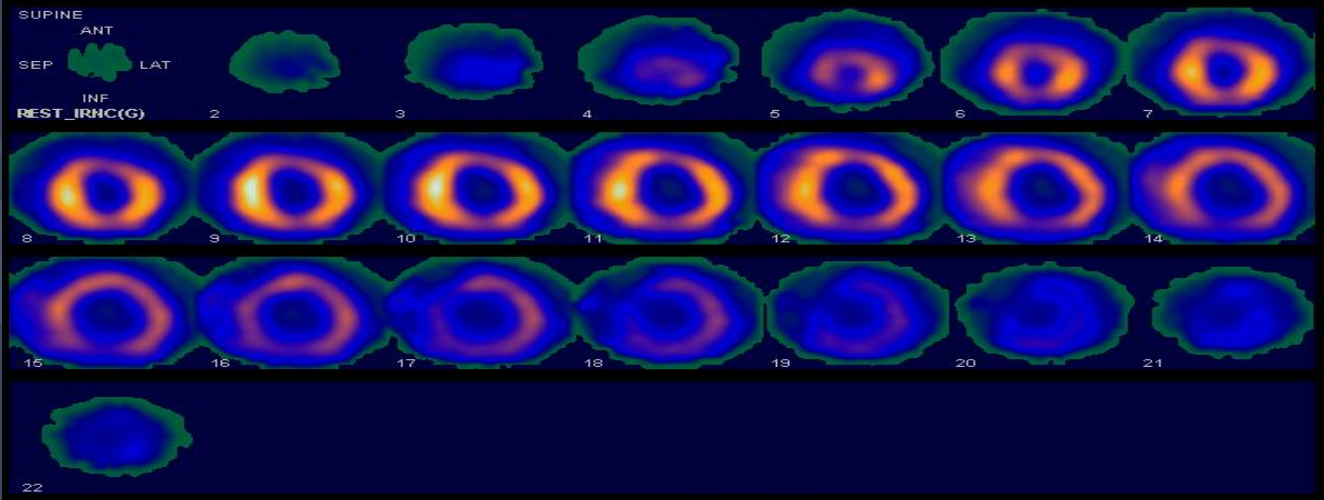
Patient Id: *****

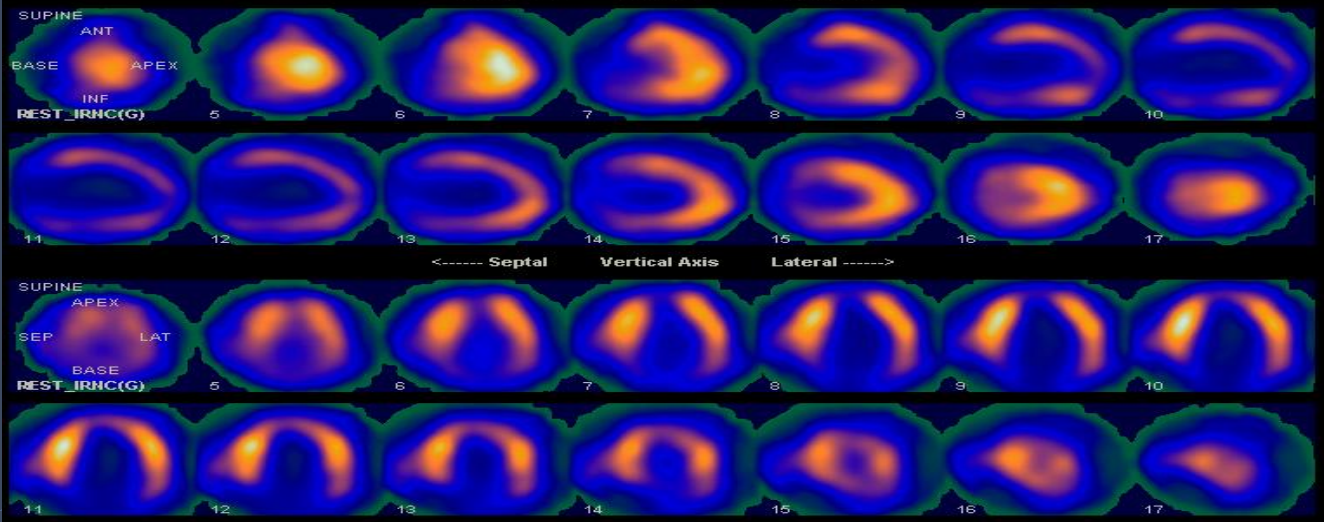
Nuclear Cardiology Unit
Rabin Medical Center Beilinson

Study Name: VIABILITY REST G

Date & Time: 02-03-10

Manufacturer Model: VENTRI





REST_IRNC(G)

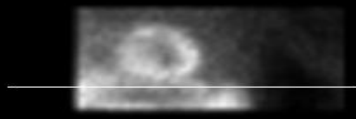
Date: 2010/03/02 12:53

EF: 24%

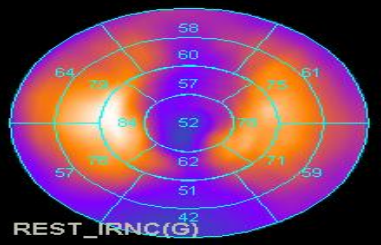
EDV: 226ml

ESV: 171ml

SV: 55ml

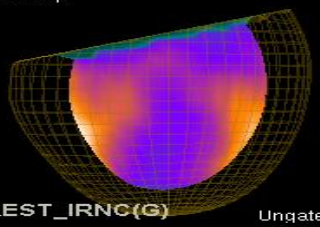


REST_Shift IRNC(G)(motion corrected)
30



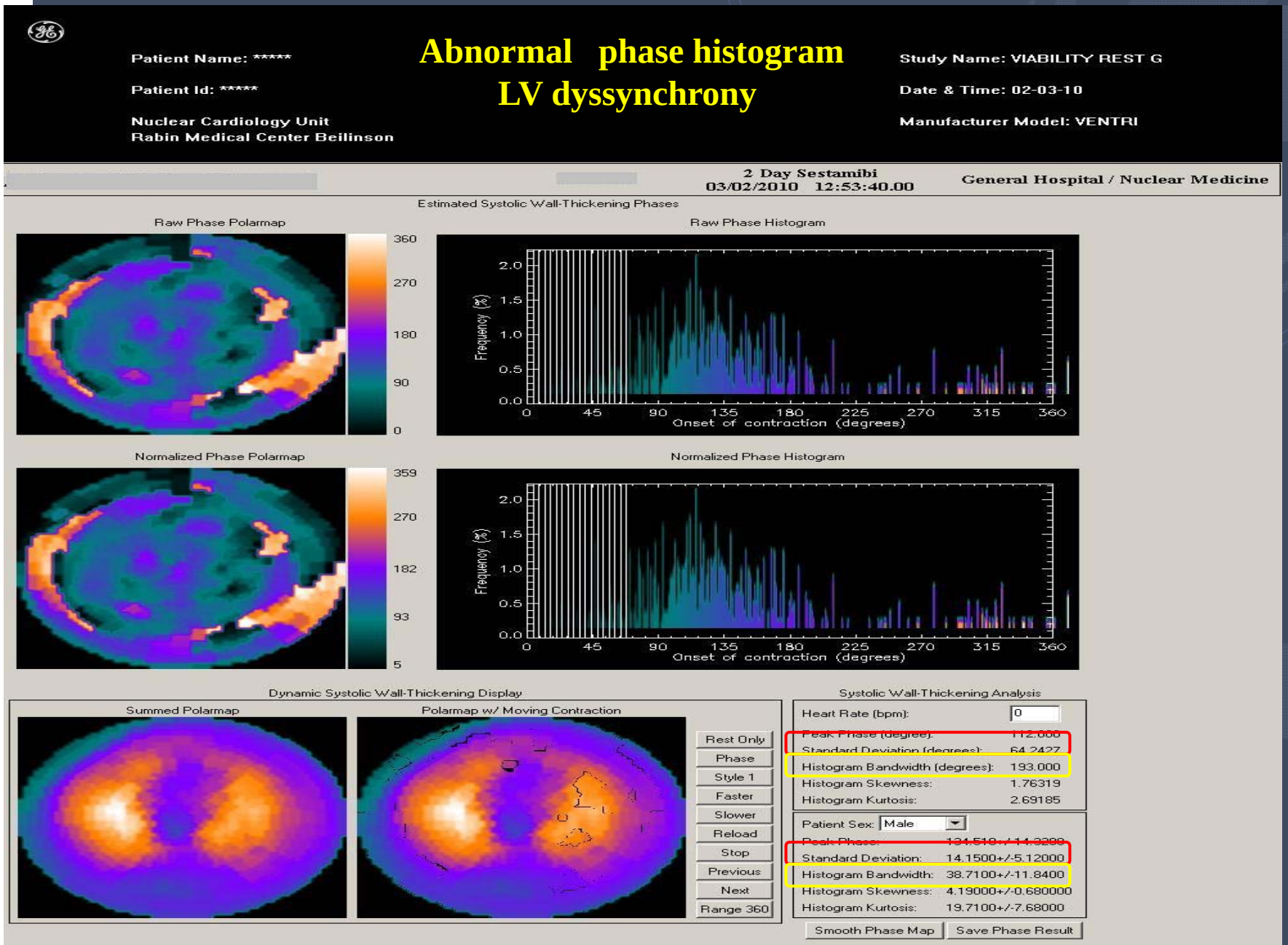
REST_IRNC(G)

Endo+Epi



REST_IRNC(G) Ungated

Abnormal phase histogram
LV dyssynchrony



Aims

- Assess LV dyssynchrony by gated SPECT MPI in patients referred for evaluation by standard Tc-99m sestamibi MPI for ischemia, scar, myocardial viability, and LV function.
- Form a local normal-control database of phase analysis parameters.
- Examine the relationship between clinical and MPI parameters, including LV dyssynchrony, with cardiac events.
- Determine the predictive value of LV dyssynchrony for cardiac events.

Methods

- Between Jan 2010 and Dec 2011, in consecutive patients referred for Tc sestamibi gated SPECT MPI, phase analysis software for evaluation of LVMD was applied.
- LVMD was measured by phase standard deviation (PSD) and histogram bandwidth (PBW).

Methods

- Patients' characteristics, risk factors for CAD, SPECT MPI, phase analysis results, ECG, QRS width of baseline ECG and EF were analyzed.

- The patients were followed-up for cardiac events defined as: cardiac death, heart failure hospitalizations, life threatening arrhythmias

Results

- The cohort study included 873 consecutive patients and 787 were followed.

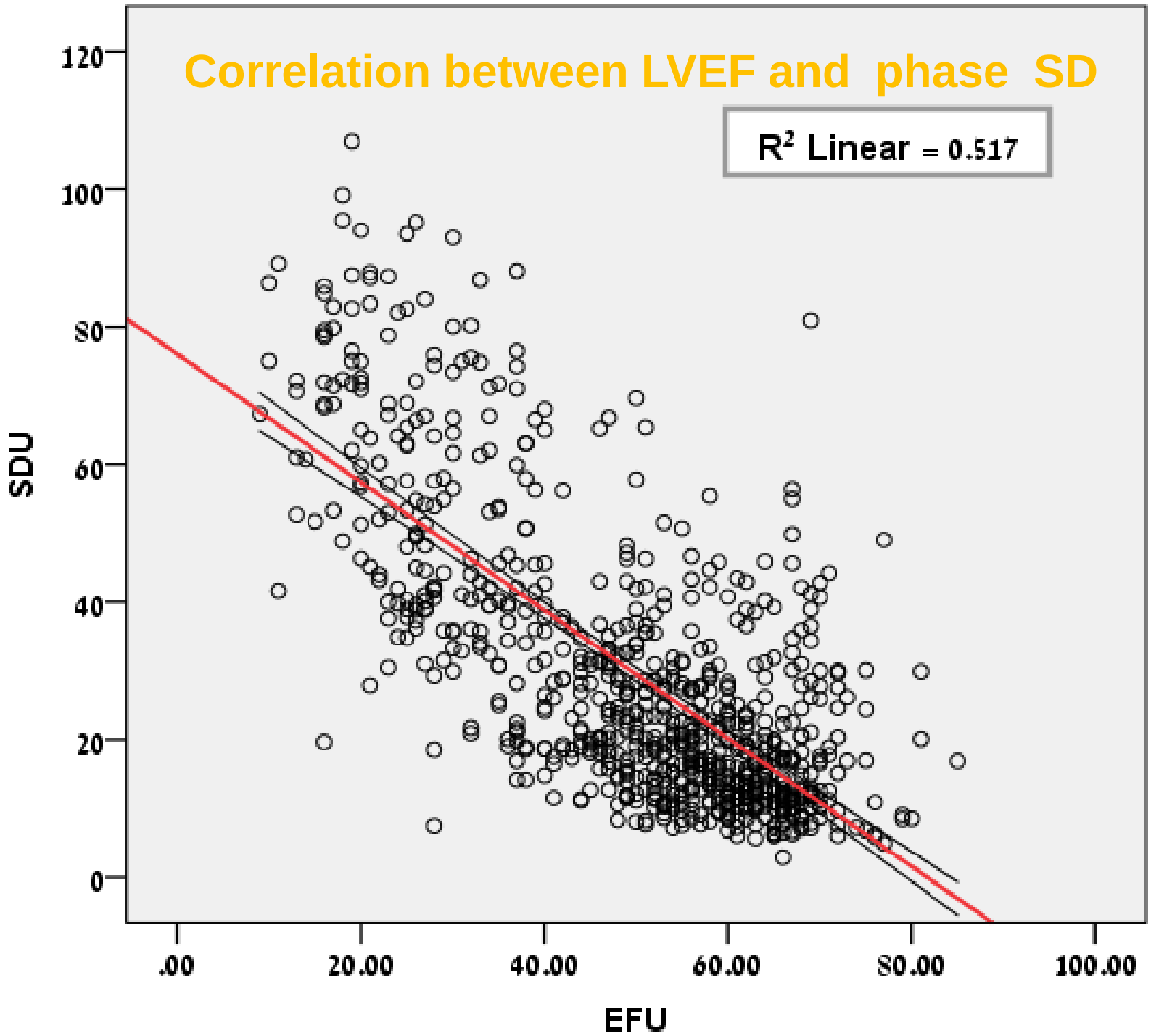
- At a median follow-up of 19.1 ± 5.7 months, 45 (5.7%) patients had at least one cardiac event
- 26 cardiac death
- 16 HF exacerbation-hospitalizations
- 3 VT/VF

Clinical Characteristics, MPI and Phase analysis results in total study population

	Total (%)
Number	**787**
Age	**66.52±11**
Male	**634 (80.6)**
DM	**260 (33.0)**
HTN	**543 (69.0)**
QRS width (msc)	**95.22±26**
NYHA	**1.64±0.7**
MPI	
Ischemia	**176 (22.3)**
Scar	**395 (50.2)**
EF	**49.68±16**
phase : peak	**132.66±24**
Phase SD	**29.78±21**
Phase BW	**83.89±67**
Skewness	**3.99±4**
Kurtosis	**16.13±10**

Table 1: Clinical characteristics, MPI and PAnalysis results in normal control patients. (Normal MPI, EF>50% and QRS<100)

Number (%)	226 (29%)
Age (mean)	63.9±10
Male	160 (70.8)
DM	62 (27.4)
HTN	172 (76.1)
QRS width (msec)	79.7±6 (65-100)
NYHA (mean score)	1.31±0.46
Ischemia	0
Scar	0
EF (%)	62.48±7
Phase analysis °	
Phase: Peak	133±17
Phase: SD	18.0±11
Phase: BW	46.0±30
Phase: Skewness	4.9±5.8
Phase: Kurtosis	21.9±10


Correlation between LVEF and phase SD
R² Linear = 0.517
SDU
EFU
120
100
80
60
40
20
0
.00
20.00
40.00
60.00
80.00
100.00

Univariate Cox regression analysis for prediction of cardiac events

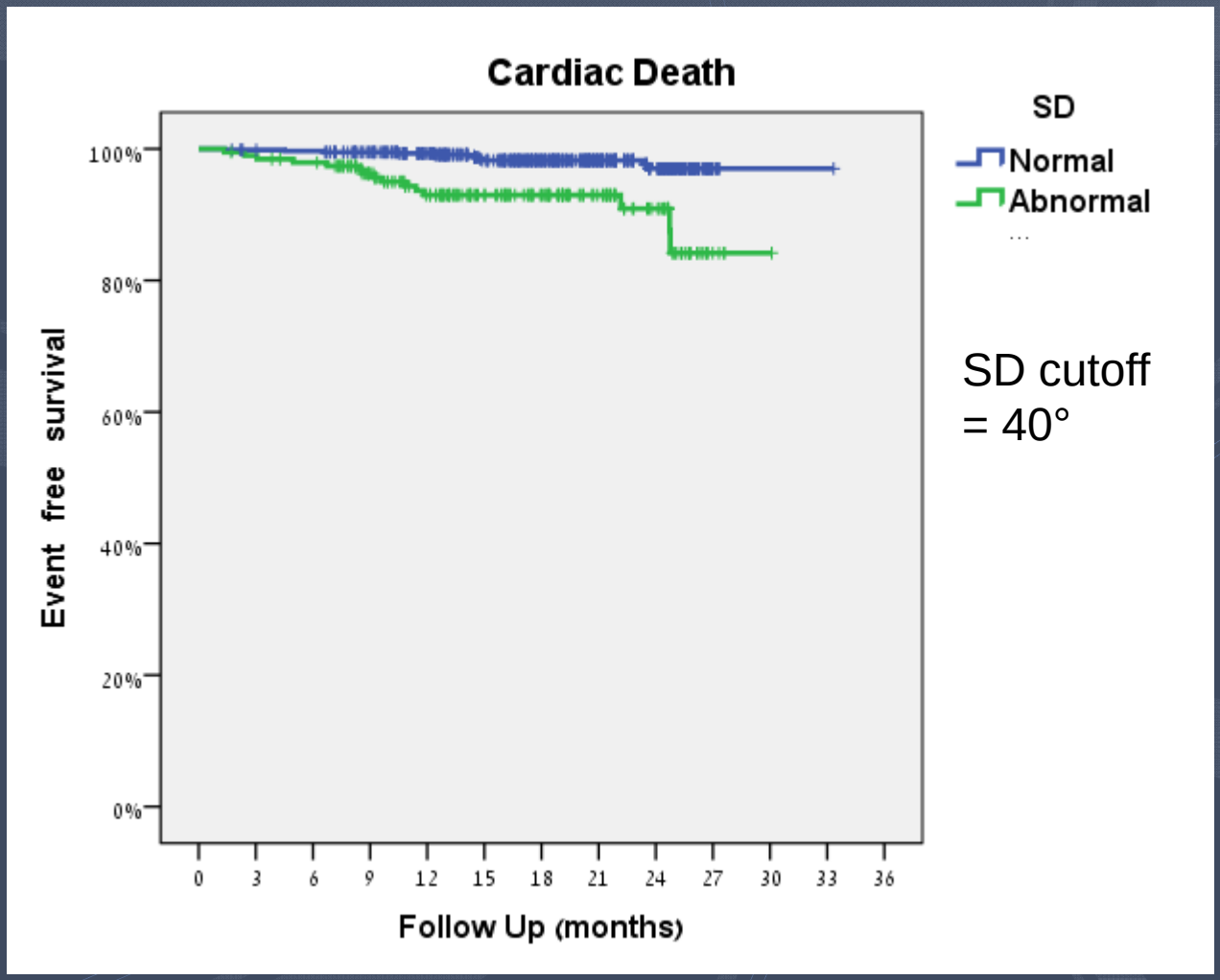
Parameter	Univariate) Hazard ratio (95% CI)	P value
Age	1.046 (1.046-1.007)	0.019
Male	0.699 (2.012-0.603)	0.2
DM		0.1
ECG (ABN)	2.924 (1.629-5.263)	0.0001
HTN		0.3
QRS width	1.021 (1.021-1.030)	<0.0001
Ischemia size		0.2
Scar size	1.514 (1.244-1.842	<0.0001
EF	0.931 (0.908-00.955)	<0.0001
Abnormal EF (50%)	9.80 (4.348-21.739)	0.0001
Phase Peak		0.091
Phase SD	1.040(1.025-1.055)	<0.0001
Phase BW	1.010(1.006-1.014)	<0.0001
Skewness	0.446(0.291-0.683)	<0.0001
Kurtosis	0.925(0.873-0.981)	<0.009

Multivariate Cox regression analysis for prediction of cardiac events

Parameter	Hazard ratio (95% CI)	P value
QRS width	1.008 (0.999-1.017)	0. 086
Abnormal EF	0.174 (0.070 -0.435)	0.0001
Phase SD	1.022(1.000-1.045)	0.052
Phase BW	0.997(0.990-1.004)	0.373

Predictors of cardiac death

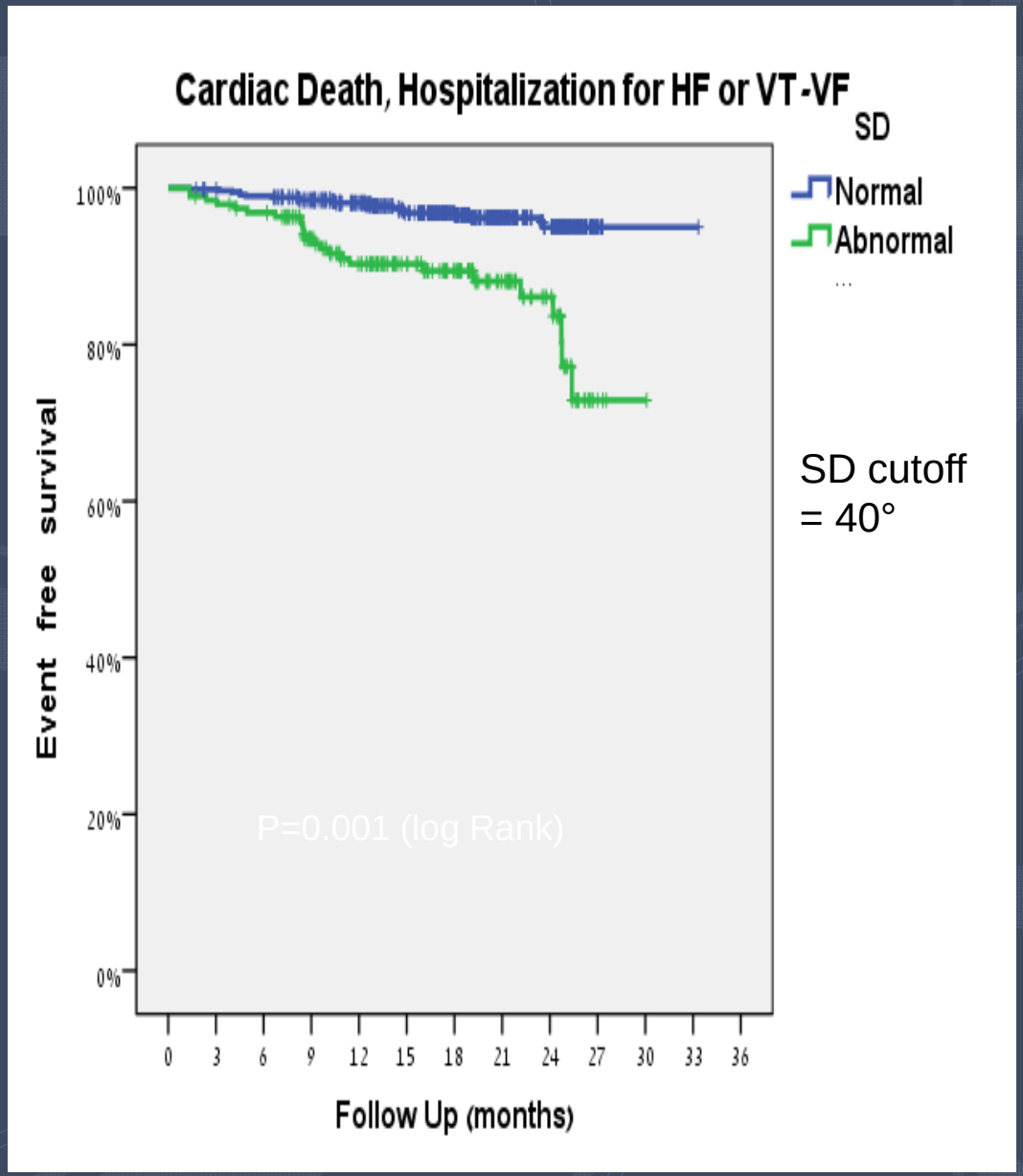
Parameter	Hazard ratio (95% CI)	P value
QRS width	1.008 (0.999-1.020)	0. 195
Abnormal EF	0.415 (0.135 -1.281)	0.126
Phase SD	1.032(1.005-1.060)	0.022
Phase BW	0.997(0.989-1.006)	0.545



SD cutoff = 40°

0	594	512	149
1	193	136	37

p=0.0001(Log Rank)



SD cutoff = 40°

0	167	127	25
1	161	123	25

p=0.056(Log Rank)

Limitations

- The study population, although being a consecutive cohort who referred for MPI, was consisted of a higher percentage of patients with heart failure who routinely referred for MPI for viability assessment.

  As such in centers were the referrals for MPI is mainly on ambulatory basis, the results might be different.

Conclusions

- Routine gated SPECT MPI with phase analysis is a useful tool to assess LV dyssynchrony

- Together with perfusion and function data, LV dyssynchrony as presented by phase standard deviation can predict cardiac outcome especially in patients with LV dysfunction as It is the only independent predictor for cardiac death.

- Thank you!!