

Scar Characteristics for Risk Stratification of Ventricular Arrhythmia in Patients with Chronic Ischemic Cardiomyopathy

M.D. thesis in Cardiology

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.....الحمد لله رب العالمين

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ABSTRACT

Background: Most patients with coronary artery disease (CAD) die of sudden cardiac death (SCD) or congestive heart failure. Left ventricular ejection fraction (LVEF) has its limitation as risk stratifier for SCD. Implantable cardioverter-defibrillator (ICD) is an important therapeutic modality for primary and secondary prevention of mortality in post-infarction patients with severe left ventricular (LV) dysfunction. Better risk stratification tools are needed to identify the best candidates for ICD implantation. Infarct characterization by cardiac magnetic resonance (CMR) has become an evolving potential tool for risk stratification.

Objective: We sought to assess scar characteristics by late gadolinium enhancement CMR (LGE-CMR) in patients with post-infarction LV dysfunction and history of spontaneous sustained monomorphic ventricular tachycardia (SMVT) and compare them with control group subjected to electrophysiological study (EPS).

Methods: Forty-eight patients with post-infarction LV dysfunction underwent CMR study. Twenty-four patients had history of SMVT and the other 24 were control group and underwent EPS to assess SMVT inducibility. Various scar characteristics were assessed in the spontaneous SMVT group and were compared with the inducible and non-inducible VT groups.

Results: All patients had LGE in CMR indicating prior myocardial infarction (MI). Out of the 24 patients in the control group, six had inducible SMVT. In univariate analysis, total scar, absolute and as percent of LV, scar core, absolute, and as percent of LV, peri-infarct zone, absolute and as percent of LV, mean infarct transmural thickness and number of segments with LGE were statistically significant predictors of spontaneous SMVT experience and SMVT inducibility by PES. In multivariate analysis total infarct as percent of LV was the only significant independent predictor of spontaneous SMVT experience (OR 1.33 per % change, 95% CI 1.12-1.6, $p = 0.001$) and SMVT inducibility (OR 1.3 per % change, 95% CI 1.1-1.6, $p = 0.004$). Peri-infarct zone as percent of LV became statistically non-significant predictor for spontaneous SMVT (OR 0.86 per % change, 95% CI 0.6-1.35, $p = 0.5$) and SMVT inducibility (OR 0.8 per % change, 95% CI 0.4-1.4, $p = 0.42$).

Conclusion: Characterization of myocardial infarct by LGE-CMR specifically total infarct size is better predictor of spontaneous SMVT experience and SMVT inducibility than LVEF. This highlights the potential importance of myocardial scarring assessment in risk stratification of patients with ischemic cardiomyopathy for selection of patients who will benefit from ICDs.

key word

SCD-SMVT-LGE,CMR- Cardiomyopathy

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Abbreviations

3D = three-dimensional

ACC/AHA/ESC = American College of Cardiology/American Heart Association/European Society of Cardiology

ACLS = advanced cardiac life support

ADMIRE-HF = AdreView Myocardial Imaging for Risk Evaluation in Heart Failure

AES = atrial extrastimulus

AF = atrial fibrillation

AFL = atrial flutter

AVN = Atrioventricular nodal

BBR = bundle branch reentrant

BEST-ICD = BEta-blocker STrategy plus Implantable Cardioverter Defibrillator

b-SSFP = balanced steady state free precession

CABG = coronary artery bypass graft

CAD = coronary artery disease

CARISMA = Cardiac Arrhythmias and Risk Stratification after acute Myocardial infarction

ce-MRA = contrast enhanced MR angiography

CHF = congestive heart failure

CL = cycle length

CMP = cardiomyopathy

CMR = cardiac magnetic resonance

CT = computed tomography

CV = cardiovascular

CV hosp. = cardiovascular hospitalization

DAD = delayed after-depolarization

DCM = non-ischemic dilated cardiomyopathy

DETERMINE = DEfibrillators To REduce Risk by Magnetic ResoNance Imaging Evaluation

DICOM = Digital Imaging and Communications in Medicine

DIR = double inversion recovery

DPTA = Gd-diethylenetriamine pentaacetic acid

ECG = electrocardiogram

EDV = end-diastolic volume

EDWT = end-diastolic wall thickness

EP = electrophysiological

EPS = electrophysiological study

ERP = effective refractory period

ESV = end-systolic volume

ETL = echo train length

FDG = fludeoxyglucose

FSE/TSE = fast/turbo spin echo

Gd = gadolinium

GRE = gradient echo

GUSTO = Global Utilization of Streptokinase and Tissue plasminogen activator for Occluded coronary Arteries

HASTE = half acquisition single shot turbo spin echo

HB = His bundle

HPS = His-Purkinje system

ICD = implantable cardioverter-defibrillator

ICE = intracardiac echocardiography

ICM = ischemic cardiomyopathy

IQR = interquartile range

LA = left atrium

LB = left bundle

LBBB = left bundle branch block

LGE-CMR = late gadolinium enhancement cardiac magnetic resonance

LV = left ventricular

LVEF = left ventricular ejection fraction

MADIT = Multicenter Automatic Defibrillator Implantation Trial

MASTER = Microvolt T-Wave Alternans Testing for Risk Stratifications of Post MI Patients

MBG = myocardial blush grade

MEA = multielectrode array

MI = myocardial infarction

MPR = myocardial perfusion reserve

MRCA = MR coronary angiography

MTWA = microvolt T-wave alternans

MUSTT = Multicenter Unsustained Tachycardia Trial

MVO = microvascular obstruction

NMV = net magnetic vector

NSR = normal sinus rhythm

NSVT = non-sustained ventricular tachycardia

NYHA = New York Heart Association

PCI = percutaneous coronary intervention

PC-MRI = phase contrast MRI

PES = programmed electrical stimulation

PET = positron emission tomography

PPI = post-pacing interval

PSIR = phase sensitive inversion recovery

Pt = patient

RBBB = right bundle branch block