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Predicting Persistent Left Ventricular Dysfunction Following Myocardial Infarction

The PREDICTS Study

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ABSTRACT

BACKGROUND Persistent severe left ventricular (LV) systolic dysfunction after myocardial infarction (MI) is associated with increased mortality and is a class I indication for implantation of a cardioverter-defibrillator.

OBJECTIVES This study developed models and assessed independent predictors of LV recovery to >35% and ≥50% after 90-day follow-up in patients presenting with acute MI and severe LV dysfunction.

METHODS Our multicenter prospective observational study enrolled participants with ejection fraction (EF) of ≤35% at the time of MI (n = 231). Predictors for EF recovery to >35% and ≥50% were identified after multivariate modeling and validated in a separate cohort (n = 236).

RESULTS In the PREDICTS (PREDiction of ICd Treatment Study) study, 43% of patients had persistent EF ≤35%, 31% had an EF of 36% to 49%, and 26% had an EF ≥50%. The model that best predicted recovery of EF to >35% included EF at presentation, length of stay, prior MI, lateral wall motion abnormality at presentation, and peak troponin. The model that best predicted recovery of EF to ≥50% included EF at presentation, peak troponin, prior MI, and presentation with ventricular fibrillation or cardiac arrest. After predictors were transformed into point scores, the lowest point scores predicted a 9% and 4% probability of EF recovery to >35% and ≥50%, respectively, whereas profiles with the highest point scores predicted an 87% and 49% probability of EF recovery to >35% and ≥50%, respectively.

CONCLUSIONS In patients with severe systolic dysfunction following acute MI with an EF ≤35%, 57% had EF recovery to >35%. A model using clinical variables present at the time of MI can help predict EF recovery.
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Persistence of severe left ventricular (LV) dysfunction after acute myocardial infarction (MI) has important prognostic implications and is associated with increased morbidity and mortality from both congestive heart failure (HF) and sudden cardiac death. Although implantable cardioverter-defibrillators (ICD) confer a survival benefit in patients with severe LV dysfunction, guidelines recommend implantation of an ICD after a 40-day waiting period (90 days if revascularization occurs) (1) for patients whose ejection fraction (EF) remains ≤35%. This waiting period is based on 2 studies showing no long-term mortality benefit from early implantation of an ICD (2,3). The proportion of patients and factors that predict which patients will continue to have an EF ≤35% 90 days after MI are unknown.

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Creatine kinase, troponin, Q waves, dyssynchrony, and wall motion abnormalities measured at the time of acute MI have all been shown to predict LV functional recovery (4–6). Cohorts in which these associations were made included heterogeneous acute MI patients, many of whom had EFs >35% (and often normal or near-normal EFs). Many of these studies occurred prior to the institution of modern HF therapies and rapid revascularization techniques, which may attenuate the inferences of these findings. Taken together, existing data provide limited utility to help us understand the unique risk profile of acute MI patients presenting with severe LV dysfunction. Therefore, it remains a clinical challenge to predict which acute MI patients with severe LV dysfunction will still meet the indications for an ICD at the end of 90 days. In the present study, we define the incidence, identify markers, and develop prediction models for LV recovery to >35% and ≥50% in patients with acute MI and EF ≤35% using data from the PREDICTS (PREDiction of ICd Treatment Study) study.

METHODS

STUDY SAMPLES. The model development study samples were drawn from the PREDICTS study, a 60-center international study conducted from July 2008 to May 2011 that followed participants previously randomized in the VEST (Vest Prevention of Early Sudden Death Trial) trial, a randomized, controlled clinical trial enrolling patients 18 years of age or older, admitted with MI and LV systolic dysfunction (EF ≤35%) measured at least 8 h after the MI or percutaneous coronary intervention (PCI). Upon discharge from the hospital, participants were randomized to a LifeVest wearable defibrillator (ZOLL Medical Corporation, Chelmsford, Massachusetts) and optimal medical therapy or optimal medical therapy alone with the primary endpoint of 90-day sudden death mortality.

At the conclusion of VEST trial participation, 90 days after discharge from hospitalization for an index MI, participants were enrolled in the PREDICTS study. In the PREDICTS study, patients were implanted with an ICD based on clinical indications or a Reveal XT (Medtronic, Minneapolis, Minnesota) if the EF recovered to >35% for arrhythmia monitoring. The purpose of the PREDICTS study was to develop a risk stratification algorithm that predicted future ICD shock or sudden death over 5 years in patients who were admitted for an acute MI with an EF ≤35%. Of these 364 participants, 231 had follow-up echocardiograms at 90 days before the study was prematurely terminated. Inclusion criteria for the PREDICTS study was the same as noted above for the VEST trial. Exclusion criteria for the VEST trial and the PREDICTS study included significant valve disease, planned coronary artery bypass graft (CABG) surgery within 2 months, existing ICD, contraindication to eventual ICD, terminal condition, chronic renal failure, chest circumference >56 inches or <26 inches, pregnancy, and discharge to a skilled nursing facility. The PREDICTS study was stopped early due to slower than expected enrollment and termination of funding (from the National Institutes of Health and Medtronic).

After the termination of the PREDICTS study, the VEST trial continued and the VEST Registry was created to follow those enrolled in the VEST trial for 1 year. The VEST registry has the same inclusion/exclusion criteria. Distinct from the PREDICTS study, a 90-day echocardiogram in the VEST study was not mandatory, but rather occurred at the discretion of the treating physician. Of the 509 participants in the VEST registry available at the time of this analysis, 236 had echocardiograms at or near 90 days. This cohort was used for model validation (Online Figure 1).

ECHOCARDIOGRAMS. Baseline echocardiograms were obtained at study sites using standard echocardiographic views and the PREDICTS study Standard Operating Procedure (based on the American Society of Echocardiography guidelines) (7), more than 8 h after MI or acute PCI. EF was calculated by

ABBREVIATIONS AND ACRONYMS

ACEI = angiotensin-converting enzyme inhibitor

ARB = angiotensin receptor blocker

BNP = B-type natriuretic peptide

CABG = coronary artery bypass graft

CI = confidence interval

EF = ejection fraction

HF = heart failure

ICD = implantable cardioverter-defibrillator

LV = left ventricular

MI = myocardial infarction

OR = odds ratio

PCI = percutaneous coronary intervention

ULN = upper limit of normal

VF = ventricular fibrillation