Non-invasive risk stratification and prediction of malignant ventricular arrhythmias in patients with implantable cardioverter-defibrillator

Half-time review, 2017-12-21

PhD student
Uzma Chaudhry
Faculty of Medicine, Cardiology, Lund University

Main supervisor
Associate Professor Rasmus Borgquist MD

Co-supervisor
Professor Pyotr Platonov MD

Opponents
Professor Frieder Braunschwieg MD, Department of Cardiology, Karolinska Institutet, and Karolinska University Hospital, Stockholm, Sweden

Associate Professor Joanna Hlebowicz Frisén MD, Department of Cardiology, Skåne University Hospital, Lund, Lund University, Sweden
Abstract

Background: Implantable cardioverter-defibrillator (ICD) is considered the most efficient mode of treatment for secondary prevention of sudden cardiac death (SCD) in patients who have survived cardiac arrest due to ventricular arrhythmia in addition to primary prevention of SCD in patients considered to be at high risk for developing life-threatening cardiac arrhythmias. While there is little debate regarding the choice of treatment options for those who have survived cardiac arrest (all those are unequivocally offered ICD-therapy as class Ia recommendation by current guidelines), the proper selection of candidates for primary ICD implantation fuels the ongoing clinical research aimed at correct identification of patients who are expected to benefit the most from the ICD therapy and are at the lowest risk for developing complications associated with therapy.

Recent publications have focused on cardiac magnetic resonance imaging (CMR) of scar in the left and right ventricles as substrate for recurrent ventricular arrhythmias. Patients with late gadolinium enhancement (LGE) detected fibrosis had a significantly higher risk of adverse outcome, suggesting that evaluation of myocardial scar might serve as a predictor for better risk stratification. However, surface ECG is a much cheaper and more widely available tool for evaluation of myocardial scar and arrhythmic events. The Selvester QRS score translates subtle changes in ventricular depolarization measured by the electrocardiogram into information about myocardial scar location and size.

Aims and Methods: We aim to ascertain the usability and applicability of the Selvester scoring in assessing scar burden by using the semi-automated Selvester scoring system software QuAReSS on standard 12-lead ECGs with strict left bundle branch block (LBBB). Furthermore we aim to investigate the relationships among
semi-automated Selvester score burden, LGE-CMR assessed scar burden and clinical outcome (ICD therapy/death) in patients with underlying heart failure, left bundle branch block and ICD treatment.

**Results:** Our results confirm that the QuAReSS software provides valid measurement of the Selvester score in patients with strict LBBB with minimal correction from cardiologists thus paving its way to become a potential tool for risk assessment and prognostic purposes. However, in the second study, it was shown that there is only a modest correlation between LGE-CMR and Selvester scoring verified myocardial scar, with the Selveter scoring having a tendency to overestimate scar burden. CMR based scar burden is correlated to clinical outcome, but Selvester scoring based scar burden is not. The Selvester scoring algorithm needs to be further refined in order to be clinically relevant and reliable for detailed scar evaluation in patients with LBBB.

**Future studies:** Three more additional studies will be included in the PhD thesis. Our ongoing projects aim to investigate a) the prognostic value of vector ECG (QRST-area) and QRS dispersion in an ICD treated population with heart failure b) prediction of the efficacy of anti-tachycardia pacing (ATP) therapy based on myocardial scar extent and scar location as evaluated by CMR and lastly c) the prognostic factors for recurrent arrhythmias in patients with idiopathic ventricular fibrillation (VF) treated with ICD. The preliminary data have shown that scar tissue immediately adjacent to the ICD electrode is associated with lower trend of ATP arrhythmia termination. This may have clinical implications for placement of the right ventricular electrode when septal or apical scar is present prior to ICD implantation. In the idiopathic VF cohort, in the vast majority of patients who survived idiopathic VF had no VF recurrence.
during long-term follow-up. ECG abnormalities though common were unspecific and had no predictive value for future VF events or appropriate ICD therapy.

Publications:
