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Clinical paper

Coronary angiographic findings and outcomes in patients with sudden cardiac arrest without ST-elevation myocardial infarction: A SWEDEHEART study☆

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ABSTRACT

Background/aim: Sudden cardiac arrest (SCA) has a substantial mortality rate and the acute coronary syndrome constitutes the major cause. Post-resuscitation electrocardiogram ST-elevation SCA (STE-SCA) is a strong indication for emergency coronary angiography, but the role of early angiography and PCI in patients without ST-elevation (NSTE-SCA) remains to be established. This paper aimed to describe this patient group and evaluate the prognostic effect of early PCI in a large nationwide cohort of NSTE-SCA patients undergoing coronary angiography.

Methods: Data from SCAAR (Swedish Coronary Angiography and Angioplasty Registry) and RIKS-HIA (Register of Information and Knowledge about Swedish Heart Intensive Care Admissions) on 4308 SCA patients in Sweden between 2005 and 2016 were descriptively analyzed and related to mortality within 30-days in both unadjusted and adjusted analyses using Cox proportional hazard models.

Results: NSTE-SCA patients had more often serious comorbidities than STE-SCA patients. Among NSTE-SCA patients, 36.4% had no significant coronary artery stenosis while severe coronary stenosis (≥90%) was present in 43.9% (1271/2896). In NSTE-SCA patients with significant stenosis (≥90%), PCI was performed in 59.2% (753/1271) with an increased unadjusted 30-day mortality (40.9% vs. 32.7%; p = .011). However, after adjustments for confounders, no difference in mortality was observed (hazard ratio 1.07; 95% CI 0.84–1.36; p = .57).

Conclusion: In resuscitated SCA patients without ST-elevation who underwent coronary angiography, this large retrospective study found severe coronary artery stenosis in 43.9% but found no clear benefit of early PCI. Prospective randomized controlled trials are needed to accurately define the role of coronary angiography and PCI in post-resuscitation care.

Introduction

Sudden cardiac arrest (SCA) has, despite advances in acute medical care, a persistently high mortality rate and the acute coronary syndrome (ACS) still constitutes the major cause [1–3]. The "chain of survival" denotes the importance of post-resuscitation care, including coronary angiography with subsequent percutaneous coronary intervention (PCI) when indicated to save the heart and avoid recurrent arrest [4,5]. Most deaths before day three after SCA are due to post SCA multi-organ failure, a condition that occurs in 68% of out-of-hospital SCA (OHCA) patients [6]. The multi-organ failure is characterized by haemodynamic instability that is reversible within three days [7].

Abbreviations: EAPCI, European Association for Percutaneous Cardiovascular Interventions; NSTE-SCA, sudden cardiac arrest without ST-elevation; RIKS-HIA, Register of Information and Knowledge about Swedish Heart Intensive Care Admissions; SCAAR, Swedish Coronary Angiography and Angioplasty Registry; SFL, Stent for Life; STE-SCA, post-resuscitation electrocardiogram ST-elevation sudden cardiac arrest; SWEDEHEART, Swedish Websystem for Enhancement of Evidence-Based Care in Heart Disease Evaluated According to Recommended Therapies

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Post-resuscitation electrocardiogram (ECG) ST-elevation SCA (STE-SCA) is a strong indication for emergent coronary angiography [5]. However, ECG has been shown to be a poor predictor of acute occlusion as approximately one in three to one in four OHCA patients without ST-elevation have acute occlusions [8–16]. Moreover, acute angiography and PCI were associated with improved survival in some observational studies [8,11,16], however, other studies report conflicting outcome data [17,18].

It is important to determine the characteristics of SCA patients without ST-elevation on the post-resuscitation ECG (NSTE-SCA), in order to identify those who may benefit from angiography and PCI. To date, no nationwide study has investigated this matter. The aim of this nationwide study was therefore to describe the demographics, angiographic findings, mortality rate and prognostic value of PCI and identify any factors associated with coronary artery stenosis (≥90%) in NSTE-SCA patients undergoing coronary angiography.

Methods

National registries and patient selection

Data were obtained from SCAAR (Swedish Coronary Angiography and Angioplasty Registry) and RIKS-HIA (Register of Information and Knowledge about Swedish Heart Intensive Care Admissions), both of which are part of the SWEDEHEART registry (Swedish Websystem for Enhancement of Evidence-Based Care in Heart Disease Evaluated According to Recommended Therapies) [19]. SCAAR contains data from all angiographies and PCI that have been performed at any of the 30 PCI centers in Sweden, whereas RIKS-HIA contains data from all patients hospitalized at any of the Swedish intensive coronary care units. A total of 387694 patients underwent coronary angiography in Sweden between January 2005 and December 2016 (Fig. 1). All patients who underwent coronary angiography due to SCA (n = 4308) or ACS (n = 212643) in Sweden during the study period were included. Cardiac arrest was categorized into STE-SCA (1412; 32.8%) and NSTE-SCA (2896; 67.2%) either by the interventional cardiologist or using the admission ECG assessment obtained from RIKS-HIA. Coronary artery occlusions were deemed chronic if they were estimated to be more than three months of age by the interventional cardiologist. Coronary angiography was performed during index hospitalization.

Endpoints

The endpoints studied in NSTE-SCA patients undergoing coronary angiography were the probability of having coronary artery stenosis of at least 90% severity, the probability of undergoing a coronary intervention (coronary artery bypass grafting (CABG) or PCI), and 30-day mortality. STE-SCA patients were used as a reference population. ACS patients without SCA were included as an illustrative reference population and were not included in comparative analyses.

Statistical analyses

Histograms were produced to assess normality. Continuous variables were compared using student's *t*-test when assumptions were met. Differences between categorical variables were analyzed with the chi-square test. Kaplan-Meier event rates were used for survival analyses. Unadjusted and adjusted Cox regression models were fitted to assess mortality. Adjustments were made for age, gender, previous MI, previous CABG, previous PCI, hypertension, hyperlipidemia, diabetes, current smoking, and cardiogenic shock. Cardiogenic shock was defined as Killip Class III or IV. Schoenfeld residuals were assessed to verify the proportional hazards assumption. Logistic regression analyses were performed to determine factors that contributed to significant coronary artery stenosis (≥90%) in NSTE-SCA patients. The Hosmer-Lemeshow test was used to assess goodness of fit ($p > .05$) for the logistic regression models and receiver operating characteristics (ROC) analyses were used to assess predictive accuracy. A two-tailed p-value $< .05$ was considered statistically significant. All statistical analyses were performed using IBM SPSS (version 24) or STATA (version 14).

Study ethics

The study was conducted in accordance with the ethical principles of the Helsinki declaration and approved by the Lund University ethical committee (dnr 2015/297). All patient subjects were anonymized with

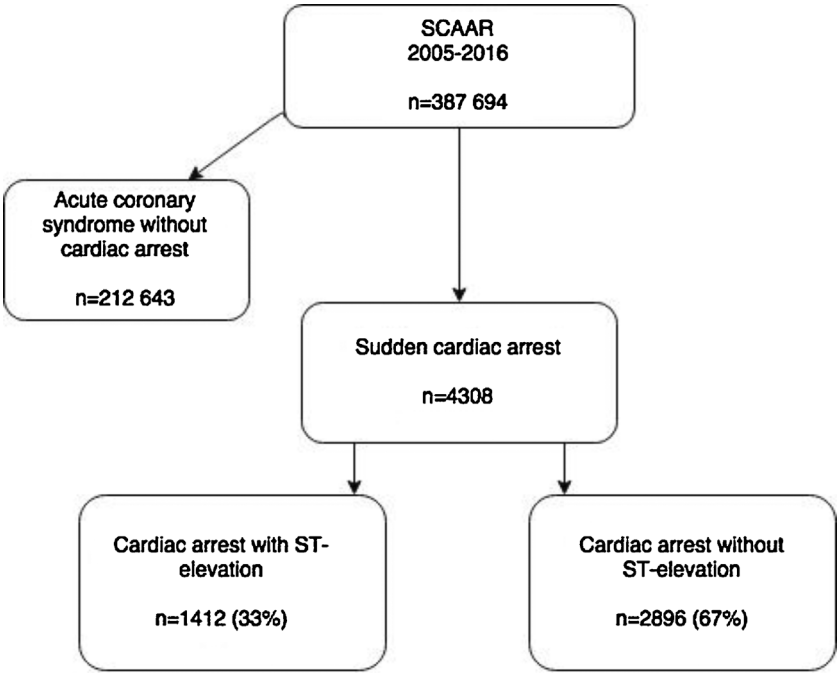

Fig. 1. Study design. Acute coronary syndrome and sudden cardiac arrest (SCA) patients in the SCAAR (Swedish Coronary Angiography and Angioplasty Registry) registry between January 2005 and December 2016 were included. SCA patients were categorized into post-resuscitation ST-elevation SCA or no-ST-elevation SCA.