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Short- and Long-Term Cause of Death in Patients Treated With Primary PCI for STEMI

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ABSTRACT

BACKGROUND Short-term mortality has been studied thoroughly in patients undergoing primary percutaneous coronary intervention (PCI), whereas long-term cause of death in patients with ST-segment elevation myocardial infarction (STEMI) remains unknown.

OBJECTIVES The goal of this study was to describe the association between time and cause of death in patients with STEMI undergoing primary PCI.

METHODS A centralized civil registration system, patient files, and public disease and death cause registries with an accurate record linkage were used to trace time and cause of death in 2,804 consecutive patients with STEMI (age 63 ± 13 years, 72% males) treated with primary PCI.

RESULTS Patients were followed up for a median of 4.7 years. During a total of 13,447 patient-years, 717 patients died. Main causes of death within the first 30 days were cardiogenic shock and anoxic brain injury after cardiac arrest. Age, culprit vessel size and flow, and the presence of heart failure and diabetes were independent predictors of mortality. After 30 days, the annual cardiac mortality rate was <1.5%. Causes of death beyond 30 days were noncardiac in 65% of cases (mainly malignancies and pulmonary diseases). The 30-day, 1-year, and 5-year all-cause (and cardiac) mortality rates were 7.9% (7.3%), 11.4% (8.4%), and 23.3% (13.8%), respectively.

CONCLUSIONS Patients who survive the first month after an STEMI treated with primary PCI have an excellent prognosis, with a <1.5% annual risk of successive cardiac death. Noncardiac causes are responsible for the majority of later deaths in these patients. (J Am Coll Cardiol 2014;64:2101–8) © 2014 by the American College of Cardiology Foundation.

Primary percutaneous coronary intervention (PCI) is the preferred initial treatment of patients presenting with ST-segment elevation myocardial infarction (STEMI) within 12 h of symptom onset, provided treatment can be initiated expeditiously by an experienced team (1–3). Knowledge of the causes of death in patients treated with primary PCI is important to implement new strategies and design clinical trials and cardiac rehabilitation and secondary prevention programs, with the goal of further reducing mortality in these patients (4,5). However, relations between time and different causes of death after primary PCI have not been thoroughly investigated in large all-comer cohorts. Thus, the objective of the current study was to describe the associations between the time and causes of cardiac and

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ABBREVIATIONS AND ACRONYMS

AMI = acute myocardial infarction

BMS = bare-metal stent(s)

CPR = civil personal registration (number)

DES = drug-eluting stent(s)

MODS = multiorgan dysfunction syndrome

PCI = percutaneous coronary intervention

STEMI = ST-segment elevation myocardial infarction

TIMI = Thrombolysis In Myocardial Infarction

VSD = ventricular septal defect

noncardiac death in consecutive patients with STEMI treated with primary PCI.

METHODS

PATIENTS. Patients were eligible for this study if treated with primary PCI at our institution between July 1998 and July 2008. A diagnosis of STEMI was made in patients who presented within 12 h of chest pain onset and ST-segment elevation in at least 2 contiguous electrocardiographic leads. All patients treated with primary PCI were entered into this analysis, including those in cardiogenic shock and those resuscitated after cardiac arrest. Before transportation to primary PCI with emergency medical services, 10,000 U of intravenous unfractionated heparin, 300 mg of aspirin, and 300 or 600 mg of clopidogrel (150 mg of ticlopidine in the first years of the study period) were administered to each patient. After primary PCI, patients were medically treated according to contemporary guidelines.

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Conscious patients were informed according to the requirements of The Joint Commission for accreditation/certification of our hospital. Unconscious or incapacitated patients were treated according to the recommendations of the Danish Council of Ethics.

RECORD LINKAGE. Patient records include a unique, personal 10-digit civil personal registration (CPR) number, assigned at birth or at registration within the Danish Centralized Civil Registration System, in which all vital events are recorded for each patient. The CPR number, patient characteristics, history, and PCI procedural data were entered into the clinical database by the operating physician and assistants in the catheterization laboratory in relation to the primary PCI procedure.

The CPR number is used in all Danish public registries, which enables accurate record linkage. The National Board of Health (case file No. 7-505-29-889/1) gave its permission to cross-check data from public registries, and the study was reported to the Danish Data Protection Agency (case file No. 2008-41-2113).

CLINICAL TRIALS. During the study period, several randomized clinical primary PCI trials were conducted within our department (6–11). Patients and procedures from these trials are included in the analysis. In total, 743 of 2,804 STEMI patients (26%) were enrolled in randomized clinical trials.

ENDPOINTS AND COMPLETENESS OF DATA. Endpoints of this study were time and causes of death obtained from the Danish Centralized Civil Registration System, patients' medical records, the Danish National Patient Registry, and the Cause of Death Registry. All patients were classified as dead or alive. When the Danish Centralized Civil Registration System receives notification of a death, the event is recorded in the system within 2 weeks. Because the minimum duration of follow-up was 2.5 years, it is highly unlikely that any death would be missing from our analysis. Emigrated patients (n = 17) were followed up until the day of their emigration.

CLASSIFICATION OF DEATH. Two physicians reviewed the files of all dead patients, ascertaining the causes of death independently. In cases of any doubt or disagreement, the files were reviewed by a third physician and discussed until a consensus was reached as to the most likely cause of death.

The cause of death was classified into 1 of the following mutually exclusive categories: cardiovascular or noncardiovascular cause. Cardiovascular death was classified as either cardiac or vascular death, and cardiac causes were subclassified into cardiogenic shock, including multiple organ dysfunction syndrome, sudden death/cardiac arrest, anoxic brain injury after cardiac arrest, new acute myocardial infarction, life-threatening arrhythmias (ventricular tachycardia, ventricular fibrillation, or advanced atrioventricular node block), or congestive heart failure (12,13). Sudden cardiac death was defined as death that followed an abrupt loss of consciousness within 1 h of the onset of possible cardiac symptoms. Any death that could not clearly be attributed to a noncardiac cause was classified as cardiac, including those that occurred during sleep. Unless another specific cause could be identified, the cause of death in a patient with reinfarction was classified as death due to reinfarction. Unwitnessed death was classified according to available files. For example, if a patient were undergoing antibiotic treatment for pneumonia, the death cause would be classified as pneumonia, and if a patient with a recent stroke were found dead, the cause of death would be classified as a stroke. Malignant arrhythmias, cardiogenic shock, and cardiac rupture were divided into subgroups depending on whether they were related to the index infarction or a reinfarction or were not infarct related.

Available files were not detailed enough to assess a specific cause of death in 38 patients. In 14 of these patients, death certificates were missing. These patients were classified in the sudden cardiac death category.