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CLINICAL RESEARCH

Incidence, Temporal Trends, and Prognostic Impact of Heart Failure Complicating Acute Myocardial Infarction

The SWEDEHEART Registry (Swedish Web-System for Enhancement and Development of Evidence-Based Care in Heart Disease Evaluated According to Recommended Therapies): A Study of 199,851 Patients Admitted With Index Acute Myocardial Infarctions, 1996 to 2008

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ABSTRACT

OBJECTIVES The aim of this study was to examine temporal trends in the incidence and outcomes of heart failure (HF) complicating acute myocardial infarction (AMI) in a large national cohort.

BACKGROUND There are limited and conflicting data concerning temporal trends in the incidence and prognostic implication of in-hospital HF that complicates AMI.

METHODS The nationwide coronary care unit registry SWEDEHEART (Swedish Web-System for Enhancement and Development of Evidence-Based Care in Heart Disease Evaluated According to Recommended Therapies) records baseline characteristics, treatments, and outcome of consecutive patients with AMIs admitted to all hospitals in Sweden. The diagnosis of HF requires the presence of crackles (Killip class ≥II) or the use of intravenous diuretic agents or intravenous inotropes. This study included 199,851 patients admitted for index AMIs between 1996 and 2008.

RESULTS The incidence of HF declined from 46% to 28% ($p < 0.001$). This decrease was more pronounced in patients with ST-segment elevation myocardial infarctions and left bundle branch block (from 50% to 28%) compared with those with non-ST-segment elevation myocardial infarctions (from 42% to 28%) ($p < 0.001$). The in-hospital, 30-day, and 1-year mortality rates for patients who developed HF during the index myocardial infarction decreased over the years from 19% to 13%, from 23% to 17%, and from 36% to 31%, respectively ($p < 0.001$ for all). Thirteen-year survival analysis showed higher mortality in patients with HF compared with those without HF (adjusted hazard ratio: 2.1; 95% confidence interval: 2.06 to 2.13).

CONCLUSIONS A marked decrease was found in the incidence of HF complicating AMI between 1996 and 2008. However, HF continues to worsen the early-, intermediate-, and long-term adverse prognostic risk after AMI.
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Heart failure (HF) is a major health problem worldwide (1,2). It carries a poor prognosis (5-year cumulative mortality of 40% to 50%) (1) and requires frequent readmissions to the hospital (35% to 50% within 6 months). Coronary heart disease and hypertension constitute the major underlying causes of HF. Both pre-existing chronic HF and the development of de novo HF as a complication of acute myocardial infarction (AMI) are associated with worsened short- and long-term outcome (3–5). The prognosis of patients after AMI has markedly improved during the past 15 to 20 years, and mortality rates from coronary heart disease in general have declined for the past 25 years in most Western countries. Remarkable changes have taken place in the factors that contribute to the incidence of post-AMI HF over the past 2 decades. Changes

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in baseline population characteristics as well as a decrease in infarct size due to salvage of myocardium by better treatment may have improved myocardial function and thus reduced the prevalence of HF after AMI (6–8). Better management of patients who develop HF may also result in improved outcomes. Previous studies have shown conflicting evidence about the incidence, temporal trends, and even prognostic impact of HF that complicates AMI (1,2,9–13). Different definitions of HF, merging of early- and late-onset HF after AMI, and different populations and study designs are reasons that could be cited for difficulties drawing clear inferences about changes in the incidence and temporal trends of post-myocardial infarction HF over the years.

By studying an unselected large cohort of patients with index AMIs registered prospectively in the SWEDEHEART (Swedish Web-System for Enhancement and Development of Evidence-Based Care in Heart Disease Evaluated According to Recommended Therapies)/RIKS-HIA (Register of Information and Knowledge About Swedish Heart Intensive Care Admissions) registry, the aim of this study was to describe the incidence, temporal trends, and prognostic significance of in-hospital post-AMI HF over a time period of 13 years.

METHODS

THE SWEDEHEART/RIKS-HIA REGISTRY. The RIKS-HIA database was established as a national quality registry in 1995 and today includes all Swedish hospitals that provide acute coronary care (n = 72). The registry enrolls consecutive patients admitted to coronary care units because of symptoms suggestive of acute coronary syndromes. Information is collected prospectively for more than 100 variables, including baseline characteristics, electrocardiographic findings, examinations, interventions, in-hospital complications, discharge medications, and diagnoses. The whole process has been described elsewhere (14,15). The variables in RIKS-HIA comply with the international Cardiology Audit and Registration Data Standards (16). This study included all patients in the registry with index diagnoses of AMI who were admitted between 1996 and 2008. If a patient was registered several times, only the first index event was included in the analysis.

From 1996 to 2001, the criteria for the diagnosis of AMI were based on the World Health Organization criteria from 1994 (17,18), combining symptoms, electrocardiographic changes, or both with an increase in a biochemical marker (mainly creatine kinase-MB) exceeding twice the upper reference level as the biochemical criterion (17,18). The electrocardiogram was evaluated for the presence or development of Q waves, ST-segment changes, T-wave inversions, or bundle branch block. From late 2001, the criteria for the diagnosis of AMI according to the European Society of Cardiology, American College of Cardiology, and American Heart Association consensus document, using troponin T or I or eventually creatine kinase-MB level exceeding the 99th percentile in a healthy population together with either typical symptoms or electrocardiographic changes, were adopted.

Mortality data were obtained by merging the RIKS-HIA database with the Swedish population register, which includes information on the vital status of all Swedish citizens through December 31, 2008. Histories of HF, stroke, renal failure, chronic pulmonary disease, dementia, cancer, AMI, and peripheral

ABBREVIATIONS AND ACRONYMS

AMI = acute myocardial infarction
CI = confidence interval
EF = ejection fraction
HF = heart failure
IV = intravenous
LBBB = left bundle branch block
NSTEMI = non-ST-segment elevation myocardial infarction
OR = odds ratio
PCI = percutaneous coronary intervention
STEMI = ST-segment elevation myocardial infarction

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