Outcomes of Patients Calling Emergency Medical Services for Suspected Acute Cardiovascular Disease

Mikkel Malby Schoos, MD, PhD[a,b,c,*], Maria Sejersten, MD, DMSc[d], Usman Baber, MD[c], Philip Michael Treschow, MD[e], Mette Madsen, MSc[f], Anders Hvelplund, MD, PhD[f], Henning Kelbæk, MD, DMSc[d], Roxana Mehran, MD[c], and Peter Clemmensen, MD, DMSc[g]

Adequate health care is increasingly dependent on prehospital systems and cardiovascular (CV) disease remains the most common cause for hospital admission. However the prevalence of CV dispatches of emergency medical services (EMS) is not well reported and survival data described in clinical trials and registries are subject to selection biases. We aimed to describe the prevalence and prognosis of acute CV disease and the effect of invasive treatment, in an unselected and consecutive prehospital cohort of 3,410 patients calling the national emergency telephone number from 2005 to 2008 with follow-up in 2013. Individual-level data from national registries were linked to the dedicated EMS database of primary ambulance dispatches supported by physician-manned emergency units. Outcome data were obtained from the Central Population Registry, the National Patient Registry, and the National Registry of Causes of Death. In patients calling the national emergency telephone number, a CV related ambulance alarm code was given in 2,541 patients of 3,410 patients (74.5%) resulting in 2,056 of 3,410 primary CV discharge diagnoses (60.3%) with a 30-day and 5-year all-cause mortality of 24.5% and 46.4%, respectively. Stroke, acute heart failure, and ST-segment elevation myocardial infarction (STEMI) carried a 25- to 50-fold adjusted mortality hazard during the first 4 days. In patients with suspected STEMI, 90.5% had an acute angiography performed. Nontransferred, nonreperfused patients with STEMI (9.1%) carried 80% short-term mortality. Noninvasive management of non−ST-segment elevation myocardial infarction was common (37.9%) and associated with an increased adjusted long-term mortality hazard (hazard ratio 4.17 [2.51 to 8.08], p <0.001). Survival in 447 out-of-hospital cardiac arrest patients (13.1%) was 11.6% at 30 days. In conclusion, patients with a CV ambulance alarm call code and a final CV discharge diagnosis constitute most patients handled by EMS with an extremely elevated short-term mortality hazard and a poor long-term prognosis. Although comorbidities and frailty may influence triage, this study emphasizes the need for an efficient prehospital phase with focus on CV disease and proper triage of patients suitable for invasive evaluation if the outcomes of acute heart disease are to be improved further in the current international context of hospitals merging into highly specialized entities resulting in longer patient transfers. **(Am J Cardiol 2015;115:13−20)**

An uncovered need remains for investigating the true underlying mortality rates in acute cardiovascular (CV) disease. Recently, a national Danish survey based on the National Patient Registry, in which all hospitalized patients are coded according to the *International Classification of Diseases* (ICD-10), showed a 14.8% (confidence interval 14.5% to 15.2%) 30-day mortality rate from 2004 to 2008 for all myocardial infarctions diagnoses (ICD I21 diagnoses: ST-segment elevation myocardial infarction [STEMI], non−ST-segment elevation myocardial infarction [NSTEMI], and unspecified myocardial infarction [MI]),[1] an incidence that is considerably higher than those reported in randomized clinical trials[2,3] and registries.[4,5] Because of this mortality discrepancy between randomized clinical trials, registries, and national data, we relied on a prehospital register of patients with a potential upstream acute CV diagnosis, enabling us to follow primary discharge diagnoses of patients calling emergency medical services (EMS) for suspected CV disease, rather than relying on acute coronary syndrome (ACS) discharge diagnoses obtained after admission at the invasive center in a consequently selected patient population. To describe the burden of CV disease in an EMS setting is important, as adequate health care is increasingly dependent on elaborate prehospital systems because hospitals condensate into fewer and highly specialized entities, conjoining smaller or rural hospitals and thereby enhancing catchment areas and

[a]Department of Cardiology, Rigshospitalet, University of Copenhagen, Denmark; [b]Department of Cardiology, Køge Hospital, University of Copenhagen, Denmark; [c]Interventional Cardiovascular Research and Clinical Trials, The Zena and Michael A. Wiener Cardiovascular Institute, The Icahn School of Medicine at Mount Sinai, New York, New York; [d]Department of Cardiology, Roskilde Hospital, University of Copenhagen, Denmark; [e]Department of Anesthesia, Nykøbing Falster Hospital, Denmark; [f]Department of Public Health, University of Copenhagen, Denmark; and [g]Department of Cardiology, Nykøbing Falster Hospital, Denmark. Manuscript received July 18, 2014; revised manuscript received and accepted September 23, 2014.

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*Corresponding author: Tel: +45 26194326; fax: +45 39632601.

E-mail address: mikkel.schoos@gmail.com (M.M. Schoos).

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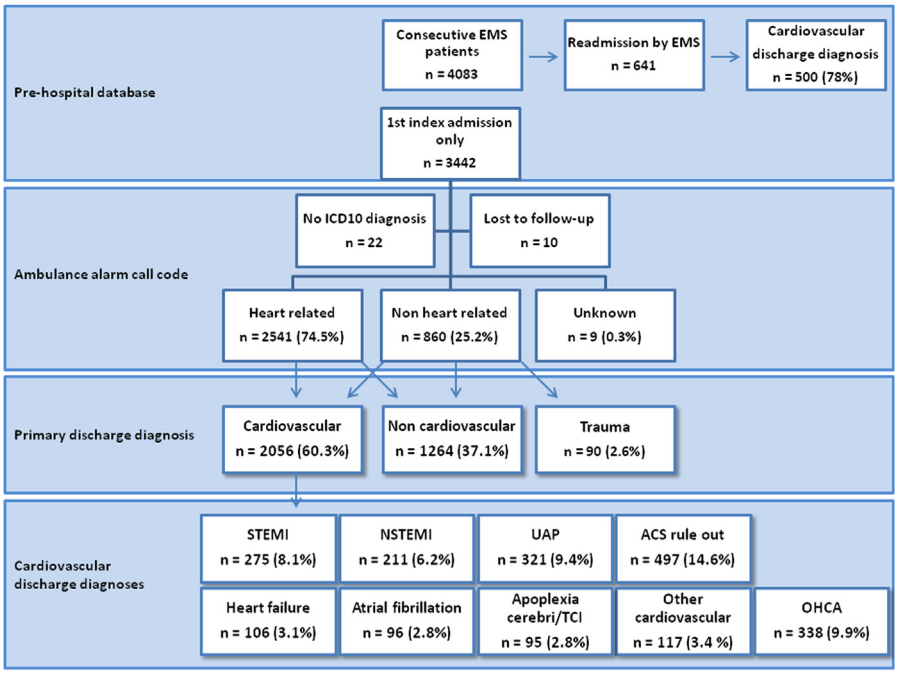

Figure 1. Flow chart. We identified a total of 447 cases with OHCA. The OHCA group (n = 338) depicted in the flow chart is exclusively constituted by non-resuscitated patients and patients who were resuscitated but died immediately after without having obtained any diagnosis leading to the cardiac arrest. Resuscitated patients and patients without return of spontaneous circulation but with a specific diagnosis for the cardiac arrest are included under their respective diagnosis.

transfer distances. We aimed to describe the prevalence and prognosis of CV disease in an upstream unselected prehospital cohort of patients calling the national emergency telephone number, for example 112 or 911.

Methods

We investigated a consecutive Danish cohort of 4,083 patient contacts with EMS in Storstrøm County in the southern part of Zealand (262,781 inhabitants and 3,398 km^2). The former Storstrøm county is a nonurban region of small cities with <45,000 inhabitants and confluent suburban areas, as well as large areas of rural character. The rate of elderly citizens >75 years of age is higher than the national average. Population increase, educational level, employment rate, and self-assessed health are lower than the national average, whereas the average alcohol and cigarette consumption and the incidence of long-term sick leave are above national average.[6]

The prehospital organization in this study has been previously described.[7] Usually the first EMS to arrive at scene is the primary ambulance staffed by emergency medical technicians or paramedics. These primary ambulances are supported by emergency medical units manned with physicians. A patient contact was registered every time a patient called the national emergency telephone number, activating a primary ambulance and physician-manned unit. Calls that did not result in an ambulance dispatch were not registered. Patients were entered, regardless of vital status at the arrival of EMS and regardless of being permanent residents in Storstrøm county. We only considered the first admission of every patient and excluded 641 (15.7%) register entries of patients repeatedly admitted by EMS (Figure 1).

The physician-manned units are fast vehicles without the space to transport patients, but are dispatched simultaneously with the primary ambulance to the injury site for a so-called "rendezvous" with the primary ambulance at the injury site or on the way, to triage and initiate advanced treatment for stabilization before transport. Patients were transferred to 2 around the clock invasive centers in Copenhagen and 4 noninvasive hospitals within the county.

We linked individual-level data from national registries to the dedicated prehospital EMS database, using the personal registration number provided to all Danish residents. The inclusion period was May 1, 2005, to January 31, 2008, with follow-up from May 6, 2013, to May 14, 2013. The EMS database contained data entries based on ambulance charts reporting time information on alarm call, arrival at scene, departure from scene and hospital arrival, vital parameters, and the tentative prehospital diagnosis. Outcome data were obtained from the Central Population Registry, the National Patient Registry, and the National Registry of Causes of Death, enabling follow-up of all patients who had not emigrated. Long-term follow-up was at least 5 years in all patients, maximum follow-up was 8 years, and median follow-up was 5 years and 6 months.

Patients were categorized according to their primary discharge diagnosis based on the ICD-10 codes. STEMI was defined by the ICD-10 codes I210B, I211B, and I213, and NSTEMI was defined by the codes I210A, I211A, and I214. The diagnosis of MI has been validated in the National Patient Registry.[8] Patients treated invasively with diagnostic coronary angiography, percutaneous coronary intervention (PCI), or coronary artery bypass grafting (CABG) were also registered in the eastern Denmark PCI database. Non specified MI was defined by I219. In these patients, we applied all available data