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Clinical paper

Temporal trends in survival after out-of-hospital cardiac arrest in patients with and without underlying chronic obstructive pulmonary disease

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ABSTRACT

Aim: Survival after out-of-hospital cardiac arrest (OHCA) has tripled during the past decade in Denmark as a likely result of improvements in cardiac arrest management. This study analyzed whether these improvements were applicable for patients with chronic obstructive pulmonary disease (COPD).
Methods: Patients ≥18 years with OHCA of presumed cardiac cause were identified through the Danish Cardiac Arrest Registry, 2001–2011. Patients with a history of COPD up to ten years prior to arrest were identified from the Danish National Patient Register and compared to non-COPD patients.
Results: Of 21,480 included patients, 3056 (14.2%) had history of COPD. Compared to non-COPD patients, COPD patients were older (75 vs. 71 years), less likely male (61.2% vs. 68.5%), had higher prevalence of other comorbidities, and were less likely to have: arrests outside private homes (17.7% vs. 28.3%), witnessed arrests (48.7% vs. 52.9%), bystander cardiopulmonary resuscitation (25.8% vs. 34.8%), and shockable heart rhythm (15.6% vs. 29.9%), all $p < 0.001$; while no significant difference in the time-interval from recognition of arrest to rhythm analysis by ambulance-crew; $p = 0.24$. From 2001 to 2011, survival upon hospital arrival increased in both patient-groups (from 6.8% to 17.1% in COPD patients and from 8.2% to 25.6% in non-COPD patients, $p < 0.001$). However, no significant change was observed in 30-day survival in COPD patients (from 3.7% to 2.1%, $p = 0.27$), in contrast to non-COPD patients (from 3.5% to 13.0%, $p < 0.001$).
Conclusions: Despite generally improved 30-day survival after OHCA over time, no improvement was observed in 30-day survival in COPD patients.

Introduction

With approximately 275,000 and 325,000 out-of-hospital cardiac arrests (OHCAs) in Europe and the United States every year,[1,2] and survival rates reported around 10%,[3–6] OHCA represents a large and devastating health-problem worldwide. Major efforts have been taken to improve the poor outcome; following these efforts, several studies have reported an increase in survival.[7–10] Also in Denmark, several national initiatives have been implemented to improve pre-hospital and advanced care following OHCA, and in the same time period survival more than tripled.[5]

Even though a general increase in survival has been observed over time,[5] it remains unknown whether these improvements in survival have benefitted different patient-groups equally, or if the chance of survival depends on underlying comorbidity. Chronic obstructive pulmonary disease (COPD) represents a common and severe comorbidity associated with high morbidity and mortality worldwide.[11–17] In Europe, the prevalence of COPD is 4–10%[18] and is an estimated cause of death for 300,000 persons yearly.[19] COPD

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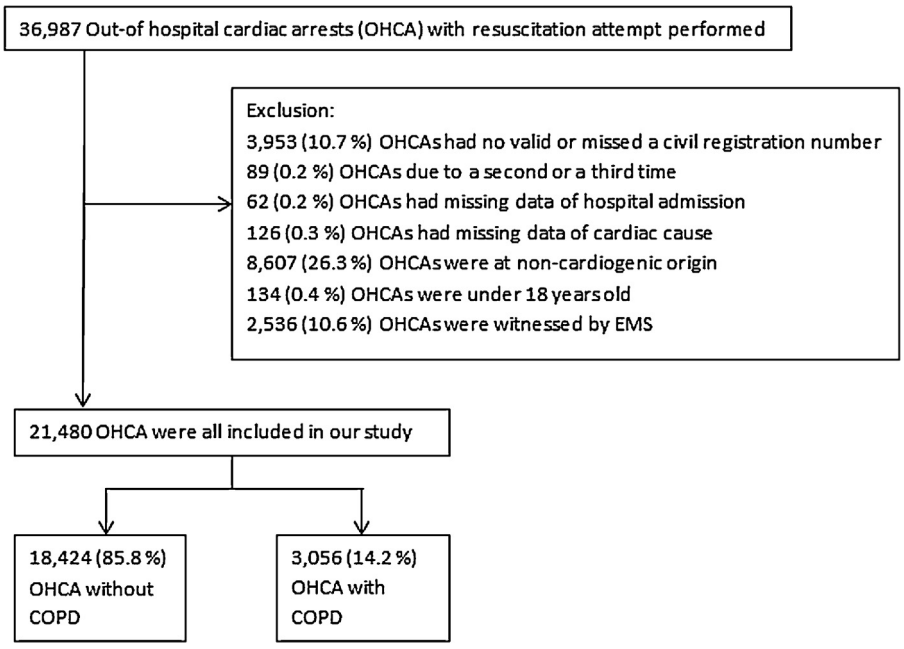

Fig. 1. Patient selection, 2001–2011. Flowchart showing the patient selection process. COPD, chronic obstructive pulmonary disease; EMS, emergency medical services.

is the third leading cause of death in the United States[20] and is expected to become the fourth leading cause worldwide in 2030.[17] COPD is also a common comorbidity in OHCA patients[21] and shares common risk factors with cardiovascular disease. However, knowledge about OHCA in COPD patients and their survival-status is sparse.

To elaborate if the reported temporal improvements in survival after OHCA[5] also apply to COPD patients; we examined changes in survival over time following OHCA according to COPD-status prior to cardiac arrest.

Methods

Design

This is an observational, retrospective register-based study and the study population is derived from the nationwide Danish Cardiac Arrest Register. The register includes all OHCA patients for whom resuscitation is attempted either by a bystander or the emergency medical system (EMS). Patients with late signs of death are not included in the register. OHCA case capture is near complete since EMS is activated for all cardiac arrest emergencies and the personnel is required to fill out a case-report form for each arrest.

Study population

In Denmark, all residents are assigned a personal and unique Civil Registration Number. Information from various national administrative registers can be linked through this individual patient-number.

All patients with an OHCA between June 1st 2001 and December 31st 2011 were included in this study. Patients younger than 18 years, EMS-witnessed arrests, and arrests of a presumed non-cardiac cause were excluded from the final study population. The study selection process is depicted in Fig. 1. The study population was then divided into two groups: (1) patients with a history of COPD defined by discharge diagnosis codes from hospital up to ten years prior to OHCA; and (2) patients without a history of COPD up to ten years prior to OHCA.

Data sources

The following was obtained from The Danish Cardiac Arrest Register: date, time and location of arrest (outside vs. inside private home); witnessed-status by bystander or EMS; whether bystander performed cardiopulmonary resuscitation (CPR) and/or defibrillated the patient using an automated external defibrillator (AED); first registered heart rhythm (shockable rhythm [ventricular fibrillation or pulseless ventricular tachycardia] vs. non-shockable rhythm [pulseless electrical activity or asystole]); estimated time-interval from OHCA recognition to rhythm analysis by EMS (time of recognition is estimated from time of emergency dispatch center call-receipt and/or bystander interviews); and whether the patient had achieved survival upon hospital arrival. From The Danish National Population Register we obtained information about patients' age, gender and vital-status. From The National Causes of Death Register we obtained diagnosis codes from death certificates with immediate, contributory, and underlying causes of death, and from The Danish National Patient Register we obtained information on admission- and discharge dates as well as discharge diagnosis codes from all hospital admissions. All the diagnosis codes are listed in accordance to the International Classification of Diseases (ICD) system. Using this information we examined patient comorbidity up to ten years before OHCA and identified patients with a history of COPD, forming the COPD-population in all primary analyses. In addition, we made a subset analysis in relation to our endpoints comparing the COPD patients found by hospital discharge diagnosis codes with those patients who did not have a hospital COPD diagnosis, but who took inhaled anticholinergic medicine prescribed by general practitioners in the last 180 days before their OHCA, as these patients may be assumed to have COPD, but perhaps less severe without hospitalization.

In order to achieve a more homogenous cardiac arrest-group, our primary analyses only included OHCA cases of a presumed cardiac cause, involving; cardiac disease, unexpected collapse or unknown disease. Non-cardiac causes involved; other medical disorders (when presumed cardiac cause related diagnosis codes were absent), events with trauma, suicide attempts, drowning and drug overdose. In a subset analysis we examined all OHCAs irrespective of presumed cause of arrest; this to test the robustness of the results