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Clinical paper

Long-term prognosis after out-of-hospital cardiac arrest with/without ST elevation myocardial infarction☆

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ABSTRACT

Aim: To describe the 3-year survival of patients after out-of-hospital cardiac arrest (OHCA) taking into account the presence of ST-segment elevation myocardial infarction (STEMI) and evaluating prognostic factors associated with pre-hospital and hospital care.
Patient group: Over a period of 29 months and with the aid of a questionnaire supplied to 24 rescue stations, we prospectively included 560 individuals (415 men; aged 16–97 years, median 68) for whom cardio-pulmonary resuscitation (CPR) for OHCA of confirmed cardiac etiology was attempted.
Results: Of 149 hospitalized individuals, 28.2% survived 1 year and 25.5% survived 3 years after OHCA. In the subgroup of patients with STEMI (26 individuals; 17.5%), 57.7% survived 1 year and 53.9% survived 3 years. In the subgroup of patients without STEMI ($n = 123$), 22% survived 1 year and 19.5% survived 3 years. The strongest predictors for long-term survival by logistic regression analysis were: age under 70 years, ventricular fibrillation as initial rhythm, CPR without atropine, and STEMI. OHCA occurrence at a public place was an indicator of better survival in the subgroup with STEMI. In the subgroup of patients without STEMI, long-term angiotensin-converting enzyme inhibitor treatment, CPR without atropine, a Glasgow Coma Scale upon hospital admission over 3, no presence of cardiogenic shock, and no manifestations of postanoxic encephalopathy (Fisher's exact test, χ^2 test) were indicators of better survival.
Conclusion: Among 560 individuals with "primary cardiac" etiology OHCA and initiation of professional CPR, 8% survived 1 year and 7% survived 3 years. A higher survival rate among patients with STEMI was documented.

1. Introduction

In spite of much progress in medicine, out-of-hospital cardiac arrests (OHCA) still remain a large health, social, and economic problem. The incidence of cardiac arrest is about one case per 1000 inhabitants per year[1,2] in Western Europe and North America. Long-term survival rates are approximately 7% at 1 year, 6% at 3 years, and from 4 to 7% at 5 years after OHCA.[3–5] The long-term prognosis of patients following OHCA depends on many factors in pre-hospital and hospital care.[5–7] An excellent prognosis is especially observed in patients with ST-segment elevation myocardial infarction (STEMI).[8] The prognosis of these patients is uniquely improved by reperfusion therapy, particularly mechanical percutaneous coronary intervention (PCI).[9–11] Analysis of prognostic factors and their influence on long-term prognosis with regard to STEMI diagnosis is rare in the literature.[12]

The aim of our prospective study was to describe the 3-year survival of patients following OHCA, focusing on analysis of the presence of STEMI and evaluating prognostic factors in pre-hospital and hospital care.

2. Methods and patient group

2.1. Study design

The methodical approach to this prospective multi-center study was described in detail previously.[13]

All individuals with "primary cardiac" etiology OHCA from the East Bohemia region (Czech Republic—an area of 11,244 km^2 with 1,236,000 inhabitants) in 61 health care units (24 operating rescue service centers, 16 anesthesiology and resuscitation departments /ARD/, 19 internal medicine departments, and two cardiac cen-

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ters in Hradec Kralove and in Pardubice) were included during the period from April 1, 2002 to August 31, 2004. Exclusion criteria were: (1) OHCA of non-cardiac etiology, such as apparent traumatic, toxic or suicidal causes, including hanging and drowning cases; (2) OHCA in the presence of emergency medical service (EMS); and (3) subjects in the terminal phase of chronic illnesses.

Data were collected using questionnaires filled out by physicians in accordance with Utstein style.[14] Data were continually obtained from clinical specialists, especially cardiologists, general practitioners, and other health service employees or directly from the patients after their discharge from hospital care.

The questionnaire included items about patient history [risk factors for ischemic heart diseases (IHD) and drug use], data regarding pre-hospital care including the location of events, initial ECG rhythm, history of cardio-pulmonary resuscitation (CPR), and the time intervals (the arrival time = the interval between reporting the event to the rescue center dispatch and the beginning of patient care by the EMS staff, the length of CPR by health care professionals). Hospitalization data concerning diagnosis (e.g., diagnosis of STEMI), clinical history, and treatment [Glasgow Coma Scale (GCS) upon admission, artificial pulmonary ventilation, presence of cardiogenic shock, postanoxic encephalopathy, and reperfusion treatment with direct PCI] were also recorded.[15]

Information regarding the 30-day and 3-year survival of hospitalized individuals, including evaluation of the central nervous system with the aid of cerebral performance categories (CPC) according to the Glasgow—Pittsburgh Outcome Categorization [16] was recorded.

2.2. Patient group

A total of 718 patients (511 men and 207 women; aged 16–97 years; median 69; average 67 ± 13) were included in the study. Professional CPR was initiated for 560 individuals (415 men and 145 women; aged 16–97 years, median 68; average 67 ± 13) with OHCA of a "primary cardiac" etiology. Among these 560 individuals, 149 (113 men and 36 women, aged 21–90 years; median 65; average 66 ± 13) were admitted to hospital care after CPR. In these hospitalized patients were found as main cause of OHCA acute STEMI in 26 cases according to the clinical history and laboratory examination. Forty-four hospitalized patients (29.5%) with 3 years of monitoring and autopsy confirmation were included.

2.3. The EMS system

The EMS system was structured as a one-tier system with physician participation in over 90% of the OHCAs. The destination of patient transport from the field was determined based on the physician base, clinical data, and 3- or 12-lead ECG recordings. Every rescue station was primarily equipped with two levels of rescue services: an advanced life support (ALS) unit (a physician, a nurse, and a paramedic-driver) and a basic life support (BLS) unit (a nurse and a paramedic-driver). Both were reinforced by an air rescue unit (a physician and a paramedic).

2.4. Statistics

For statistical evaluation of survival, we used the Fisher's exact test, χ^2 test, and logistic regression analysis. A P value <0.05 was considered as statistically significant.

2.5. Definition

STEMI is defined as dynamic elevation of ST-segments on the ECG (at the J point with the cut-off points $\leq$0.2 mV in V_1 through V_3 and $\leq$0.1 mV in other leads) along with a typical rise (minimally three times greater than the upper limit of normal values), followed by a fall in biochemical markers of myocardial necrosis [e.g., serum creatinine kinase (CK) and its MB fraction] and eventual evolution of a pathological Q wave on the ECG (0.04 s or more in duration). For interpretation of biochemical markers of myocardial necrosis and STEMI after CPR (blood samples were evaluated at all patients), we included an evaluation of the urgent coronary angiogram prior to direct PCI (20 patients), myocardial wall kinetics (ultrasound) (all patients), and even the autopsy report (three patients) for diagnostic purposes.

Non-ST-segment elevation myocardial infarction (*NSTEMI*) is defined as a typical rise (minimally three times greater than the upper limit of normal values), followed by a fall in biochemical markers of myocardial necrosis [e.g., serum creatinine kinase (CK) and its MB fraction] without dynamic elevation of ST-segments on the ECG. For diagnostic purposes, we evaluated myocardial wall kinetics (ultrasound) and autopsy reports.

Cardiogenic shock is defined as evidence of tissue hypoperfusion induced by heart failure after correction of preload, defined as systolic blood pressure <90 mmHg or a drop in mean arterial pressure >30 mmHg and/or low urine output (<0.5 ml/(kg-h)).

Sudden cardiac death (SCD) is defined as an unexpected total circulatory arrest within 1 h from onset of symptoms or without any warning.

3. Results

Table 1 shows the basic characteristics of 149 hospitalized patients. STEMI was diagnosed at the time of hospital admission in 26 individuals (22 men and 4 women; aged 35–79; median 59; average 57 ± 10). There were 123 individuals (91 men and 32 women; aged 21–90; median 67; average 64 ± 14) in the subgroup of patients without STEMI.

3.1. Three-year follow-up

Among 149 individuals hospitalized after OHCA, 43.0% survived 30 days, 28.2% survived 1 year, 26.9% survived 2 years, and 25.5% survived 3 years (day 0 = day of OHCA occurrence). Measurement of survival beginning at 30 days following the occurrence of OHCA showed that 65.6% survived 1 year, 62.5% survived 2 years, and 59.4% survived 3 years (day 0 = the 30th day following OHCA occurrence).

In the STEMI subgroup (n = 26), 73.1% survived 30 days, 57.7% survived 1 year, and 53.9% survived 2 and 3 years (day 0 = day of OHCA occurrence). Measurement of survival beginning at 30 days following the occurrence OHCA showed that 79% survived 1 year and 73.7% survived 2 and 3 years (day 0 = the 30th day after OHCA occurrence). In the patients without STEMI (n = 123), 36.6% survived 30 days, 22% survived 1 year (compared with 60% when measuring from 30 days following the occurrence of OHCA), 21.1% survived 2 years (compared with 57.8% from day 30), and 19.5% survived 3 years (compared with 53.3% from day 30). Thus, a longer survival time was demonstrated in patients with STEMI (p = 0.00118) (Fig. 1, Table 2).

3.2. Cerebral performance category (Table 3)

In the group that survived OHCA, 73.4% were in good neurological condition (CPC-1,2) at 30 days, 92.9% at 1 year, 95% at 2 years, and 97.4% at 3 years. This level of neurological condition was noted in all surviving patients in the STEMI subgroup. In contrast, several patients were diagnosed with a mental disability or a coma/vegetative state (CPC-3,4) in the patients without STEMI.