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Original research article

Cardiac arrest center – One-year experience of the Regional Hospital Liberec

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ABSTRACT

Introduction: Out-of-hospital cardiac arrest (OHCA) is one of the most common causes of death in the adult population in developed countries. Centralization of post-resuscitation care may improve the patients' prognosis. Expert statement of the Czech Society of Cardiology recommends the establishment of cardiac arrest centers using the infrastructure of existing tertiary cardiac centers. The introduction of this system in the region of Liberec started in April 2016. The aim of our work is to present the one-year results compared to the results from previous years.

Methods: All patients treated in the Department of Cardiology of Regional Hospital Liberec after OHCA from 1st April 2016 to 1st April 2017 were enrolled consecutively. Neurological status and mortality were evaluated for the time period of 30 days from the day of admission. The data were compared to the registry of patients hospitalized in the same department after OHCA and successful resuscitation from 1st January 2013 to 31st November 2015.

Results: After the establishment of the Cardiac Arrest Centre, an increase of primarily transported patients of 39.5% (0.81 vs. 1.13 patient per week) was observed. There was a statistically significant increase in the proportion of patients with non-shockable rhythm (25.2 vs. 42.6%, $p = 0.013$). Despite this, the proportion of patients with cardiovascular etiology of cardiac arrest did not change (71.4 vs. 77.0%). There was also no reduction in the proportion of patients with acute coronary syndrome (47.6 vs. 44.3%). There was no statistically significant change of proportion of patients undergoing selective coronarography (63.9 vs. 54.1%) and percutaneous coronary intervention (35.4 vs. 36.1%). There was an increase in 30-day mortality, which was not statistically significant (36.7 vs. 49.2%, $p = 0.096$). Most of the surviving patients (75.4 vs. 71.0%) were in a good neurological condition.

Conclusion: Centralization of post cardiac arrest care using previously established infrastructure is feasible in our region. Furthermore, it resulted in the increase of directly transported patients and led to the increase of the total number of patients admitted without increasing the proportion of patients with a non-cardiac cause of OHCA. There was no significant change in mortality and neurological outcome.

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Introduction

The Czech Republic ranks among the countries with the highest incidence of out of hospital cardiac arrest (OHCA) in Europe. According to recent data, there are about 100 resuscitations per 100,000 people per year [1]. Pre-hospital care is implemented by the Emergency medical service (EMS) in accordance with the contemporary guidelines of the European Resuscitation Council and achieves the results comparable to other European countries [1–3]. During the latest decade, a sustained trend in the improvement of OHCA patient prognosis could be observed, mainly due to the early recognition of cardiac arrest, telephone assisted cardiopulmonary resuscitation and the early defibrillation [4].

Despite the undeniable progress, OHCA is one of the most common causes of death of adults in developed countries. Restoration of spontaneous circulation (ROSC) and transport to the hospital is achieved in approximately 30% of patients. Less than 15% out of all resuscitated patients survive and are finally released from a hospital. Up to 47% of patients with shockable rhythm and witnessed cardiac arrest survive with a good neurological outcome [1,4–6].

The major factor influencing the morbidity and mortality of patients after ROSC consists in the complex treatment of post cardiac arrest syndrome; in particular, identification and treatment of reversible causes of cardiac arrest, good organ perfusion and neuroprotective treatment. The particular healthcare facilities differ significantly in the methods of treatment and the results which depend not only on the availability of specific therapeutic methods [7]. Centers specialized in life-threatening diseases, such as acute myocardial infarction, stroke and polytrauma have become standard practice, which improved both morbidity and mortality of the patients admitted [8–12]. The establishment of specialized cardiac arrest centers may improve the prognosis of OHCA patients in the same way [13–18].

Until 2016 post-cardiac arrest care in Liberec region was not standardized. Patients with OHCA and obvious acute coronary syndromes were primarily transported to the Department of Cardiology of Liberec hospital and other patients were transported to the other district hospitals. The ability of EMS personnel to perform a reliable differential diagnosis in the field was very limited [19]. Some patients with a later diagnosed cardiovascular cause of cardiac arrest were, with variable delay, transported from the district hospital to the referral Cardiovascular center. According to the data from our registry, 19% of all patients were admitted to our department this way, out of which 43% were patients with STEMI, where the delay between the first contact with a physician, the correct diagnosis and intervention, can significantly affect their prognosis [9,12].

Considering the fact that more than 75% of OHCA have cardiovascular cause and more than half of patients with CAD die because of sudden cardiac death [5,6], the approach of referral cardiology departments to the care of these patients should be more proactive.

A major step forward was made by the publication of the expert statement of the Czech Association of Acute Cardiology of the Czech Society of Cardiology and of a number of other

expert societies, which, for the first time, set the conditions for the establishment of cardiac arrest centers using the infrastructure of previously established cardiovascular centers [20].

Methods

The Region of Liberec, with the population of approximately 441,000 inhabitants, is the second smallest region in the Czech Republic. Liberec Regional Hospital is the tertiary care hospital and with the capacity of 950 beds and about 40,000 hospitalizations annually is thus the largest provider of health care in the region. Intensive care is provided in 7 ICUs, with a total of 60 beds. Liberec Regional Hospital disposes of the cardiovascular center with a catheterization laboratory fully operational 24/7 and a unit with 8 beds of intensive cardiology care. There are 7 other district hospitals in the region. The EMS of the Liberec Region has 1 dispatch center, 14 bases with a total of 30 response units (20 paramedic units and 10 units with an emergency physician) and 1 helicopter unit. In addition, police and firefighter units are equipped with a total of 36 automatic external defibrillators. From April 1st 2016, post-cardiac arrest treatment is being provided in accordance with the new guidelines of the EMS of the Liberec Region and of the Department of Cardiology of Regional Hospital Liberec. The document itself is divided into two parts – pre-hospital and in-hospital phase. During the pre-hospital phase, the patient with cardiac arrest of apparent or probable cardiovascular etiology (cardiovascular etiology cannot be ruled out) is referred to the ICU of cardiology department together with a 12-lead ECG using the same communication pathways which are already routinely used in the care of patients with suspected acute coronary syndromes (direct telephone line and ECG transmission). In the case of suspected cardiac causes (especially STEMI or LBBB), a standard “fast track” concept is applied and the patient is transported directly to the catheterization laboratory. In other cases, the patient is transported to the Emergency room of the Liberec Regional Hospital. During the in-hospital phase, the treatment is described in the second part of the protocol and is led in accordance with contemporary guidelines for post-resuscitation care [21].

Population

All patients treated in the Department of Cardiology of Regional Hospital Liberec after OHCA from 1st April 2016 to 1st April 2017 were consecutively enrolled. The neurological outcome and mortality were evaluated within the time period of 30 days from the day of admission. The neurological outcome was evaluated using the Cerebral Performance Category, according to which, the CPC score of 1 and 2 was considered to be a favorable outcome. The results were compared to the registry of patients hospitalized in the same department after OHCA and successful resuscitation within the time span since 1st January 2013 to 31st November 2015. The pre-hospital part of the protocol was developed in cooperation with the EMS physicians. All physicians, paramedics and other employees of all the workplaces concerned, including the dispatching center, have been informed of the

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