Expert consensus statement

Cardiac Arrest Centers

Joint statement of Czech Professional Societies:
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http://dx.doi.org/10.1016/j.crvasa.2017.03.009
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Introduction

In the Czech Republic, out-of-hospital cardiac arrest (OHCA) is experienced in 60–100 patients per 100,000 population/year and ranks among the leading causes of death similarly to other developed countries [1,2]. Advances in the organization of pre-hospital emergency care have helped to improve the quality of cardiopulmonary resuscitation (CPR) through, e.g., mandatory availability of dispatcher-assisted cardiopulmonary resuscitation, introduction of so-called “first responder” activation systems with automated external defibrillators, and other measures [1,3]. Return of spontaneous circulation (ROSC) is achieved in about 40–50% patients suffering OHCA, who receive advanced cardiovascular life support, and the number of patients admitted for further post-resuscitation care in hospital wards is increasing [1,3]. Still, despite the advances in current medicine, the success rates of this therapeutic strategy remain relatively low. In the Czech Republic, less than 15% of post-resuscitation patients can usually be discharged without a major neurological deficit to receive home care [2].

The body of literature-based evidence regarding individual therapeutic strategies employed in post-resuscitation care remains absolutely inadequate. Of the commonly used therapeutic options, only maintaining body temperature at 33 °C or 36 °C has been relatively reliably shown to improve prognosis [4–6]. However, despite the lack of data from large prospective studies, there has been recently consensus (particularly based on retrospective studies) that a number of out-of-hospital cardiac arrest survivors do benefit from specialized care including diagnostic and therapeutic strategies currently available only in major healthcare facilities [7–16]. This is the reason behind the recently launched initiative to create specialized Cardiac Arrest Centers (Cardiac Arrest Receiving Centers) to admit cardiac arrest survivors and provide comprehensive dedicated post-resuscitation care [17–26]. The Czech Republic is no exception in this respect and it is most likely that improving of the logistics of care for cardiac arrest survivors may help improve the outcomes of these patients.

Definition of the Cardiac Arrest Center

Each such facility should have an adequate number of resuscitation care beds available to admit cardiac arrest patients as well as qualified medical and paramedical staff trained in diagnostic and therapeutic modalities and decision-making processes to be applied in this patient population. The following procedures/techniques should be available and feasible on a round-the-clock, 24/7 basis:

- Diagnostic workup using the necessary imaging techniques (primarily echocardiography, ultrasound, and CT);
- Coronary angiography and percutaneous coronary intervention;
- Temporary cardiac pacing;
- Pericardiocentesis;
- Targeted temperature management keeping body temperature at 33 °C or 36 °C;
- Comprehensive resuscitation and post-resuscitation care;
- While extracorporeal CPR (ECP)R may be an advantage, it is not obligatory given the small body of current evidence.

Depending on the cause of sudden circulatory arrest, other findings in each individual patient, and current availability, the respective resuscitation bed may be part of cardiac intensive care units (CICUs), departments of anesthesiology...
and resuscitation/intensive care medicine, and/or other specialized, and multidisciplinary critical care units.

**Organization of pre-hospital care**

Unless the patient has an obvious non-cardiac cause of out-of-hospital circulatory arrest (asphyxia, injury, etc.) and has no known disease justifying non-provision of further resuscitation care (e.g., end-stage chronic disease), the mobile Emergency Medical Service (EMS) team should contact a Cardiac Arrest Center (CAC). In cases where there are no objective reasons for adopting a different strategy, the patient should be – after recorded online/phone consultation between the Center’s and EMS physicians – transported primarily to CAC right from the field. Post-resuscitation patients with ST-segment elevation (STEMI) documented by 12-lead ECG should be preferentially transported directly to the catheterization lab without being admitted through the emergency department or ward of the receiving hospital (so called “fast track concept”).

In patients suffering OHCA refractory to initial steps in the algorithm of advanced life support (particularly defibrillation shocks) while meeting favorable prognostic criteria (cardiac arrest occurring in the presence of a mobile EMS team or bystanders, resuscitation initiated by lay or professional rescuers without delay, initially shockable rhythm or likely reversible cause of cardiac arrest or intermittent ROSC), it is advised to consider transfer of the patient to CAC while continuing to use mechanical CPR [27]. The decision to transport the patient should be made in the early phase of resuscitation, ideally within 10 min of initiating advanced life support (i.e., after the third defibrillation shock at the latest) [28]. A prerequisite for this is a predefined algorithm of well-coordinated pre-hospital and in-hospital care including the possibility to immediately transfer the patient to a catheterization lab, availability of teams experienced in mechanical CPR and percutaneous coronary intervention during continuous CPR. However, given the current level of evidence, this strategy should not be applied on a routine basis [27].

**Procedures in the Cardiac Arrest Center**

All patients admitted to hospital following an out-of-hospital cardiac arrest should have baseline assessment in the Emergency Department or other resuscitation bed of the receiving facility (except for STEMI patients transported preferentially directly to the catheterization lab). The aim of this strategy is to identify – based on rapidly available data – the cause of cardiac arrest, assess prognostic markers and, possibly, initiate causal therapy. Other necessary steps, in addition to assessment of available medical history data, include physical examination, ECG (evaluated by a cardiologist), bedside echocardiography, and chest ultrasound, quick assessment of the internal milieu (blood gases, kalemia, hemoglobin/hematocrit, lactate) or, possibly, brain CT. It is in this particular stage that blood samples should also be obtained from all patients for further basic laboratory tests. In cases where the cause of cardiac arrest has been identified, it is critical to proceed according to the established diagnosis (e.g., STEMI or, most likely, non-ST-segment elevation acute coronary syndrome, cardiac tamponade, pulmonary embolism, hyperkalemia, bradycardia, intracranial hemorrhage). In patients experiencing a cardiac arrest of unclear etiology while an acute coronary syndrome cannot be ruled out and no markedly adverse prognostic factors are present (e.g., unwitnessed cardiac arrest, long time to resuscitation initiation, initial asystole, high lactate levels), urgent coronary angiography should always be considered. As coronary artery obstruction is a frequent cause of cardiac arrest even in this patient subpopulation, coronary intervention may improve their prognosis. Patients in whom the cause of cardiac arrest continues to be unclear can be considered for head and chest CT. Head and cervical spine CT should also be considered in all patients with a history of fall. Monitoring of body core temperature should be started without any delay and achieving and maintaining the target temperature of 33 °C or, alternatively, 36 °C is mandatory as soon as possible.

The patient is subsequently admitted to a resuscitation bed of a CICI, department of anesthesiology and resuscitation, or, possibly, another specialized or multidisciplinary ICU capable of providing comprehensive resuscitation and post-resuscitation care. The Cardiac Arrest Center should also provide further specialized care (e.g., neuroprognostification, cardioverter-defibrillator implantation, post-cardiac arrest psychological care etc.) or determine further strategy of individualized patient care.

Given the need for providing further specialized post-resuscitation care and the Center’s limited bed capacity, the patient may alternatively be transferred to a regional medical center to receive subsequent care (intensive, internal, neurologic, rehabilitation, etc.).

**Aims of creating Cardiac Arrest Centers**

The aim of the initiative is to create a Czech nationwide network of Cardiac Arrest Centers designed to provide current evidence-based comprehensive care of cardiac arrest survivors. Except for cases specified above, these centers should admit all adults experiencing out-of-hospital cardiac arrest of suspected cardiac etiology.

**Preconditions for creating a Cardiac Arrest Center**

With respect to the above specified requirements for round-the-clock availability of diagnostic and therapeutic procedures in specialized centers, a nationwide network of such centers could be based to some extent on the cardiovascular centers (i.e., those providing highly specialized complex cardiovascular care and those providing highly specialized cardiovascular care) whose contribution to care of cardiac arrest survivors is absolutely critical. Medical centers becoming Cardiac Arrest Centers should provide active interdisciplinary cooperation involving cardiologists, emergency physicians, anesthesiologists, intensivists, neurologists, radiologists, and other specialists. A conditio sine qua non
is an adequate number of resuscitation beds to accommodate emergency admissions of cardiac arrest survivors who may benefit from specialized care. Other important aspects include logistics of transport of patients who no longer require care in the Center to regional inpatient facilities so as to vacate beds for other emergency patients experiencing cardiac arrest as well as close cooperation with the EMS provider in the respective region.

REFERENCES


