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Is Sudden Cardiac Arrest with the Maintained Sitting Position at Emergency Medical Services Arrival a Different Entity

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Abstract

Introduction: Cardiac arrest is a cessation of cardiac mechanical function leading to loss of consciousness, apnoea or stertorous breathing, and impalpable large arterial pulse.

Objective: Aim of study was to assess whether the sitting position maintained during Out-of-Hospital Cardiac Arrest (OHCA) impacts Return of Spontaneous Circulation (ROSC) and survival to hospital admission in patients who received Cardio Pulmonary Resuscitation (CPR).

Patients and Methods: The documentation of OHCA patients in the OHCA registry of part of Silesian Voivodeship 01-06.2018 was accessed yielding 634 patients for analysis. (Clinical Trials. Gov Identifier: NCT03654859).

Results: Sitting position was found in 41 (6.5%) victims of cardiac arrest at Emergency Medical Service arrival. Sitting position in patients compared with those lying at Emergency Medical Service arrival was more frequent in women 46.3% *vs* 30.6%, p=0.036, with greater age 69.8+/-17.8 *vs* 62.9+/-17.6 years, p=0.017; with less frequent administration of cardiopulmonary resuscitation (CPR) by bystanders 7.3% *vs* 63.6%, p < 0.001, while ROSC was obtained with similar frequency 34.2% *vs* 34.1% p=0.99, survival to hospital admission in ROSC group was lower 50% *vs* 75.5% p=0.036.

Conclusions: Cardiac arrest in maintained sitting position, found at Emergency Medical Services arrival, occurs in 6.5% of patients with out of hospital cardiac arrest in whom resuscitation attempts were undertaken and is related to unfavourable outcomes. These patients are older and more often female. Out of hospital cardiac arrest presenting in maintained sitting position demands particular consideration of its' aetiology.

Key words: Cardiac arrest; Cardiopulmonary resuscitation; Sitting position

Introduction

Cardiac arrest is a cessation of cardiac mechanical function leading to loss of consciousness, apnoea or stertorous breathing, and impalpable large arterial pulse [1]. Depending on how OHCA is defined, the condition is diagnosed in Europe with the incidence of 38/100,000 inhabitants per year [2,3], in the United States - with the frequency of 76/100,000 inhabitants per year [4] in Poland - with the frequency 69,7-95/100 000 inhabitants per year [5,6].

Most of the victims of cardiac arrest are in the lying position, in which they may be at the onset of cardiac arrest or which they assume due to a fall caused by decrease in postural muscle tone [7,8]. Patients who are initially in a seated position usually fall down unless supported by people or objects in the environment, or when the subject has a low centre of gravity [9,10].

The position of patient's body during cardiac arrest may delay the correct diagnosis and resuscitation by witnesses and even by members of medical services [10,11].

The importance of a maintained sitting position during cardiac arrest for the recognition of the condition and its' prognosis is unknown. The sitting position may be accidental or caused by adoption of this position before the arrest due to premonitory symptoms. However, it cannot be excluded that sitting may be associated with activities involved in the cause of cardiac arrest such as passing urine or stool [12]. In patients with syncope, a fall is considered to be a mechanism by which the adverse hemodynamic situation, i.e., hypotension and/or bradycardia are improved by removing gravitational reduction in venous return to the heart. Delay in adopting the horizontal body position is likely to extend the duration of Loss of Consciousness (LOC), and may potentially lead to permanent cardiac arrest. Moreover, the defibrillation threshold is likely to be rising at this time in leading to ineffective shocks.

The aim of the study was to assess whether the sitting position maintained during Out-of-Hospital Cardiac Arrest (OHCA) impacts Return of Spontaneous Circulation (ROSC) and survival to hospital admission in patients who received Cardio Pulmonary Resuscitation (CPR). Moreover, whether the sitting position is related to important events during OHCA treatment like bystander CPR and defibrillation.

Patients and Methods

The study group and methods were described elsewhere. Briefly, a questionnaire regarding cardiac arrest data and circumstances was completed by Emergency Medical Services (EMS) personnel. The Silesian Registry of Out-of-Hospital Cardiac Arrest (SIL-OHCA; Clinical Trials. Gov Identifier: NCT03654859) provided the material for the study. From a total of 853 questionnaires compiled between January and June 2018: the following questionnaires were excluded: 162 where cardiac arrest was recorded to have occurred after EMS arrival, 1 questionnaire of a patient referred to Helicopter Emergency Service (HEMS), 42 questionnaires covering the same patients completed by basic and specialist EMS personnel and 14 patients in whom the position of the body at EMS arrival was classified as other than sitting or lying or was not assessed yielding 634 patients for inclusion.

The following data were retrieved from these questionnaires: sex, age, place of incident, the assessed mechanism of cardiac arrest as

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traumatic or non-traumatic, presence of witnesses of the event, CPR by layperson(s) consisting of Automated External Defibrillation (AED) use or chest compressions, symptoms before cardiac arrest (chest pain, dyspnoea, weakness), comorbidities (previous myocardial infarction, diabetes, previous stroke, Coronary Artery Bypass Graft (CABG)/Percutaneous Coronary Interventions (PCI), pace Maker (PM), Implantable Cardioverter-Defibrillator (ICD) if available from bystanders, duration between call and EMS arrival, body position at EMS arrival, first recorded rhythm, defibrillation, obtaining ROSC and survival to hospital admission.

The following data were lacking: age in 18 patients, gender in 2 patients, location of cardiac arrest in 2 cases, in 5 cases it was not noted if witnesses were present, in 58 patients the first recorded rhythm was not noted or was not clearly stated.

Statistical analysis

Data are presented as means and standard deviation and compared by student's t test or numbers and percentages and compared by chi^2 test.

Logistic regression analysis was performed to find factors associated with achievement of ROSC, survival to hospital admission and defibrillation during resuscitation.

Bioethical Commission of Silesian Medical Chamber assessed that opinion of bioethical commission is not necessary for collecting data for The Silesian Registry of Out-of-Hospital Cardiac Arrest. The present study was performed on the basis of this registry. The study follows the principles of the Declaration of Helsinki. $P < 0.05$ was considered significant.

Results

The sitting position was found in 41 (6.5%) victims of cardiac arrest at EMS arrival. Among 20 patients with traumatic cardiac arrest 3 (15%) are sitting at EMS arrival, whereas among the rest of 614 patients 38 (6.2%) are sitting (p=0.12).

The demographics, OHCA circumstances and clinical data are presented in the Tables 1 and 2.

Patients found in sitting position in comparison with those found lying were more frequently women 46.3% *vs* 30.6% p=0.036 , were older 69.8+/-17.8 *vs* 62.9+/-17.6 years p=0.017; less frequently given CPR by bystanders 7.3% *vs* 63.6% p < 0.001, the ROSC was obtained with similar frequency 34.2% *vs* 34.1% p=0.99 but survival to hospital admission in ROSC patients earlier found by EMS personnel in sitting position was lower than those found in lying position 50% *vs* 75.5% p=0.036.

The stepwise regression analysis revealed that the sitting position was related to symptoms before cardiac arrest OR 4.9 95% CI 1.9-12.3 p=0.001 and bystander CPR (chest compressions or/and AED) OR 0.05 95% CI 0.02-0.17 p < 0.001; and PM/ICD presence 0R 3.9 95% CI 1.3-11.7 p=0.014.

The stepwise regression analysis revealed that ROSC was related to bystander CPR (chest compressions or/and AED OR 1.8 95% CI 1.2-2.5 p=0.025; defibrillation, OR 2.37 95% CI 1.67-3.37 p<0.001.

The stepwise regression analysis revealed that survival to hospital admission was related to bystander CPR (chest compressions or/and AED) OR 2.10 95% CI 1.13-3.90 p=p=0.019; defibrillation OR 2.93 95% CI 1.61-5.31 p<0.001.

The stepwise regression analysis revealed that defibrillation is related to male gender OR 2.0 95%CI 1.4-2.9 p < 0.001, bystander CPR (chest compressions or/and AED) OR 1.7 95% CI 1.2-2.4 p=0.005; sitting position OR 2.3 95% CI 1.1-4.6 p-0.023, previous myocardial infarction OR 1.7 95% CI 1.0005-2.93 p=0.048 and PM/ICD presence OR 0.37 95% CI 0.15-0.94 p=0.036 and dyspnoea prior to collapse OR 0.59 95% CI 0.37-0.96 p=0.036.

Discussion

The main finding of the study is that 6.5% patients with out of hospital cardiac arrest are found in the sitting position by arriving Emergency Medical Services. The sitting position occurs in 15% of patients with traumatic cardiac arrest. The reason for maintaining the sitting position in trauma may relate to seat belt fastening in a vehicle or limited space around a victim that does not permit adoption of a lower position or fall. However the patients with traumatic cardiac arrest found in sitting position constitute only a small percentage of patients in sitting position.

Reports regarding body position at EMS arrival at the arrested patient in the literature are scarce and this was not the main consideration of the available publications. The victim's body position at EMS arrival was not included in the Utstein style reporting of cardiac arrest, therefore, the data were not systematically collected. However, some information is available from papers regarding occurrence of cardiac arrest in toilets or circumstances of OHCA recorded on video.

Kiyohara et al. reported that 4.6% of OHCA in Japan occurred in the toilet. The outcome of these events was poor mainly because of delayed recognition. Hayashi et al compared the percentage of cardiac arrests preceded by a given daily life activity with the estimated percentage of time spent performing it. Three kinds of activities were related to higher than expected incidence of OHCA: Using a bath which may be a special consideration in Japan due to the practice of very hot baths and their relationship to Vaso Vagal Syncope (VVS), using a toilet, walking or cycling, and during sport or heavy work. Abe et al reported an increased incidence of OHCA due to drowning during bathing at home in Japan, particularly in the elderly. They presumed syncope due to the hot environment as the cause of drowning.

Victims found in the sitting position were significantly older than those found lying and tended to be more frequently female. These differences in demographics suggest that the relation of the sitting position in cardiac arrest may not be merely random but also causative. Furthermore, premonitory symptoms such as weakness or chest pain were more frequent in the sitting group. The orthostatic posture of the victim may indicate the possibility that cardiac arrest was provoked by central hypovolaemia due to orthostasis or reflex mechanisms. However, a sitting position in cardiac arrest may be due to limited space, immobilization by something preventing falling or low centre of gravity regardless of the cause of the cardiac arrest. In contrast, some patients, who faint, may fall and regain consciousness but have profound post-syncopal bradycardia and hypotension progressing to cardiac arrest in a lying position. Thus, multiple factors play a part in the final position adopted by the victim of cardiac arrest.

In the group of those found in a sitting position only a small percentage receive bystander CPR. ROSC was obtained by similar percentage of victims in both groups by EMS personnel but survival to hospital admission was less frequent in this group. In fact, performance of CPR in a sitting position is difficult and inefficient. CPR has been successful during neurosurgery only when the patient was placed in the lying position. Infrequent bystander CPR in the sitting group and similar frequency of ROSC suggest the possibility that there is another factor at play other than bystander CPR which increases ROSC frequency.

Similar ROSC frequency in the sitting and lying groups did not lead to the same survival to hospital admission which was lower in the sitting group. The similar ROSC frequency in sitting patients with cardiac arrest, compared with those found lying, despite adverse impact factors of older age and less frequent CPR, suggests existence of other factors which may favourably influence their prognosis. These could include the pathogenesis of their cardiac arrest.

The survival to hospital admission was related only to defibrillation during CPR and bystander CPR. Prompted examination of factors related to defibrillation. Surprisingly, in multivariate analysis the sitting position was such a factor. Defibrillation during CPR means that the myocardial cells are in better condition than presentation in asystole or electromechanical dissociation. Defibrillation during CPR is associated with better prognosis regardless of whether VF / PVT was the first rhythm found or occurred as a result of conversion from another rhythm during CPR.The sitting position of victims may be an example of resuscitation in the head-up position which was initially considered to improve chances of ROSC. However, recent findings have not confirmed this although some elevation of the head in the lying position is believed to reduce cerebral oedema. ROSC depends mainly on blood supply to the heart. This supply could be higher where blood supply to brain is gravitationally reduced by a partial or complete upright position. However, ultimate survival depends on brain blood supply yielding better brain preservation, which is threatened by the sitting position.

A study assessing the usefulness of specific situational information such as the patient's posture in cardiac arrest did not help its recognition. In cases of cardiac arrest in the sitting position, possibly imposed by the immediate surroundings, effective chest compressions require the patient be lowered to supine. The results of this study indicate the necessity to include advice into dispatcher education to encourage bystanders to change the victim's position to supine even before EMS personnel arrive. In recording of events by EMS personnel, the victim’s position when first found will prove helpful and if the victim has remained in the sitting position the advice should be to lower the patient to supine as quickly as possible.

The resuscitation protocols provide basis for looking for factors related to CPR outcomes. Including body position into such protocols may improve resuscitation efforts outcomes.

Conclusions

Sitting position of the out of hospital cardiac arrest victim at Emergency Medical Services arrival is recorded in 6.5% of patients in whom resuscitation attempts were undertaken.

Victims of cardiac arrest found in the sitting position at Emergency Medical Services arrival are older, more often female and have comorbidities than those found in the lying position pointing to the need to seek the underlying mechanisms of cardiac arrest.

Victims in the sitting position at Emergency Medical Services arrival have received bystander CPR significantly less frequently, however, the sitting position in multivariate analysis increases the chance of defibrillation.

Patients in the sitting position at Emergency Medical Services arrival have similar chances for ROSC to those found lying but of those sitting position patients who have ROSC there are slightly lower chances of survival to hospital admission.

There is a case to be considered that out of hospital cardiac arrest presenting in the sitting position may reflect a different aetiology from that in the lying position.

Contribution Statements

All authors confirm they have had full access to data and contributed to the drafting of the paper. KN and DZ designed and coordinated the study. All authors analyzed the data. All authors edited and approved the final version of the manuscript.

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