Unrecognized Out of Hospital Cardiac Arrest Symptoms during Thailand's Emergency Medical Services

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Abstract

BACKGROUND: To improve survival rate, the main focus of adult cardiac arrest management includes rapid recognition, prompt administration of cardiopulmonary resuscitation (CPR), defibrillation for shockable rhythms, post-return of spontaneous circulation care, and identification and treatment of underlying causes. This study aimed to identify the determinants of unrecognized cardiac arrest and to study the recognition rate of out-of-hospital cardiac arrest (OHCA) by emergency medical services (EMS) call handlers.

METHODS: We included all OHCA patients who were transferred to hospital via EMS of Srinagarind hospital, Khon Kaen, Thailand, from January 01, 2020, to December 31, 2020. The primary outcome was to identify symptoms that lead to an unrecognized cardiac arrest by the EMS call handlers. Secondary outcomes were to identify the recognition rate of OHCA by EMS call handlers, and assess the outcome of CPR.

RESULTS: There were a total of 58 patients in the present study, 26 patients (44.8%) and 32 patients (55.2%) belonged to the unrecognized and recognized cardiac arrest groups, respectively. The most common symptoms that led to unrecognized cardiac arrest were a state of unconsciousness (46.2%), major trauma (15.4%), and seizure-like activity (11.5%). The rate of survival to hospital discharge was higher in the recognized cardiac arrest group (6.3% vs. 0%).

CONCLUSIONS: Falling unconscious is the most common symptom of unrecognized OHCA cases seen by EMS in Thailand. Basic life support, especially an immediate assessment of a patient's respiratory status should be taught in health programs in school or through public service channels.

Introduction

Survival and recovery from adult cardiac arrest depend on the coordinating efforts of a complex system to secure the best outcome for the victim. The main focus in adult cardiac arrest events includes rapid recognition, prompt administration of cardiopulmonary resuscitation (CPR), defibrillation of malignant shockable rhythms, post-return of spontaneous circulation (ROSC) supportive care, and the identification and treatment of underlying causes [1]. Typical survival rates were around 8.8%, which was relatively higher among patients who received bystander CPR [2]. Therefore, fast and accurate recognition of out-of-hospital cardiac arrest (OHCA) by the Emergency Medical Services (EMS) call handlers is essential.

EMS call handlers to have three roles in OHCA: (1) Recognition; (2) facilitation of rapid EMS attendance; and (3) provision of bystander resuscitation instructions including identification of public access defibrillators [3]. In Thailand, the EMS's task is guided by criteria-based dispatch algorithms. However, using these algorithms properly in large part depends on the call handler's skill of interpreting the caller's description of symptoms which has often proven to have been a challenging task [4].

A systematic review of call handler-caller interaction suggested that the most sensitive and specific combination of reported symptoms of OHCA were unconsciousness together with absent or abnormal breathing [5]. However, it is often difficult to obtain an accurate description of the patient's condition and because of these challenges, call handlers' recognition of OHCA ranged from 14.1% to 96.9% among studies [6]. These factors can give rise to delayed response, poor rates of bystander resuscitation instructions, and led to reduced survival rates. A recent study has shown that factors such as a reduced or fluctuating level of consciousness, abnormal pulse/heart rate, and patients being female were associated with a lack of recognition of OHCA by call handlers [3].

Survival to hospital discharge from OHCA in Thailand was about 10% [7], [8], while survival

rates in some other countries were reported as up to 25% [9]. A study in Northern Ireland demonstrated that a contributing factor to low survival rates was poor call handler sensitivity for the identification of OHCA [10]. There are still limited studies about the determinants of unrecognized cardiac arrest, and the recognition rate of OHCA in the Thai population. This study aimed to identify the commonly missed symptoms of those whose cardiac arrest went unrecognized.

Methods

Study design and population

This study was conducted in the EMS department of Srinagarind hospital, a 1000-bed tertiary care university hospital located in northeast Thailand, from January 01, 2020, to December 31, 2020.

All OHCA patients who were transferred to Srinagarind hospital via EMS from January 01, 2020, to December 31, 2020, were included in the study. Those who had no dispatched data available were excluded from the study.

This study was conducted in accordance with the principles of the Declaration of Helsinki and Good Clinical Practice guidelines. The Khon Kaen University Ethics Committee for Human Research approved the study and waived the requirement for written individual informed consent (HE641287).

Outcome and statistical analysis

The primary outcome was to identify symptoms that lead to recognition failure of cardiac arrest by the EMS call handlers. Secondary outcomes were to identify the recognition rate of OHCA by EMS call handlers and the outcome of CPR on OHCA patients in the Northeast of Thailand.

The patient's baseline characteristics and clinical measurements were reported as mean±standard deviation (SD) for continuous variables with a normal distribution. Median and minimum - maximum were used to describe continuous variables with non-normal distribution. Number and percentage were used for categorical variables. For comparison between the recognized and unrecognized groups, an independent sample t-test and Mann-Whitney U test were used for continuous variables and Pearson's chi-square or Fisher's exact test for proportions for categorical variables. All statistical analyses were performed using IBM SPSS statistics for Windows, version 27.0 (SPSS Inc).

Results

We enrolled a total of 58 patients in this study, the total number of patients with unrecognized cardiac arrest was 26 patients (44.8%), and those with recognized cardiac arrest was 32 patients (55.2%). Baseline characteristics of patients with unrecognized cardiac arrest differed from those with recognized cardiac arrest in multiple respects, including older age (60 years vs. 50 years, p = 0.019) and fewer bystanders performing CPR prior to the ALS team arrival (38.5% vs. 87.5%, p < 0.001). For the outcome of administered CPR, we found that the rate of ROSC was higher in the unrecognized cardiac arrest group (34.6% vs. 15.6%) but none of them survived until hospital discharge. In contrast, even though the rate of ROSC was lower in the recognized cardiac arrest group, some of them survived until hospital discharge (6.3%) (Table 1).

Table 1: Baseline characteristics of OHCA patients

Clinical Characteristics	Unrecognized cardiac arrest (n = 26)	Recognized cardiac arrest (n = 32)	p-value
Age (yr) (mean ± SD)	60.19 ± 13.68	50.38 ± 16.64	0.019
Male, n (%)	21 (80.8)	24 (75.0)	0.754
Shift, n (%)			0.755
Morning	12 (46.2)	12 (37.5)	
Afternoon	9 (34.6)	14 (43.8)	
Night	5 (19.2)	6 (18.8)	
Median response time (min-max)	9.5 min (6.0–25.0)	9.0 min (4.0–29.0)	0.672
Median scene time (min-max)	5.0 min (2.0–22.0)	5.0 min (2.0–18.0)	0.956
Initial rhythm, n (%)			0.209
Asystole/PEA	25 (96.2)	27 (84.4)	
VT/VF	1 (3.8)	5 (15.6)	
AED, n (%)	0 (0)	0 (0)	NA
Bystander performing CPR before ALS team arrival*, n (%)	10 (38.5)	28 (87.5)	<0.001
ROSC, n (%)	9 (34.6)	5 (15.6)	0.126
Survival to discharge, n (%)	0 (0)	2 (6.3)	0.497

yr: Year; SD: Standard deviation; min-max: Minimum – maximum; PEA: Pulseless electrical activity; VT: Ventricular tachycardia; VF: Ventricular fibrillation; AED: Automated external defibrillator; CPR: Cardiopulmonary resuscitation; ALS: Advanced life support; ROSC: Return of spontaneous circulation. *Bystander CPR before ALS team arrival could be a layperson or basic life support team.

The most common reported symptoms of the unrecognized cardiac arrest were unconsciousness (46.2%), followed by the experience of major trauma (15.4%) and seizure-like activity (11.5%) subsequently. The symptoms that the call handler never missed cardiac arrest were drowning, unconscious with no breathing, and electrical shock (Table 2).

Table 2: Dispatched symptoms

Symptoms	Unrecognized cardiac arrest n = 26 (%)	Recognized cardiac arrest n = 32 (%)
Unconscious	12 (46.2)	18 (56.3)
Major trauma	4 (15.4)	6 (18.8)
Seizure-like activity	3 (11.5)	0 (0)
Reduced consciousness	2 (7.7)	1 (3.1)
Falling	1 (3.8)	0 (0)
Malaise/fatigue	1 (3.8)	0 (0)
Noisy breathing	1 (3.8)	0 (0)
Gun shot	1 (3.8)	0 (0)
Hanging	1 (3.8)	1 (3.1)
Drowning	0 (0)	2 (6.3)
Unconscious with no breathing	0 (0)	2 (6.3)
Electrical shock	0 (0)	2 (6.3)

Discussion

In the present study, we found that the recognition rate of cardiac arrest by call handlers was

55.2%, which was in the range of the recent international systematic review (14.1–96.9%) and similar to the recent Korean study (45.8%) [6], [11]. However, this recognition rate is relatively low compared to the median recognition rate of cardiac arrest from the international systematic review (73.9%) [6]. This may reflect the lack of knowledge about basic life support in the Thai laymen population. We also found that a significant factor which affected the recognition of cardiac arrest was the patient's age, the older patients tended to have unrecognized cardiac arrest. Our finding was similar to Viereck *et al*. [6]. The possible explanation of the finding could be the sedentary lifestyle of the elderly or the fact that some of them were bedridden patients, which caused the caretaker to let the abnormality go unnoticed.

The most common symptom of unrecognized cardiac arrest was unconsciousness, which was the same as the study of Crabb *et al*. [12]. Unconsciousness was also the most reported symptom of cardiac arrest in our study as in the study of Watkins *et al*. and a recent American Heart Association adult basic and advanced life support guideline [1], [3]. By adding a recognition of breathing patterns such as absent or agonal or abnormal breathing, we may achieve a higher recognition rate of cardiac arrest. In the study of Watkins *et al*. determining breathing pattern can lead to an increase of 7 points of recognized cardiac arrest if the call handler was strict on the protocol [3]. The main obstacle of recognizing OHCA was the difficulty of determining the patient's respiratory status for bystanders [12]. Another important reported symptom of cardiac arrest in our study was seizure-like activity, which may mislead the call handler from recognizing cardiac arrest to epilepsy as in the study of Vaillancourt *et al*. [5], [13].

Third, we found a very low survival to hospital discharge rate (6.3%) in the recognized cardiac arrest group (overall survival to hospital discharge rate was 3.4%). Compared with the OHCA survival to hospital discharge rate of 10.6% in the same hospital in the previous 5 years [7]. This might be a result of the method of our data collection. In Thailand, especially in the Northeast region of Thailand, people believe that if someone will die soon, their relatives should bring them home, to die at home. So, we defined the people whose relatives brought the patient to die at home as a non-survivor, where the previous study may have defined those cases as survivor. The other possible reason for the lower survival rate might be the increased popularity of palliative care in Thailand that lets the patients looking at poor outcomes die peacefully instead of suffering. When compared to the recent global survival to hospital discharge rate of 8.8% [2], our study has also shown a very low survival to discharge rate. The main reasons are the lower rate of bystander CPR administered and the fact that there was no AED used in this study which were both key elements of survival of the American Heart Association adult basic and advanced life support guidelines [1].

To the best of our knowledge, this is the first study in Thailand to identify the recognition rate of cardiac arrest by EMS call handlers. Our study also reported the common symptoms of unrecognized OHCA in Thailand. However, there are some potential limitations to this study. First, due to the retrospective nature of the data collection, some data was missing. Second, this study is a single-center study that may not represent the entire country.

Conclusions

Unconsciousness is the most common symptom of unrecognized OHCA by the EMS in Thailand. Basic life support, especially the immediate identification of the patient's respiratory status should be considered a fundamental part of health education, taught in schools or public services to the Thai population.

Acknowledgements

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