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Original Article

A Study of the Outcomes and Effective Factors on Cardiopulmonary Resuscitation in an Educational Hospital

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Abstract

Background and aims: Cardiopulmonary resuscitation (CPR) success rate is an important issue for all healthcare facilities. In the present study, success rate and related factors were assessed in a hospital in Iran.

Methods: This descriptive-correlational study was conducted in 2017. By using the convenience sampling, 156 patients were selected. Variables based on the In-Hospital Utstein-Style were used, which included 3 categories: patients, cardiac arrest and follow-up. Data were analyzed by SPSS 22.

Results: Of 156 participants, 92 were male and the average age was 61.4±5.5 years. Most cardiac arrest occurred in night shift (43.6%). The most common cause of cardiac arrest was cancer (33%). Of 156 patients, 102 died. Results showed a significant correlation between success rate, a patient's sex, rhythm type and medication administered during resuscitation ($P<0.001$).

Conclusion: Success rate in our study was low in comparison to previous studies. Further attention should be paid to this issue.

Keywords: Cardiopulmonary resuscitation, success rate, Utstein-Style, developing countries

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Introduction

Although the first cardiopulmonary resuscitation (CPR) was conducted nearly forty years ago, the survival rate is still not ideal. The statistics in different countries are various. The outcomes of cardiac arrest and CPR depend on the rapid and correct interventions of the medical team, especially rapid defibrillation (electric shock) and effective cardiac massage.[1] According to the records of National Center for CPR in the United States, there are 209 000 in-hospital cases of cardiac arrest and 326 200 out-of-hospital cases per year in the country.[2] The outcomes of CPR are classified as successful and unsuccessful. Unsuccessful CPR outcome refers to the patient's death in less than 20 minutes after the onset of CPR. Successful CPR is divided into short- and long-term survivals. Short-term survival refers to the return of spontaneous circulation (ROSC) within the first 20 minutes after the onset of CPR up to 24 hours, and long-term survival refers to ROSC from 24 hours after the onset of CPR to the time of the patient's discharge.[3]

Different sources have studied the prediction of CPR outcomes by various factors. These factors are various in different researches, with varying degrees of severity and weakness. Many of these factors are affected by the environment in which the CPR is carried out. The manpower, facilities and equipment needed to perform CPR, and even the type of building where CPR is carried out can affect the results. The difference in the type of cardiac arrest, available CPR equipment and its implementation by the CPR team, age, the time of defibrillation, the cause of cardiac arrest, initial rhythm, the time of initial life support, the type of department, and the time of cardiac arrest have also been investigated for their potential impacts on the CPR outcomes.[2,4-9]

Although CPR outcome has drawn much attention of the researchers in recent years, most studies have examined out-of-hospital CPR, and less attention has been paid to in-hospital CPR outcomes. The results of previous studies regarding the factors affecting CPR outcomes are various. Therefore, the present study was conducted to examine the success rate of CPR and the factors affecting it.

Materials and Methods

This descriptive-analytical study was conducted to investigate factors related to the success rate of CPR

according to the Utstein-Style in patients with in-hospital cardiac arrest in Velayat educational hospital of Qazvin, Iran. The study population consisted of all patients who suffered from in-hospital cardiac arrest and underwent CPR in the hospital under study. Using the following formula and according to the study of Salari et al, as well as taking into account the CPR success rate of 28.4%, confidence level of 0.95, and accuracy of 0.77, 156 patients were recruited.[9] The tool used in this study was the standard CPR case report form of the Utstein-Style. The information collected by this form is divided into three sections:

1) Patient-related factors, such as age, sex, cause of cardiac arrest, heart rhythm;
2) Incidence-related factors such as work shifts, CPR location (department);
3) Factors related to the time of the performed actions (the time of ROSC including three times: shorter than 20 minutes, 20 minutes-24 hours, 24 hours after CPR until discharge; time of cardiac arrest, time of CPR team arrival, time of CPR onset, time of the first shock, time of intubation, CPR duration, and ultimate outcomes of CPR including short-term survival (within the first 20 minutes), survival between 20 minutes and 24 hours, and long-term survival (24 hours after CPR until discharge).

The outcomes of CPR are classified as successful and unsuccessful. Unsuccessful CPR outcome refers to the patient's death in less than 20 minutes after the onset of CPR. Successful CPR is divided into short- and long-term survivals. Short-term survival refers to ROSC within the first 20 minutes after the onset of CPR up to 24 hours, and long-term survival is survival 24 hours after CPR until discharge (3). The success rate of CPR was measured according to ROSC in the three above-mentioned periods. Patients' brain function at the time of discharge was determined by the Glasgow Coma Scale (GCS) and divided into five levels of severity (good, moderate, severe, coma, and brain death).[9]

In order to collect data, the researcher received a written letter of introduction for sampling from the university and the approval of the ethics committee of the university for the study protocol. The researcher then attended the research setting and collected data using the Utstein-Style. Upon announcing the CPR code by the hospital pager, the researcher visited the patient and recorded the patient's initial heart rhythm, the cause of cardiac arrest, the time of CPR team arrival, the time of CPR onset, the time of the first shock, the time of CPR termination, and the reason for CPR termination announced by the responsible physician and CPR team leader. The researcher was present in the hospital during the sampling period. When the researcher was not at the hospital, two of the resident supervisors in the hospital assisted with the sampling and the questionnaire was carefully completed. Patients' demographic information was recorded from their files. The information was collected at three times (from the onset of CPR to 20 minutes after it, at the end of the first 24 hours after CPR, and at discharge). For patients with ROSC, the duration of ROSC, and their conditions were recorded and followed up for 20 minutes and 24 hours after CPR and at discharge. The brain function was evaluated at different intervals by using the items in the post-CPR checklist according to GCS.

In order to observe confidentiality, all collected information was anonymous. The study objectives were also explained for the first-degree relatives of the patients to whom consent letters were provided to be able to participate in the study.

Results

Among the 156 participants in this study, 92 (59%) individuals were male and 64 (41%) were female. The mean age of our participants was 65.38±17.22 (range: 18-96) years. The highest incidence of cardiac arrest was observed during the night shifts (43.6%) and the lowest during the morning shifts (26.9%). The highest incidence of cardiac arrest was reported from the internal department (34.2%) and the lowest from the nephrology department (1.9%). The most common cause of cardiac arrest was cancer (37.8%) and the least common cause heart attack (0.06) followed by poisoning (0.6%) (Table 1).

The measures taken were chest compression for 153 patients (98.1%), opening the airway for 143 patients (96%), and artificial ventilation for 103 patients (75.2%). The most frequent measure was chest compression. The highest observed rhythm was due to asystole (76.9%) and the lowest observed rhythm due to ventricular tachycardia without a pulse (0.6) (Table 2).

Successful CPR in 16 patients (10.3%) lasted less than 20 minutes, in 28 patients (17.9%) lasted between 20 minutes to 24 hours, and in 10 patients (6.6%) lasted over 24 hours. In the majority of cases (102, 65.4%), CPR

Table 1. Frequency Distribution According to the Cause of Cardiac Arrest

Possible Cause of Cardiac Arrest	Number	Percent
Dangerous arrhythmia	5	3.2
Reduced blood pressure	7	4.5
Heart failure	21	13.5
Metabolic disorders	24	15.4
Trauma	3	1.9
Heart attack	1	0.6
Poisoning	1	0.6
Cancer	59	37.8
Unknown	35	22.4
Total	156	100

Table 2. Frequency Distribution According to the Initial Rhythm of Patient

Initial Rhythm of Patient	Number	Percent
Ventricular fibrillation	4	2.6
Ventricular tachycardia without a pulse	1	0.6
Asystole	120	76.9
PEA	2	1.3
Bradycardia	17	10.9
Rhythm with a pulse	12	7.7
Total	156	100

Abbreviation: PEA, Pulseless electrical activity.

was unsuccessful and the patient died. The percentage of mortality was higher in men (70.7%) than in women (57.8%). The success rates of CPR after 24 hours in women and men were 0.0 and 10.9%, respectively. The chi-square test showed a significant relationship between the CPR success rate and gender (P=0.001). The highest rate of death was reported during the morning shifts (69%) and the greatest CPR success rate was after 20 minutes until discharge during the night shifts (38.2%). The chi-square test showed no statistically significant relationship between the CPR success rate and the shift of cardiac arrest (P = 0.448). Death rates during CPR in patients with and without chest compression were 66% and 33.3%, respectively. The chi-square test showed no statistically significant relationship between the CPR success rate and chest compression (P = 0.448). Death rates during CPR in patients with and without artificial ventilation were 68.9% and 52.9%, respectively. The chi-square test showed no statistically significant relationship between the CPR success rate and artificial ventilation (P = 0.063). Death during CPR in patients with and without medication injection was 67.3% and 0%, respectively. The chi-squared test showed a statistically significant relationship between the CPR success rate and medication injection during advanced CPR interventions (P = 0.063).

Discussion

CPR is the most important action of the treatment team to save the lives of patients suffering from cardiac arrest. A variety of events may lead to cardiac arrest (sudden stop of spontaneous cardiac output) and subsequent respiratory arrest. Cardiac arrest is a critical, acute and important emergency situation that can occur in or outside of the hospital. In fact, cardiac arrest is one of the major factors that increase mortality and morbidity throughout the world. The present study was conducted to evaluate the success rate of CPR and the factors affecting it. Based on the results obtained in our study, the CPR success rate was obtained approximately 35%.

The results of this study showed that the success rate at the time of CPR was about 35%. Evidence on the CPR outcomes in Iran is scarce. In a study, Keivanpazhoh et al examined the CPR outcomes in a hospital in Urmia, Iran. As with the present study, they also used the Utstein-Style to investigate CPR outcomes. They studied the outcomes of 70 CPR cases. The results of the study of Keyvanpajooh et al were similar in many aspects to those of the present study, except for the survival rate which was 13% in that study, much less than the results of the present study.[4] A study conducted between 2011 and 2013 examined the CPR outcomes in patients referring to the emergency department of one of the hospitals in Sari. In that study, the survival rate after CPR was a little lower than that obtained in the present study.[10] In another study in Tabriz, Ojaghi Haghighi et al examined the CPR outcomes in 354 patients referring to 2 hospitals. They used a different style to investigate the CPR outcomes.[11] The success rate of CPR in the study of Ojaghi Haghighi et al was 21%, which is slightly less than that of the present study. Differences between the results of various studies are somewhat expectable because improvements have been made in the training of the personnels involved in CPR procedures in recent years, as well as significant developments having occurred in the implemented technologies, which have improved the CPR process and, as a result, led to better CPR outcomes. There has been also a remarkable development in CPR teams in each hospital, which has also improved the CPR process and thus CPR outcomes.

CPR is a vital procedure for the lives of patients whose cardiopulmonary system has stopped for some reason. Having enough information on the CPR outcomes and the factors affecting them can help managers and planners better allocate resources and implement plans. Considering the results of our study and different results in most of the previous studies, it appears that the CPR outcomes in many cases depend on the facilities and personnels of the hospital, which indicates the need for several studies specific for each city and each hospital. Therefore, it is recommended that this issue be taken into account in the relevant planning processes.

Conclusion

Based on the results of this study, nearly 35% of the subjects survived after CPR. Factors such as sex, received medication, available initial respiration and pulse, and the initial rhythm of the patient are effective on CPR outcomes. The results of this study can be used by relevant planners to improve the existing conditions. It is recommended that further studies be conducted at the inter-hospital and inter-regional studies in order to compare the results. It is also recommended to examine the impact of effective interventions, such as improvement of CPR teams training on the CPR outcomes.

Ethical Approval

The Research Council and the Ethics Committee

affiliated with Qazvin University of Medical Sciences approved the research study proposal(No. IR.QUMS. REC.1395.290). The participants were all informed about the purpose of the study and were assured that their names would remain anonymous. Lastly, individuals who participated in this study signed a written consent form.

Conflict of Interest Disclosures

None.

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