



Investigating the Success Rate of Cardiopulmonary Resuscitation, Survival Rate in Patients, and their Related Factors

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Abstract

Background: Cardiopulmonary resuscitation (CPR) procedure consists of measures taken to restore the acts of the heart and the brain in a person who has lost their own consciousness. Thus, the purpose of the present study was to investigate the success rate of Cardiopulmonary Resuscitation, survival rate in patients, and their related factors in order to assist in improving effective conditions and measures within hospitals to increase the success rate of CPR.

Methods: This cross-sectional analytic study was conducted in 2016. To this end, a total number of 199 patients affected with cardiopulmonary arrest and undergoing the CPR procedure in the emergency wards and other hospitals units in Iran were recruited using a convenience sampling method. Then, patient information was collected through a researcher-designed checklist as well as a review of clinical records. The data were also analyzed via the SPSS.16 software. Data analysis was similarly performed using descriptive statistics and Chi-square and t-test.

Results: The mean age of patients was 44 years. The result of 36.7% of CPR procedures conducted was reported successful, however, only 4% of patients finally survived. In general, the findings revealed that factors such as age, gender, hospital, history of prior diseases, checked initial rhythm, work shift, time of work shift change, pre-resuscitation intubation status, and underlying cause of cardiopulmonary arrest had no effects on the success rate of CPR procedure. However, location of the occurrence of cardiopulmonary arrest ($P = 0.03$) and specialty of physicians in charge of resuscitation teams ($P = 0.01$) were among the factors affecting the success rate of CPR procedure. Furthermore, checked initial cardiac rhythm ($P < 0.0001$) and a history of prior heart diseases ($P = 0.05$) in patients had impacts on their survival rate.

Conclusions: Given the simplicity and teachability of the principles of basic life support (BLS), health status, and survival rate in patients can be easily and significantly promoted through the public education of the initial resuscitation measures. Moreover, according to the investigations made in this respect, post-resuscitation measures can dramatically affect the survival rate of individuals. Therefore, it is suggested to investigate post-resuscitation measures in other studies of prospective type in order to propose strategies to improve the survival rate of patients.

Keywords: Cardiopulmonary Resuscitation, Heart Arrest, Success Rate, Survival Rate

1. Background

The cardiopulmonary arrest, which might occur unexpectedly at any time or any place is taken into account as one of the most common factors leading to death (1, 2). It is also considered as one of the most important medical emergencies, which can arise in various situations from unexpected events out of hospitals to the foreseeable ones in intensive care units (3). In the cardiopulmonary resuscitation (CPR) procedure, there are efforts to restore 2 vital organs of the body (the heart and the lung) through resuscitation in order to assist in possible patient survival. The CPR in the past was performed in the form of blow-

ing air through the mouth, giving chest compression, and sometimes inducing physically painful stimuli. Over time and thanks to scientific advances and developments, major changes were made in the methods and medications used as well as the skills of the medical teams. Nowadays, the resuscitation procedure is practiced through advanced medications and devices in 2 phases, i.e. primary basic measures for survival and advanced cardiac life support (4, 5). It should also be noted that cardiopulmonary arrest is recognized as the cause of half of death rates (1). Overall, 50% of mortality happens suddenly and only 25% of patients undergo CPR procedures (6). Thus, the number

of successful CPR procedures is considered as one of the most significant indicators for emergency wards in hospitals; therefore, the higher rates in this respect reflect the success rate of such departments (3). It should also be noted that numerous cases of cardiopulmonary arrests are returnable through fast and accurate CPR (7). Likewise, a patient's return to life by 100% is the ideal result for a CPR procedure (3). In developed countries, the survival rates of in-hospital cardiac arrests and those occurring out of this context are lower than 30% and 10%, respectively (8). Every year, 310,000 deaths arising from heart diseases also takes place in emergency wards in the United States, of which 166200 cases i.e. 53.6% of them come from cardiac arrests (9). Therefore, this issue led to the growth of out-of-hospital cardiac care in 1960 and its expansion up until now (10). As well, the survival rate for out-of-hospital cardiac arrests varies from 2% to 26% (6). In this regard; the investigation into the factors affecting the success or failure of CPR medically, economically, and morally is of utmost importance; thus, identifying the given factors can lead to adopting appropriate scientific strategies to reduce barriers to a successful CPR. It is hoped that the present study could provide effective conditions and measures in hospitals to improve the success rate of CPR and to assist in reducing the factors that cause failures in such a procedure.

2. Methods

In this cross-sectional analytic study conducted from September 2016 to February 2017, a total number of 199 individuals were recruited retrospectively. Given the results of previous studies (1-4, 11-13), it was expected that hospital-related factors were among ones influencing the success rate of CPR. On the other hand, it was assumed that the given factors were different in various hospitals; therefore, the study was conducted using a convenience sampling method with proportional allocation of sample size and adopting a multi-center process to enhance its accuracy.

The target population included patients undergoing the CPR procedure due to cardiopulmonary arrest. The study sample was also comprised of all patients who had received CPR in Ali Ebne Abi Talib (AS) hospital and Khatam al-Anbia (PBUH) hospital in the city of Zahedan following cardiopulmonary arrests. In this respect, patients with no full cardiopulmonary arrests were excluded from this study. The success rate of CPR and the patient's final status were considered based on the return of the heart, breathing in an individual, and their discharge from the hospital, respectively.

Besides, the data collection instrument was a researcher-made checklist that contains patients' baseline characteristics (age, sex, checked initial rhythm,

history of prior diseases, and underlying cause of cardiovascular arrest) and hospital-related factors (work shift, pre-resuscitation intubation status, location of occurrence of cardiopulmonary arrest, specialty of physicians in charge of CPR teams and duration of CPR).

After the approval of the proposal, the permission of entrance to the units and access to patients' information was obtained from Zahedan University of Medical Sciences. To this end, the name of patients was first obtained from the report forms of Ministry of Health and Medical Education available for the CPR procedure in the emergency wards, then, the full patient information was extracted based on their clinical records. Provided that the CPR procedure was successful, the ultimate status of patients was also monitored.

Data were analyzed using the SPSS software for windows version 21. The quantitative data were described by mean \pm standard deviation and qualitative variables were presented using frequency and percentage.

The chi-square test was employed to compare the qualitative variables of the study. Moreover, the normality of the data was examined by Kolmogorov-Smirnov test and consequently, t-test was used to examine the relationship between the quantitative variable and other variables of the study. The 0.05 significance level was also considered in this study.

3. Results

The total number of patients recruited in this study was equal to 199 individuals with a mean age of 43.6 ± 25.5 years. The age range of patients was also from 1 month to 91 years old. Most cases of cardiopulmonary arrests had occurred between the age range of 16 to 30 years and then between 46 and 60 years. Of the patients, 99 individuals were women and 100 of them were men. In addition, 54.3% of patients had received CPR during this period in Ali ebne Abi Talib (AS) hospital and Khatam al-Anbia (PBUH) hospital as a trauma center.

Cardiopulmonary arrest among 57.3% of patients had occurred in hospital departments (except ICU). In this respect, 24.6% and 16.1% of such arrests had happened in emergency wards and out of hospitals, respectively. It should be noted that 81% and 63% of people affected with cardiopulmonary arrests respectively out of hospitals or in other hospital departments had unsuccessful CPR procedures. According to the Chi-square test results, the location of the occurrence of cardiopulmonary arrests was among the factors affecting the results of CPR ($P = 0.036$). Besides, 74% of individuals suffering from cardiopulmonary arrests in the present study had a history of prior diseases; however, it was not significantly correlated with the CPR re-

sults. The checked initial rhythm in patients at the beginning of the CPR procedure was Asystole and VF in 88% and 70.3% cases, respectively. Such a rhythm in other cases was VT and PEA. In this respect, people with Asystole and PEA rhythms had the lowest chances of successful CPR procedure. The most cases of the CPR procedures had also occurred in the morning, night, and evening work shift with frequency values of 41.1%, 31.5%, and 27.4%; respectively. The highest rate of successful cases of CPR was reported for the morning work shifts (42%). Furthermore, 19% of cases of CPR procedures had taken place at the time of work shift changes; however, no statistically significant relationship was found between work shifts, CPR procedures while changing work shifts, and the CPR results. As well, 31.1% of the individuals studied had been intubated prior to undergoing initial resuscitation. Besides, 75% of individuals with unsuccessful CPR had a history of prior diseases. In 25.9% of cases of CPR, an anesthesiologist in charge of the CPR team was present; however, in the rest of the cases, the physicians were specialized in internal medicine, pediatrics, cardiology, emergency medicine, etc. Given the results, the specialty of physicians in charge of the CPR team was significantly correlated with the result of the CPR ($P = 0.009$). The causes of cardiopulmonary arrests included 7 categories of respiratory problems, trauma, cardiovascular disorders, internal causes, sepsis, and CVA. The 7th group also consisted of people whose cardiopulmonary arrest was categorized in 2 or more of such categories. Most cases of cardiopulmonary arrests were due to internal diseases (24.7%) and cardiovascular ones (22.1%).

Moreover, the highest rates of unsuccessful CPR had occurred due to cardiovascular diseases and internal ones, respectively.

In general; factors such as age, gender, hospital, history of prior diseases, checked initial rhythm, work shift, time of work shift change, pre-resuscitation intubation status, and the underlying cause of cardiovascular arrest had no effects on the success rate of CPR (Table 1).

In the present study, the results of 36.7% of CPR procedures were reported successful, of which only 4% of individuals receiving CPR finally survived.

Moreover, the majority of patients who ultimately died had a history of prior diseases and the results of the Chi-square test in this respect showed a significant relationship between the given factor and the final status of the individuals ($P = 0.05$). In addition, the checked initial rhythm was taken into account as an important factor affecting the final status of patients after undergoing CPR procedure ($P < 0.0001$) (Table 2).

Table 1. Frequency Distribution for the Factors Affecting Successful CPR

	Successful, %	Unsuccessful, %	P Value
Location of occurrence of cardiopulmonary arrest			0.03
Out of hospital	8.6	21.3	
Emergency ward	32.8	21.3	
Other departments	58.6	57.4	
Specialty of physicians in charge of CPR teams			0.01
Anesthesia	37	19	
Others	63	81	

Table 2. Frequency Distribution for the Factors Affecting Final Status of Patients

Final Success	Alive, %	Deceased, %	P Value
Checked initial rhythm			< 0.0001
PEA and Asystole	28.6	9.3	
VF and VT	71.4	90.7	
History of prior diseases			0.05
No	42.8	74.8	
Yes	57.2	25.2	

4. Discussion

The study was conducted in 2016 on 199 patients with cardiac arrest, with the aim of determining the success rate of cardiopulmonary resuscitation in traumatic and non-traumatic hospitals and also investigating the factors affecting cardiopulmonary resuscitation.

The results of this study showed that 36.7% of the initial CPR procedures were successful, however, the vast majority of CPR procedures had led to death. The initial success rate after CPR has also been reported from 13% to 33% (14, 15).

The results obtained by other researchers had also shown that the initial success rate of CPR was between 19% and 60% and the ultimate success rate of CPR varied from 3% to 39% (16, 17). Although the overall survival rates following cardiopulmonary arrests have been reported low in numerous studies, the findings of the present study were not consistent with the results of some research studies in this respect.

In addition, the initial success rates of CPR in Iran had been reported 25%, 32%, 23%, 49% and 28%, and the ultimate success rates (Survival Rate) had been estimated at 3%, 13%, 20%, 10%, and 5% (6, 18, 19).

Given the various reports of research studies in terms of the initial success and ultimate success rates following CPR procedures, it was concluded that various factors

could have effects on the success rate of CPR. In one of the most extensive studies in this respect, a total number of 985 and 433 cases of in-hospital CPR procedures for patients aged over 65 years were investigated from 1992 to 2005. The results of this study indicated that 18.2% of patients had been discharged alive from hospitals with no significant changes over 13 years. In this study, the probability of successful CPR in men and older people was reported at lower rates (20).

In the present study, the age groups examined did not reveal any significant differences in terms of the percentage of successful CPR procedures. In the studies by Nichols (21) and Slonim (22), the factor of age did not also influence the success rate of CPR. Therefore, other factors along with patient's age were assumed to change the success rates of CPR. In the present study, a history of prior diseases had an impact on the survival rate of an individual, which was in line with the findings obtained by Abrishami (23).

In another study conducted between 2000 and 2002, a total number of 14720 patients affected with cardiopulmonary arrests in 207 hospitals in the United States were examined. In this respect, 3 major causes of cardiac arrhythmia, acute respiratory failure, and lower blood pressure were listed for cardiopulmonary arrests in adults (24); of which, 44% of patients had a successful initial CPR, however, only 17% of the given individuals were discharged alive from hospitals. In the present study, internal diseases, cardiovascular problems, and then respiratory disorders were among the 3 major causes of cardiopulmonary arrests. It seems that cardiovascular and respiratory problems have been similarly included among the common causes of cardiopulmonary arrests in majority of studies.

According to the results of this study, one of the other factors affecting the survival rate of individuals was the checked initial rhythm; therefore, people with VF and VT rhythms had the highest chance to survive. Thus, it is of utmost importance to realize cardiopulmonary arrests at the initial stages and begin the CPR procedure without delay.

In addition, individuals who had suffered out-of-hospital cardiopulmonary arrests had the lowest chance of successful CPR. It seems that the survival rate of an individual drastically gets down due to late arrival of a patient to medical centers and in most cases no start of BLS measures. It was also observed that the individuals affected with cardiopulmonary arrests in emergency wards had the greatest chance of successful CPR. In this respect, accessibility to the required measures along with the permanent presence of CPR technicians in these departments to carry out such a procedure and to make an airway are among the important factors affecting successful CPR. Given that most of the cases of cardiopulmonary arrests in this study had oc-

curred within hospital departments, the hospital authorities were suggested to provide the required conditions in all departments and thus contribute to an increase in the figures and statistics associated with the success rates of CPR.

Considering the simplicity and teachability of BLS, including chest compressions and placing individuals in the right positions as well as maneuvers to help in opening the airways and providing pulmonary ventilation, the health status and the survival rate of individuals can be significantly improved through public education of the measures for initial CPR procedures.

Furthermore, the attendance of an anesthesiologist in charge of the CPR teams while doing the CPR procedure can also augment its success rate. Thus, the presence of an anesthesiologist during the CPR procedure carried out by the given teams seems to increase its resulting success rate. However, this result is logical due to the fact that the knowledge and experience of anesthesiologist is reliable in the process of implementing and managing interactions during the CPR; therefore, it is useful for hospitals to set some rules for presenting an anesthesiologist in the CPR team in order to increase the CPR quality.

5. Conclusions

According to the results of the present study, the location of the occurrence of cardiopulmonary arrests and the specialty of physicians in charge of the CPR teams were among the factors affecting the success rates of this procedure. Moreover, the checked initial rhythm and history of prior diseases in patients were among the factors affecting their survival rates. However, the point that needs further research here is why, in this study, the survival rate of people is much lower than other studies? Therefore, given the results of the investigations conducted in this respect as well as the substantially low survival rates of patients following CPR procedures in this study, it seems that post-resuscitation measures could significantly affect the survival rates of patients. Thus, it was suggested to investigate post-resuscitation measures in other studies of prospectively in order to propose strategies to add to the survival rates of patients.

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