Successful Cardiopulmonary Resuscitation Rate and Related Factors in Emergency Departments

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Abstract
Cardiopulmonary Resuscitation, also called CPR, is a set of actions taken by conscious and willing individuals to restore the functions of two vital heart and lung organs and deliver blood and oxygen to the brain to prevent brain damage. This is an immediate intervention to prevent or delay death in a person who has suddenly had a cardiopulmonary arrest. About 40 years have passed since the start of cardiopulmonary resuscitation, so the survival rate is low. Research has shown that about 10 to 15 percent of people survive after resuscitation. Cardiac resuscitation is on the rise among hospitalized patients, so these measures and the factors that contribute to its success are crucial. Our aim is to review the success rate of cardiopulmonary resuscitation and its associated factors in emergency departments and hospitals. In this review study, keywords such as cardiopulmonary resuscitation, cardiopulmonary arrest, emergency, underlying cause, success rate, resuscitation outcome and related factors and search on reputable Google scientific databases Scholar, Pubmed, Web of Science, WHO Web site, Articles and theses published between 1989 and 2019, and finally a number of sources were selected and critiqued, interpreted, and analyzed. We concluded at the time of cardiopulmonary arrest, the speed of technicians, equipment, and devices and medicines used will increase the chances of successful cardiopulmonary resuscitation.

Key words: cardio-pulmonary resuscitation, cardiopulmonary arrest, emergency, underlying cause, rate of success, CPR outcome

Introduction
Cardiopulmonary resuscitation is all that is done to return to life after death for two important organs of the body, such as heart and lung. It has been found to be more effective in patients who have died from sudden death than those who have died from underlying and dangerous diseases. Sudden death is a death that occurs naturally without any known or underlying disease and loses life symptoms (1, 2).

One of the greatest and most important scientific achievements in the world is immediate intervention to delay death or prevention of one’s death, who has sudden stroke and has lost his life symptoms. Favorite in hospital resuscitation, is complete recovery of one’s life. Many factors influence the success of resuscitation including types of underlying disease that a person has, the interval time between cardiac arrest and resuscitation, the availability of hospital and emergency services, equipment and supplies needed for resuscitation (3).

For the first time, in 1960 Kowenhoven, performed cardiopulmonary resuscitation but still despite of developments in techniques and medical staff, mortality rates after cardiopulmonary arrest is high compared to other causes of death. Cardiopulmonary resuscitation is a series of organized actions performed on patients with cardiopulmonary arrest and is an attempt to keep the circulatory and respiratory systems active enough to provide enough oxygen to keep the body’s vital organs alive. Until the spontaneous physiological activity of the circulatory system returns to normal (5). On average, the United States annually loses about 400,000-350000
people because of sudden cardiac death that most of them had an unsuccessful Cardiopulmonary resuscitation (6, 7). In studies of American Heart Association has repeatedly emphasized the need for a more immediate Cardiopulmonary resuscitation in 3 to 5 minutes which increases person survival after a cardiac arrest. Also, public education to learn about resuscitation and its principles has been emphasized before EMS arrived (8). Cardiopulmonary arrest is responsible for half of all deaths (9). Overall, 50% of deaths occur suddenly, of which only 25% perform cardiopulmonary resuscitation (10). Most of the deaths that occur in different parts of a hospital are largely dependent on one’s underlying disease and are not similar to those of cardiac arrest outside the hospital, so researchers are now studying Cardiac arrest mainly uses and emphasizes epidemiological records and knowledge. The epidemiology of cardiac arrest focuses on factors that are individually and increase the risk of cardiac arrest (11).

The number of successful cardiopulmonary resuscitation cases is one of the most important and most noteworthy features of the emergency, for example, the high rate of which confirms the success of the emergency (12). In previous studies, some factors such as location and time of cardiac arrest were considered. for example, Dehaven et. al. declared cardiac arrests which occurred out of emergency will have an unfavorable resuscitation (13). Nurses are among the first people to prepare for their responsibilities at the time of cardiopulmonary arrest. They must have had extensive experience in the field of cardiopulmonary resuscitation. Since the late 1980s, there have been numerous studies on CPR skills (14). Some of these studies have shown the impact of having educated people on the resuscitation process (15-19).

In many cases, at the moment of cardiopulmonary arrest, the individual may return to life if performed quickly and correctly (20). Nearly 40 years after the start of the procedure, the survival rate after resuscitation is not ideal, and mortality rates after cardiopulmonary arrest remain high compared to other causes of death. In developed countries, cardiac arrest survival rates in hospital and out of it are less than 30% and 10%, respectively (21). Out-of-hospital cardiac survival rates range from 2% to 26%. Reports of success rates of cardiopulmonary resuscitation in different countries vary widely (11, 22, 23) 2 to 27% at in-hospital cardiac arrest and 2 to 10% at out-of-hospital cardiac arrest. Reported (24-27)

**Methods and Materials**

In this Narrative Review study, we used key terms including cardiopulmonary resuscitation, cardiopulmonary arrest, emergency, underlying cause, success rate, resuscitation outcome by searching the databases. International sites including: pubmed, Web of science, Google Scholar, Scopus, Elsevier, and internal science databases including: Barakatkn Knowledge System, Academic Jihad Scientific Database, Medlib Iranian Medical Library, Magrian journals database, Civilica knowledge reference and search on the WHO site.

A total of 70 scientific sources, including books, articles, theses, and reports published between 1989 and 2019 in Farsi and English on the success of cardiopulmonary resuscitation and related factors, were collected. Unrelated articles and sources were excluded and references related to our review were studied. Finally, 55 articles and scientific sources were selected and analyzed according to the purpose of the study.

**Findings**

Much has been done to increase the impact of cardiopulmonary resuscitation on patients who have died. Considering the factors that can contribute to cardiopulmonary resuscitation including the types of underlying disease that a person has, the time spent between cardiac arrest and cardiopulmonary resuscitation, the availability of experts, emergency services, Required Devices and Supplies (3). Factors that were found to be effective in resuscitation failure include age, time interval between cardiac arrest and resuscitation, cardiac arrest time, hospital staff skills, and some physiological variables such as systolic blood pressure, arterial acidity, serum potassium level and primary rhythm (28).

**Patient’s age**

Different people of different ages have different reactions to disease, cardiac arrest and resuscitation. Generally young people have shown a better response to cardiac resuscitation.
Thus age has been identified as one of the most important factors in the ultimate success of cardiopulmonary resuscitation. Due to Jaberi’s study, people under 50 years old had a higher successful resuscitation rate also based on study of Keivanpazhouh et al. approximately 42% of patients under 55 years old and 35% of patients over 55 had successful resuscitation (30).

**Cardiopulmonary arrest location**

Cardiac arrest can occur in different locations, including outside the hospital, as well as in the hospital and its various departments, where people’s response to cardiopulmonary resuscitation varies both outside and inside the hospital.

According to the study of Khoshfetrat, 57.3% of people in different parts of the hospital except ICU had a cardiac arrest, 24.6% of patients in the emergency and 16.1% outside of hospital had cardiac arrest, 81 percent of whom Out of the hospital, they were resuscitated and 63% of those resuscitated in the hospital were unsuccessful (31).

**Systolic pressure**

When the heart contracts or is the pressure inside the arteries. In the elderly, because of the reduced elasticity of their arteries, they cannot be easily expanded, leading to elevated systolic pressure. In Borimnejad study of 63 patients who had cardiopulmonary resuscitation and whose systolic blood pressure was controlled several hours before cardiac arrest occurred, 89.7% of them had blood pressure above 130 mm Hg (28).

**Potassium**

Potassium is a chemical (electrolyte) in blood that is required for proper functioning of nerve and muscle cells, especially heart muscle cells. Sometimes the amount of potassium is higher or lower than normal. 43% of patients with cardiac arrest had high blood potassium and there was a significant relationship between arterial blood pH and primary cardiac rhythm (28).

**Discussion and Conclusion**

Cardiac arrest is known as stopping blood circulation. In this case, the heart muscle has no contraction and heart has no outflow or blood flow (32). Cardiac arrest is different from a heart attack or bloodflow disorder, although cardiac arrest may also be due to a heart attack (33). Heart disease is more common in old age, and is more common in men than in women (34). Before taking any cardiopulmonary resuscitation procedure, make sure that it does not threaten the health of you or the injured person with the spread of diseases such as AIDS and hepatitis. The most important change in 2010 resuscitation guidelines is the change from A-B-C (airway-breathing-circulation) to C-A-B (circulation-airway-breathing) (35). With the exception of newborn infants, out-of-hospital CPR stages are (left to right) respectively: cardiac massage, airway opening, and artificial respiration (36). Symptoms of cardiac arrest are sudden and severe and include:

- Sudden fainting, lack of pulse, interruption of breathing and loss of consciousness. Sometimes other signs and symptoms are seen before cardiac arrest. For example, fatigue, faint, dizziness, chest pain, shortness of breath, weakness, palpitations, or vomiting are among the symptoms that occur before cardiac arrest. But cardiac arrest often occurs without any warning. The first cause of cardiac arrest is usually a disorder of the heart rhythm (arrhythmia), which is the result of a problem with the heart’s electrical system. Unlike other muscles in the body that rely on neural connections to get the electrical stimuli they need, our heart has its own electrical stimulus, a special group of cells called the sinus node, located in the right upper chamber of the heart (right atrium). The sinus node generates electrical impulses that flow through the heart in an orderly manner to synchronize the heart rate and coordinate the pumping of blood from the heart to other organs.

If there is a problem with the sinus node or the flow of electrical pulses to the heart, it may lead to an arrhythmia that will cause the heart to become too fast, too slow or irregular. Often, these interruptions in the rhythm are transient and harmless, but some types of arrhythmias can be serious and lead to sudden stoppages in heart function (heart arrest). If the person has pulse but has stopped breathing, he should continue mouth-to-mouth breathing (37).

The most common cause of cardiac arrest is a type of arrhythmia called ventricular fibrillation. Ventricular fibrillation occurs when rapid electrical pulses cause
your ventricles to shake in vain rather than pumping blood.

Most often, cardiac arrest-induced arrhythmias do not happen by themselves. In a person with a healthy heart, a sustained irregular heart rhythm, without an external factor, such as electrical shock, drug use, or a severe trauma to the heart cycle (heartbeat) is unlikely to progress.

The most common cause of cardiac arrest out of hospital and its deaths in adults is cardiovascular disease. Coronary artery disease and cardiomyopathy causes 10-15% of sudden deaths (38), sudden death incidence increasing at age 30 with its peak at age 45 to 75. The incidence in adult population is approximately 1 to 2 cases per 1000 individuals per year (38,39).

As a sign of death in most heart disease is sudden death to further reduce related mortality from disease, according to CPR and basic determinants of its success that increase the efficiency of cardiopulmonary resuscitation outside hospital is in the center of researcher’s attention. Outpatient cardiovascular outcomes are reported to range from 1.4% to 29%, and this success is more in towns and less in cities (40). Possibility of successful CPR Outside of hospital depends on several factors. The probability of success depends on the patient’s first recorded rhythm, better prognosis in ventricular tachycardia (VT) and then ventricular fibrillation (VF) and resuscitation time, collapse interval to resuscitation, and collapse interval to first electric shock (40).

In Jaberi et al.’s study of age variables (final success only), collapse interval time to endotracheal intubation, non-monitoring of cardiac arrest, underlying disease (initial success only), first rhythm on monitor, and hospitalization (final success only) increased resuscitation success. However, only the variables of the collapse interval time to the resuscitation team presence, non-monitoring of the patient before cardiac arrest and the first rhythm on the monitor independently predicted resuscitation success. Gender, hospitalization to cardiac arrest interval time, collapse interval time to resuscitation, number of resuscitations were not correlated with resuscitation success (29).

The largest number of cardiac resuscitation trials in four hospitals by Branner and his colleagues accounted for 433,985 of patients over the age of 65 in the United States from 1992 to 2005 (41); The rapid review of these studies shows despite of outside-hospital resuscitation, hospital resuscitation speed related factors are not as important as resuscitation quality related factors (42). Alba et al. regarding to America heart association declared quality of resuscitation as an important factor in successful resuscitation. In Karnstedt study resuscitation success increased from 8am to 4pm, another manifestation of the effect of resuscitation quality on its success (43, 44). Marik et al. believe the speed of resuscitation is important on its success (45). In the Boyd and Peters study in Australia, similar results have been observed and the emphasis on the speed of resuscitation has been successful in resuscitation (45). Based on Jaberi’s study, time interval between hospitalization and cardiopulmonary arrest has no effect on resuscitation outcome (29).

According to Nazri et al.’s study, the highest number of cardiopulmonary resuscitation occurred in the morning shift with a frequency of 41.2%, followed by night shift with frequency of 31.2% and evening shift with frequency of 27.6%, but There were no significant correlations between shift and outcome of cardiopulmonary resuscitation as well as the gender of the patients on resuscitation rate (46). Also, the mean age of patients studied was 43 and this was similar to the mean age in the Jafarian study (47) in Nichols and selenium study, age has not had much effect on success rate. It seems additionally to age there are some other effective factors on success of CPR (48,49).

Cardiopulmonary arrest location was one of the factors influencing the outcome of resuscitation; more preparations and the continued presence of anesthesia technicians to perform resuscitation and airway resection was an important determinant of resuscitation success. As of most Cardiopulmonary arrests occur in ward, it is recommended that respected authorities provide the conditions in the ward and add to the success statistics.

The interval between cardiopulmonary arrest and the onset of cardiopulmonary resuscitation has been one of the most discussed variables during the study of Nazri et al. According to research one of the most important reasons for the success of the first minute resuscitation after 5 cardiopulmonary resuscitations...
is timely and effective cardiopulmonary resuscitation, which significantly increases the chance of success; The most important objectives of this variable in this study were to obtain this time interval to improve the quality of cardiopulmonary resuscitation and hospital readiness in emergency departments and wards, but, contrary to expectations, in all patients with cardiac arrest, the time of onset of cardiac arrest and the onset of resuscitation in the files were quite similar, which, according to personnel’s quotes, this value may be due to inaccurate recording of data because it may take a short time after being recalled from the patient’s bedside. The purpose of this study was to obtain this interval and measure the speed of the resuscitation team, but this time recorded in file was not valid (46).

One of the most important factors in a successful resuscitation is the opening of the airway and the patient’s intubation in less than 5 minutes. According to the hospital staff, 115 technicians do not intubate the patient and act only in transferring the patient to hospital. This is due to insufficient education so that the necessary education and awareness can help patients successfully resuscitation (46).

**Conclusion**

Given above, at the time of cardiopulmonary arrest, the speed of technicians, equipment, and devices and medicines used will increase the chances of successful cardiopulmonary resuscitation.

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