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P-ISSN : 2085-5931
e- ISSN : 2085-5931

Sekolah Tinggi Ilmu Kesehatan Ngudia Husada Madura
Bekerja sama dengan Persatuan Perawat Nasional Indonesia (PPNI) Kabupaten Bangkalan

NURSING UPDATE
Jurnal Ilmiah Ilmu Keperawatan

Article

STRATEGIES TO IMPROVE THE QUALITY OF CARDIOPULMONARY RESUSCITATION (CPR): A LITERATURE REVIEW

Widya Addiarto[1], Rizka Yunita[2]

[1]Program Studi D-III Keperawatan, STIKES Hafshawaty Pesantren Zainul Hasan, Probolinggo, Indonesia
[2]Program Studi Ners, STIKES Hafshawaty Pesantren Zainul Hasan, Probolinggo, Indonesia

SUBMISSION TRACK

Received: Mau 29, 2023
Final Revision: June 07, 2023
Available Online: June 09, 2023

KEYWORDS

CPR, High Quality CPR, cardiac arrest, rescuer, strategies

CORRESPONDENCE

Phone: 082231389498

E-mail: addiartowidya@gmail.com

ABSTRACT

Background: Nowadays, the incidence of cardiac arrest affects about 135 million people with the survival rate ranges from 2% to 11%. Seeing the trend of the incidence of cardiac arrest that occurred at this time, the necessary steps for appropriate treatment increased the survival rate of cardiac arrest patients performing well in CPR. Increasing the high quality of CPR gives a great impact on patient safety in both cardiac arrest outside and inside the hospital. The aim of this study was to identify the strategies to improve high quality of CPR. **Methods:** This literature review was done by collecting and analyzing articles concerned on high quality CPR. Articles were collected through electronic databases: EBSCOhost, ProQuest and Science Direct used keywords about CPR, high quality CPR, and cardiac arrest. A number of research articles were reviewed and the criteria of articles was full text and published between 2009 until 2021. **Results:** The important strategies in achieving indicators of high quality CPR are: correct patient position, using hand dominant position, turn over the rescuer position, body mass index and body posture, using video simulation, and using music to maintain the correct rhythm during CPR. **Conclusion:** High quality CPR is essential to apply both intra or out of hospital to maintain the survival rate of cardiac arrest patients. Therefore, using a strategy is expected to improve skill and outcome of high quality CPR.

I. INTRODUCTION

Today, the incidence of cardiac arrest is very high and has become a global problem faced by all countries in the world (Terzi, 2012). According to

Meaney et al., (2013) more than 135 million people died because of heart disease, due to cardiac arrest outside the hospital. The incidence of cardiac arrest stands from 20 to 140 in 100,000 populations with survival rate ranging from 2% to 11%. In the USA, the incidence of cardiac arrest is more than 500 thousand people with a survival rate less than 15% outside the hospital. Meanwhile, the survival rate in the hospital figure reached 18% for adult patients and 36% for pediatric patients. In Indonesia, the incidence of cardiac arrest is still uncertain, but based on data from the National Heart, Harapan Kita Hospital, for a day there are 3-5 people with cardiac arrest admitted to the hospital. So that the estimates of the prevalence of patients with cardiac arrest in Indonesia in one year is estimated at about 10 thousand citizens or means 30 people in one day patients with coronary heart disease (Sapuan, 2016).

Seeing the trend of the incidence of cardiac arrest that occurred at this time, it needs steps for appropriate treatment to increase the survival rate of cardiac arrest patients. The survival rate of cardiac arrest patients related to effort and quality of CPR. This is in accordance with the opinion of Stiell et al., (2012) in Meaney et al., (2013) which states that the implementation of the CPR that does not meet the standards will decrease the survival rate of cardiac arrest victims. Suppose that the depth of compression is done in less than 5 cm and made with compression slowly (less than 100 beats/minute) will cause victims in case of return of spontaneous circulation (ROSC) in hospitals to deteriorate from 72% to 42%. The statement indicates that the management of cardiac arrest by increasing the high quality of CPR gives a great impact on patient safety in both cardiac arrest outside and inside the hospital. Opinion was supported by Bryan et al., (2011) that the appropriate treatment of patients with cardiac arrest outside or inside the hospital became the first priority with a waiting time of zero minutes. This will require the readiness and ability of all health workers, including nurses to perform high quality CPR. This is because almost all the cases of cardiac arrest in the emergency encountered by nurses, so that early rapid initiation of cardiac arrest required knowledge and skills from nurses to perform well in high quality CPR (Terzi, 2012). The implementation of measures CPR within minutes of gold including rapid resuscitation and early defibrillation within 1-2 minutes can improve survival in cardiac arrest patients to 60% (Hasegawa et al., 2014).

However, problems may arise when a series of measures to improve the high quality of CPR is done with inadequate procedure. The statement explained that the implementation of the real CPR is very difficult to do if the rescuer is not familiar enough to perform well in CPR, so the result was poor. Problems were found either in the hospital or within the hospital that a rescuer perform of high quality CPR is usually difficult in maintaining CPR quality with good covering chest compressions to the rhythm constant, the depth of 5 cm, interruptions are minimal and recoil maximum, so this is an issue faced by rescuers of cardiac arrest victims (Travers et al., 2010)

According to Gutwirth, Williams and Boyle, (2009), the most important problem that arises when implementing high quality CPR is derived from the rescuer itself. Other studies according to Rajab (2011) states that the implementation of high quality CPR is influenced by several things that contribute significantly include the dominant hand position when performing chest compression, rotation carried by rescuers and body posture

from the rescuer.

The aim of this study was to identify the components of high-quality CPR performed and individual factors that influence the quality cardiopulmonary resuscitation because the application of high quality CPR is not performed optimally. It takes effort to increase it so that all health workers, especially nurses can perform CPR quality in the treatment of cardiac arrest cases.

II. METHODS

This literature review collected and analyzed the article on high quality CPR (Cardio Pulmonary Resuscitation). Articles collected through electronic databases, EBSCOhost, ProQuest and ScienceDirect and using the keyword about CPR, chest compression, high quality CPR, and cardiac arrest. The criteria of articles was full text and published in the period between 2009 and 2021. A number of research articles were reviewed. ScienceDirect databases were searched for relevant articles. Reference lists of original papers and literature review were searched for additional research papers, and availability followed up on the ScienceDirect databases.

III. RESULT

a. Cardiac Arrest Victims

Despite important advances in prevention, cardiac arrest remains a substantial public health problem and a leading cause of death in many parts of the world and occurs both in and out of the hospital. Cardiac arrest is a common occurrence that is sudden or unexpected and can lead to death quickly. Cardiac arrest is characterized by the cessation of cardiac function suddenly in someone as a result of the electrical activity of the heart stopping and accompanied stopping breathing (Jacobs, Bahr, Berg and Billi, 2004). Victims who suffered cardiac arrest has been limited to providing blood flow and adequate oxygen to the brain and muscles, causing sudden death when the electrical system of heart does not function properly and produce abnormal heart rhythms such as VT without pulse, VF, PEA and asystole (Berg et al., 2012; Travers et al., 2010).

b. Effort to Improve Survival Rate Cardiac Arrest Patients With CPR

Today, one of the efforts to deal with cardiac arrest is to provide action cardiopulmonary resuscitation (CPR) both outside and inside the hospital. Cardiac arrest is treated with cardiopulmonary resuscitation (CPR) and chest compressions are a basic component of CPR. The quality of the delivered chest compressions is a pivotal determinant of successful resuscitation. In spite of this, the quality of chest compressions, even if delivered by healthcare professionals, is often suboptimal. Therefore it is important that providers carefully familiarize themselves with this technique (Rajab, Pozner, Conrad, Cohn, & Schmitto, 2011). CPR is a procedure to save the lives of cardiac arrest patients by increasing circulation and oxygenation through the action of compression and ventilation breathing . The real objective of CPR is to provide oxygen to the brain and heart until the start of the medical definitive treatment and precisely to restore the function of the heart and lungs back to normal.

Meanwhile, according to the indications from Travers et al., (2010) CPR can be given to all ages of victims, there are only specific technical differences related to age.

CPR can be given to people who suddenly collapse, fall unconscious or are not accompanied by pulse was not palpable. It could be due to cardiac arrest or respiratory arrest. After CPR was performed, there was some reason to stop CPR, the heart started beating them adequately, the environment was not safe for the rescuer, medical personnel took over the action and rescuer fatigue.

Implementation of CPR is the second action after early access to 5 chains of survival, so that CPR is a mandatory action that must be carried out by rescuers when it finds the victim of cardiac arrest while waiting for medical personnel to arrive on the scene. Implementation of the 5 chain of survival is highly dependent on the rescuer or helper, events and availability of EMS (Travers et al., 2010)

c. *Component High Quality CPR*

Currently, to get the best outcome in the management of patients with cardiac arrest, requires the application of high quality CPR. The application of these principles become essential when helping victims of cardiac arrest before the defibrillator. According to Travers et al., (2010) focus on maintaining high quality CPR. The main thing is to keep the rhythm of chest compression to the maximum while the components in the implementation of high quality CPR is: 1) Depth compression means that depression is as deep as 5 cm chest with one hand rescuer second snap. 2) Full Recoil means that the opportunity for the chest wall to inflate the maximum after a given pressure is 5 cm. 3) Compression speed means that the number of chest compressions were performed within one minute of at least 100 beats/minute. 4) Minimal interruptions it means that minimize interruptions up to 10 seconds, so that the compression process is done effectively

d. Strategies to Improve Perform in High Quality CPR

Strategies to improve the quality of CPR is to maintain the quality of chest compressions. The technique of delivering chest compressions is highly standardized and based on international consensus that is updated in 5-year intervals (Rajab et al., 2011). There are some of the strategies to improve high quality CPR: 1) Make sure the patient position is correct, 2) Using hand dominant position, 3) Turn over the rescuer position, 4) Body mass index and body posture, 5) Using video simulation to maintain high quality CPR, and 6) Using music to maintain the correct rhythm during CPR.

IV. DISCUSSION

Cardiopulmonary resuscitation (CPR) is a series of lifesaving actions that improve the chance of survival following cardiac arrest. Although the optimal approach to CPR may vary, depending on the rescuer, the victim, and the available resources, the fundamental challenge remains: how to achieve early and effective CPR (Travers et al., 2010). Some studies suggest that there are several strategies to improve the quality of CPR is as follows:

a. *Correct Patient's Position*

Rajab et al., (2011) said that the patient in cardiac arrest should be placed in supine position with the rescuer standing beside the patient's bed or kneeling beside the patient's chest. Adjustment of the bed height

or standing on a stool allows leveraging the body weight above the waist for mechanical advantage. For optimal transfer of energy during chest compressions the patient should be positioned on a firm surface such as a backboard early in resuscitation efforts. This decreases wasting of compressive force by compression of the soft hospital bed. While re-positioning the patient, interruptions of chest compressions should be minimized and care should be taken to avoid dislodging any lines or tubes (Sapuan, 2016).

b. Using Hand Dominant Position

Strategies that can be selected to maintain the high quality of CPR is to use the dominant hand when carrying out CPR. Place the dominant hand over the center of the patient's chest. This position corresponds to the lower half of the sternum. The heel of the hand is positioned in the midline and aligned with the long axis of the sternum. This focuses the compressive force on the sternum and decreases the chance of rib fractures. Next, place the non-dominant hand on top of the first hand so that both hands are overlapped and parallel. The fingers should be elevated off the patient's ribs to minimize compressive force over the ribs. Also avoid compressive force over the xiphisternum or the upper abdomen to minimize iatrogenic injury (Rajab et al., 2011).

The previously taught method of first identifying anatomical landmarks and then positioning the hands two centimeters above the xiphoid-sternal notch was found to prolong interruptions of chest compressions without an increase in accuracy (Nikandisha, Shahbazib, Golabic, & Beygic, 2008). Similarly, the use of the internipple line as a landmark for hand placement was found to be unreliable. Therefore these techniques are no longer part of the international consensus guidelines. For maximum mechanical advantage keep your arms straight and elbows fully extended. Position your shoulders vertically above the patient's sternum. If the compressive force is not perpendicular to the patient's sternum then the patient will roll and part of the compressive force will be lost (Rajab et al., 2011).

Related research conducted by Jiang, Jiang, Zhao, Xu and Zhou (2015) suggests the use of the dominant hand during chest compression because it will increase high quality CPR by increasing the depth of compression, the average compression per minute and prevent premature fatigue in the helper. With our dominant hand we can easily search for landmarks chest compression to achieve and maintain a quality CPR. Use the dominant hand also minimizing fatigue during chest compression. The statement according to research of Jantti et al., (2009) that the cause of the decline in the quality of chest compressions during CPR is physical exhaustion of the helper. Each implementation of CPR with maximum compression quality compression quality will decline by 20% within 2 minutes. Compression depth and chest wall recoil to be the most prevalent decline.

Another opinion according to Travers et al., (2010) which states the effective implementation of high quality CPR in just 2 minutes. It means that the physical condition of a person capable of performing chest compressions adequately tolerance in just 2 minutes without fatigue. However, in this case there is little difference with the opinion of Aston et al., (2002); Hightowe et al., (1995); Ochoa et al., (1998); and Greingor

(2002) in Gutwirth, Williams and Boyle (2009) which states that the compression fatigue in the implementation of CPR will appear in the minutes to 3-4. While the minutes of the previous compression performed an inadequate level can still be maintained. So that we can know that the maximum time a person can survive optimally in maintaining a high quality CPR is approximately 1-3 minutes.

c. Turn Over Position Rescuer

High quality CPR can be achieved by performing the rotation of the rescuer during the implementation of the CPR. The aim of changing the rotation is to reduce fatigue of the rescuer to maintain the quality of the compression in CPR. This was stated by Zhang, Yan, Huang and Bai (2013) that female helper turnover should be done in the implementation of CPR on a regular basis to maintain a given compression quality and avoid fatigue quickly. Thus, female rescuers can control or delay physical fatigue, maintain the speed and quality of adequate chest compressions during resuscitation. This is due to the fact that because the women rescuer has a lighter weight than the man rescuer, it gives the man the possibility of making a greater effort in performing chest compression (Addiarto & Yunita, 2021). This statement is in line with research of Hasegawa et al., (2014) that describes the weight helper will be directly related to the quality of chest compressions given during the implementation of the CPR.

d. Body Mass Index and Body Posture

Another study says that men can maintain the quality of CPR in terms of the depth of chest compression and the average amount of compression performed than women at 70% for 8 minutes. Whereas in women after 1 minute of performing CPR, average speed and depth compression decreased by 20% but in terms of physical exhaustion, women with low weight have better resistance levels than men (Shin et al., 2014). This means that if the rescuers have less weight, he can't maintain the quality of compression but more tolerance to physical fatigue. So it can be concluded that the higher weight of the rescuer is more given the quality of compression but makes the rescuer have a high level of physical fatigue (Addiarto & Yunita, 2021).

Another alternative could be done to improve the quality of CPR is identify the ideal helper posture. This is consistent with research Mokhtari (2012) in Hasegawa et al., (2014) states that the problems experienced by the majority of the ER nurses in Japan is a matter of body posture. The majority of 95 % of nurses in Japan is a woman with a body posture that is relatively smaller than the nurse with the European race in general. So it will greatly affect the quality of CPR performed.

e. Using Video Simulation to Maintain High Quality CPR

Apart from the rescuer, high quality CPR can be improved through some effort into improving their knowledge and skills as well as video or simulation based learning CPR. According to research conducted Creutzfeldt, Hedman and Tsai (2012) suggests the use of simulation games on the implementation of CPR can improve knowledge, skills and confidence to participants. In addition, a simulation game can be used in performing CPR guidelines. Another opinion says CPR training programs for 45 minutes can

improve CPR quality and attitude of non-medical participants. This suggests that CPR can be learned and understood and applied by everyone (Hirose et al., 2014).

f. *Using music to maintain the correct rhythm during CPR.*

According to Roach, Langdon, DeFalco and George (2014) described that the use of music enhancement in training can improve nurses' ability to demonstrate the recommended chest compression rate for CPR immediately after the education and practice session. Music enhancement may improve their ability to maintain the correct rate of compressions during recertification more than traditional instruction.

V. CONCLUSION

The incidence of cardiac arrest is very high, but the numbers of survival rate patients are still low. This is because the management of cardiac arrest is still not optimal, especially in the management of CPR. High quality CPR can be achieved if the compression depth indicator is more than 5 cm, the compression speed min 100 beats/minute, full recoil and minimal interruptions reached. To achieve high quality CPR, there are several strategies to improve high quality CPR 1) make sure the patient position is correct, 2) using hand dominant position, 3) turn over the rescuer position, 4) body mass index and body posture, 5) using video simulation to maintain high quality CPR, and 6) using music to maintain the correct rhythm during CPR.

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BIOGRAPHY

First Author Widya Addiarto, S.Kep.,Ns., M.Kep was born on Jember 16 May 1989. Completed his Masters in Nursing at Brawijaya University Malang in 2016, currently active as a lecturer, researcher at the STIKes Hafshawaty Pesantren Zainul Hasan Probolinggo East Java. addiartowidya@gmail.com.