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HOW TO MAINTAIN HIGH QUALITY CARDIOPULMONARY RESUSCITATION IN ADULTS : LITERATURE REVIEW

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INTRODUCTION

Intra-Hospital Cardiac Arrest (IHCA) incidence is quite high and varies with an average of 3.8 to 13.1 per 1000 patient. Most IHCA (60%) due to heart problems such as pulseless electrical activity (PEA), asystole, and the combined ventricular fibrillation-ventricular tachycardia. While, the cause IHCA by hypoxia about 30% (Becker, Aufderheide, & Graham, 2015). The mortality rate are recorded very high. America Heart Association (AHA) stated that only 14% of adults and 27% of children who survive after experiencing IHCA (Morrison, 2013).

Cardiopulmonary resuscitation (CPR) is one of the most important emergency actions in life-threatining conditions. The performance of cardiopulmonary resuscitation has an important position in the chain of survival, but despite new techniques and technology the survival rates from cardiac arrest are still low and the incidence of in-hospital cardiac arrest is rarely reported in the literature. Cardiopulmonary resuscitation is a complex of emergency procedures, if that performed correctly, can provide the necessary minimum of circulation until return of spontaneous circulation (ROSC) to patients with sudden cardiac arrest (Stiell, et. al., 2012). The high incidence, low rate of survival, and unpredictability of cardiac arrest makes it a grave public health issue and a medical emergency. The application of CPR plays a critical role in saving lives from cardiac arrest in the hospital, and chest compression is the first part to plays a key role in CPR. (Chen, et al, 2015). High-quality chest compressions of sufficient depth and rate with full recoil of the chest between compressions and avoidance of interruptions are crucial to patient survival. The efficiency of CPR in decreasing the death rate from avertable causes is a very important factor. However there are relatively few data available on the efficiency of cardiopulmonary resuscitation in hospitals, which play an essential role in the chain of survival. Despite the fact that the cardiopulmonary resuscitation was introduced more than 50 years ago, the survival rate is still relatively low and there is no trend of improvement of the situation observed, although the technologies have developed rapidly (Neumar, et.al., 2015).

The survival of patients with cardiac arrest depends on the quality of CPR is given. The success of CPR can be seen from the results whether the patient is awake and back to life with normal function or only slightly deformed, conscious and returned with moderate disabilities, unconscious with severe disabilities, coma or vegetative state, brain death, or death from other causes (Lallestedt, 2011).

Although resuscitation guidelines provide a logical, sequential algorithmic approach, they have mainly emphasized technical tasks performed by individual rescuers and have not addressed issues of adapting to the complex nature of most actual resuscitations. Part of this complexity relates to the fact that in a healthcare environment resuscitations are usually performed by teams of responders, not by isolated rescuers (Bhanji, et.al., 2011). Therefore, high quality CPR must be applied in each treatment in cardiac arrest by using methods and best performance to maintain the quality of life of patients.

OBJECTIVE

The purpose of this study is to discribe how to maintain hight quality CPR during resuscitation in adult cardiac arrest.

METHOD

This study is literature review. A literature search of the international published from 2011 through 2015, was performed in electronic database including ProQuest, PubMed, and Science Direct. The database search was complemented by thorough review of reference lists and review articles. Inclusion of papers was limited to studies optimum chest compression, mechanical compression device, and teamwork.

RESULT

The initial search identified 18 abstracts, which were evaluated for relevance. Fourteen articles were considered as potentially relevant and evaluated in full text. Ultimately, 14 articles were selected. The final selection was based on relevance, and eligibility. The result were :

Optimum Chest compression

According to Stiell, et.al. (2012) in experiment study, in adult cardiac arrest, CPR is reasonable for rescuers to perform chest compressions at a rate of 100 to 120/min. The experimental study showed optimal coronary perfusion at this range, and hemodynamic deviation if less or more than the rate range. Further, on the basis of the randomised trial study by Heide, et.al. (2011), active compression-decompression CPR with augmentation of negative intrathoracic pressure should be considered as an alternative to standard CPR to increase long-term survival after cardiac arrest.

Stiell, et.al., (2012) reported that mean values for CPR process measures were compression rate of 108 per minute and chest compression fraction of 0.68. Of all patients, 31.3% had ROSC, 22.8% survived 1 day, and 7.3% survived to hospital discharge. Compression depth data showed, which was available per case for a median of 7 minutes (interquartile range, 5–10). The overall median chest compression depth was 41 mm (interquartile range, 35–48 mm), and 36% of cases had a mean value <38 mm. In addition, they calculated that 40% of cases were not within the 2005 recommended range for depth. They study also found that compression rate and depth were inversely related (*P*<0.001), such that 53% of cases with a compression rate >120 also had depth <38 mm

A compression depth of approximately 5 cm is associated with greater likelihood of favorable outcomes compared with shallower compressions. While there is less evidence about whether there is an upper threshold beyond which compressions may be too deep, a recent very small study suggests potential injuries (none life-threatening) from excessive chest compression depth (greater than 2.4 inches (6 cm). Compression depth may be difficult to judge without use of feedback devices, and identification of upper limits of compression depth may be challenging. It is important for rescuers to know that chest compression depth is more often too shallow than too deep (Hazinski,et.al., 2015)

The study shows the distribution of survival to hospital discharge by compression depth categories with unadjusted smoothed spline plots and shows much poorer outcomes for patients with the lowest mean compression depth values. There is a gradual increase in the probability of survival as average depth increases, but this appears to fall off again at the greater depth levels, with a similar pattern for both men and women. (Stiell, et.al., 2012).

Mechanical compression device

According to Perkins, et.al. (2015), mechanical compression devices can be a reasonable alternative to conventional CPR in spesific setting where the delivery of high quality manual compressions may be challenging or dengerous for the provider (eg, limited rescuers available, prolonged CPR, CPR during hypothermic cardiac arrest, and CPR in a moving ambulance). A cluster randomised controlled trial study by Perkins, et.al. (2015), found that in the intention to treat analysis, 30 day survival was similar in the mechanical compression device group (104 [6%] of 1652 patients) and in the manual CPR group (193 [7%] of 2819 patients).

Preparation of mechanical compression equipment by rescuers take time so it is important for the rescuers to know how to correct use, in particular to reduce the gap during a crucial time in the first minutes of cardiac arrest. However, the study showed that there was no significant difference in survival rate (Neumar, et.al., 2015).

Teamwork

According to Kupper (2015), aerobic endurance of the service CPR provider is needed in order to remain qualified. This is necessary because during CPR performed increased cardiac workload. The indicator is an increase in average heart rate of 83 beats / minute to 110 beats / min. Breathing increases of 15 beats / min to 27 / min. Oxygen uptake (VO2) increased by 126% during CPR of 0.5 liter / min to 1, 13 liter / min.

Yeung, et.al. (2012) suggest that high quality CPR involving the resuscitation team. CPR involves teams will increase effectiveness, and must be set tasks for each team member. The team leader and give priority attention to the actions taken and directs all team members with a primary focus on high-quality CPR. Team members perform their duties in accordance activities under the coordination of the team leader. Debriefing after cardiac arrest and the events that have been done to improve the quality of resuscitation. The study showed that teams led by leaders with the best leadership skills performed higher quality cardiopulmonary resuscitation with better technical performance ($R = 0.75$, $p < .001$), shorter preshock pauses ($R = 0.18$, $p < .001$), with lower total hands-off ratio ($R = 0.24$, $p = .01$), and shorter time to first shock ($R = 0.14$, $p = .02$).

Individual characteristics of resuscitation team members such as technical skills, previous experience, communication, and leadership skills influence the course of action during a resuscitation. In addition to individual factors, social aspects and the collective interaction patterns that emerge within a team during a

resuscitation event can promote or impede coordinated execution of CPR guidelines. Indeed, recent clinical observations demonstrated that suboptimal adherence to CPR guidelines and deviations from treatment algorithms are associated with lower survival rates (Bhanji, et.al., 2010).

Modern and sophisticated equipment such as accelerometers, smart backboard, and reference markers may assist in monitoring the performance of the team during CPR. Early fatigue and inaccuracy in chest compressions should be caught early and corrected by the turn of the compressor (Avramidis 2014).

CPR checklist to documentation the activities during CPR can provide invaluable feedback and improve the effectiveness of the team and also for further improvement. Quality improvement can also be achieved by using the simulation training team and refreshing courses on a regular basis (Yang, et al, 2012).

A prolonged process of team building and poor leadership behavior are associated with significant shortcomings in CPR. Teamwork and leadership training have been shown to improve subsequent team performance during resuscitation and have recently been included in guidelines for advanced life support courses (Hunziker, et.al., 2011).

DISCUSSION

The result of this literature review showed that that high-quality CPR improved survival from cardiac arrest (Neumar, et.al., 2015). To ensure CPR performed well and qualified, then the component with high-quality CPR required to be applied. Those components include chest compression fraction, chest compression depth, compression rate chest, chest recoil, and ventilation (Hazinski, et.al., 2015).

Chest compression fraction is the proportion of time chest compressions are performed during cardiac arrest. Chest compression interruptions typically occur in the initial assessment of patients, call for help, prolonged ventilation, and the pause pre - post defibrillation. Chest compression fraction less than 80% are associated with decreased return of spontaneous circulation (ROSC), survival, and discharge patients from hospital. To minimize the loss of time, it is necessary to direct the initiation of resuscitation after cardiac arrest (or gasping breathing), minimizes the time lag pre defibrillation and ventilation and chest compressions immediately after defibrillation without rhythm analysis. How to increase the fraction of chest compression is to continue chest compressions during defibrillator charging and quick transfer between team members resuscitation (Avramidis 2014).

High quality chest compression depth is very important. The target is to encourage a minimum depth of 5 cm and a maximum of 6 cm (Hazinski, et.al., 2015). The depth of chest compressions were not associated with a reduction achieved ROSC and survival rates (Stiel, et. Al., 2012).

Optimum chest recoil sought to avoid a decrease in venous return and cardiac output (Niles, 2011). To keep the recoil of the chest wall between the compression, providers should maintain a position that does not rest on the chest (Hazinski, et.al., 2015). Other efforts are underway to avoid hyperventilation during CPR. Soon after cardiac arrest oxygen content at the beginning of compression is enough. High-quality chest compressions important in the circulation of oxygenated blood. To avoid hyperventilation, especially in monitored cardiac arrest, ventilation rate (breaths per minute) should be below 12 times per minute. Excessive positive pressure ventilation also affect venous return, so the increase in chest wall alone indicates the adequacy of tidal volume. In addition, gastric insufflation and aspiration of gastric contents caused by hyperventilation can increase complexity resuscitation efforts (Avramidis 2014). It may be reasonable for the provider to deliver 1 breath every 6 seconds (10 breaths per minute) while continuous chest compressions are being performed (ie, during CPR with an advanced airway). (Hazinski, et.al., 2015). The loss of time to ventilation and airway management (tracheal intubation) affects of chest compression fraction and defibrillation success (Avramidis 2014).

It is important in advanced resuscitation is monitoring CPR parameters. Monitoring parameters may improve the quality of CPR. Main determinants of effective resuscitation is coronary perfusion pressure (CPP), which is the difference between aortic diastolic pressure and diastolic pressure of the right atrium. Ideal conditions for CPR is when a central venous catheter were observed to reach TPK> 20 mmHg. If no catheter arterial / venous central, CPR with the achievement of end tidal CO2 (ETCO2) > 20 mmHg reflects the good quality of CPR performed. Capnography is also good as an indicator of ROSC when there is a rapid improvement to the normal level of 35 to 40 mmHg (Avramidis 2014).

High quality CPR in hospitals need readiness officer. In a literature study, Goldberger, et.al. (2011) suggested that CPR duration varies among hospitals. Treat hospital patients with CPR longer have a higher likelihood to return to spontaneous circulation. This shows that the systematic effort to

increase the duration of resuscitation may improve survival in high-risk populations (Goldberger, et.al., 2012).

In advanced life support, medications used in CPR including epinefrine. In cardiac arrest, epinefrine given intravenously or intraosseus a dose of 1 mg (10 ml of 1: 10,000) given every 3-5 minutes during resuscitation. Each provision of premises flush followed by 20 ml NaCl 0.9% and raise the arm for 10-20 seconds after administration. When administered through an endotracheal route, dose of 2-2.5 mg diluted in 10 ml normal saline. While amiodarone given by rapid intravenous dose of 300 mg (diluted with 20-30 ml of Dextrose 5%). The next award can be considered to use a dose of 150 mg intravenous administration interval of 3-5 minutes (Lee, 2011; Neumar, et.al., 2010; Neumar, et.al., 2015). During CPR in progress, all resuscitation drugs should be administered intravenously. Where intravenous access is delayed or can not be achieved, an intraosseous access can be considered. Central venous access provides better concentration, and peak drug circulation time is shorter, but also more difficult to obtain such access and cause interruptions in CPR. The study also found that there was not any benefit from the administration of drugs via the endotracheal route (Lee, 2011)

Low quality CPR has harmful effects on survival and neurological status of patients after resuscitation. Conversely, high quality in the implementation of the CPR more able to maintain viability. CPR with high quality done by using performance targets in keeping up the pace and depth of compression, providing the perfect opportunity chest recoil between each compression, minimizing disruption in compression, and avoid excessive ventilation. In addition to how to do CPR, CPR critical parameters to improve the quality of patient including feedback and resuscitation team, and a team approach to quality improvement strategies (Avramidis 2014).

All aspects of the incident cardiac arrest resuscitation, CPR and post-cardiac arrest care to return to a productive life, can be achieved through an integrated care system. The treatment system consists of several parts of the work are interdependent, each of which has an effect on every aspect of the care system. To bring about improvements, CPR service providers must maintain and respect the needs of mutual dependence of the various parts of the system in the hospital (Hazinski, et.al., 2015).

CONCLUSION

Maintaining high-quality cardiopulmonary resuscitation during cardiac arrest resuscitation in adults are absolutely necessary to achieve ROSC and better quality of life. High quality CPR performance can shown by the compression and teamwork quality. Mechanical compression devices used only when manual compressions may be challenging or dengerous for the provider.

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