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COMPRESSION-ONLY CARDIOPULMONARY RESUSCITATION AS AN ASSESSMENT TOOL FOR NURSING STUDENTS – AN EVALUATIVE LITERATURE REVIEW

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ABSTRACT

Aim/Objective: To examine, evaluate and analyse the validity of compression-only CPR developed by the AHA (2010) as an assessment tool that can be used by nursing students.

Methods: Search engines/databases were Proquest, Medline and CINAHL. The PICO guide helped in the search and eliminated all the irrelevant literatures. The populations were adult victims/patients resuscitated with compression-only CPR. Of the 100 studies, only 5 were used. The cycle of compression-only CPR on adult out of hospital and in-hospital cardiac arrests/sudden deaths are systematically reviewed according to their strengths and weaknesses.

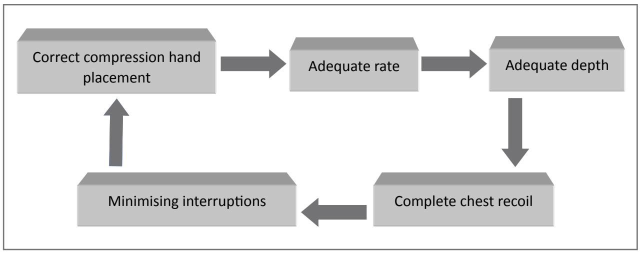
Results: The relevance and benefit of compression-only CPRs can be integrated to the nursing education with proper body mechanics. Student nurses can achieve survival rate among adult populations with less than 5 minutes of sudden death/cardiac arrest during an initiation of the cycles of compression-only CPRs, that requires no significant one superior hand placement on the COC (p=0.4); a >100 compression rates per minute (p=0.0083); deep chest compressions (p=<0.001); chest recoils after every chest compressions (p=<0.025); and an 11 seconds minimal interruptions (p=0.05).

INTRODUCTION

This literature review validates the applicability of the newly revised assessment tool of Basic Life Support (BLS) of the American Heart Association (AHA) (2010) for the nursing education. Specifically the subscale of high quality chest compression-only cardiopulmonary resuscitation (CPR) is analysed, examined and evaluated in this review. By looking into the relevance and benefits of compression-only CPR for student-nurses, the author sees the need to validate the cycle of compression-only CPR.

The subscale is illustrated in a cycle in figure 1 that starts with the initiation of (1) correct compression hand placement followed by an (2) adequate rate; followed by (3) an adequate 2 inches depth; enhanced by (4) a complete chest recoil; and ends in (5) minimizing interruptions.

***Figure1**. The cycle of high quality chest compression -only CPR*



HISTORICAL BACKGROUND

BLS tool historically was developed in 1967 (AHA, 2010) to enhance the care for adults with out-of-hospital and in-hospital cardiac arrests/sudden deaths. However, BLS tools were basically procedure manuals and were not assessed for their effectiveness. That is why the AHA in the 1980s re-developed a standard

CPR assessment tool (AHA, 2010; Nolan, 2012) to sustain and improve the quality and standard of resuscitation.

The AHA (2010) introduced the latest development of the tool in 2010. A major development done by stakeholders in the AHA BLS assessment tool was the change in methods applied – from airway, breathing and circulation algorithm to a compression, airway and breathing algorithm (AHA, 2010). The rationale behind the change in algorithm was to emphasize the importance of an immediate administration of high quality chest-compression (Sasson *et al*., 2012) for untrained rescuers (Hollstrom *et al*., 2000; Bunch *et al*., 2003).

The nursing education also adopted BLS assessment tool to evaluate the basic skills in resuscitation (Berman *et al*., 2008; Kasmah *et al*., 2010; Gatward *et al*., 2007).

SEARCH STRATEGY

Key words were placed on databases/search engines as text words, text headings and index headings. Databases are CINAHL (Cumulative Index for Allied Health Literatures) (3 studies) and Medline (2 studies); while search engines are Proquest (50 studies) and Google Scholars (45 studies).

This review used adults with in-hospital and out-of-hospital cardiac arrest/sudden death (Sladjana, 2011) since it is an easily defined population (Clare, 2006). The literature search was guided by the PICO (population, intervention, comparison and outcome) breakdown. Limits were set on the searches such as English languages and the year of publication on databases from 2004 to 2014 supporting the AHA BLS tool. Boolean phrases were used.

An extraneous variable was considered on the search which is the golden time of five minutes after an unwitnessed or witnessed sudden death/cardiac arrest (Nagao *et al*., 2007).

This evaluative literature review interpreted findings using Ryan *et al.,* (2007) and Coughlan *et al.,* (2007) guidelines in critiquing studies.

FINDINGS

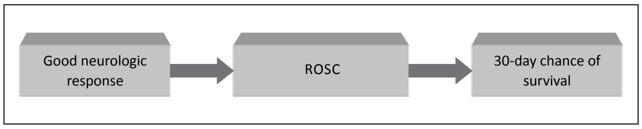
Of the one hundred studies, only five were used to focus the discussion on the cycle of compression-only CPR in order to examine, analyze and evaluate the validity of the AHA BLS tool (table 1).

Table 1. Probability findings validating AHA BLS assessment tool

Comparison	Intervention	Population	Probability
Qvistad *et al* (2013)	One superior correct hand placement on the COC	30 in hosp	0.4
Abella *et al* (2005)	>100 beats per minute fast chest compressions	97 out of hospital	0.0083
Tomlinson *et al* (2007)	Adequate 2 inch chest compression depthness	91 out of hospital	<0.001
Ogawa *et al* (2011)	Chest recoil every chest compressions	20,707 out of hospital	<0.025
Valenzuela *et al* (2005)	Chest compressions with minimal interruption	61 out of hospital	0.05

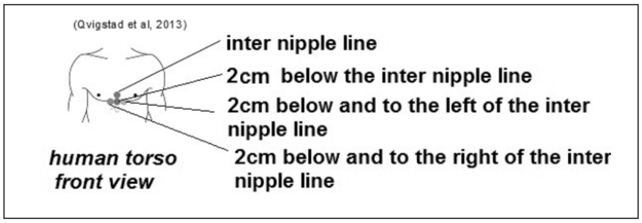
Compression only CPRs was found to be appropriate by student-nurse since it achieves good results like a good neurologic response, a return of spontaneous circulation (ROSC) (Nolen, 2012) and a 30 day chance of survival after both witnessed and unwitnessed cardiac arrest/sudden deaths (Sladjana, 2011) (Figure 2).

Figure 2. *Clinical outcome in a pathway*



The first of the cycle was validated by a clinical pilot study of 30 adult patients to validate the correct compression hand placement and monitor optimal chest compression done by Qvigstad *et al*., (2013). The probability test result showed that there is no significant difference (*p*=0.4) to demonstrate one superior hand position on the center of chest (COC), but inter-individual differences suggested optimal hand positions may vary. The COC uses four sites (figure 3) such as the inter-nipple line, 2 cm below the inter-nipple line, 2 cm below and to the left of inter-nipple line and 2 cm below and to the right of inter-nipple line.

Figure 3. *The four sites of the COC*



In order to ensure the validity and reliability of this research study, the probability testing was monitored with capnography and an end tidal carbon dioxide compression pressure rate to prove that the distribution of blood is effective during chest compressions on the COC (Qvigstad *et al.,* 2013).

The 100-beat per minute rate is the second subscale from the cycle of high quality compression-only CPR. Abella *et al*., (2005) used 97 adults with in-hospital cardiac arrest to measure the effectiveness of at least 100 beats per minute chest compressions. Validation data were evaluated with Pearson correlation coefficient analysis, using a randomized controlled trial (RCT). In the patients 100-beats per minute chest compression rates were analyzed and recorded using a novel tool with a personal digital assistant (PDA; Palm Pilot m500, Palm, Inc) programmed with the assistance of a Visual Basic Application Platform (AppForge Professional, Edition 2.1.1, AppForge, Inc). This research study gave a probability result of 0.0083 which means that there is a significant difference between the comparison of a <100 and ⩾100 compression rate per minute.

An adequate 2-inch deep chest compression is the third subscale from the cycle of high quality chest compression CPR as a continuation from the first and second cycles.

Tomlinson *et al*., (2007) used a population of 91 adults with <50 kilograms mostly having an out-of-hospital cardiac arrest and received a ⩾38 to 50 millimeters (mm) adequate chest compression depth. The hypothesis of Tomlinson *et al*., (2007) research is accepted and says that shallow chest compressions significantly affected the survival rate than those with deeper chest compressions with a probability of < 0.001. However, chests do not need to be forcefully compressed >51mm as the number of chest compressions increases and those who have softer chest can maintain a less forceful chest compression (⩾38 to 50 mm) and still acquire a 2-inch deep chest compression. The result is validated using a specially designed monitor/defibrillator equipped with a sternal pad fitted with an accelerometer and a pressure sensor to measure compression force and depth during CPR.

The fourth cycle of compression-only CPR is known as the complete chest recoil that is needed to support the first, second and third cycles.

Ogawa *et al*., (2011) validated an observational study among 20,707 patients out of hospital patients in the United States America and Canada with a probability value of <0.025 to be significantly affecting a survival rate after each initiation of a chest recoil. However, total population who achieved a ROSC did so only after 30 minutes of resuscitation with minimal interruptions and chest recoil. The populations used by Ogawa *et al*., (2011) consider extraneous variables such as patients with existing disorders, presence of heart rhythms during cardiac arrests, curable illness category and critical care interventions after a <5 minutes cardiac arrest

The 5th thematic subscale in the cycle of chest compressions is known as the minimal interruptions of 11 seconds.

This allows oxygen to circulate because the rescuer continuously performs chest compressions according to the study of Valenzuela *et al*., (2005). This RCT used 61 individuals out of hospital cardiac arrest adult patients and measured their results using Fishers exact test proving the hypothesis that there is a significant difference on the survival to hospital discharge (p= 0.05) if there is a limited interruption of 11 seconds during high quality chest compressions.

DISCUSSION

The strength of compression-only CPR is basically its reliability and validity to achieve its clinical outcomes (figure 2). These outcomes are evidenced by a result of an increased blood pressure and an electro cardiography tracing of a normal sinus rhythm (Hupfl *et al*., 2010; Babbs *et al*., 1983; Edelson *et al*., 2006), a normal pupillary reaction (Koenig, 2011; Nagao, 2009) and an increase in the Glasgow coma scale result (Sanders *et al*., 2002).

A weakness of the AHA BLS tool for compression-only CPR is the lack of assessment in the case of maintenance of a stable position at the COC and the initiation of proper body mechanics. Student-nurses need to know that maintaining a stable hand position at the COC pushes blood continuously (Qvigstad *et al*., 2013; Yeung *et al*., 2011; Whitfield *et al*., 2003; Nolan, 2012). Proper circulation of oxygen is ensured thus leading to a good neurologic response by a manifestation of a ROSC (Shin *et al*., 2007) to achieve a 30-day chance of survival after a both witnessed and unwitnessed cardiac arrest/sudden death (Sladjana, 2011).

In nursing education, it is also important to emphasize the correct elbow position of the rescuers (Berman *et al*., 2008). Student-nurses need to assess the maintenance of the elbow and wrist locked on the COC so that it will not create an interval during an ideally optimal chest compression (Berman *et al*., 2008; Whitfield *et al*., 2003).

Proper body mechanic must be taught to student-nurses because it can adequately and consistently provide a single rescuer with the strength to initiate a deep and fast 100 beats per minute rate since the musculature of a resuscitator is stable and well maintained (Svensson *et al*., 2010; Berman *et al*., 2008; Whitfield *et al*., 2003).

Lastly, the rescuer must allow chest to recoil by slightly lifting the hands off the COC at about 0.5 seconds, each episode of chest compressions (Sanders *et al*., 2002; Verghese *et al*., 1994). Student-nurses need to be assessed on this because they need to remember that blood pumps out of the ascending aorta or on the roof of the aorta every time the lungs and heart recoil allowing oxygen and blood to circulate at the same tme (Shin *et al*., 2007; Verghese *et al*., 1994; Hollstrom *et al*., 2000).

IMPLICATIONS TO PRACTICE

Nursing students should provide early chest compression-only CPR and incorporate the use of proper body mechanics on mannequins (Rossler *et al*., 2013; Gatward *et al*., 2007; Kasmah *et al*., 2010; Berman *et al*., 2008). Plant and Taylor (2013) stated that untrained rescuers need more practice. Hands-on practice on mannequins enable BLS resuscitators to perform repeated trainings that improves performance and retention (Gatward *et al*., 2007; Plant and Taylor, 2013; Passali *et al*., 2011).

ETHICAL ISSUES

One of the ethical issues is the benefit of achieving the clinical outcomes that outweighs the harm of painful chest-compressions that also extends to adverse effects such as pneumothorax, rib fractures and gastric distention (Walls, 2001).

Autonomy is another ethical principle when initiating chest-compressions. It is by moral justification and a Good Samaritan attitude (Abdulaziz, 2005; Al-Bukhari, 1979) whereby legal and theological bodies recognise that compression-only CPR can be done autonomously with or without medical advice (Zinn, 2012; Muhammad and Al-Bukhari, 1979).

CONCLUSION

It is therefore concluded that the AHA BLS tool on compression-only CPR is valid because its evidences are tested and retested by other studies to achieve an outcome of ROSC, good neurologic response and a 30-day survival rate.

Thus it can be concluded that compression-only CPR when integrated with proper body mechanics is reviewed to be very appropriate for student-nurses.

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