Original article

Basic Life Support Skills for high school students pre and post-cardiopulmonary resuscitation training- An interventional study

Stemi Stanly, Akhila Babu, Ramesh Unnikrishnan

Email: akhila.babu@manipal.edu

Abstract

Introduction: Immediate Bystander CPR improves the survival outcome of victims experiencing sudden cardiac arrest. Therefore, this study aimed at assessing the emergency preparedness level, training feasibility and knowledge retention of BLS skills among High School students. **Materials and Methods:** A total of 16 participants were included in the study by convenience sampling method. They were provided with Sudden Cardiac Arrest (SCA) scenario and were asked to perform on a CPR training manikin and assessed using a checklist. Following this session, a theoretical background and hands-on training was given to the students by an AHA certified instructor. This session was concluded by reassessing the participants. A week later, we re-assessed their skill retention. **Results:** The mean pre-training score was 2.6 (± 1.9). The post-training and one week recall scores was 12.44 (± 0.89) and 12 (±1.05) respectively. We observed a significant difference between the pre- and post-training scores ($p<0.001$). The post-training score and the one week recall scores were similar which implies that the students have good short term knowledge retention of BLS skills. **Conclusion:** Knowledge of basic life support skills is low among high school students. They have the ability to learn with good hands-on training and instruction. They also have good retention of the skills one week later.

Keywords: Basic life support, sudden cardiac arrest, American Heart Association

Introduction

Sudden cardiac arrest (SCA) and sudden cardiac death (SCD) is referred to as the abrupt termination of the cardiac activity with haemodynamic collapse, often due to sustained ventricular arrhythmias mainly ventricular tachycardia or ventricular fibrillation.[1] In the United States, the annual incidence of sudden cardiac death is 356,500 and the bystander-initiated CPR accounts for 37%, with a survival rate of 11%.[2] The reported mortality statistics in Southern India for SCA is 10.3% of which circulatory failure is the major cause (31%).[3] Cardiac arrest can occur in the hospital and out of the hospital. Approximately 70% of the cardiac arrests occur at homes, wherein the bystanders are usually family members, and can include adolescents.[2] In our out of hospital scenario, Basic Life Support (BLS) is a definitive life-saving therapy in victims experiencing cardiopulmonary collapse. Improving the links in the chain of survival, that is, early identification and initiation of bystander Cardiopulmonary Resuscitation (CPR) increases the survival rates.[4] Several researchers have reported that if 15-20% population could effectively provide BLS skills, mortality rate could greatly reduce and yet, less than 1% of the population could perform it adequately.[5] In the year 2003 in the United States,

Stemi Stanly, BSc RT, (MSc RT)
Department of Respiratory Therapy, School of Allied Health Sciences, Manipal University, Manipal, Karnataka, INDIA

Akhila Babu, MSc RT,
Assistant Professor Department of Respiratory Therapy, School of Allied Health Sciences, Manipal University, Manipal, Karnataka, INDIA

Ramesh Unnikrishnan, MSc RT, RRT,
Assistant Professor- Senior Scale, Department of Respiratory Therapy, School of Allied Health Sciences, Manipal University, Manipal, Karnataka, INDIA

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International Liaison Committee on Resuscitation (ILCOR) has recommended CPR training and automated external defibrillator (AED) as part of secondary school curriculum and has become a requirement for their graduation.[6]

We aimed to assess the emergency preparedness, knowledge retention level, effectiveness and barriers in performing BLS skills by high school students.

Materials and Methods

An Interventional study was conducted to assess the Basic Life Support skills among high school students. Ethical approval was obtained before commencement of the study. Informed consent and assent was obtained from the parents as well as from the participants. The study duration was seven months.Participants were included from 8th grade to 10th grade and those who had current infections, cardiorespiratory diseases, physical disability were excluded from the study. This study was conducted in the Medical Simulation Centre. The Little Anne CPR manikin, AED trainer, pocket mask and a stopwatch were used during the training program. No training videos were used.

The participants were individually provided with a simulated SCA situation by the investigator, *"A friend who has fallen unconscious in front of you."* They were asked to perform whatever they knew to revive the victim for a period of 3 minutes on a CPR training mannikin. The events and the skills performed were observed and recorded in an expert validated checklist by second and third investigator (AHA certified instructors) and the average of final scores was used for analysis.

Following this evaluation, an age appropriate theoretical background of SCA and training in BLS was conducted by an AHA instructor according to 2015 AHA guidelines.[7] Emphasis was given to the chain of survival, correct CPR performance and application of AED. Immediately after this session, students were divided into three groups, each group receiving BLS training for 10 min. They practiced CPR on the Little Anne manikin under the supervision of dedicated instructors. Their queries were cleared after the practice. The session was concluded by reassessment of the skills with the same checklist and same SCA scenario. A week later, participants were called again to the centre and their CPR skills were reassessed. Retraining of the participants was done if they could not perform BLS skills or missed the critical steps.

Data collection

The demographic data including the age, height, weight, BMI and gender of all participants were recorded. An expert validated checklist was used for the study. Their BLS performance was calculated based on the scores obtained after performing each item in the checklist ***(Table 1)***. The maximum total score that could be achieved was 13. The following items (response checking, EMS activation and hand placement) were considered critical steps and were given 2 points. All other items in the checklist were considered less critical and were given one point.

Statistical analysis

All data were compiled in Excel and transferred to SPSS for Windows, Version 16.0. Chicago, SPSS Inc, for analysis. Descriptive statistics are expressed as mean ± SD. Paired t -test was used for comparing the difference in means of pre-training and post-training. A p value of <0.05 or less was considered statistically significant.

Results

A total of sixteen high school students were trained among which 56% students were males and 44% were females. The mean height, weight and BMI are shown in (***Table 2***) Two students were lost to follow up. The mean pre-training score was 2.6 (±1.9). The post training and one week recall scores were 12.44 (±0.89) and 12 (±1.05) respectively. A significant difference between the pre-and post- training scores was observed. p (< 0.001) ***(Table 3)***.

A course feedback was distributed among the students to assess the overall program quality. The students felt confident in BLS after the training program as shown in (***Table 4***) Barriers faced by the students in performing the BLS were analysed by directly interviewing the students and found that students felt difficulty in understanding the scientific terms, remembering the algorithm stepwise, effective compression required intense strength and complained of pain over the wrist.

Discussion

According to AHA , about 70% sudden cardiac deaths happen at home and 20% in the public settings.[2] India being the second most populated country in the world and the incidence of SCA is advancing, critical life saving measures and BLS must be accessible to the community.[8] Educating people with BLS skills allows them to feel confident in delivering resuscitation measures and to become a responsible lay rescuer.[9] Several studies have been done among different categories of population to show the efficacy of bystander initiated CPR in saving the lives of cardiac arrest victims. Training programs for school children ensures that a wide population is reached including the minor communities and it serves as an effective strategy to increase the number of trained bystanders in the community.[5]

A study conducted by Fleischhackl ***et al*** reported that 9 year old students are capable of learning CPR skills including AED placement which were similar to our study with a mean age of 13 (±0.96), thus highlighting the feasibility of training high school students.[10] Physical strength in providing high quality CPR among high school students is a matter of concern. A study conducted by Hostler ***et al*** reported that 45% students of those aged between 13-14 years can provide adequate compression depth similar to that achieved by adults.[11] A study conducted by Jones ***et al*** reported that age may be a limiting factor pertaining to physical strength in providing CPR, but cognitive skills are independent and with periodic training improves the BLS skills over time.[12] In our study participants reported fatigue and pain at wrist post-delivery of CPR. The emergency preparedness level was low prior to the CPR training which is observed in their pre-training scores 2.50 (±1.9). An increase in the knowledge of CPR was seen post-skill training 12.4 (±.0.89) and after one week recall 12.2 (±1.05) which proves that the retaining capacity and application knowledge are maximum among high school students. It is imperative to note that the retention and performance skill of the students are markedly identical even after one week post training. Our results were similar to the study conducted by Meissner ***et al*** in Germany in 2013, where the researcher observed that mean score before the training was 3.9 (± 2.5) and post and 4 month re-evaluation score is 9.4 (±1) and 9.4 (±1.2) respectively.[13] A similar study was reported by Onyeaso ***et al*** among Nigerian high school students in 2016, where the researcher reported that CPR skills were virtually zero prior to the training and post-training knowledge gain in CPR skills and performance was 92.0% ($p< 0.05$).[14] Similarly, in our study the CPR training was highly effective and positively impacted with the post training scores 12.2 (±1.05) and the difference between pre- and post-training scores was highly significant. A study conducted by Collonny ***et al*** in United Kingdom, 2007 analysed the knowledge retention skills between students who received CPR training and a control group with a questionnaire.[15] The researcher observed that basic knowledge in the CPR group prior to the training was 46.7% and in the control group was 51%. Post-training there was a total knowledge gain of 82%. Following the six-month re-assessment, the knowledge in the CPR group was decreased to 61.1% ($p < 0.001$) but remained higher than that of the control group 52.3%. Woollard ***et al*** conducted a study on training laymen from a UK airport in which the researcher reported that the interval in CPR and AED training should never exceed more than seven months or further.[16] There is considerable evidence that BLS skills knowledge retention promptly deteriorates after the initial training. Several researchers have investigated this issue but there is no consensus about the optimal time interval between training sessions in the literature. Berden ***et al*** evaluated a faction of nurses in noncardiac units, showed that every six months re-training was adequate to maintain CPR skills,[17] but another study conducted by Riegel ***et al*** on lay volunteers, reported that even after 17 months of initial training there was good retention in BLS skills.[18] However, in our study we could not assess the long term knowledge retention. The post-training and one week scores were similar and it is reasonable to assume that students have good retention skills. The students were confident and were willing to provide CPR skills after the training session. A study conducted by Hubble ***et al*** reported that students and lay people are not pleased to provide BLS skills due to concerns of cross

infection, shock, legal issues and risk of harming the victim.[19] It is possible that students in our population were unaware of these consequences. In our study, a course feedback was collected from participants and suggested that free discussion, situational examples and utilisation of the videos are required for better understanding in the training program. Several researchers have observed that there are potential barriers for introducing BLS training program among schools particularly regarding the cost and time availability which was also observed in our study.[20]

This being a pilot study and the sample size being low, the study results cannot be generalised. Further follow up could not be done due to time and financial constraints. In future, cost effective and shorter BLS training program needs to be developed, thus reducing the training time and cost involved in training a large group of participants.

Conclusion

The knowledge on BLS skills is low in the high school students. When trained, they are able to understand and have a good retention skill.

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