Original Article

The understanding and recall of school children in Mumbai in compression only life support cardiopulmonary resuscitation

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Submitted: 07-Nov-2019
Revised: 04-Jan-2020
Accepted: 03-May-2020
Published: 01-Jun-2020

Access this article online

Website: www.ijaweb.org

DOI: 10.4103/ija.IJA_814_19

Quick response code

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ABSTRACT

Background and Aims: Out of hospital cardiac arrest (OHCA) is a leading cause of mortality worldwide. Increased bystander cardiopulmonary resuscitation (CPR) is observed in regions where school CPR training has been mandatory and led to reduced mortality by OHCA. We would like to explore the feasibility of teaching compression only life support (COLS) CPR to Indian school children through the following objectives determining their understanding of theoretical knowledge after a training session in the Indian Society of Anaesthesiologists' (ISA) COLS protocol and reviewing the information recall three months later. **Methods:** The participants of this quasi-experimental study were 132 school children, aged 12 to 15. The children were all below the age of 18 and consent was obtained vicariously through the principals of the schools and assent from the students in the form of willingness to answer the multiple-choice questionnaires. The study sample comprised of participants who responded to both questionnaires, immediately post-training session and three months later. Their responses were compiled in Excel and analysed using the paired *t*-test and R programming language. **Results:** None of the children had any previous knowledge on COLS. A one-hour session in COLS proved sufficient to increase the baseline knowledge with a mean post-training score by 82%. On comparing the two scores obtained, a statistically significant attrition rate was observed ($P < 0.001$). **Conclusion:** The children exhibited good understanding of COLS after a single training session. This makes us believe that more periodic revision, probably by inclusion of COLS in school curricula could be a satisfactory solution towards lowering the attrition in knowledge recall.

Key words: COLS, retention, school children, theoretical knowledge

INTRODUCTION

Out of hospital cardiac arrest (OHCA) is a leading cause of mortality worldwide.[1] The mortality in sudden cardiac arrest in India is approximately 4280/100,000 in contrast to 60–151/100,000 inhabitants in the United States of America.[2] This is due to deployment of a more sophisticated pre-hospital cardiac and trauma care system in the United States of America as compared to India, where emergency services are fragmented and not accessible throughout the country. Most people do not know the number to call in case of an emergency; services such as Dial 108/102/1298 Ambulances, Centralised Accident and Trauma Service (CATS), and private ambulance models exist with wide variability in their dispatch and transport capabilities.[3]

Following cardio-circulatory arrest and no blood flow, the brain can survive for only three to five

How to cite this article: Dhansura T, Ghurye N, Khurana A, Kudalkar S, Upadhyay Y. The understanding and recall of school children in Mumbai in compression only life support cardiopulmonary resuscitation. Indian J Anaesth 2020;64:501-6.

minutes without any damage.[4] CPR performed before emergency medical services (EMS) arrival was associated with a 30-day survival rate after an OHCA that was more than twice as high as compared to an OHCA associated with no CPR before EMS arrival.[5]

Therefore, one of the ways to reduce the mortality by OHCA, would be by increasing the bystander CPR rates. It has been observed in a study in Norway, where CPR has been mandatory as a part of school curriculum since decades, the bystander CPR rates remain the highest worldwide.[6]

This highlights the need for the hands-on training of Indian school children in CPR as well. Through our study we would like to explore the idea and feasibility of teaching compression only life support (COLS) CPR to school children in India, through the following objectives: First, after a hands-on training session in COLS, determining the understanding of the theoretical knowledge of COLS in school children aged 12–15. Second, reviewing the recall of information on COLS, three months after the training session.

METHODS

This a quasi-experimental study. The participants of this study were 132 school children studying in standards seven to ten and were 12 to 15 years of age. The participants were students of two different English-medium schools in South Mumbai where the principals had conveyed interest and granted permission for carrying out a training session in COLS. The first school in which the training session was carried out was an all-boys school with 36 participants and the second school was a co-educational school with 96 participants.

As the children were all below the age of 18, consent was obtained vicariously through the principals of the respective schools and assent from the students in form of willingness to answer the multiple-choice questionnaire administered post-session.

The children received a one-hour training session on COLS, where they were shown a slideshow presentation in English, which included the Indian Society of Anaesthesiologists (ISA) and Indian Resuscitation Council (IRC)- COLS guidelines (2017) and steps to correctly administer chest compressions.

They also underwent hands-on training for the same by a group of anaesthesiologists, consultants or anaesthesiologists-in-training from a local hospital in Mumbai. The trainers throughout the course of the study remained the same. In the hands-on training, the trainers oversaw the students as they carried out the COLS protocol of CPR and they were guided through the correct technique of compressions as per the guidelines. None of the children had any previous knowledge about CPR, as noted by their collective answer when they were questioned before the presentation.

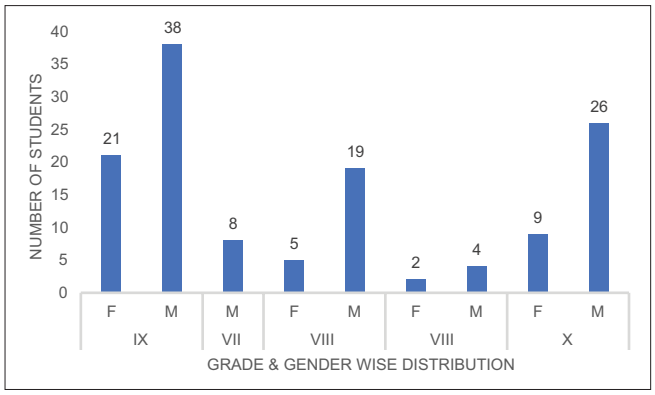
They were then administered a multiple-choice questionnaire (MCQ) [Appendix 1] comprising five questions, with English being the language of administration. The questions tested facts about COLS and gauged the understanding of the same.

After three months, a reassessment was done and the same set of MCQ was administered to the children who had attended the previous training session to determine the recall of information regarding the theoretical knowledge of COLS. The only exclusion criteria consisted of students who had attempted only one of the two questionnaires.

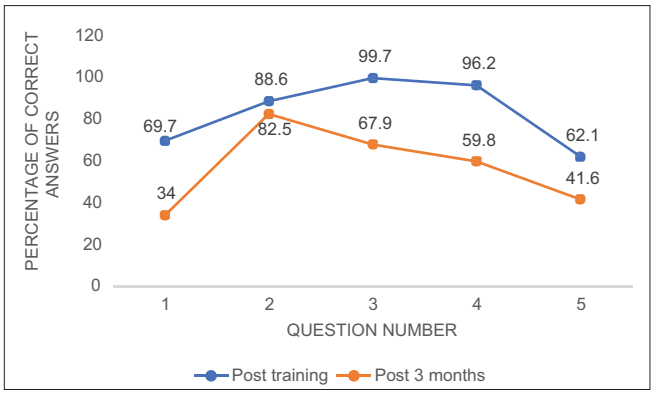
Data was compiled using Microsoft Excel and analysis was done by the following statistical tests using Excel and the R programming language. There was one point awarded for each correct question on the five-item MCQ and the total points obtained by each student on answering all five questions were calculated from their post-training questionnaire and the questionnaire administered after three months. The students' roll numbers served as a form of identification while comparing the post-training responses with the responses obtained on the questionnaire three months later. The findings in both were compared via the paired student's *t*-test where a *P* value of below 0.05 was considered to be statistically significant.

RESULTS

The standards and gender of the children is represented graphically [Graph 1]. None of the children had any previous knowledge of CPR. 193 responses were received when the questionnaire was administered post a one-hour training on COLS, for the first multiple choice questionnaire. The MCQ administered after three months received a total of 132 responses, the dropout rate in this study was 31.6%, which has been further elaborated upon in the discussion section.



Graph 1: Grade and Gender wise distribution of students



Graph 2: A comparison of percentage of answers answered correctly by students post training and post three months

A comparison of how the students performed on each individual question post-training to three months after training is graphically represented [Graph 2]. There was an attrition observed on comparing the correct answers post training, to that of three months after the training. The attrition rate was calculated on a per question basis. An attrition rate of 25.76% was observed on the first question, an attrition rate of 6.06% was observed on the second question, an attrition rate of 30.30% was observed on the third question, an attrition rate of 36.36% was observed on the fourth question and finally, an attrition rate of 20.46% was observed on the fifth question [Table 1]

When points were awarded for each correct answer, maximum points that could be obtained on the questionnaire were five and minimum points that could be obtained were zero. On comparing the scores obtained in the post-training questionnaire to the questionnaire administered after three months, a *P* value of $P < 0.001$ was obtained, which proved to be statistically significant [Table 2].

DISCUSSION

The age group in this study was selected in accordance with the WHO-endorsed "Kids Save Lives" Statement in 2015, a joint statement from the European Resuscitation Council (ERC), the European Patient Safety Foundation (EPSF), the International Liaison Committee on Resuscitation (ILCOR), and the World Federation of Societies of Anaesthesiologists (WFSA). This statement recommends two hours of CPR training annually from the age of 12 years in all schools worldwide.[7] At age 12, children are seen to be more responsive to instructions and they learn more easily to help others. Similarly, German anaesthesiologists together with the German Resuscitation Council were successful in convincing the delegates of the German Education Ministries to recommend CPR training for two hours per year from class seven onwards in all schools nationwide. In some parliaments, education of school children in CPR has been approved or is just about to be approved.[8] Starting at a young age also means that CPR is like swimming or riding a bike: children will not forget how to save a life.[9]

CPR training was imparted through a COLS module. This is in accordance with the current practice guidelines of CPR, which have been developed by the IRC, for resuscitating cardiac arrest victims outside the hospital by a layperson.[2] This COLS protocol has been developed by the IRC for making resuscitation attempts possible by laypersons who are unlikely to have access to automated external defibrillator (AED) but can call for help and provide effective chest compressions.[10]

Two large, randomised controlled trials have shown that COLS is just as effective as traditional CPR performed by laypersons.[11,12]

A one-hour session of COLS proved sufficient to increase the baseline knowledge of the children, as the mean post-training score was 4.16 points out of 5 and there was no pre-training exposure of the children. This training was highly effective considering the minimal amount of previous knowledge the students possessed. Similarly, in a study carried out in Nigeria, the performance of high school children in CPR was positively impacted where the pre-training CPR skills were virtually zero and post-training gain in CPR skills was of 92.0%.[13] In another study carried out involving high school students in South India, the pre-training CPR skills score was 2.6 and the post-training CPR skills score was 12.44, the difference of which

Table 1: A comparison of percentage of answers answered correctly by students post training and post three months along with the attrition rate

Question	Percentage of students answering correctly post training	Percentage of students answering correctly post three months	Attrition rate
1) Arrange what you would do when you see an unconscious person in sequential order	69.70%	34.09%	35.61%
2) Checking response to find out if person is unconscious is done the the following way?	88.64%	82.58%	6.06%
3) Local emergency helpline number is?	97.73%	67.42%	30.31%
4) Rate of chest compressions per minute should ideally be?	96.21%	59.85%	36.36%
5) Depth of chest compressions should be?	62.12%	41.66%	20.46%

Table 2: Paired *t* test

Post training	
Mean test score (out of 5)	4.1439394
Range	0-5
Standard Deviation	0.8921419
Post 3 months	
Mean test score (out of 5)	2.8560606
Range	0-5
Standard Deviation	1.0347591
Paired *t* test	
P	4.011E-22

ended up being statistically significant.[14] This again displayed good knowledge retention by the students.

A dropout rate of 31.6%. was calculated. This high dropout rate could perhaps be attributed to absenteeism on the day the second questionnaire was administered or maybe lesser importance was given to it or there was unwillingness to participate in the study, as CPR training is not a part of routine school curricula, which could have resulted in a few students not answering this second questionnaire.

On comparing the points obtained on the post-training questionnaire which averaged 4.16 to the questionnaire administered three months after training which averaged 2.8, it was seen that the difference proved to be statistically significant (P value <0.001) with an attrition rate of 25.76%. Contradictory results were obtained in studies carried out in Germany[15] and Pakistan.[16] In the former, no significant difference in knowledge was seen in the results of the questionnaire answered by students with three years of annual training events with a three-year gap and students who had attended annual training events for a continuous six years. This could be attributed to the difference in previous exposure to CPR by the students as well as regular annual training for three years. In the latter, results of the post-training questionnaire and questionnaire after three months did not show any statistically significant difference, which could perhaps be attributed to the degree of pre-training knowledge of the students. The attrition observed in our study could perhaps be satisfactorily lowered by periodic revision of the COLS protocol.

However, a study carried out in the United States of America showed similar results to our study. Students who didn't have a revision for four months between the time they learnt CPR, and gave a repeat knowledge questionnaire had a significantly lower value of retention than their counterparts who were re-educated within the same four month period.[17] All three studies showed that continual revision would be of help with knowledge retention, something which is reflected in our study as well.

The limitations of our study are as follows: our study focuses solely on testing the theoretical understanding and recall of school children of COLS. This study is one of the first of its kind in COLS in the country. It can therefore serve as a starting point in replicating bystander COLS on a larger scale along with necessary modifications, such as adding the component of monitoring technique. Since marked attrition was observed, we believe that there is a need for continual revision of the COLS protocol, which could be carried out by its introduction into the curricula of schools.

CONCLUSION

The children exhibited a good understanding of COLS after only a single training session. This leads us to believe that a more periodic revision, probably by involving the inclusion of COLS in the school curriculum, could be a satisfactory solution towards lowering the attrition rate we observed in the recall of the protocol. This would ultimately contribute towards mitigation of the high mortality associated with OHCA by the virtue of increasing bystander CPR rates in the future.

Acknowledgements

Mr Yash Dhuldhoya and Mr Mihir Gada for their contribution towards analysis of the data. Ms Radhika Shah for her contribution towards proofreading the manuscript of this study.

Declaration of patient consent

The authors certify that they have obtained all appropriate patient consent forms. In the form the patient(s) has/have given his/her/their consent for his/her/their images and other clinical information to be reported in the journal. The patients understand that their names and initials will not be published and due efforts will be made to conceal their identity, but anonymity cannot be guaranteed.

Financial support and sponsorship

Nil.

Conflicts of interest

There are no conflicts of interest.

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APPENDIX

Questionnaire -Methodology -Appendix 1

Response sheet

Name-

Standard-

1) Arrange what you would do when you see an unconscious person in sequential order

A) Start compressions

B) Check for response

C) Call for help

D) Check if scene is safe

Select the correct answer

2) Checking response to find out if person is unconscious is done the following way

a) only tapping the person's shoulders b) only calling out to the person

c) tapping the shoulders and calling out to the person d) no need to check for response start compressions immediately

3) Local emergency helpline number is

a) 108 b) 100

c) 101 d) 103

4) Rate of chest compressions should ideally be

a) 60–70 / minute b) 10–12/ minute

c) 80–90 / minute d) 100–120/ minute

5) Depth of chest compressions should be

a) atleast 5cm and not more than 6cm b) atleast 7cm not more than 9cm

c) atleast 1cm and no more than 2 cm d) It does not matter