

To Assess the Knowledge and Effectiveness of Compression-Only Life Support (COLS) Training among Layperson: A Prospective Study

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ABSTRACT

Introduction: Cardiac arrest has been recognized as a global public health concern and can occur anywhere, even outside the hospital setting. Low bystander cardiopulmonary resuscitation (CPR) rate is one of the factors responsible for the poor outcome for patients having cardiac arrest outside the hospital.

Aim: This study aims to assess the knowledge and effectiveness of Compression-Only Life Support (COLS) training among layperson as per Indian Resuscitation Council (IRC) guidelines.

Methodology: A prospective study was conducted on 100 laypersons residing in a residential campus of a tertiary care hospital in North India, from June to November 2019. Participants were enrolled using convenient sampling. Data was collected using a structured validated questionnaire, followed by COLS training by interactive lecture, demonstration and hands-on practise by participants. In the post-test, knowledge and COLS skill was assessed. Data were analysed using frequency, percentage, and paired t-test. A p-value <0.05 was accepted as significant.

Results: Significant difference was observed in the mean knowledge score of before (2.7 ± 1.51) and after the training (13.88 ± 1.09) ($P=0.001$). After the training, 96 participants had good COLS knowledge and a median (IQR) score of COLS skill was 40 (0). Eighty participants attained 100% competence in performing COLS in the first attempt and all after three attempts. COLS training is effective in increasing knowledge and developing

competence regarding CPR among laypersons. It is a simple algorithmic approach and easy to learn for a layperson.

Keyword: chest compressions, cardiopulmonary resuscitation, compression-only life support, layperson, out of hospital cardiac arrest.

INTRODUCTION

In India out of 4280/100,000 population, die from sudden cardiac arrest (SCA) and nearly 85% of cardiac arrests occur outside the hospital. [1] Among 56.5% of witnessed out of hospital cardiac arrest (OHCA), only 1 (1.3%) received the bystander CPR. [2] High-quality early cardiopulmonary resuscitation (CPR) including early defibrillation improves neurological outcome. [3] Hence, it is important to impart the CPR training to laypersons as well. Various professional bodies provide guidelines for layperson CPR. [4,5] Indian Resuscitation Council (IRC) has formulated the CPR guidelines for the layperson- Compression Only Life Support (COLS). [1] These guidelines have been used for teaching and training across India and landmark training programme was conducted during the world restart a heart day. [6] However, the published data related to its knowledge and effectiveness of training is scarce. This study was conducted with an aim to assess the knowledge and effectiveness of COLS training among layperson and to explore the barriers for the

execution of the COLS programme in real-time.

MATERIALS AND METHODS

This prospective study was conducted after the approval of the ethical committee (vide no IEC PG-118/28.02.2019 dated 28th February 2019). The study was registered at clinical trial registry-India (vide no CTRI/2019/06/019910 dated 27th June 2019).

The study included 100 family members of health care workers of a tertiary care institute of north India. Participants above 18 years of age who can read and understand Hindi, never undergone any kind of CPR training in their lifetime and were willing to participate were included in the study. Health care providers (medics, paramedics) were excluded from the study. The participants were provided a written participant information sheet for study protocol and any queries were answered.

A standardized bilingual information leaflet (Hindi and English) was made by the researcher based on a review of literature related to layperson CPR. This leaflet included information related to the death of people due to cardiac arrest outside the hospital. The cardiac arrest which can occur at any place like home, market, restaurant and the workplace and among these 90% of cardiac arrest victims die was emphasized. The need of early chest compression even by trained layperson increases the chances of survival of a victim by two to three times. All houses (180 in number) in the residential campus were line-listed. The leaflet containing information regarding COLS was distributed in each house. Following this, details of eligible and consenting (written informed consent) participants were collected who were willing for COLS training. Training sessions were organized on weekends in both morning and evening sessions at an open spacious hall in the vicinity of residential campus from the first weekend of September 2019 to November 2019. The participants were given a choice to choose

any of these sessions as per their convenience.

A structured demographic data sheet and validated knowledge assessment questionnaire based on COLS guidelines as per IRC were administered to all the participants after the enrolment. The knowledge assessment questionnaire was a validated multiple choice 15 items self-developed structured questionnaire. The questionnaire was prepared in English and then translated into Hindi language and validated by to and fro translation by language experts. The reliability of the questionnaire was established by the test-retest method and Karl Pearson's correlation coefficient was 0.84. The maximum possible knowledge score was 15 and the minimum was 0. A score above 80% was considered as adequate knowledge. An educational training program was prepared which included an introduction to the basic functioning of heart, the difference between heart attack and cardiac arrest, the importance of COLS in cardiac arrest, identification of a victim in cardiac arrest and steps of COLS as per IRC guidelines. Implementation of the training program was done in the form of interactive COLS session based on a PowerPoint presentation displayed on a laptop screen followed by a manikin based live demonstration by the IRC trained instructors. Standardized PowerPoint presentation of COLS was available in both Hindi and English language and was accessed from the IRC website (www.cprindia.in). The approximate duration for the interactive session was 15-30 minutes and another 10-15 minutes to answer the queries of participants. The approximate duration of the hands-on demonstration for the whole group was 15-20 minutes and additional 5-10 minutes for queries or re-demonstration. Following the demonstration, participants were given time to practice COLS skills on a manikin in a group of 3-4 participants with a participant to manikin to instructor ratio of 1:1:1. Each participant was provided 15-30 minutes to master the COLS skills.

Following the practice session, knowledge and skill were assessed as per standardized tool. The same knowledge assessment questionnaire used for pre-test was used for post-test assessment. For the assessment of COLS skills, multiple validated standardized case scenarios of cardiac arrest were prepared by the researcher along with a validated COLS skill assessment checklist based on core links and algorithm of the COLS as per IRC guidelines. Inter-rater reliability of the checklist was tested and was 94%. There were 4 core domains in the COLS skill assessment checklist: scene safety (1 item), early recognition and activation (10 items), good quality chest compressions (8 items) and response check after 5 cycles of chest compression (1 item). For each, correctly performed COLS skill scored 2, partially correctly performed skill scored 1 and skill which was not performed scored zero. Competency in skill was considered with 100% skill performance in all the 4 domains. In case, participants were unable to achieve 100% skill performance in the first attempt, remedial training was provided and retesting was done until participants achieve 100% skill performance. Participants were randomly asked to select a standardized case scenario from the number provided and the chosen case scenario was explained to them. Participants had to then demonstrate COLS skills on the manikin provided individually and assessed by an independent instructor.

After the intervention, feedback regarding COLS training was obtained using a standardized performance prepared by the researcher.

Statistical Methods

The sample size was calculated based on the pre-test knowledge score

(5.12 ± 1.60) in the pilot study done on 14 participants, taking relative precision of 10% with a 90% confidence interval. The calculated sample size was 39. Finally, 100 participants attended the training as per their availability. Data were analysed using software, STATA 11.2 version. Frequency and percentage were used to analyse the demographic data. Paired t-test was used to compare the pre-test and post-test knowledge score and level of significance was kept $P < 0.05$.

RESULT

Amongst 210 eligible participants, 160 laypersons showed interest to attend COLS training however, 100 consented and attended the training. The training was completed in six weekends with 11 morning sessions and one evening sessions. In the first weekend 17 participants, followed by 20, 14, 20, 13, 16 participants attended the training in subsequent weekends. As per the convenience of participants language used for teaching and demonstration of COLS was Hindi in all the sessions.

The mean age of the participants was 33 ± 10.7 years and 64 were females. More than half of participants (52) had an educational qualification of higher secondary followed by primary (24), graduation (22) and post-graduation (2). Most of the female participants were housewives and unemployed (49). Out of 100 participants, only 8 participants had heard regarding COLS from college or school (4), workplace (2) and newspaper (2).

At baseline, all 100 participants had inadequate knowledge regarding COLS that improved significantly after the training (mean difference of 11.1 at $P = 0.001$)

Table 1: The knowledge and skill scores for COLS (n-100)

| | Baseline | After Training | p value |
|--|------------------------|------------------------------|--------------|
| Knowledge Score (0-15) Mean \pm SD (95% CI) | 2.7 ± 1.51 (2.4-3) | 13.88 ± 1.09 (13.6-14.1) | 0.001 |
| COLS Skill Score (0- 40) Mean \pm SD | Not assessed | 39.77 ± 0.489 | |

Table 2: Item wise performance of COLS (n=100)

| COLS Checklist Item | 1 st Attempt | | | 2 nd Attempt | | | 3 rd Attempt | | |
|---|-------------------------|--------------------------|----------|-------------------------|--------------------------|----------|-------------------------|--------------------------|----------|
| | Correctly Done | Partially Correctly Done | Not Done | Correctly Done | Partially Correctly Done | Not Done | Correctly Done | Partially Correctly Done | Not Done |
| Ensuring Scene Safety | | | | | | | | | |
| Scene safety ensured | 100 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Early Recognition and Activation | | | | | | | | | |
| Checked Victim's Response | 100 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Shouted for help | 100 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Dialled emergency number | 100 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Identified himself/herself | 100 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Identified location | 100 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Explained number of victims | 100 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Explained age of victim | 97 | 0 | 3 | 100 | 0 | 0 | 0 | 0 | 0 |
| Explained sex of victim | 100 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Explained number of rescuers | 100 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Ensured to hang up the call | 100 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Chest Compression | | | | | | | | | |
| Placement of heel of hand | 100 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Interlocking of fingers | 100 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Elbows kept straight; shoulders perpendicular to victim's chest | 100 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Depth was kept between 5-6cm | 98 | 2 | 0 | 100 | 0 | 0 | 0 | 0 | 0 |
| Rate kept 120/min | 92 | 8 | 0 | 98 | 2 | 0 | 100 | 0 | 0 |
| 5 cycles of compressions provided | 100 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Complete chest recoil allowed | 96 | 4 | 0 | 99 | 1 | 0 | 100 | 0 | 0 |
| Interruptions were kept minimum | 97 | 3 | 0 | 99 | 1 | 0 | 100 | 0 | 0 |
| Response Check After Chest Compression | | | | | | | | | |
| Response of victim checked after 5 cycles of chest compression | 100 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

Eighty participants achieved competence in all domains of core skills in the first attempt. Twenty participants lack competence in performing COLS skills at first attempt in the domain of chest compression (17 participants) and early recognition and activation (3 participants). The median (IQR) of COLS skill score of these 20 participants was 39(0). These participants were unable to maintain the depth of compressions to 5-6cm, maintain a compression rate of 120 compressions per minute, allow complete chest recoil, maintain minimum interruptions during chest compressions and did not explain the age of the victim. In the 2nd attempt after remediation, 13 participants achieved competence in performing COLS in the domain of chest compressions and three participants achieved competence in the domain of early recognition and activation. Remaining 4 participants were still lacking competence in performing COLS in the domain of chest compression. The median (IQR) of COLS skill score of these 4 participants was 39(0). The training was reinforced for these 4 participants to perform COLS steps and finally, all participants achieved competence in performing COLS in the third attempt.

Table 3: Barriers in performing COLS in real time among layperson (n=100)

| Barriers | Frequency |
|--|-----------|
| Reasons for not performing COLS on near and dear ones | |
| • Fear of causing harm to victim | • 1 |
| • Fear of making mistake | • 1 |
| Reasons for not performing COLS on stranger | |
| • Fear of causing harm to victim | • 1 |
| • Fear of making mistake | • 2 |
| • Anxiety | • 1 |

The feedback received from participants after the training revealed that all participants expressed that COLS training is important and they would like to attend COLS training in future too. All participants will encourage their near and dear ones and neighbours for COLS training. Ninety-nine participants stated that they are confident in performing COLS on a cardiac arrest victim. Feedback also revealed that 98 participants will perform

COLS on their near or dear ones and 96 participants will perform COLS on a stranger. The participants expressed certain barriers for not performing COLS.

DISCUSSION

Compression-Only Life Support (COLS) structured training, using the lecture method followed by a hands-on demonstration and practice for an optimal time was effective in increasing the knowledge and skill regarding COLS among layperson.

The hands-only CPR and COLS are the simple algorithmic approach for teaching and training CPR. [1] These simplified trainings are easy to learn and understand for laypersons who do not have any medical background and are inexperienced in performing CPR.

COLS skill competency was achieved by 80% laypersons in the first attempt and by 100% after three attempts which are satisfactory among laypersons who were exposed to such training for the first time. This was because a simplified COLS algorithm was taught in an easy and understandable language along with hands-on practice to the layperson. Onyeaso AO et al, [7] Salunkhe PA et al [8] and Devi CS et al [9] reported similar results among students, police and students respectively using layperson CPR techniques. Our study also identified core steps in skill teaching that needs more emphasis during COLS training. In the present study, all 100 participants ensured scene safety, checking victim's response, shout for help, identification of location during call, recheck victims' response correctly as these are simple steps to be followed. Complete chest recoil step in COLS is technical and was not done by 4 participants. Ali S et al also presented that scene safety and call for help were performed effectively, response check, and site identification were performed by the majority and the domain of chest recoil was performed by 71% which was 96% in our study. [10] This was possible as we demonstrated hands-on followed by

sufficient practice time whereas in their study the steps of compression-only CPR were demonstrated on a manikin within 9 minutes. For a layperson, who do not have any information regarding CPR it will take some time to understand and remember all steps which are not possible within a short duration of 9 minutes. So, we need to provide sufficient time to assimilate the information and hands-on practice for sufficient duration as well to learn the COLS. The only domain lacking competence was of chest compressions which require more practice and reinforcement as this is a very important key step and involves technical as well specific sensory-motor activity which can be attained only by practice. This area of lacking should be emphasized by trainers for layperson CPR by providing more practice sessions with adequate time.

Though there was an increase in knowledge and skill related to hand only CPR after the training but no follow up was done to assess the retention of CPR knowledge and skill as it was not the objective of the study. The various professional body for CPR training has mandated retraining which could be because of the obvious reason that the knowledge and skill decline over time. A study done among school children regarding CPR training in Mumbai very well emphasizes the need for regular revision of the CPR knowledge and skill. [11]

The feedback regarding the acceptance of training was attained and the willingness to perform COLS was an overwhelming response. More than 98% of participants were willing to perform chest compressions on their near or dear ones as observed in few other studies also. [12-15] Most of our participants expressed a willingness to perform COLS on a stranger as they felt confident in performing COLS and wanted to save lives. Chen M et al reported that 76.3% were willing to perform CPR on a stranger. [13] In India under Good Samaritan law, helping road accident victims is now free of legal and procedural

hassles which could be a possible explanation in the present study for providing chest compression to a stranger.

Few barriers identified for not performing chest compressions were fear of making mistake, fear of causing harm to victim and anxiety as reported by Jarrah S et al [15]. In contrast, Cho GC et al [16] reported fear of legal liability and fear of disease transmission as significant obstacles in performing CPR. Concern regarding HIV infection transmission was reported by Jelinek GA et al [14] as these participants were taught BLS which includes mouth to mouth ventilation and transmission of HIV infection via mouth to mouth might be a myth to the participants.

The strength of the study is that this kind of study is the need of the hour for increasing the number of bystanders in the community to improve outcome among victims of cardiac arrest outside the hospital by timely initiating the COLS. It's suggested to undertake similar studies in different settings targeting different populations like police, traffic policeman, security guards, teachers, school children, drivers etc. Different methods of teaching the skills and updating knowledge can also be compared. Keeping in mind that the knowledge and awareness of COLS are important among laymen, the IRC has started celebrating the 'World Restart a Heart Day' by having such COLS sessions all over the country. [6]

The limitation identified is that COLS skills were evaluated by providing hypothetical scenarios of cardiac arrest instead of real-time assessment wherein the participants might be in a panic state. The rescuer might be in such geographical area where no help is available or is unable to initiate chest compressions. Also, long term retention of such training needs to be assessed. Reinforcing the COLS training at certain intervals will enhance CPR skills and more trained people will be competent to provide COLS when needed.

CONCLUSION

To conclude, Compression-Only Life Support (COLS) training among layperson taught by interactive session followed by hands-on demonstration and practice was effective in increasing the knowledge and competency in performing COLS.

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