

## Evaluation of the Effectiveness of Basic Life Support Training on the Knowledge and Skills

Mohammad Afzalimoghaddam<sup>1</sup> (MD); Morteza Talebideloi<sup>2\*</sup> (MD); Mohammadtaghi Talebian<sup>1</sup> (MD); Shervin Farahmand<sup>1</sup> (MD)

<sup>1</sup> Department of Emergency Medicine, Imam Khomeini Hospital, Faculty of Medicine, Tehran University of Medical Sciences, Tehran, Iran.  
<sup>2</sup> Patient Safety Research Center, Imam Reza Hospital, Faculty of Medicine, Mashhad University of Medical Sciences, Mashhad, Iran.

ARTICLE INFO	ABSTRACT
<p><b>Article type:</b> Original Article</p> <hr/> <p><b>Article history:</b> Received: 26- Dec-2013 Accepted: 14- Jan-2014</p> <hr/> <p><b>Keywords:</b> Basic cardiac life support Cardiopulmonary resuscitation Knowledge Medical student</p>	<p><b>Introduction:</b> Basic Life Support (BLS) as the first level of medical care in sudden cardiac arrest and life-threatening illnesses can improve survival outcomes. The aim of this study was to compare the knowledge and skills of BLS among medical students at the beginning and the end of the training course in the emergency department.</p> <p><b>Materials and Methods:</b> This is a descriptive analytic cross-sectional study among 90 medical students in their sixth academic year during emergency medicine training course. At first, a standard Objective Structured Clinical Examination (OSCE) was performed to obtain their basic knowledge and skills of BLS. Then a training course was provided in two theoretical and practical parts using the 2006 American Heart Association guidelines for cardiopulmonary resuscitation and emergency cardiovascular care. At the end of the study, the same standard OSCE was performed.</p> <p><b>Results:</b> The mean score of the primary OSCE was 4.9 with 55 students (61.11%) having a score between zero to five and 35 (35.89%) between five to ten. The mean scores increased significantly after training regarding checking the patient's response, head tilt and chin lift maneuvers, number of massages and correct breathing (<math>p &lt; 0.05</math>). This training did not change the knowledge of students concerning location and depth of compression. (<math>P</math>-value=0.1)</p> <p><b>Conclusion:</b> Standard BLS training could significantly increase the knowledge of medical students who should provide CPR in a safe, timely, and effective manner. Therefore, standard BLS training is recommended as part of medical curriculum.</p>

► *Please cite this paper as:*

Afzalimoghaddam M, Talebideloi M, Talebian MT, Farahmand Sh. Evaluation of the Effectiveness of Basic Life Support Training on the Knowledge and Skills. *Patient Saf Qual Improv.* 2014; 2(2):73-76.

### Introduction

Sudden Cardiac Arrest (SCA) is one of the most common causes of death in many countries (1). While for many of the victims a Cardio Pulmonary Resuscitation (CPR) was performed, the survival to discharge after CPR was about 6.9% (2).

CPR is a series of actions done by witnesses at the scene, and its aim is to restore cardiac and pulmonary functions and prevent brain damage.

Initiation of Basic Life Support (BLS) in less than four minutes from cardiac arrest followed by Advanced Cardiac Life Support (ACLS) will increase the success rate (1). In addition, the quality of CPR performance will affect the outcomes (3, 4). The level of training in health care providers will influence the quality of CPR (5, 6). Several studies have demonstrated that CPR quality is not satisfactory in some hospitals, and the

healthcare providers have limited knowledge about CPR, particularly appropriate thoracic compression and avoidance of continuous hyperventilation (7).

CPR training is an important part of medical courses, but the most effective method of training is still unclear and depends on trainees' groups and previous theoretical knowledge of CPR among them (8).

Although several studies have shown that medical students' knowledge and performance of CPR is not satisfactory, it has not been a part of medical courses in Iran yet (9). The aim of our study was to compare the knowledge and skills of BLS among medical students between the beginning and end of the training course in the emergency department and to assess the necessity of providing BLS training in the medical curriculum.

## Materials and Methods

This study was an analytic interventional non-experimental study conducted among the medical students in their sixth academic year during their eight-week emergency medicine training course in Tehran University of Medical Sciences. All students were asked to complete an informed consent form. The teaching committee of the emergency department (consisting of faculties of emergency department) approved the study. In addition, the ethical approval was obtained from the ethics committee of Tehran University of Medical Sciences.

In the beginning, a standard Objective Structured Clinical Examination (OSCE) was obtained from the students at the Clinical Skills Center of Tehran University of Medical Sciences. During the exam, students were supposed to perform different parts of BLS on a standard manikin, and a rater evaluated their skill using the 2006 American Heart Association (AHA) CPR testing checklist including checking for unresponsiveness by shouting and shaking the manikin, asking for help and calling EMS, opening the airway using head tilt-chin lift maneuver, checking breathing, giving two breaths, checking the carotid pulse, baring the victim's chest and locating the CPR hand position, performing the first cycle of compressions, and giving two breaths after the first cycle of compressions. The students were rated for the first nine skill steps and also an additional step regarding checking for environmental safety. Skills related to Automated External Defibrillator (AED) were omitted from the test. For each step, the student got one score for appropriate performance and zero for inappropriate one. A total score of ten was for complete performance in all steps. A single rater (an emergency medicine resident) evaluated all the tests and all the students.

After the exam, all the participants attended a BLS training workshop in which major BLS techniques were taught by the faculties of emergency medicine.

The workshop was a six-hour course divided into two sessions, and every session was divided into one hour of theoretical training and two hours of practice on the standard manikin. Each student should have participated in at least five real CPRs during his/her emergency rotation. At the end of the eight-week rotation, students were re-assessed for BLS skills by the same standard OSCE. The collected data was analyzed using SPSS (Statistical Package for the Social Sciences) version 17 for Windows (Chicago, IL, USA).

The data was analyzed anonymously and expressed as means  $\pm$  S.D and percentage. Wilcoxon signed rank test, Mantel-Haenszel test, McNemar's test and paired T-test were also used for statistical analysis, and P-values < 0.05 were considered statistically significant.

## Results

Ninety medical students, 39 men (43.3%) and 51 women (56.7%) volunteered to enter this study.

The mean score of the participants in the first OSCE was  $4.9 \pm 2.07$  with 55 students (61.1%) having a score between zero and five and 35 (35.89%) between five and ten. In the second exam, the mean score was  $8.5 \pm 1.44$  with 19 students (21.1%) having a score between zero to seven and 71 (78.9%) a score between seven and ten.

The mean score in the second OSCE was significantly higher than the primary exam ( $P < 0.000$ ).

Students' scores in the first and the second OSCE shown in Table 1. There were no significant differences in the examination scores between genders, neither in primary nor in the secondary exam ( $P = 0.12$ ).

**Table 1: The effect of training on undergraduate medical students' functional skills (MCNEMAR Test)**

skill	Number of accurate performance 1 <sup>st</sup> OSCE	Number of accurate performance 2 <sup>nd</sup> OSCE
Check for environmental safety	28(31.1%)	71(78.8%)*
Check for unresponsiveness shouting	42(46%)	88(97.8%)*
Check for unresponsiveness shouting	46(51.1%)	87(96.7%)*
Call EMS-ask for help	27(30%)	88(97.7%)*
Air way opening (head tilt-chin lift)	27(30%)	73(81.1%)*
Check of breathing	31(34.4%)	74(82.2%)*
Giving 2 correct breathing	44(48.8%)	84(93.3%)*
Check pulse	19(21.1%)	65(72.2%)*
Locate CPR & hand position	79(87.8%)	86(95.5%)
Correct massage Number of massage in 1st CPR cycle	51(56.7%)	80(88.9%)*
Correct massage Depth of massage in 1st CPR cycle	74(82.2%)	81(90%)
Give 2 correct breathing	17(18.9%)	41(45.6%)*

\* P-value < 0.05

**Checking for environmental safety:** Before the training workshop, 28 students (31.1%) checked for the safety of the environment before reaching to the manikin. By the end of the course, a statistically significant difference was shown with 71 students (78.8%) doing the safety check ( $P < 0.000$ ).

**Checking for unresponsiveness:** Before the workshop, 42 students (46%) shook the manikin and 46 (51.1%) shouted to check for its responsiveness. After the training, these numbers rose to 88 for shaking (97.8%) and 87 (96.7%) for shouting ( $P < 0.000$ ).

**Asking for help and calling EMS:** Before the training,

27 students (30%) asked for help and called EMS, while 88 (97.7%) did these steps after the workshop ( $P < 0.000$ ).

**Opening airway using head tilt-chin lift:** In the first OSCE, 27 students (30%) did an accurate head tilt-chin lift maneuver, but in the second exam, 73 students (81.1%) had a correct performance ( $P < 0.000$ ).

**Checking breathing:** Thirty-one students (34.4%) checked for breathing in the first exam and 74 of them (82.2%) performed it in the second one ( $P < 0.000$ ).

**Giving two breaths:** In this part, 44 students (48.8%) before the training course and 84 students (93.3%) after it had an accurate performance ( $P < 0.000$ ).

**Checking carotid pulse:** Nineteen students (21.1%) checked for carotid pulse before the training while 65 students (72.2%) did this part after the workshop ( $P < 0.000$ ).

**Baring the victim's chest and locating the CPR hand position:** Seventy-nine students (87.8%) before the training and 86 students (95.5%) after it chose a correct location for chest compression and had an acceptable hand position. There was not statistical significance regarding baring the victim's chest and locating the CPR hand position between pre-test and post-test score ( $P < 0.11$ ).

**Performing the first cycle of compressions:** In this section the numbers of compressions along with the appropriate depth were evaluated. During the first OSCE, 51 students (56.7%) performed 30 compressions in less than 23 seconds. In the second exam, 80 of them (88.9%) did adequate number of compressions ( $P < 0.000$ ).

**Giving two breaths after the first cycle of compressions:** Before the workshop 17 students (18.9%) performed this step properly, while 41 (45.6%) gave two appropriate breaths to the manikin in the second exam ( $P < 0.000$ ).

## Discussion

The current study compared the knowledge and skills of BLS among medical students at the beginning and the end of the training course in an emergency department. We found that BLS training course could significantly increase the knowledge of medical students who should have the ability to recognize several life-threatening emergencies and provide CPR in a safe, timely, and effective manner. The influence of adequate knowledge on the accuracy and quality of BLS/CPR has been shown in studies (10). In addition, early institution of CPR can remarkably increase the victim's chance of survival from sudden cardiac arrest (11, 12). In our study, pattern of responses showed that

medical students had unstructured knowledge of BLS.

Similarly, a study that was conducted in Pakistan showed scattered knowledge about BLS among medical students (13, 14). Moreover, a larger study in South India concluded that awareness of BLS among students, doctors, and nurses of medical, dental, homeopathy, and nursing colleges was very poor (14).

Our results are in accordance with poor performance of healthcare providers in manikins described by Flesche (15). Previous studies showed that CPR plus early delivery of shock can provide survival rates as high as 49 to 75% (16, 17). While missing or delaying the diagnosis of cardio circulatory arrest will reduce the patients' chance of survival to zero within about 10 minutes (3). Therefore, with a simple course we could improve skills of BLS in medical students. In a study conducted by Flesche et al, it was shown that in CPR manikins only 50% of BLS-trained medical students, 17% of experienced ambulance crew members, and 3% of BLS-trained lay persons were able to assess unresponsiveness and carotid pulse within 30 seconds (15, 18). Thus, knowledge about carotid pulse checking has been described as modest. Similarly, our study demonstrated that medical students have some problems in BLS skills such as checking for carotid pulse and checking for unresponsiveness or maintaining accurate CPR sequence in giving two breaths after the chest compressions cycle. These steps, though seemingly simple, have many important effects on the CPR outcome. Hence, BLS training may improve these pivotal skills in medical students. In addition, the findings of our study showed a significant improvement in CPR skills except hand position and chest compression depth. The less improvement in correct hand position and depth of compression may be due to previous knowledge of the students in this study.

Taking everything into consideration, structured teaching of BLS/ACLS is lacking in medical curriculums because medical students are currently expected to learn resuscitation skills in a clinical setting, where there is little opportunity to correct poor techniques (8, 9). On the other hand, after graduation, learning resuscitation skills may be complicated due to busy residency schedules and lack of resources. Given this situation, many junior doctors may not be competent enough to carry out effective cardiopulmonary resuscitation without a structured training course. In conclusion, CPR workshops and usage of manikin for CPR training can improve medical students' skills and should be considered as an obligatory part of training in medical courses.

## References

- 1- Committee E. Subcommittees and Task Forces of the American Heart Association. 2005 American Heart Association guidelines for cardiopulmonary resuscitation and emergency cardiovascular care. *Circulation*. 2005;112(24 Suppl):1-203.
- 2- Suraseranivongse S, Chawaruechai T, Saengsung P, Komoltri C. Outcome of cardiopulmonary resuscitation in a 2300-bed hospital in a developing country. *Resuscitation*. 2006 Nov;71(2):188-93.

- 3- Meaney PA, Bobrow BJ, Mancini ME, Christenson J, de Caen AR, Bhanji F, et al. Cardiopulmonary resuscitation quality: [corrected] improving cardiac resuscitation outcomes both inside and outside the hospital: a consensus statement from the American Heart Association. *Circulation*. 2013 Jul 23;128(4):417-35.
- 4- Wik L, Steen PA, Bircher NG. Quality of bystander cardiopulmonary resuscitation influences outcome after prehospital cardiac arrest. *Resuscitation*. 1994 Dec;28(3):195-203.
- 5- Sutton RM, Niles D, Meaney PA, Aplenc R, French B, Abella BS, et al. Low-dose, high-frequency CPR training improves skill retention of in-hospital pediatric providers. *Pediatrics*. 2011 Jul;128(1):e145-51.
- 6- McGlynn EA, Asch SM, Adams J, Keesey J, Hicks J, DeCristofaro A, et al. The quality of health care delivered to adults in the United States. *The New England journal of medicine*. 2003 Jun 26;348(26):2635-45.
- 7- Abella BS, Sandbo N, Vassilatos P, Alvarado JP, O'Hearn N, Wigder HN, et al. Chest compression rates during cardiopulmonary resuscitation are suboptimal: a prospective study during in-hospital cardiac arrest. *Circulation*. 2005 Feb 1;111(4):428-34.
- 8- Batcheller AM, Brennan RT, Braslow A, Urrutia A, Kaye W. Cardiopulmonary resuscitation performance of subjects over forty is better following half-hour video self-instruction compared to traditional four-hour classroom training. *Resuscitation*. 2000 Jan;43(2):101-10.
- 9- Afzalimoghaddam M, Hoseinidavarani H, Hosseinejad H. Evaluating the impact of emergency medicine education on medical interns' knowledge scores. *European journal of emergency medicine: usage of manikin for CPR training can improve medical students' skills and should be considered as an obligatory part of training in medical courses*. official journal of the European Society for Emergency Medicine. 2011 Oct;18(5):257-60.
- 10- Isbye DL, Meyhoff CS, Lippert FK, Rasmussen LS. Skill retention in adults and in children 3 months after basic life support training using a simple personal resuscitation manikin. *Resuscitation*. 2007 Aug;74(2):296-302.
- 11- Becker LB, Ostrander MP, Barrett J, Kondos GT. Outcome of CPR in a large metropolitan area-- where are the survivors? *Annals of emergency medicine*. 1991 Apr;20(4):355-61.
- 12- Herlitz J, Bang A, Alsen B, Aune S. Characteristics and outcome among patients suffering from in hospital cardiac arrest in relation to the interval between collapse and start of CPR. *Resuscitation*. 2002 Apr;53(1):21-7.
- 13- Abbas A, Bukhari SI, Ahmad F. Knowledge of first aid and basic life support amongst medical students: a comparison between trained and un-trained students. *JPMMA The Journal of the Pakistan Medical Association*. 2011 Jun;61(6):613-6.
- 14- Avabrattha KS, Puranik G, Shenoy KV, Rai BS. A Study of the Knowledge of Resuscitation among Interns. *Al Ameen Journal of Medical Sciences*. 2012;5(2):152-56.
- 15- Flesche C, Noetges P, Schlack W, Zucker T-P, Tarnow J. O109 Quality of lay public cardiopulmonary resuscitation (CPR) after standard first aid training courses. *Resuscitation*. 1994;28(2):S25.
- 16- White RD, Asplin BR, Bugliosi TF, Hankins DG. High discharge survival rate after out-of-hospital ventricular fibrillation with rapid defibrillation by police and paramedics. *Annals of emergency medicine*. 1996 Nov;28(5):480-5.
- 17- Marengo JP, Wang PJ, Link MS, Homoud MK, Estes III NM. Improving survival from sudden cardiac arrest: the role of the automated external defibrillator. *Jama*. 2001 Mar;285(9):1193-200.
- 18- Flesche C, Neruda B, Breuer S, Tarnow J. O107 Basic cardiopulmonary resuscitation skills: A comparison of ambulance staff and medical students in Germany. *Resuscitation*. 1994;28(2):S25.