



[ORIGINAL ARTICLE]

Changes in objectively assessed chest compression quality after a basic life support course: an initial report

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ABSTRACT

This study objectively assessed changes in the quality of cardiopulmonary resuscitation (CPR) performed by 34 nurses outside of the emergency medicine field who had no prior experience with CPR. Aspects of CPR quality were assessed before nurses participated in a basic life support (BLS) course for healthcare providers and immediately and 3 months after the course completing the course. Overall, 49.4%, 58.5%, and 61.0% of the subjects performed chest compressions satisfactorily before, immediately after, and 3 months after the course, respectively. The compression depths were 43.4 mm, 45.5 mm, and 46.9 mm before, immediately after, and 6 months after the course, respectively. The corresponding adequate recoil allowance rates were 91.5%, 92.7%, and 95.0%, respectively, and the corresponding correct compression performance rates were 28.4%, 31.7%, and 58.7% 6 months after the course, respectively. Correct hand positioning was used by 91.4%, 96.0%, and 96.3% of subjects before, immediately after, and 3 months after the course, respectively. All measured performance indices improved at 3 months after the BLS course. At this time point, the chest compression quality improved presumably because the course simulated a clinical setting and fostered a mindset that would allow the trainee to react under actual conditions. In the future, the chest compression quality should be assessed at 6 months and 1 year after course completion to facilitate decision-making regarding the methods of instruction needed to maintain CPR quality.

Introduction

Quality of a cardiopulmonary resuscitation (CPR) is an important form of care because it promotes the return of circulation while maintaining blood flow to major organs. The American Heart Association (AHA) states that the characteristics of high-quality CPR include “compressing the chest at an adequate rate and depth,” “allowing complete chest recoil after each compression,” “minimizing interruptions in compressions,” and “avoiding excessive ventilation” ^{1,2)}. According to the Japan Resuscitation Council (JRC), high-quality CPR

involves compressing the chest in the correct location and at the correct depth and rate and allowing the chest to return to its normal position between each compression while minimizing interruptions³⁾. However, actual resuscitation care often involves the performance of lower-quality CPR. Accordingly, CPR instruction has been widely implemented both inside and outside of medical facilities. However, no studies have objectively examined related changes in the quality of CPR. Previous studies have examined the understanding of CPR and acquisition of skills⁴⁾ or attitudes following training and the practical use of skills towards⁵⁻⁷⁾. To date, no studies have used objective indices to

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Table 1. Changes in chest compressions

	Overall performance (%)	Proper hand positioning(%)	Average depth of compressions (mm)	Average rate of chest compressions (100–120/minute) (%)	Average number of compressions	Adequate recoil allowed (%)
Before the course	49.4	91.4	43.4	28.4	128.1	91.5
Immediately after the course	58.5	96.0	45.5	31.7	124.1	92.7
3 months after the course	61.0	96.3	46.9	58.7	118.3	95.0

specifically examine changes in the quality of chest compressions⁸⁾.

Hence, the current study aimed to ascertain changes in the quality of CPR at 3 months after a basic life support (BLS) course.

Materials and Methods

1) Subjects

Thirty-four nurses who participated in a BLS course conducted by the Yokohama ACLS in June–November 2014.

2) Study period

September 2014–January 2015 (i.e., 3 months after the BLS course).

3) Methodology

A mannequin designed for the objective assessment of CPR skills (Resusci Anne with QCPR® from Laerdal Medical, Tokyo, Japan) was used to examine the quality of chest compressions before, immediately after, and 3 months after the BLS course. “Hand positioning”, “depth of compressions”, “rate of compressions” and “chest recoil allowed” were measured and analyzed to assess the quality of chest compression. These aspects are required to perform high-quality CPR, according to the AHA and JRC. Data were collected without providing feedback about the quality of chest compressions either before or after the study was conducted.

4) Ethical considerations

This study was approved by an ethics committee. The study details were explained to potential subjects verbally and in writing, and a submitted response from a potential subject was deemed to indicate consent to

participate in this study. Responses were encoded to anonymize individuals and protect their privacy.

Results

1) Overview of subjects

Thirty-four subjects consented to participate in this study. The subjects had an average of 3.7 (\pm 2.9) years of nursing experience (range: 0–11 years). All subjects had received CPR training at either the facility where they worked or elsewhere. Thirty-two subjects (94%) had not previously taken the BLS course, whereas two subjects (6%) repeated the course. All subjects worked in a department other than the emergency room or an intensive care unit, and none of the subjects performed CPR after taking the course.

2) Changes in the quality of chest compressions

Overall, 49% of the subjects satisfactorily performed chest compressions before the course; these rates increased to 58.5% and 61.0% immediately after and 3 months after the course, respectively. Subjects used proper hand positioning at rates of 91.4%, 96.0%, and 96.3% before, immediately after, and 3 months after the course, respectively. The average compression depths were 43.4 mm, 45.5 mm, and 46.9 mm before, immediately after, and 3 months after the course, respectively. Furthermore, 28.4%, 31.7%, and 58.7% of subjects administered an appropriate compression rate before, immediately after, and 3 months after the course, respectively. The average numbers of chest compressions were 128.1/minute, 124.1/minute, and 118.3/minute before, immediately after, and 3 months after the course, respectively. Furthermore, 91.5%,

92.7%, and 95.0% of subjects allowed adequate chest recoil before, immediately after, and 3 months after the course, respectively. In summary, indices such as the overall performance, proper hand positioning, average compression depth, chest compression rate, and adequate recoil allowance improved 3 months after the course. The average compression rate was 100–120/minute, in accordance with the guidelines (Table 1).

Discussion

The evaluations of chest compressions 3 months after the BLS course revealed that all measured performance indices improved relative to the values measured before or immediately after the course. Substantial evidence indicates that CPR skills (including chest compressions) rapidly diminish after initial training; more specifically, some studies have revealed that BLS skills diminish 3 months after initial training⁹⁻¹¹. Bhanji et al. observed decreases in BLS skills during assessments at 1–6 months and 7–12 months after training¹². However, the current results counter the results of previous research, as the quality of chest compressions performed by nurses who rarely encountered the need perform CPR in their wards improved at 3 months after study completion.

This discrepancy may be attributable to the process and extent by which nurses (the subjects of the current study) integrate, absorb, and utilize skills in cognitive, behavioral, and psychomotor areas to improve their performance of CPR. Self-efficacy must be instilled so that nurses can perform the skills acquired in a BLS course in actual situations requiring resuscitation^{13,14}. In other words, the skill-related contents of a BLS course were effectively taught in a short period of time. Nurses can improve their performance of CPR through assessments involving standardized indicators of the achieved skill level, the use of training DVDs, practical training in cognitive, behavioral, and psychomotor areas, and feedback from and debriefing by an instructor^{15,16}.

However, the current results indicate that nurses did not perform chest compressions at the 5–6-cm depth recommended by the AHA. Effective CPR requires appropriately deep chest compressions. Inadequately deep compressions can affect the relative increase in

intrathoracic pressure, as well as blood flow from the heart to the systemic circulation. Furthermore, the chest compression depth is intertwined with the compression rate. If the chest compression rate exceeds 120/minute, the compressions will be proportionately shallower¹⁴; accordingly, CPR courses must implement objective indices during and after training to improve proficiency in the appropriate compression depth and rate, as well as other aspects. This approach will help to maintain or improve the quality of CPR.

The quality of chest compressions improved presumably because the BLS course simulated a clinical setting and fostered a mindset that would allow the trainee to react under actual conditions. The current study did not interview or survey subjects regarding changes in their attitudes or behaviors; therefore, future studies should continue to assess changes in the quality of chest compressions at 6 months, 1 year, and 2 years after the course. These data will facilitate decision-making about the methods of instruction used to maintain chest compression quality.

In conclusion, although the quality of chest compressions improved 3 months after the BLS course, chest compressions were not performed at a depth of at least 5 cm (AHA recommendation). The study results revealed that the chest compression quality should be examined at 6 months and 1 year after the course to determine how best to maintain or improve the quality of CPR with respect to chest compressions and other aspects.

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要 旨

客観的評価機能を用いたBLSコース受講後の胸骨圧迫の質の推移について（第1報）

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心肺蘇生の経験が少ない救急領域以外の看護師 34 名の心肺蘇生 (cardiopulmonary resuscitation 以下 CPR とする) の質の推移について, Basic Life support (以下 BLS とする) コース受講前・受講後及び 3 か月後に客観的評価機能を用いて調査を実施した。胸骨圧迫全体のパフォーマンスは受講前 49.4%。受講後 58.5%, 3 か月後 61.0%。深さは受講前 43.4 mm, 受講後 45.5 mm, 6 か月後 46.9 mm。リコイルは受講前 91.5%, 受講後 92.7%, 3 か月後 95.0%。正しい速さは受講前 28.4%, 受講後 31.7%, 6 か月後 58.7%。手の位置は受講前 91.4%, 受講後 96.0%, 3 か月後 96.3%でどの項目も 3 か月後の数値の上昇が認められた。受講 3 か月後に胸骨圧迫の質が上昇した要因は, BLS コース内容を臨床で想起することが可能となり, 実際の場面に遭遇した時に実践できるように意識することができたと推測される。今後は受講 6 か月後, 1 年後の胸骨圧迫の質を評価することで CPR の質の維持に対する教育方法について検討することが求められる。

キーワード: 心肺蘇生法, BLS, 看護師, トレーニング

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