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Original Research Article

Effective simulation training for advanced cardiopulmonary resuscitation for first year students of a nursing university

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Abstract: The first year students in the Juntendo University Faculty of Health Science and Nursing have undertaken an Immediate Cardiac Life Support (ICLS) course. However, this study confirmed the degradation of knowledge on cardiac life support among students who had taken the ICLS course 4years previously. To prevent the degradation of skill and knowledge related to cardiac life support, remedial training must be provided as often as required, and resuscitation training equipment should be made available.
Keywords: simulation training, advanced cardiopulmonary resuscitation, outcome.

INTRODUCTION

The Juntendo University Faculty of Health Science and Nursing (JNFHSN) were opened in 2011 in Mishima city, Shizuoka prefecture, Japan. Since its inception, the university's first grade students have undertaken an Immediate Cardiac Life Support (ICLS) course [1]. The ICLS course, which was developed and launched by the Japanese Association for Acute Medicine,[1]was designed as a multi-professional one-day (8 hours) resuscitation course to teach the essential skills and team dynamics required to manage a patient in cardiac arrest for 10 minutes before the arrival of a cardiovascular specialist. The course consists of skill and scenario sections. The skill sections provide basic life support (BLS) with an automated external defibrillator (AED), basic airway management and in-hospital management with electrocardiographic (ECG) monitoring with a manual external defibrillator. A questionnaire survey after the ICLS course revealed that most first grade students were happy with their training. However, the students received no follow up training during their later university education and the degradation of the knowledge and skills obtained from the course was not evaluated. We investigated the aspects of their knowledge on cardiopulmonary resuscitation that had become degraded after graduation from the university.

METHODS

All first year staffs of Shizuoka Hospital, Juntendo University (excluding medical doctors) were asked to perform a multiple-choice examination in April 2014. The same multiple-choice examination was executed at the end of the ICLS course every year for the first grade students of JNFHSN. The multiple-choice examination consisted of 20 questions with a maximum total score of 20 points. The questions are shown in Table 1. The staffs in their first year of work at Shizuoka Hospital were divided into two groups: those who had graduated from JNFHSN (FHSN group), and those who had graduated from another university (Control group). The age, sex, occupation (nurses versus non-nurses, pharmacists, medical technologists, radiologists and the clerical staff), the number of ICLS providers (those who had already passed the ICLS course), the number of ICLS instructors, and the results of the multiple-choice examination of the ICLS course participants were analyzed.

We also compared the above variables and the results of the multiple-choice examinations of the first year JNFHSN students who attended the ICLS course in February 2014 (first year group), with the results of the FHSN graduate group.

The statistical analyses were performed by χ^2-test and non-paired Student's t-test. A p value < 0.05 was considered to indicate a statistically significant

difference. All of the data are presented as the means ± standard error.

RESULTS

The results of the comparison between the FHSN graduate and Control groups are shown in Table 2. The numbers of nurses and ICLS providers in the FHSN graduate group were significantly higher than in the Control group. There were no significant differences between the two groups with regard to age, sex, number of ICLS instructors or examination scores.

Table 1: the contents of a multiple-choice examination on the Immediate Cardiac Life Support course at Juntendo University Faculty of Health Science and Nursing

Questions

Q1. What should you check after confirming safety at the scene and standard protection?
Q2. What should you do after confirming unconsciousness?
Q3. How should you check the respiration of a patient?
Q4. Which artery should be checked when you check the pulse?
Q5. Which rate of chest compression is correct?
Q6. To what depth should you compress a patient's chest?
Q7. Until what length of time should you re-start a chest compression?
Q8. Which is incorrect with regard to a chest compression?
Q9. Which is correct with regard to mouth to mouth respiration?
Q10. Which is correct with regard to the evaluation of the effectiveness of artificial respiration?
Q11. Which is correct with regard to the ratio of chest compression and artificial respiration?
Q12. What should you do first when you use automated external defibrillator?
Q13. Which is the best course of action in relation to the provision of advanced cardiac life support?
Q14. What are the correct instruments for securing the airway and back mask respiration?
Q15. What is incorrect with regard to tracheal intubation?
Q16. Which is correct with regard to the performance of artificial respiration after tracheal intubation?
Q17. Which action should be executed first when you see ventricular fibrillation (needs identification of figure)?
Q18. Which is correct with regard to pulse less electrical activity?
Q19 which is the best style for a resuscitation team?
Q20. Which is an incorrect action after hearing code blue?

Table 2: Results of comparison between the FHSN graduated and Control groups

	FHSN graduates	Control	p value
Total number	58	74	
Age	22.0 ± 0.1	22.8 ± 0.7	n.s.
Sex (Male/Female)	3/55	12/62	0.06
Proportion of nurses	100%	75.6%	p <0.0001
ICLS providers	58 (100%)	6 (8.1%)	<0.0001
ICLS instructors	1	1	n.s
Examination scores	14.4 ± 0.2	13.9 ± 0.3	n.s

FHSN: Faculty of Health Science and Nursing
ICLS: Immediate Cardiac Life Support
n.s.: not significant
Results are expressed as the mean ± standard error

Table 3: The number of questions and correct answer in which the accuracy rate significantly differed between the FHSN graduate and Control groups

	Graduate(n=58)	Control(n=74)	p value
Q3. Agonal respiration is respiratory arrest.	29 (50%)	51 (68.9%)	<0.05
Q4. Pulse should be checked at the carotid artery.	21 (36.2%)	45 (60.8%)	<0.01
Q5. Chest compression should be performed at over 100 BPM.	52 (89.6%)	54 (72.9%)	<0.05
Q17. Vf requires electrical cardio version	53 (91.3%)	54 (72.9%)	<0.01

FHSN: Faculty of Health Science and Nursing
Graduate: FHSN graduate group
BPM: Beats per minute
Vf: ventricular fibrillation
BLS: basic life support

Table 4: Results of the comparison between the FHSN graduate and first year groups

	Graduate	First year	p value
Total number	58	96	
Age	22 ± 0.1	19 ± 0.1	<0.0001
Sex (Male/Female)	3/55	9/87	n.s.
ICLS instructor	1	0	n.s
Score of examination	14.4 ± 0.2	18.6 ± 0.1	<0.0001

FHSN: Faculty of Health Science and Nursing
Graduate: FHSN graduate group
First year: FHSN first year group
ICLS: Immediate Cardiac Life Support
n.s.: not significant
Results are expressed as the mean ± standard error

Table 3 shows the number of questions from Table 1 for which there was a significant difference between the FHSN graduate and Control groups in their accuracy rate and in the correctly answered questions. The ratio of respondents who correctly answered questions on agonal respiration and the location for performing a pulse check was significantly lower in the FHSN graduate group than in the Control group. The ratios of correct knowledge concerning the following items: speed of chest compression, ventricular fibrillation, the requirement of electrical cardio version, and the importance of the resuscitation team, was significantly higher in the FHSN graduate group than in the Control group.

Table 4 shows results of a comparison between the FHSN graduate and first year groups. The examination score of the FHSN graduate group was significantly lower than that of the first year group, even though the graduates had been examined on the same subjects four years previously.

DISCUSSION

This study confirmed the degradation of knowledge on cardiac life support among students who had taken the ICLS course 4years previously. Their average score on the multiple-choice examination was approximately the same as the study subjects who had not taken the ICLS course. A possible reason for the similarity of their scores is that the health care providers of the Control group had gained knowledge and skills related to BLS during their own education, or in their preparation for a state examination for health care providers that assesses this knowledge[2,3].Another possibility is that the knowledge and skills were gained elsewhere. The Japanese National Police Agency announced that 81 million people had a driver's license, which is approximately equal to 80% of the people who are eligible to obtain driver license. Driving schools are supposed to educate students on BLS knowledge and skills [4].

The average score in the multiple-choice examination on BLS in this study was 12/20 (60%). Accordingly, besides the degradation of knowledge attained in the ILCS course, the prevailing BLS knowledge and skills in Japanese adults and the commonality of the questions in the study, may have led the two groups to achieve similar scores on the multiple-choice examination.

While the average examination scores of the GHSN graduate and control groups were approximately the same, there were some differences in their responses to particular questions. The subjects in the FHSN graduate group learned the speed of chest compression, or identify ventricular fibrillation requiring electrical cardio version, and the importance of a resuscitation team through their practice in the ICLS course. Such practical learning has been shown to be more effective in helping students to establish regular practices than self-administered training using written and audio materials [5]. In addition, BLS training does not involve teaching trainees to identify ventricular fibrillation requiring electrical cardio version or teach the importance of a resuscitation team. Accordingly, the practice of the FHSN graduates group may lead graduates to achieve higher scores than members of the Control group. ICLS instructors in JNFHSN taught knowledge related to agonal respiration by way of a lecture; the trainees did not experience simulated agonal respiration. In addition, nursing students in their third and fourth year were taught to measure blood pressure at the brachial artery and to check pulse at the radial artery during lectures in the course of their bed side learning. These lectures in the FHSN graduates group may have led to poorer scores on certain questions in comparison with the Control group.

The degradation of skill and knowledge on cardiac life support is common after taking part in a course, even when high-fidelity patient simulators are used [6].Evaluating students a short time after training has been shown to yield favorable results with regard tithe preserving of skill and knowledge, and the

reported satisfaction of learners was high [7, 8]. In addition, training in cardiopulmonary resuscitation is useful for improving clinical outcomes in patients with cardiac arrest [9-11]. However, the most important thing is how suitably the performance of cardiopulmonary resuscitation can be executed when a learner (even one who rarely sees cardiac arrest), encounters cardiac arrest unexpectedly. To prevent the degradation of skill and knowledge related to cardiac life support, remedial training must be provided as often as required, and resuscitation training equipment should be made available at the ward/unit level to allow self-study and practice to prevent knowledge and skill degradation between training updates [12].

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