The Effect of Advanced Cardiovascular Life Support Simulation Education for Nursing Students

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Abstract: ***Background/Objectives: The study's goal is to research the effectiveness of the simulation training of ACLS (Advanced Cardiovascular Life Support) in nursing students and determining the advanced cardiovascular life support knowledge and skills obtained by them. Methods/Statistical analysis: The subjects of the study were41 senior nursing students of a university in "C." The simulation training program used in the study consisted of theoretical education and practical exercise.***

Findings: The study outcome showed that the level of knowledge after the education program of the advanced cardiovascular life support was 21.44 points on average, and that the level of performance in practice after the practical training was 27.98 points on average. The study outcome shows that the Advanced Life Support Simulation program is more effective in improving clinical practice ability than lecture-oriented conventional educational methods. Improvements/Applications: It is encouraged to expand the simulation education program for nursing students or health professionals' caring for cardiac arrest patients. Therefore, designing the simulation for emergency care for cardiac arrest patients should be implemented, by developing scenario-based programs with various clinical situations in order to solve problems through critical thinking.

Keywords: ACLS, Simulation, Education, Nursing student, Emergency Care

I. INTRODUCTION

The concept of the survival chain to cardiac arrest patients has been revised to five chains in 2015, which consist of precautionary and early discovery of cardiac arrest, an immediate report, prompt practice of CPR, swift practice of defibrillation, and efficient advanced life support and post-cardio arrest treatment. Therefore, the educational goal of life support is to enable cardiac arrest patients to continuously receive the treatment based on the most up-to-date medical knowledge under the concept of chain of survival [1].

According to recent material [2], Korea's cardiac arrest rate has increased from 37.5 people per 100,000 people in 2006(the survey starting year) to 46.8 people per 100,000 people in 2010, with annual increases, and the death rate from Ischemic heart diseases has increased from 18.4 people per 100,000 people in 1999 to 28.9 people per 100,000 people, with an increase of 10.5 people in the 2000s. Korea's survival rate of cardiac patients is 4.9 % . Although the **figure** indicates the survival rate of Korea's cardiac arrest patients outside the hospital has been increasing, it is still low compared to that of other developed countries such as the United States, European countries and Japan [3, 4, 5]. Cardiac arrest by heart diseases is an emergency and an unpredictable cause of death, which also belongs to one of the three main causes of death every year. Cardiac arrest patients can't maintain life without such medical means as Cardiopulmonary Resuscitation (CPR) and Automated External Defibrillator (AED). However, various studies have proved that prompt appropriate "on-the-spot" first aid can increase the survival rate, which means that the advantages from following the life support guideline are greater than the potential danger. It is known that over 80% of sudden deaths are from those related to heart diseases, and the causes should be promptly found together with CPR treatment because patients lose consciousness within an hour from the change of the cardiovascular condition.

Under the condition of cardiac arrest with the shockable rhythm demanding defibrillation, defibrillation is the only treatment, and prompt defibrillation treatment is critical in that the more it is delayed, the more the survival rate of the patients decreases at the rate of 7-10% per minute [6]. In this regard, cardiopulmonary resuscitation for the purpose of resuscitating patients in patient administration is very important and should be effectively carried out.

Simulation based education started from the 1960s, and the cardiac arrest simulation has been included in the advanced cardiopulmonary resuscitation simulation since 1981[7]. The term simulation means experimenting mimetically to investigate the characteristics of complicated problems or social phenomena, creating models similar to the actual, which in the area of health care refers to creating unexpected situations that might happen in the field through artificial mechanical manipulation using educational apparatus or simulators [8].

Simulation education can progress personally or in group, and for its effectiveness the reasonable number of persons in each team is four or five [9], eight to ten [10], or less than ten [11].

Simulation education has enabled students to gain indirect experience under a safe practice environment, which has made it possible to repeat practices applicable to the actual field. The ability of setting up and carrying out judgment and practicing the order of medical treatment for patients' condition can improve by repeating practical exercise. Moreover,

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it also provides associate health care providers with the opportunity to communicate and cooperate, which helps improve the overall clinical practice ability [12, 13, 14].

Clinical competency indicates the ability to capably deal with the comprehensive ability of knowledge, judgment, skills, and so forth required in the rapidly changing medical environment, and the clinical competency of the advanced cardiopulmonary resuscitation should be proficient to provide patients with quality medical treatment. It is expected that the improvement of practical service procedure and clinical practice ability, and basic medical knowledge can be obtained through simulation practice [15].

Simulation education inspires critical thinking through the debriefing steps, analyzing suitability for the problems, patients' situation, and treatment procedures and methods from the scenario implementation between instructors and students, which helps in obtaining clinical competency related knowledge through iterative learning as well as improve communication ability among those learning. It has also been reported that simulation education enables students to increase satisfaction and confidence toward the practice education and promote learning motivation [16]. Knowledge improves through memory and transition process by simulation based education which combines experiential learning, self-examination and debriefing, and the process of self-examination promotes possession of knowledge and transition to the clinical field by encouraging experiential learning [17, 18, 19, 20].

Typically, more than two rescuers attend the cardiopulmonary resuscitation within a hospital in that it requires various complicated techniques simultaneously, and thus teamwork is considered meaningful. However, due to the recent trend of underlining consumers' protection of health rights, safety and emphasis on the sense of rights, it is very restrictive for nursing students to practice the activities directly on the spot, and naturally it is not good enough for them to acquire the ability to react to emergency. Hence, it is significant for them to receive enough teamwork and leadership trainings by attending the simulation training with various scenarios, which have them prepared for emergencies on the clinical field. In addition, the education for cardiopulmonary resuscitation should be carried out in a consistent universal manner, this way the outcome should be devised for ordinary people or health professionals to carryout[21, 22, 23, 24, 25].

The subjects of the study are senior nursing students, and it aims to figure out the efficiency after carrying out the theoretical education of the first aid for cardiac arrest patients and the team simulation practice following the advanced cardiopulmonary resuscitation algorithm. Verifying the algorithm applied in the team simulation training is helpful to improving nursing students' clinical performance. The data will be used as not only the reference data for management of the simulation education and its evaluation for later use, but also the basic line data for applying the effective advanced cardiopulmonary resuscitation for the emergency care for cardiac arrest patients.

II. MATERIALS AND METHODS

2.1. Subject of study

The subjects of the study were41 senior nursing students of a university in "C," and the study was carried out upon their voluntary agreements after explaining the significance of the study.

2.2. Design of study

The simulation training program used in the study consisted of theoretical education and practical exercise. The former was implemented for 60 minutes including review of ACLS, ECG rhythm, and team work concept& simulation checklist review. The latter was carried out in teams of six, in which BLS (Basic Life Support), recognition & team activation, compression & BVM, alternative airway and defibrillation & medication were practiced for 20 minutes each[Table1].

TABLE 1. Time schedule of Advanced Cardiovascular Life Support Simulation Education

Contents	Time (min)	Teaching Method
Course summary, Review of ACLS ECG rhythm	40	Lecture
Procedure lab : recognition and team activation	20	Practical Exercise
: compression and BVM	20	Practical Exercise
: Alternative airway: LT, LMA, ETT	20	Practical Exercise
:Defibrillation-paddles, pads; medication	20	Practical Exercise
team work concepts & Simulation checklist review	10	Lecture
Simulation :Arrest care [PEA/Asystole/VF session]	60	Practical Exercise
Remind time) ECG guided KALS	10	Lecture
TROICA: In-hospital CA simulation test	40	Simulation Test
Written test	20	Written Test
Remediation and wrap-up	10	

The subjects consisted of teams of six following the theoretical and basic practical training, each member of the respective team had the assigned role of a leader, chest compressions, keeping airways open and breathing, administering a dose, defibrillation and recording. The simulation was exercised for 60 minutes. For the practice simulation, high fidelity simulator (SimMan3G) and debriefing system were used [Figure 1].

All the theoretical education and practical training were followed by the written test and the simulation practice test.

Fig 1. High fidelity simulator (SimMan3G)

2.3. Research tool

The equipment for the visual and auditory senses together with the handouts with the education contents was utilized for the theoretical education, and for the practice education an Advanced Life Support Simulator Mannequin and the simulation scenario of cardiac arrest were prepared. As a tool for evaluating its education effectiveness and checking the level of knowledge, the written test for KALS(Korean Advanced Life Support) was applied, carrying out the practical examination of TROICA(Training of In-hospital Cardiac Arrest) to check the level of performance in the practice. TROICA consists of 15 items (30points) in total; high quality chest compression under one medical personnel situation, two BLS performance items to verify the ability of high quality chest compression(four points in maximum),three items to verify teamwork under the condition of the arrival of resuscitation team (six points in maximum), three items to verify for a team leader to proceed cardiopulmonary resuscitation following KALS algorism and leading smooth cooperation among team members (six points in maximum), three items to verify the ability of ventricular fibrillation(VF)/pulseless ventricular tachycardia(VT) management (six points in maximum), two items to verify the ability of pulseless electrical activity(PEA)/asystole management(four points in maximum), and two items to verify the ability of post cardiac arrest care(four points in maximum)[26].

2.4. Data collection and statistical analysis

A perfect score in the written test is 25 points, and 30 points for the practice test, meaning the higher the points are, the better education effectiveness of advanced cardiovascular life support is. The collected data was analyzed by using IBM SPSS statistics 21. Mean and standard deviation were used for the score in the written and practical tests, and Pearson correlation test for the relation between the level of knowledge through the written test and performance competency through the practical test [27].

III. RESULTS AND DISCUSSION

The study outcome showed that the level of knowledge after the education program of advanced cardiovascular life support was 21.44 points on average and the level of performance in practice after the practical training was 27.98 points on average [Table2].

TABLE 2. Level of knowledge after the education program of ACLS

Test	Lowest score	Highest score	Mean± SD
Written test	19	24	21.44±1.32
Performance test	23	30	27.98±1.65

The detailed results of practical examination of TROICA (Training of In-hospital Cardiac Arrest) to check the level of performance in practice is shown in [Table3].

The average point of the level of detailed performance was 3.98 points in BLS performance, 5.80 points in Teamwork, 5.20 points in Ensure KALS algorism, 5.61 points in VF/pulseless VT management, 3.54 points in PEA/asystole management and 3.90 points in post cardiac arrest care.

TABLE 3. Level of performance in practice after the education program of ACLS

Score of performance test	Lowest score	Highest score	Mean± SD
BLS performance	3	4	3.98±0.16
Teamwork	5	6	5.80±0.40
Ensure KALS algorithm	3	6	5.20±1.01
VF/pulseless VT Management	3	6	5.61±0.70
PEA/Asystole Management	1	4	3.54±0.75
Post Cardiac Arrest Care	3	4	3.90±0.31

It was proven that there was no correlation between the level of knowledge for study subjects' cardiac arrest emergency care and the level of practical performance of the simulation. (r=0.20, p=0.21)[Table 4].

TABLE 4. Pearson correlations between level of knowledge and performance in practice

Test	Written test	Performance
Written test	1	
Performance test	0.200 (0.21)	1

IV. CONCLUSION

Education through simulation can complement the uppermost limit of the activity which cannot be carried out in the practical field where consumers' protection of health rights and the sense of entitlement are emphasized, and it also helps nursing students or health professionals to obtain the ability to react in emergency conditions. Therefore, the simulation-based emergency nursing education program should be developed and applied which includes the advanced cardiopulmonary resuscitation so that they can treat patients reacting to accidents without embarrassment in the emergency condition of the nursing field.

The study's outcome shows that the Advanced Life Support Simulation program is more effective in improving clinical practice ability than the lecture-oriented conventional education,

so it is encouraged to enlarge this simulation education program for nursing students or health professionals' caring for cardiac arrest patients.

Thus, designing the simulation for emergency care for cardiac arrest patients should be implemented, by developing scenario-based programs with various clinical situations in order to solve problems through critical thinking.

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