Original Article

The effect of Cardiac surgery simulation training on the level of knowledge of operating room Technologists

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ABSTRACT

Introduction and object: Nowadays, cardiac surgery simulation training has increased significantly. The objective of this study was to evaluate the effect of cardiac surgery simulation training on the knowledge of operating room technologists. Methods and Materials: This quasi-experimental study was conducted on 30 operating room technologists working in open heart surgery hospitals affiliated to Iran University of Medical Sciences. The research tool included a demographic characteristics form and a researcher-made questionnaire used to assess the operating room technologists' level of knowledge about the cardiac surgery. First, the demographic characteristics form and a questionnaire of knowledge about the stages of cardiac surgery were completed by the participants. Then, using the simulator software, samples were trained in eight sessions and the questionnaire of knowledge about the stages of cardiac surgery was re-completed by the samples. Descriptive statistics and paired t-test were used to analyze the data. $P < 0.05$ was considered as a significant level. Results: The mean score of operating room technologists' knowledge of the cardiac surgery stages was 2.09 before the simulation training and it increased to 2.83 after training. Conclusion: The cardiac surgery simulation training can enhance the knowledge of the operating room technologists. Therefore, it is recommended that this method to be used to train this group.

Keywords: training, surgery simulation training, knowledge, operating room technologists

Introduction

One of the modern training methods is the training of skills through simulated systems. Simulation is a method through which an artificial experience is created making a person involved in an activity so that he or she experiences the real life conditions without hazardous consequences of a real situation [1]. This method can be effective and useful in identifying unexpected changes in work processes [2]. In addition, this method improves the critical thinking skills, problem solving, and team leadership by senior and experienced staff [3-5]. The knowledge learned through simulation leads to the sustained knowledge and faster achievement to functional skills [6]. The focus in simulation is often based on the application and integration of knowledge, skills and critical thinking [3]. This method also increases the satisfaction of learners [7]. Studies have shown that this method is more realistic compared with traditional methods and enhances the acquisition of knowledge. It is also more enjoyable for learners [8-16] and enhances the learning and acquisition of initial technical skills [17]. The use of simulations in medicine and nursing has increased growingly over the last 20 years. In fact, growing changes in the healthcare systems have led to a move towards simulation training in many countries [18, 19], so that simulation has become a common method in teaching surgical skills in recent years [19]. The interest in surgical simulation along with the development of technology has recently resulted in rapid progress in surgical simulation models [20].

Simulation in the surgery is attractive for learners and increases their interest in learning. It is also easier and less costly and it has lower risk for patients [10]. The goal of surgery simulation is training the skills and evaluating the skills before they are learned in the operating room [21]. Heart simulation training has

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been used in other studies [22-27]. The 2007 VSC (Visioning simulation conference) and the establishment of the Thoracic Surgery Directors Association Boot Camp in 2008 have been important recent events to advancement of CT surgery simulation [28]. Over 8 million heart surgeries in the world and about 40000 open heart surgery are performed in Iran every year [29]. Cardiovascular surgery requires a very complex technology and it requires to have a high level of knowledge and skill [30]. For this purpose, improving the knowledge and skills of technologists in the operating room seems to be necessary [31]. One of the ways to acquire this knowledge is using the simulation method [32]. Thus, the objective of this study was to evaluate the effect of cardiac surgery simulation training on the knowledge of operating room technologists

Methods and Materials

This quasi-experimental study was conducted on operating room technologists working in open heart surgery operating rooms in medical and teaching hospitals of Iran University of Medical Sciences in 2017-2018. A total of 30 people were selected by census method. The research inclusion criteria included operating room technologists with the role of heart surgery scrub, whose employment history in cardiac surgery was less than 1 year. The research tool was a demographic form, a researcher-made questionnaire to assess the level of knowledge on cardiac surgery stages. The validity of the questionnaire was determined by content validity. Accordingly, the questionnaire was distributed among 7 faculty members of the operating room and cardiac surgery department. The final questionnaire was developed based on their corrective comments. The reliability of the questionnaire assessing the operating room technologists' knowledge was calculated 0.712 using Cronbach's alpha method. As it was higher than 0.7, it was evaluated at desirable level.

Samples were entered into the study after obtaining their informed consent. The objective of the research was explained for samples in a session and the required information on simulation software, the way of working with it, and evaluation method was provided for the samples. Then, a demographic questionnaire assessing the knowledge level of the samples was completed. Then, using Touch surgery simulation software, samples were trained in 8 sessions of 30 minutes, and then, the questionnaire assessing the knowledge about the cardiac surgery stages was re-completed by samples. To analyze the data, the demographic characteristics of the samples were described by descriptive statistics. To examine the difference in knowledge of the cardiac surgery stages before and after simulation training, paired t-test was used. P <0.05 was considered as a significant level.

Results

The research results revealed that out of the 30 operating room technologists, 60 percent of them were women and 66.7 percent of them were single. Majority of them were 21-25 years old (56.7 %). Also, most of them had bachelor level of education (96.7%). The income level in 66.7 %of them was adequate and 93.3 % of them had rotational shifts; moreover, most samples (73.3 percent) had a history of less than 6 months in cardiac surgery, and most of them (73.3%) had employment history in heart surgery for less than 6 months; finally, most of them (66.7%) had total employment history of less than 1 year (Table 1).

Table 1 - Demographic characteristics of research samples

Variable	Type	Frequency	percentage
gender	Male	12	40
	female	18	60
Age	21-35 years	17	56.7
	26-30 years	13	43.3
Education	Associate degree in operating room	1	3.3
	Bachelor degree in operating room	29	96.7
Marital status	Single	20	66.7
	Married	10	33/3
Income adequacy	Adequate	20	66/7
	Not adequate	10	33.3
Work shift type	Morning shift	2	6.7
	Rotational	28	93.3
Employment history of heart surgery	Less than 6 months	22	73.3
	6-12 months	7	3.4
Total employment history	Less than 1 year	20	66.7
	1-5 years	10	33.3

The results also showed that the mean score of knowledge of the operating room technologists before the simulation training was 2.09 and increased to 2.83 after the simulation training, which this increase was significant (p <0.05) (Table 2).

Table 2 - The mean score of research samples' knowledge before and after simulation training

Knowledge level	Before training mean ± SD	After training mean ± SD	P and t
	2.09 ±0.24	2.83 ±0.07	t = 20.82 p<0.05

Moreover, the results showed that the level of knowledge of female samples after simulation training was increased significantly higher than that of male samples (p <0.05) and the level of knowledge of operating room technologists with rotational working shift was increased significantly higher than that in morning working shift samples (p <0.05). In addition, the level of knowledge of operating room technologists with employment history less than 6 months in heart surgery was increased significantly higher than that of operating room technologists with employment history between 6 and 12 months in heart surgery (p <0.05) and the level of knowledge

of operating room technologists with a total employment history of less than 1 year was increased significantly higher that of operating room technologists with a total employment history between 1 and 5 years ($p < 0.050$. No significant difference was found in other variables (Table 3).

Table 3 - The mean of knowledge about the research samples in terms of demographic variables

Variable	Type	Mean before training	Mean after training	p and t
gender	Male	2.26	2.89	p = 0.010
	female	1.98	2.79	t= 2.767
Age	21-35 years	2.06	2.81	P = 0.733
	26-30 years	2.16	2.88	t= 0.345
Education*	Associate degree in operating room	2.03	2.88	-
	Bachelor degree in operating room	2.10	2.83	
Marital status	Single	2.01	2.81	p = 0.069
	Married	.20	2.87	t= 1.89
Income adequacy	Adequate	2.10	2.83	p = 0.648
	Not adequate	2.08	2.84	t= -0.461
Work shift type	Morning shift	2.46	2.90	p = 0.021
	Rotational	2.07	2.83	t=2.44
Employment history of heart surgery	Less than 6 months	1.98	2.81	p = 0.000
	6-12 months	2.42	2.92	t= 6.39
Total employment history	Less than 1 year	2.03	2.82	p = 0.045
	1-5 years	2.22	2.86	t= 2.10

*Only one person was found with associate degree, so it caused the variance and degree of freedom to be zero. As a result, it was not possible to perform a statistical test in order to compare the mean differences in the scores of these two groups.

Discussion

The results revealed that the knowledge of the operating room technologists after the simulation of cardiac surgery, was significantly increased ($p < 0.05$). The results of the research conducted by Harold et al. [33] and Hicks et al. [34] showed that scores of knowledge increased after CPB simulation training. The results of the research conducted by Ramirez et al also showed that residents' knowledge of the surgical procedure increased after training the thoracic surgery simulation [35]. The results of the research conducted by Robinson et al on novice residents indicated that an open vascular simulation training course improved the knowledge scores [36]. Moreover, the results of the research conducted by Costello et al showed that Ventricular Septal Defect (VSD) simulation training increased the knowledge about anatomy and clinical control of VSD in the participants [37, 38]. The results of the research carried out by Banks et al showed that laparoscopic tubal ligation simulation training increased the knowledge level of residents in the operating room [39]. The results of the study conducted by Källström et al on urological residents showed that training of TURP surgery simulation increased the knowledge of the surgery stages and the technical equipment used [40]. The results of the research conducted by Patel et al showed that simulation of the operating room increased the knowledge of the learners of the operating room [41]. The results of the study conducted by Hannani et al on the students of the operating room indicated that the knowledge scores increased after the training of spine fusion surgery simulation [42]. The results of other studies also showed that simulation training increased knowledge scores in nursing students [43, 44]. The results of the study conducted by Heidarzadeh et al indicated that simulation training increased the knowledge score of midwifery students [45]. Moreover, the results of other studies presented that the mean score of knowledge increased significantly in nurses after simulation training [46-50]. It seems that the training provided by the simulation was interesting and effective for the samples in this research and it increased their interest and motivation to learn the principles of cardiac surgery, and thus, it increased their level of knowledge about the stages of cardiac surgery.

The results also revealed that the knowledge of female samples after simulation training was increased significantly higher than that of male samples ($p < 0.05$). The results of the studies conducted by Heidarzadeh et al and Hannani et al showed that the knowledge level of female samples increased significantly after training of simulation compared to that of male samples [42, 51]. It seems that females are more careful while training than males, leading to increased score in the females.

Moreover, the results of the study revealed that the level of knowledge of operating room technologists with rotational working shift was increased significantly higher than that of operating room technologists with morning working shift ($p < 0.05$). The results showed that no study has been conducted in this area. This result can be justified in this way that the number of samples in the morning working shift was much less than the number of samples with rotational working shifts, so another study with an equal number of samples in both groups needs to be conducted.

The results also showed that the level of knowledge of operating room technologists with employment history of less than 6 months in heart surgery was increased significantly higher than that of operating room technologists with employment history of 6 to 12 months in heart surgery ($p < 0.05$) and the level of knowledge of operating room technologists with a total employment history of less than 1 year was increased significantly higher than the level of knowledge of operating room technologists with a total employment history of between 1 and 5 years ($p < 0.05$). The results also showed that no study has been conducted in this regard. It seems that the working conditions and characteristics and the work problems faced by less experienced staff, as well as higher interest and motivation of operating room technologists with a low employment history for faster success and progress in their jobs and their tendency to keep a pace with experienced operating room technologists increased their interest and motivation to learn the principles and basics of

heart surgery and they acquired the basic knowledge and skills through simulation training. For this reason, the effect of training was more in this group.

Conclusion

The results reveled that training of stages of cardiac surgery simulation improved the level of knowledge of the operating room technologists. Thus, this method can be used in in-service training of operating room technologists.

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