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Teaching Cardiac Arrhythmias Using Educational Videos and Simulator Software in Nurses: An Educational Interventional Study

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Abstract

Background: Cardiac arrhythmias are among the most prominent causes of mortality in patients with heart diseases. By timely diagnosis of arrhythmias, nurses can provide necessary therapeutic measures to these patients.
Objectives: The purpose of this study was to determine the effects of teaching cardiac arrhythmias using educational videos and simulator software in nurses.
Methods: In this quasi-experimental study, 22 novice nurses were selected based on the census method. Evaluations were performed before and after educational interventions for cardiac arrhythmia. The interventions included using simulator software and face-to-face education. A questionnaire with 20 questions regarding cardiac arrhythmias organized in 4 parts of sinus arrhythmias, atrial arrhythmias, ventricular arrhythmias, and blocks and junctional rhythm, and each with 5 questions was used to collect data. Each question was scored 1 point, and the final score ranged from 0 to 20. The scores were categorized into poor (< 10), moderate (11 - 15), and good (16 - 20) levels. Data were analyzed using SPSS V.20 software.
Results: There was a significant difference in the mean of total score regarding the diagnosis of arrhythmias before (9.9) and after (15.68) the education (P value = 0.022). This indicated an increase of about 6 scores at post-intervention. The classification of the scores showed that 9 (40.9%) and 13 (59.1%) nurses had poor and moderate diagnostic abilities before training. However, following education, 10 nurses (50%) acquired moderate and 10 (50%) nurses obtained good scores.
Conclusions: Arrhythmia scores varied before and after training, with the mean scores after training increased, and arrhythmia detection rate was increased after the intervention. It is advisable to use modern educational methods as good alternatives for reviewing educational content and concepts.

Keywords: Cardiac Arrhythmias, Educational Films, Software, Nurses

1. Background

Life expectancy has increased in today's societies due to advances in science and technology. Cardiovascular diseases are the most common causes of death in most countries, including Iran. In addition to high mortality rates, these chronic diseases impose high costs on patients' families and health care systems (1-3). Coronary heart diseases (CHDs) cause the highest rates of disabilities and mortalities among people (1, 2). The prevalence of CHDs is rising in Iran with an increment from 20% to 45% (4, 5). Changes in lifestyle, decreased physical activity, obesity, and type 2 diabetes contribute to the increasing trends in the incidence of cardiovascular risk factors and CHDs in developed countries (4-6).

Changes in electrocardiogram rhythms are called dysrhythmias, which are detected by electrocardiography as the first-line diagnostic method (1, 2). Clinically important arrhythmias include AF-VF, which are fatal in most cases, and there is a high risk of recurrence in those who survive (7, 8). These patients require specialized nursing care (9). If nurses can timely identify arrhythmias, they can provide better and timely care and medical treatments for patients (10, 11).

Learning and mastering cardiac arrhythmias are difficult, requiring training and practicing all arrhythmias. Without adequate educations and skills, it may be impossible to deliver sufficient and appropriate therapeutic measures (12, 13). Face-to-face education using animations is a viable training method (14).

2. Objectives

The aim of this study was to determine the impacts of teaching cardiac arrhythmias using educational videos and simulator software on nurses' abilities to detect these abnormalities.

3. Methods

This quasi-experimental study was conducted on 22 novice nurses working in the educational hospitals affiliated to the Ilam University of Medical Sciences in 2018 selected based on census method. The nurses participated in educational courses held in December 2018.

3.1. Inclusion and Exclusion Criteria

All novice nurses working in Ilam's educational hospitals who had at least one-year working experience and a bachelor's degree or higher were included. The exclusion criteria were not willing to participate in the study and missing the educational sessions during the study.

3.2. Educational Interventions

These included using a cardiac arrhythmia simulator software (15) and face-to-face educations by a cardiologist. The sessions were filmed, and then the films were handed to the participants. The data collection tool was a questionnaire containing 20 questions about cardiac arrhythmias categorized into four parts, including sinus arrhythmias, atrial arrhythmias, ventricular arrhythmias, and blocks and junctional rhythms (each part with 5 questions). Each question was presented along with an electrocardiogram (ECG) image asking the name of the arrhythmia. Each correct answer was assigned one score. Either incorrect or blank answers received no scores. The scores ranged from zero to 20 and were categorized as poor (scores less than 10), moderate (scores 11 to 15), and good (scores 16 to 20). The ECG images were in original size and quality figures that belonged to the actual patients. Demographic data (age, gender, work experience, and educational level) were also collected by a questionnaire. Each participant received a special code before the training. The time for responding to each question was considered one minute.

The arrhythmia simulator software included educational contents about ECG interpretation, diagnosis, etiology, clinical symptoms, and treatment of all sinus, atrial, and ventricular arrhythmias, as well as various types of blocks and junctional rhythms. The entire session was filmed (about 45 minutes); and then the film was given to the participants. Afterward, the same questionnaire was given to the same participants to answer the questions.

3.3. Statistical Methods

The sample size was determined using the following formula:

$$n = \frac{(Z1 + Z2)^2 (2S)^2}{d^2}$$

Where, "Z1" was 95% confidence coefficient (1.96), "Z2" represented the power of 80% (0.84), "S" was an estimate of the standard deviation of arrhythmia score, and "D" was the least difference (0.8) between the average scores obtained before and after educations.

The data were analyzed using SPSS V.20 software. Descriptive (mean, frequency, and percentage) and inferential (*t*-test and ANOVA) statistics were used for this purpose. The significance level was considered as P value < 0.05.

4. Results

From the 22 nurses, 9 nurses (40.9%) were male and 13 (59.1%) nurses were female. Considering age, 2 nurses (9.1%) were less than 27 years, 16 nurses (72.7%) were between 27 - 35 years, and 4 nurses (18.2%) were older than 35 nurses. In addition, 8 (36.4%), 8 (36.4%), and 6 (27.3%) participants had < 5, 5 - 10, and > 10 years of working experience. Table 1 shows the participants' descriptive information in each educational group.

Table 1. Scores of Arrhythmias Diagnosis Pre- and Post-Education[a]

Phase of Study	Values	Max	Min
Pre-education			
Sinus arrhythmia	2.27 ± 1.02	4	1
Atria arrhythmia	1.95 ± 1.36	4	0
Ventricular arrhythmia	3.81 ± 1.065	5	2
Blocks and junction	4.27 ± 0.76	5	3
Total	9.9 ± 3.63	15	4
Post-education			
Sinus arrhythmia	3.4 ± 0.908	5	2
Atria arrhythmia	2.9 ± 0.52	4	2
Ventricular arrhythmia	4.9 ± 0.29	5	4
Blocks and junction	4.27 ± 0.767	5	3
Total	15.68 ± 0.945	18	14

[a]Values are expressed as mean ± SD.

The mean total score of arrhythmia diagnosis was 9.9 and 15.68 before and after educations, respectively (P = 0.022). Therefore, the educational interventions significantly improved the mean total score of arrhythmia diagnosis by about 6 scores.

The average scores regarding the diagnosis of each arrhythmia are presented in Table 2. No significant changes

Table 2. Mean Scores of Arrhythmias Diagnosis Based on Demographic Variables

Group	Age, y			Sex		Work Experience, y		
	> 35	27 - 35	< 27	Female	Male	> 10	5 - 10	< 5
Pre-education								
Sinus arrhythmia	2.25	2.87	3	2.84	2.66	2.5	3	2.75
Atria arrhythmia	0.75	2.31	1.5	2.38	1.33	1.5	2.62	1.62
Ventricular arrhythmia	3.25	3.87	4.5	4.3	3.11	3.5	3.5	4.37
Blocks and junction	4.5	4.31	3.5	4.38	4.11	4.5	4	4.37
Total	6.75	10.62	10.5	11.23	8	8.33	11.37	9.62
Post-education								
Sinus arrhythmia	3.5	3.31	4	3.07	3.88	3.5	3.5	3.25
Atria arrhythmia	3.5	2.81	2.5	2.69	3.22	3.33	2.87	2.62
Ventricular arrhythmia	4.75	4.93	5	4.92	4.88	4.66	5	5
Blocks and junction	4.5	4.31	3.5	4.38	4.11	4. 5	4	4.37
Total	15.75	15.62	16	15.3	16.62	15.66	15.62	15.75

were observed in the scores of none of the sub-categories before and after the educations.

Overall, 9 (40.9%) and 13 (59.1%) nurses had poor and moderate arrhythmia diagnosis scores before educations. Overall, nurses 10 (50%) obtained moderate and good diagnosis scores at post-intervention.

5. Discussion

The purpose of this study was to investigate the effects of educational interventions (i.e., educational videos and a cardiac arrhythmias simulator software) on arrhythmia diagnosis scores of nurses. In many studies, the lecturing has been noted as the routine educational method for teaching ECG (16-19). However, many studies have reported that lecturing is a low-impact educational method in comparison with other techniques (18, 20, 21). According to the results of this study, using simulator software could augment the learning process in nurses. Other studies have also verified the positive impacts of various learning strategies, including computer-based educational methods. Arhami Dolatabadi et al. (22) compared the ECG interpretation skills between the nurses working in the emergency and coronary care unit (CCU) departments and showed that the mean scores were higher in nurses working in CCU. This indicated that nurses in CCU were more familiarized with CHDs, which may be due to their higher experiences and skills and participation in ECG interpretation workshops (16). Also, in a study by Derakhshanfar et al. in 2013, they reported better ECG interpretation skills in the residents of the emergency departments in comparison with residents of pediatric wards. The residents of the emergency department had passed more heart-related courses and also have visited more patients with CHDs, resulting in their superior diagnostic abilities. This observation suggested the necessity of education, repetition, and experience over time to obtain ECG interpretation skills (17). Noorifrotagheh et al. (23) assessed the impacts of organizational evaluation and providing feedbacks on ECG interpretation skills in cardiology assistants of Shahid Beheshti University of Medical Sciences. The results showed a significant increase in the scores after educational courses, which indicated the effectiveness of the feedback and testing strategy. Accordingly, the weaknesses (i.e., incorrect responses) can be detected and resolved by further educations and repetitions. Therefore, it is recommended to attain feedbacks to understand the effectiveness of learning methodologies (18).

The use of software and other computer programs is a new method, which has been described as an effective educational approach (20, 24, 25). The results of a study showed that nurses educated by software acquired higher scores than those educated by conference (19). The participants of the recent quasi-experimental study were nurses working in intensive care units of hospitals in Urumieh City. The nurses in the control and intervention groups were educated using the conference and arrhythmic simulator software, respectively. The results showed that both methods were effective in increasing nurses' knowledge of arrhythmia; nevertheless, cardiac simulator software was more effective.

In the present study, the means total arrhythmia diagnosis scores were 9.9 and 15.68 before and after educations,

respectively (P value = 0.022). Our results reflected the impacts of the educational interventions on increasing the mean total arrhythmia diagnosis scores, which was consistent with the results of other studies. The active learning process requires feedbacks on how much learners have learned and what they have not remembered correctly. Therefore, these materials should be under focus to deliver a more productive learning process (22, 23, 26). Using films or software can deliver greater impacts on the learning process. In research conducted by Nilsson et al. (24), they investigated the roles of computer programs on ECG interpretation skills in medical students. In addition to routine internal medicine courses, the intervention group was also educated using computer software, whereas controls were educated by lectures. The results showed more effective learning in students who were educated by the computer program (24).

Concerning different types of arrhythmia, the diagnostic scores obtained for ventricular arrhythmias were greater than those of atrial arrhythmias in our study. In a study by Ebrahimian et al. (27) in 2015, the scores related to atrial arrhythmias were higher than those of ventricular arrhythmias and blocks and junctional rhythms in both control and intervention groups before and after the intervention. This was not consistent with the results of our study, which may be due to different types of used educational methods. In the present study, arrhythmias were educated by moving animations, which implant more lasting images in mind and result in a higher average score. Some of the advantages of educational methods based on the internet and computer programs are saving both time and space (28) and providing quick access to a large body of information (29). Simulator software also provides a bridge between theoretical lessons and practice (30).

In this study, most of the nurses misdiagnosed the wandering pacemaker as multifocal atrial tachycardia. These two arrhythmias are different in the number of heartbeats as the heart rate is normal in wandering pacemaker. This is while the heart rate is greater than 100 in multifocal atrial tachycardia.

5.1. Limitations

One of the limitations of the current research was that we could not compare our results with international studies. This was the first report on the application of the Persian version of the simulator software used in this study; therefore, the comparisons were limited to studies conducted in Iran. There were also no comprehensive studies reporting subgroup analyses based on the demographic variables (age, gender, and working experience), which prevented us from comparing our results with other studies. In addition, using the census method, small sample size, and lack of control group were other limitations.

5.2. Suggestions

Educating nurses by educational software and animations can significantly improve their scores in interpreting ECG. Therefore, these educational approaches are suggested as viable methods for training nurses. It is recommended to use this software for other students, especially cardiology residents.

5.3. Conclusions

Scores before and after training in the diagnosis of arrhythmias varied so that the average scores increased after the education. On the other hand, the arrhythmia detection rate was increased after the intervention. Using modern educational methods, such as educational software and animations plays an important role in expediting the learning process. These new methods can be appropriate alternatives for reviewing lessons and concepts. Furthermore, educational videos can be used repeatedly to address nurses' weaknesses at different times and locations.

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Footnotes

Authors' Contribution: All the authors made significant contributions to the research and met the authorship criteria in terms of concept and design, data analysis, drafting and critically revising the manuscript, and final approval of the manuscript.

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