

Original Article

The Impact of an Educational Program on Nurses' Practice Related to Care of Patients with Chest Tube

Nabila A. Bedier

Department of Medical Surgical Nursing, Faculty of Nursing, Alexandria University, Egypt

Amal Bakr Abo EL-Ata

Department of Medical Surgical Nursing, Faculty of Nursing, Port Said University, Egypt

Noha Mohammed Ibrahim

Department of Medical Surgical Nursing, Faculty of Nursing, Port Said University.

Correspondence: Amal Bakr Abo EL-Ata Department of Medical Surgical Nursing, Faculty of Nursing, Port Said University, Egypt e-mail amelsarwat@yahoo.com

Abstract

Background: Chest tube is a widely applied therapeutic postsurgical intervention in respiratory and cardiothoracic care. Chest tube can be a life saving intervention for patients presenting with pneumothoraces, effusions and hemothoraces. It is however associated with significant morbidity and mortality.

Aim of this study: The study aimed to evaluate the impact of an educational program on nurses' practice related to care of patients with chest tube.

Methodology: A quasi-experimental design was used in the current study. The study was carried out on a convenient sample of 30 nurses working in intensive cardiothoracic unit, cardiothoracic care unit, and general surgical unit at Ismailia University Hospital. Data were obtained through; Nurses' chest tube performance observation checklist. The educational program was designed based on an extensive revision of the related materials, recent medical textbooks, studies and literature.

Results: of this study indicated that all studied nurses (100.0%) had statistically significant unsatisfactory level of practice pre-program implementation. The statistically significant level of improvement in nurses' practice was very high immediately after the program implementation and there was decline in the studied nurses' total practice scores throughout the first follow-up and second follow up after program implementation but it showed significant improvement than pre-test ($P < 0.0001^{***}$, $P = 1.0$, $P = 0.031^*$ respectively).

Conclusions: The study concluded that there was statistically significant improvement immediately after program implementation and throughout the follow up phases regarding nurses' practice related to care of patients with chest tube.

Recommendations: The study recommended that regular continuous educational program should be designed to give information about chest tube for enhancing and reinforcement of nurses' practice to achieve high quality care.

Key words: Educational program, Nurses, practice, Care, Chest tube

Introduction

Chest tube drainage is a common intervention applied in many patients and as it is supported by (Steninmann et al., 2010) in USA every year more than 300,000 patients undergo cardiothoracic surgery requiring placement of at least one chest tube, because following thoracic surgery, tension pneumothorax is one of the main causes of cardiac arrest in the initial post-

operative period. In this situation the immediate diagnosis and appropriate treatment is insertion of chest tube.

Moreover, chest tube is also used for therapeutic purpose in pleural diseases, specifically pleural effusions, it is one of the more common clinical problems encountered by the internist. Estimates of the incidence of pleural effusions vary, with some estimating an annual incidence of up to 1

million in the United States. Pleural effusions are often associated with advanced malignancies such as carcinoma of lung or breast. Over 150,000 new cases of malignant pleural effusion are diagnosed each year. In these patients, chest tube insertion is done not only for the therapeutic purpose but also for the removal of fluid for the diagnostic purpose (Held et al., 2008).

A professional nurse engages in lifelong learning that will influence practice and ultimately impact the quality of care that a patient receives. The technical skills and critical demonstrated care provided by the critical nurse at the bed side are not enough to sustain an evidence based practice. They need to adopt a healthy work environment that gives merit to continuing education (Skees, 2010).

Significance of the Study

Chest tube insertion is a commonly performed procedure in hospital practice. Inappropriate management of chest tubes and their drainage systems may lead to delayed or incomplete evacuation of the collected air or fluid in the pleural space, delayed re-expansion of the collapsed lung, and even development of tension pneumothorax. They are associated with significant morbidity, leading to prolonged hospitalization or even mortality. Therefore, it is important that every member in the team taking care of patients with chest tube, should have adequate understanding of the physical principles of chest tube and its drainage system (Sim, 2011).

Numerous authors stated that there is lack of nurses' performance which may lead to a lot of complications due to bad nursing intervention for patients with chest tube such as blockage, infection, discomfort, pain and restricted mobility (Hutton et al., 2008, Johnny et al., 2010, and Lit et al., 2010)

Ibrahim's (2011) found that the majority of studied nurses at Ismailia University Hospital had statistically unsatisfactory level of practice related to chest tube. The need to develop training programs related to chest tube was suggested. Such program was expected to improve nurses' practice related to chest tube. So, this study focuses on improving nursing practice through planning and implementing an educational program for nurses related to care of patients with chest tube.

Aim

The aim of the present study was to evaluate the impact of an educational program on nurses' practice related to care of patient with chest tube.

Objectives:

To assess nurses' practice related to care of patients with chest tube.

To develop a training program for nurses related to care of patients with chest tube.

To implement the training program.

To evaluate the effect of the implemented training program on the practice related to care of patients with chest tube.

Research Hypothesis:

The following research hypothesis was formulated to accomplish the aims of the research

The practice of nurses attending the educational program related to care of patients with chest tube would be improved.

Methodology

Research Design: The design of the present study was a quasi-experimental design done to evaluate the impact of an educational program on nurses' practice related to care of patients with chest tube.

Setting: This study was conducted in intensive cardiothoracic unit, cardiothoracic care unit and general surgical unit at Ismailia University Hospital.

Subjects: All available nurses working with patients with chest tube in intensive cardiothoracic unit, cardiothoracic care unit and general surgical unit at Ismailia University Hospital (30 nurses), so the sample was convenient.

Instruments of Data Collection: The "Nurses' chest tube performance observation checklist" developed by the researcher, and presented to a jury of expert professors from medical surgical nursing department and medicine department, that is to suit the hospital standard and check its clarity. Their comments and suggestions were taken into considerations, and the final form was developed by the researcher to evaluate nurses' practice in relation to care of patient with chest tube. It compromised two parts:

Part I: it included items related to socio-demographic characteristics of the studied nurses

as their names, ages, educational levels, departments, years of experience, attendance of undergraduate studying unit about chest tube or its nursing care and attendance of any training courses about intensive care, infection control and chest tube care postgraduate.

Part II: It included (10 items containing 119 steps) divided into; a. care of the patient with chest tube after insertion (7 items containing 79 steps) related to the following areas; patient assessment (5 steps), chest drainage assessment (9steps), continuing care (14steps), changing chest drainage system (17steps) chest tube dressing (8 steps), Care of the patient after thoracotomy (18 steps) and documentation (8steps). b. care of the patient for removing chest tube (3 items containing 33 steps). related to the following areas; care of the patient before removing chest tube (7 steps), care of the patient during removal of chest tube (17 steps) and care of the patient after removing chest tube (9 steps). It was a two point Likert type scale of done took one score and not done took zero.

Scoring system: As regard nurse's practice each step checked answer was scored one for (done) and checked (not done) was scored zero. The total nurse's practice score was summed up then converted to percentage. Total nurses' practices were calculated as the following: All values <75% considered satisfactory practice. All Values >75% considered unsatisfactory practice.

Content Validity: The tool was tested for their content validity and clarity by 14 expertise in nursing and medical fields then appropriate modification was done accordingly (4 professors, 3 assistant professors, 6 lecturers from Alexandria, Ain shams, Suez Canal, Port said, Zigzags Universities).

Ethical Considerations: An official permission was obtained from the directors of the specific hospital through an official formal letters from the dean of The Faculty of Nursing Port Said University.

Informed consent was obtained from each nurse in the study after explaining its purpose and importance. Confidentially of the information was assured by the researcher.

Pilot Study: A pilot study was carried out after the development of the tools. It was carried out on 10 % of the nurses working in intensive

cardiothoracic care unit, cardiothoracic care unit and general surgical unit at Ismailia University Hospital to test the reliability and applicability of the tools of the study. The necessary modification was done based on the results of the pilot study. These nurses were excluded from the subject of research work to assure the stability of performances. Following this pilot study, the process of data collection and implementation of educational program consumed 12 months from the beginning of May 2013 to the end of February 2013. The actual study was conducted through four phases: assessment phase, program development phase, implementation phase and evaluation phase.

Assessment phase: In this stage, the researcher assessed nurses' learning needs using "Nurses' chest tube performance observation checklist" which was designed to assess nurses' practice as each nurse was observed by the researcher during her actual clinical practice. The nurse was evaluated by using the same instrument. Also, the researcher assessed available place, time, equipment, supplies, and instructional materials for conduction of the training program.

II. Educational program development phase

The training program was developed based on the identified needs and demands of nurses gathered in phase I, in the light of the most recent pertinent literature and based on Ibrahim master thesis (2011). This phase included the following;

Formulation of objectives: The aim of the program was to improve nurses' practice related to care of patients with chest tube through: Improving nurses' practice related to care of patient with chest tube.

B- Contents: covered all areas about caring of patient with chest tube which include: steps for caring patient after chest tube insertion and steps for caring patient during chest tube removal.

C-Planning of action: In this step the researcher designed a plan for a training program implementation. This plan included five sessions was implemented in five weeks for each group. Each week included six groups of nurses. Each group contained five nurses from the same department. The time was spent in explanation with each group was 45 minutes and 75 minutes break between each group. Also, the program teaching strategy was determined by; a)

Choosing the appropriate teaching method which was in the form of (lecture, demonstration and re-demonstration), b) Choosing the appropriate teaching media which was in the form of (handout, audiovisual material (lab), real object)

D- Clinical area preparation: Permission for conducting the study was taken from the head of nurse responsible for training after explaining the purpose, the time and the place of the study.

Then she informed the head nurses of intensive cardiothoracic unit, cardiothoracic care unit and general surgical unit to obtain cooperation.

Nurses were informed to participate in the study according to their need. Some nurses refused to participate throughout the training program phases as the training program was not mandatory. Agreement on participation in the study was taken orally from nurses.

The study was carried out only on nurses who participated in all stages of the training program. Many copies of the Nurses' chest tube performance observation checklist and training program were prepared by the researcher to facilitate learning and evaluation of the nurses' performance related to care of patients with chest tube.

III -Program Implementation: At the beginning, the studied nurses were divided into six groups each group consisted five nurses, then each group was gathered in the real setting separately, the session was taken at available time to the gathered group which was during the working shift, time available for nurses working at the early shift was 12.30 – 1.15 PM & at the late shift 2.30 – 3.15 PM.

The training program was implemented for five weeks at a rate of one session a week for each group. Each session took 45 minutes per day. At the beginning of the training program implementation, introduction to the training program and its importance, presentation of the training program plan and presentation of learning objectives of the training program were explained to each group separately.

A copy of handout was given to each nurse to facilitate remembering and demonstrating the procedure steps of the program. The program was presented in clear and concise form using different teaching methods as lectures, demonstration and re- demonstration and

appropriate teaching media as audiovisual material (lab) and real object.

At the beginning of each session, it was suitable to start with a brief revision of what was given before. This was followed by statement of the objectives of the present session. Nurses were asked to observe the researcher carefully during the demonstration of care provided to patient after chest tube insertion and during chest tube removal because every one of them will re-demonstrate the procedure in front of the researcher and they will be evaluated by the researcher.

The researcher demonstrated all the procedure steps in front of the nurses while discussing with them the rationale and the precaution for each step. At the end of the demonstration, nurses were asked about any unclear steps which needed repetitions or explanation before re-demonstration. The demonstrator (the nurse who performed the procedure) was asked to evaluate her performance (self-evaluation). The researcher emphasized that this session was done for teaching purpose not for evaluation, so mistakes and forgetting were allowed and were corrected immediately by the researcher.

Feedback about the procedure performance was given to each nurse immediately after re-demonstration. The nurse was asked to give her feedback about her performance for example (tell me about your feeling after performing the procedure, was that exactly what you expected to do? was it a procedure good or bad experience and tell me why? What was the step that you forget, do you think that you will forget it again the next time you perform the procedure)?

Each nurse was allowed re-demonstrating the procedure more than one time on different patients under the researcher's supervision and encouragement until she mastered it. Finally, the researcher gave her feedback starting with positive points then negative ones and any missing points or mistakes were corrected immediately to prevent other nurses from falling into the same mistakes.

Also nurses were asked to give their feedback about the researcher.

IV- Evaluation phase: The program outcome was evaluated by using Nurses' chest tube performance observation checklist, first evaluation immediately after program

implementation, second evaluation after three months and the third evaluation after six months. Immediately after program implementation, nurses' practice was evaluated by using Nurses' chest tube performance observation checklist.

The second evaluation after three months, the researcher informed nurses that she came to evaluate effectiveness of her program not to evaluate them, their practice was observed but they did not know for more accurate evaluation by using Nurses' chest tube performance observation checklist. The third evaluation after six months, also the researcher informed nurses that she came to evaluate effectiveness of her program not to evaluate them, their practice was observed but they did not know for more accurate evaluation by using Nurses' chest tube performance observation checklist.

Statistical Analysis: The raw data were coded and transformed into coding sheets. The results were checked. Then, the data were entered into SPSS system files (SPSS package version 18) using personal computer. Output drafts were checked against the revised coded data for typing and spelling mistakes. Finally, analysis and interpretation of data were conducted. The following statistical measures were used:

Mean percent score was calculated for practice of nursing care offered for patients with chest tube among the studied nurses. Descriptive statistics including frequency, distribution, mean, and standard deviation were used to describe different characteristics. Kolmogorov – Smirnov test was used to examine the normality of data distribution. Univariate analyses including: Student t-test and paired t-test were used to test the significance of results of quantitative variables. Mc Nemar test was used to test the significance of results of qualitative variables. The significance of the results was at the 5% level of significance.

Results

Table 1 shows the personal characteristics of the studied nurses. Regarding nurses' ages, two thirds of the studied nurses (63.3%) were among the age of twenty years old to less than twenty-five years old. As regards their marital status, it was found that the majority of them (80%) were married. In relation to educational levels, more than two thirds of the studied nurses (70%) were having nursing diploma. Moreover, it is clear that

equal percentages of studied nurses (33.3%) working in cardiothoracic care unit, intensive cardiothoracic care unit and general surgical units attended the nursing educational program concerning care of patients with chest tube.

Regarding nursing experience, more than half of the studied nurses (56.7%) had experience on patients with chest tube ranging from five years to less than ten years. Furthermore, only one third of the studied nurses (30%) had undergraduate training courses about nursing care of chest tube, while about two thirds of the studied nurses (63.3%) did not have postgraduate training courses about infection control.

Table 2 shows differences in studied nurses' practice related to care of patients with chest tube throughout the program intervention. Very high statistically significant difference in total score of studied nurses' practice was found between pre and post immediate program implementation in relation to patient assessment, chest drainage system assessment, continuing care, changing the drainage system, chest tube dressing, care of patient after thoracotomy ,documentation and removal of chest tube ($P < 0.0001$).

Also very high statistical significant difference was found between post immediate & post 6 months program implementation in relation to patient assessment, continuing care and care of patient after thoracotomy ($P \leq 0.0001$). High statistical significant difference was found between post immediate & post 6 months program implementation in relation to chest drainage system assessment, chest tube dressing and documentation ($P \leq 0.001$).

Moreover, this table shows that the only high statistically significant difference was found between post immediate and post 3 months after the program implementation in relation to patient assessment ($P = 0.001$) and continuing care ($P = 0.008$). Although some decline was evident between post immediate and post 3 months after the program implementation but it was still higher than pre-program implementation.

Table 3 presents differences in the total score of studied nurses' practice related to care of patients with chest tube throughout the program intervention. Very high statistically significant difference in total score of studied nurses' practice in relation to care of patient after chest tube insertion was found between pre/ immediate

program implementation ($P < 0.0001$) and a high statistically significant difference between immediate/ 6 months was found ($P = 0.002$). Also, this table shows that only very high statistically significant difference was found in relation to care during removal of chest tube between pre and post immediate program implementation ($P < 0.0001$).

Moreover, a very high statistically significant difference was found in relation to total score of studied nurses' practice between pre and post immediate program implementation ($P < 0.0001$). Also, a significant difference was found in relation to total score of studied nurses' practice between post immediate and six months post program implementation ($P = 0.031$).

Table 4 show the comparison between mean score (%) of studied nurses' practice related to care of patients with chest tube among the studied nurses throughout the program intervention according to their characteristics. The only statistically significant difference was found between practice of studied nurses and post graduate training courses about infection control before program implementation ($P = 0.013$).

Limitation of the Study

It was difficult to gather all the nurses from the same department at the same time to attend the program session. This problem was overcome by dividing the studied nurses in each shift in each department to two groups.

Discussion

Lifelong learning is essential for the nurse to maintain and increase competence in nursing practice. There are many different means to meet continuing professional development needs. Formal means include continuing education, staff development, academic education and research activities.

However, many individuals also continue their professional growth through informal means such as consultation, professional reading, experiential learning and self-directed activities.

The purpose here is to help the nurses to maintain and improve their competencies as required for the delivery of quality care to the consumer. Interventions in the form of ward based educational program, specifically designed nursing compliance, perceive gaps in their

knowledge and would welcome the opportunity to be updated regularly (Bastable, 2003).

The results of the present study revealed that the majority of studied nurses their ages ranged from twenty years old to less than twenty five years old and they were graduated from secondary nursing school.

These results might be due to that the Faculty of Nursing at Ismailia started only 7 years ago so the number of graduates up-till now is not enough to cover all units. So, these graduates worked only in intensive care unit, or as administrator. This result went in line with *Ahmed (2003)* who stated that the majority of the nursing manpower in Egypt were graduated from diploma school and it expected that nowadays they are employed in all nursing service.

However, they added that, the trends was –at the time- that graduates from The Faculty of Nursing employed in areas were geared to care for patients in need for high technology care.

Moreover, the findings of the present study indicated that the majority of studied nurses did not have any undergraduate training courses about chest tube care as they graduated from secondary nursing school and about half of them had less than 10 years experience.

Also, they did not attend any postgraduate training program related to chest tube or intensive care. While only one third of them attended training program related to infection control.

This finding was supported by *Kwekkeboom et al., 2006* who stressed that training programs were required to target the specific needs of nursing staff working at different care settings. The present study was in the same line with *Clinton et al., (2006)*, *Levett-Jones et al., 2006* and *Jarrett et al., (2007)* who emphasized that educational programs should provide nurses with the necessary attitude and behavior skills basic to efficient practice of the work.

Table (1): Personal characteristics of the studied nurses (n=30).

Personal characteristics	Studied nurses (n=30)	
	No.	%
Age (years)	2	6.7
Less than 20	19	63.3
20-<25	6	20.0
25-<30	3	10.0
30-<35		
Marital status	6	20.0
Single	24	80.0
Married		
Educational level	21	70.0
Nursing diploma	9	30.0
Technical institute		
Department of employment	10	33.3
Intensive cardiothoracic unit	10	33.3
Cardiothoracic care unit	10	33.3
General surgery units		
Duration of experience with patients with chest tube (years)	4	13.3
Less than 5	17	56.7
5-<10	9	30.0
10 years or more		
Undergraduate training courses about nursing care of chest tube	9	30.0
Yes	21	70.0
No		
Postgraduate training courses about infection control	11	36.7
Yes	19	63.3
No		

Table (2): Differences in studied nurses' practice related to care of patients with chest tube throughout the program intervention (n=30).

Practice score	Before		Immediately after		After 3 months		After 6 months		Sig. (before/ immediate)	Sig. immediate/3M)	Sig. immediate/6M)
	No.	%	No.	%	No.	%	No.	%			
Assessment											
Unsatisfactory (<75%)	30	100.0	0	0.0	11	36.7	13	43.3	P<0.0001***	P=0.001**	P<0.0001***
Satisfactory (≥75%)	0	0.0	30	100.0	19	63.3	17	56.7			
Chest drainage system assessment											
Unsatisfactory (<75%)	30	100.0	1	3.3	4	13.3	12	40.0	P<0.0001***	P=0.25	P=0.001**
Satisfactory (≥75%)	0	0.0	29	96.7	26	86.7	18	60.0			
Continuing care											
Unsatisfactory (<75%)	30	100.0	1	3.3	9	30.0	14	46.7	P<0.0001***	P=0.008**	P<0.0001***
Satisfactory (≥75%)	0	0.0	29	96.7	21	70.0	16	53.3			
Changing the drainage system											
Unsatisfactory (<75%)	27	90.0	0	0.0	0	0.0	0	0.0	P<0.0001***	-NA-	-NA-
Satisfactory (≥75%)	3	10.0	30	100.0	30	100.0	30	100.0			
Chest tube dressing											
Unsatisfactory (<75%)	28	93.3	0	0.0	3	10.0	8	26.7	P<0.0001***	P=0.25	P=0.008**
Satisfactory (≥75%)	2	6.7	30	100.0	27	90.0	22	73.3			
Care after thoracotomy											
Unsatisfactory (<75%)	30	100.0	1	3.3	5	16.7	15	50.0	P<0.0001***	P=0.125	P<0.0001***
Satisfactory (≥75%)	0	0.0	29	96.7	25	83.3	15	50.0			
Documentation											
Unsatisfactory (<75%)	30	100.0	1	3.3	4	13.3	11	36.7	P<0.0001***	P=0.25	P=0.002**
Satisfactory (≥75%)	0	0.0	29	96.7	26	86.7	19	63.3			
Removal of tube											
Unsatisfactory (<75%)	30	100.0	1	3.3	1	3.3	1	3.3	P<0.0001***	P=1.0	P=1.0
Satisfactory (≥75%)	0	0.0	29	96.7	29	96.7	29	96.7			

Sig: Mc Nemar test

*significant at $P \leq 0.0$ **high significant at $P \leq 0.001$ ***very high significant at $P \leq 0.0001$

Table (3): Differences in the total score of studied nurses' practice related to care of patients with chest tube throughout the program intervention (n=30).

Practice total score	Before		Immediately after		After 3 months		After 6 months		Sig. (before /immediate)	Sig. (immediate/3M)	Sig. (immediate/6M)
	No.	%	No.	%	No.	%	No.	%			
Care after insertion of chest tube											
Unsatisfactory (<75%)	30	100.0	1	3.3	3	10.0	11	36.7	P<0.0001***	P=0.5	P=0.002**
Satisfactory (≥75%)	0	0.0	29	96.7	27	90.0	19	63.3			
Care during removal of chest tube											
Unsatisfactory (<75%)	30	100.0	1	3.3	1	3.3	1	3.3	P<0.0001***	P=1.0	P=1.0
Satisfactory (≥75%)	0	0.0	29	96.7	29	96.7	29	96.7			
Total score											
Unsatisfactory (<75%)	30	100.0	1	3.3	2	6.7	7	23.3	P<0.0001***	P=1.0	P=0.031*
Satisfactory (≥75%)	0	0.0	29	96.7	28	93.3	23	76.7			

*Sig: Mc Nemar test *significant at P≤0.05 **high significant at P≤0.001 ***very high significant at P≤0.0001*

Table (4): Comparison between mean score (%) of studied nurses' practice related to care of patients with chest tube throughout the program intervention according to their characteristics (n=30).

Characteristics	n	Practice score									
		Before		Immediately after		After 3 months		After 6 months			
		Mean±SD	Significance	Mean±SD	Significance	Mean±SD	Significance	Mean±SD	Significance		
Age of nurses (years)											
Less than 25	21	40.7±6.9	t=0.385 P=0.703	94.1±11.8	t=0.554 P=0.584	86.5±12.9	t=0.584 P=0.564	81.9±13.2	t=0.434 P=0.668		
25 or more	9	41.7±6.0		96.3±2.1		89.1±3.7		79.9±6.0			
Marital status											
Single	6	38.2±4.2	t=1.144 P=0.262	96.3±2.1	t=0.416 P=0.68	89.4±6.3	t=0.516 P=0.61	84.2±8.6	t=0.681 P=0.502		
Married	24	41.6±6.9		94.4±11.1		86.8±1.9		80.6±12.1			
Education											
Nursing diploma	21	40.4±6.8	t=0.658 P=0.516	93.5±11.7	t=1.044 P=0.305	85.8±12.5	t=1.136 P=0.266	79.9±12.2	t=0.959 P=0.346		
Technical institute	9	42.2±6.3		97.7±0.9		90.8±5.4		84.4±9.5			
Department of employment											
Intensive cardiothoracic unit	10	44.7±7.7	F=3.236 P=0.055	91.8±17.2	F=0.696 P=0.507	86.7±17.7	F=0.027 P=0.973	83.6±17.5	F=0.366 P=0.697		
cardiothoracic care unit	10	40.5±5.1		95.7±1.9		87.9±3.5		79.1±5.9			
General surgery units	10	37.7±5.4		96.9±1.7		87.4±8.0		81.1±8.6			
Duration of nursing experience (years)											
<10	21	40.7±6.9	t=0.385 P=0.703	94.1±11.8	t=0.554 P=0.584	86.5±12.9	t=0.584 P=0.564	81.9±13.2	t=0.434 P=0.668		
≥10	9	41.7±6.0		96.3±2.1		89.1±3.7		79.9±6.0			
Undergraduate training courses about chest tube											
Yes	9	42.2±6.3	t=0.658 P=0.516	97.7±0.9	t=1.044 P=0.305	90.8±5.4	t=1.136 P=0.266	84.4±9.5	t=0.959 P=0.346		
No	21	40.4±6.8		93.5±11.7		85.8±12.5		79.9±12.2			
Postgraduate training courses about infection control											
Yes	11	44.8±7.9	t=2.669 P=0.013*	96.9±1.8	t=0.878 P=0.387	91.2±4.9	t=1.512 P=0.142	85.2±8.1	t=1.464 P=0.154		
No	19	38.7±4.7		93.6±12.4		85.0±12.9		78.9±12.7			

t: t-test F: ANOVA test *significant at P≤0.05 **high significant at P≤0.001 ***very high significant at P≤0.0001

The findings of the present study revealed that practice scores of studied nurses related to patient assessment, chest drainage assessment, continuing care, changing the drainage system, chest tube dressing, care after thoracotomy, documentation, removal of chest tube and total practice score were highly statistically significant unsatisfactory pre-program implementation. This result might be due to that all studied nurses did not have any under or postgraduate training courses about chest tube care, lack of supervision, unrepresented evaluation system for nurses' performance or staff workload.

Moreover, this result is in agreement with Ibrahim (2011) who found that most of the studied nurses did not have satisfied level of performance regarding care of patients undergoing chest tube. So, he recommended developing system of periodical nurses' evaluation to determine strategies of upgrading their knowledge and enhancing their practice, developing specific procedure book about the care of patient with chest tube and chest drainage system, developing follow up courses. In-service training programs should be conducted to maintain efficient performance of individual previously trained in care of patients with chest tube and emphasized on monitoring and supervision as important for service improvement.

The current study indicated that there was a highly statistically significant improvement in the studied nurses' practice about patient assessment, chest drainage assessment, continuing care, changing the drainage system, chest tube dressing, care after thoracotomy, documentation, removal of chest tube and total practice score immediately after the program intervention. This high statistically significant improvement post program implementation might be due to the effect of the in-service training program which did not only stress the acquisition of knowledge of chest tube but also stressed on practical training to gain information and change work practice using adequate sessions, different teaching strategies as discussion, lecture, demonstration and re-demonstration, using media as handout including pictures and knowledge as well as availability of sufficient materials and supplies needed for achievement of the work, this motivated the studied nurses to achieve the desired objectives through rewarding and acknowledgement of

positive attitude and discouragement of negative attitudes. All nurses participated in the program had received a handout of the program content. Also, recurrent reinforcement for both knowledge and practice was done in each session.

This result is in agreement with Ibrahim's, (2013) findings that show an improvement in total practice score of nurses regarding infection control in caring for patients with peripheral intravenous cannula after implementation of program with highly statistically significant difference between pre and post program implementation. The above mentioned result is explained by Gallagher (2006) argument who stated that continuing education has been shown to increase nurses' professional behavior and improve the knowledge of patient management and nursing practice.

In the present study, regarding nurses' practice score about chest drainage assessment, changing the drainage system, chest tube dressing, care after thoracotomy, documentation, removal of chest tube and total practice score at the first follow up (three months later), there was mild decline but still improvement in nurses' practice was very high compared to pre-program intervention. This mild decline might be due to effectiveness of the training program but indicated that nurses need refreshing training programs to maintain their satisfied performance. Johnny et al., (2010) reported that a comprehensive educational session relating to chest tube management should be held regularly. An appropriate evidenced-base clinical guidelines and protocols are needed to develop for safe clinical practices.

In the present study at the second follow up, six months post program implementation, there was more decline in total nurses' practice score than the first follow up but was still higher more than pre-program intervention.

The current study revealed that there were relations between practice of studied nurses pre-program implementation and postgraduate training courses about infection control, this means that nurses who attended postgraduate training courses about infection control gained high performance score than those who did not attended pre-program implementation. This finding pointed to the successful effect of the implemented training program.

In conclusion, the results of the present study revealed a statistically significant improvement of nurses' practice was found regarding care of patients with chest tube throughout the program phases. Based on this finding, the research hypothesis was fulfilled.

Recommendations

Based on the results of this study, the following recommendations are suggested:

Recommendations for nurses: Importance of presence of protocol related to care of patients with chest tube. Upgrading nurses' practice about caring of patients with chest tube through:

Encouraging nurses to attend national and international congresses, seminars, symposia and workshops regularly about chest tube & care of patients with chest tube is considered helpful. Regular continuous educational program plan about chest tube & its management should be designed to nurses working in ICU at least every six months for enhancing nurses' knowledge and practice to achieve high quality of care.

Encouraging nurses dealing with patients with chest tube to attend regular formal in-service educational programs about chest tube, is another option. Developing a system of periodical evaluation of nurses is considered useful for determining strategies of upgrading their knowledge and enhancing their practice. Chest tube training program should be mandatory for newly employed nurses. Nurses involved in patient care should have a valid chest tube care certification and renew it regularly at least every one year. Nursing school curriculum must include all items about chest tube care including; definition, indications, insertion, chest drainage systems, problems associated with chest drainage system, complications of chest tube, role of nurses towards patients with chest tube and chest tube removal.

Studying the impact of educational programs on chest tube continuously using a wide probability sample in different areas to monitor improvement in nurses' performance and points of weakness for developing more educational program to nurses dealing with patients with chest tube to improve nurse's performance.

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