

Effect of Educational Guidelines on Nurses' Performance for Caring of Critically Ill Patients with Digital Chest Drainage System

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Abstract

Background: Caring for critically ill patients with chest drain is an essential part of nursing practice so that, nurses must be equipped with appropriate knowledge and skills to meet the needs of such group of patients safely and competently. **Aim:** This study aims to assess the effect of educational guidelines on nurses' performance for caring of critically ill patients with digital chest drainage system. **Design:** A quazi experimental design was utilized. **Setting:** At cardiac intensive care unit & chest intensive care unit which affiliated to Ain Shams University Hospital at Cairo - Egypt. **Sample:** A purposive sample of 60 nurses caring for patients with digital chest drainage system in the previously mentioned units were recruited in the current study. **Tools:** Two tools were used to collected data related to achieve the aim of the present study as following I-Nurses' knowledge self-administered questionnaire and II-nurses' practice observational checklist. **Results:** Less than three quarter of nurses had total unsatisfactory level of performance regarding caring for critically ill patients with digital chest drainage system pre the educational guidelines implementation. Meanwhile the majority of the study sample had statistically significant improvement in their performance post the educational guidelines implementation. While this improvement lowered slightly post- implementation by follow up. **Conclusion:** The educational guidelines for nurses was effective in improving their performance regarding caring for critically ill patients with digital chest drainage system. **Recommendations:** Implementing the educational guidelines on a wider field including all governmental hospitals is necessary to raise the efficiency of nursing care given for patients with digital chest drainage system.

Key words: digital chest drainage system, educational Guidelines, nurses' Performance

Introduction

Most patients with complicated respiratory problems or undergo cardiothoracic surgery will receive one or more chest drain to remove air, blood and other fluid from the pericardial and pleural cavities and to preserve hemodynamic stability and cardiopulmonary function. Digital chest drainage system has been widely used in over 1 million patients worldwide (Slinger, 2019). The new digital chest drainage system is a different than old chest tube drainage, it has a water-seal chamber, a suction-control chamber, and a collection chamber; with a one-way valve prevents air and fluid from returning to the chest. Almost all newer systems are self-contained and provide everything needed for rapid setup and function (Barozzi et al.,2020).

Chest tubes and chest drainage systems are a complex and critical nursing function. Learning about their components and techniques about them will protect the patients and help in recovery from a serious pulmonary problem. The nurses must assess patency of the chest drainage system by observing respiratory fluctuations of the fluid in the water-seal chamber when the patient is on gravity drainage, observes air drainage from the chest tube and marked the amount of sterile water directly on the drainage chamber according to institution's policy (Batra, & Khan, 2019).

Caring for critically ill patients with digital chest drainage system presents nurses and other health care provider with one of the more complex and challenging endeavors. Proper management and early recognition of complications allow for prompt intervention and

progress toward optimal outcomes for these patients (**Batchelor, 2019**). Based on the evidence available, guidelines produced by the United Kingdom National Institute for Health and Care Excellence (NICE) support the use of digital chest drainage device, as it has many benefits for patients including; reduced drainage time, reduced length of stay in hospital, improved safety, improved mobility, cost saving, easy to manage, higher rates of patients' satisfaction (**Ravi, & McKnight, 2022**).

Several complications associated with unsafe care of chest drainage system summarized in the following items; improper filling of the reservoir with sterile water, twisting of chest tube, drain tubing disconnected, leakage from chest tube site, blockage of chest tube, accidental removal of chest tube (drain dislodgement), local site of chest tube infection (**Salime et al., 2021**).

According to **Urden et al., (2019)** the guidelines for caring critical ill patients with digital chest drainage system including theoretical knowledge as anatomy of the chest cavity that relevant to chest tube placement, purpose, indications, structures and complications associated with chest drainage system. In addition to **Renton et al., (2020)** mentioned the practical skills that required for critical ill patients with digital chest drainage system involving infection control measures, assessment the patients' respiratory status, obtaining pain assessment, providing care for chest tube, changing the chest drainage system if needed and documenting & reporting any abnormalities.

The quality of nursing care is influenced by the level of knowledge, skills, and training courses regarding the care that provided for critically ill patients with digital chest drainage system. It is important for nurses dealing for such group of patients understand the risks associated with chest drain to know how to assist with the preparation of the digital chest drainage system, perform ongoing patient assessments, document appropriately, and troubleshoot possible problems related to chest tube & its' drainage (**Taraq et al., 2020**).

Significance of the Study

Nurses who are responsible for the safe delivery of care should be knowledgeable and skillful regarding providing the care that may be utilized to ensure adequate respiration and preventing respiratory compromise for critically ill patients with digital chest drainage system (**Cooper & Browne, 2019; Sheykhasadi et al., 2019**). So that, it is necessary to assess the effect of educational guidelines on nurses' performance regarding caring of critically ill patients with digital drainage system.

Aim of the Study

This study aimed to assess the effect of educational guidelines on nurses' performance for caring of critically ill patients with digital chest drainage system through the following:

1. Assessing nurses' level of knowledge & practice regarding caring of critically ill patients with digital chest drainage system.

2. Developing and implementing educational guidelines for nurses included in the study regarding caring of critically ill patients with digital chest drainage system, based on their needs.

3. Evaluating the effect of educational guidelines on nurses' level of knowledge & practice.

Research Hypothesis:

Implementation of educational guidelines will have positive significant improvement on nurses' level of performance (knowledge & practice) regarding caring of critically ill patients with digital chest drainage.

Subjects and methods

Research design:

A quasi-experimental design (pre and post test) was utilized to meet the aim of the study.

Study Setting:

The current study was conducted two ICU at cardiac & chest intensive care units

which affiliated to Ain Shams University Hospital at Cairo in Egypt

Subject:

A purposive sample of 60 nurses caring for patients with digital chest drainage system were recruited in the current study through the following inclusion criteria; nurses already, their years of experience not less than 6 months for working at previous mentioned setting and who are willing to participate in the study. **Sample size;** was calculate by using power test to confidence interval 95% with margin of error adjusted to 5 %

Tools:

Two tools were used to assess nurses' performance regarding caring of critically ill patients with digital chest drainage system

Tool I: Nurses' structured self-administrated questionnaire: It was developed by the researchers and includes two parts:

Part I: nurses' characteristics; it includes six items about (age, gender, qualification, marital status, years of experience, and training courses about digital chest drainage system).

Part II: nurses' knowledge regarding caring of critically ill patients with digital chest drainage system. This questionnaire was designed after reviewing recent related literature (**Good & Kirkwood, 2018; Urden et al., 2019**). It consisted of 30 questions in the form of multiple-choice questions (MCQ), it distributed into six subtitles as the following: anatomy of the chest cavity that is relevant to chest tube placement system (three questions), meaning & purpose of digital chest drainage system (five questions), structures of digital chest drainage system (five questions), indications of digital chest drainage system (five questions), complications associated with chest drain (five questions) and guidelines for safe use of digital chest drainage system (seven questions).

Scoring system:

The total score of knowledge was 30 grades. Each correct answer was given one

mark and the incorrect answer was given zero. It was considered that:

- $\geq 85\%$ was satisfactory level of knowledge (≥ 26 grades correct answers).

- $< 85\%$ was unsatisfactory level of knowledge (< 26 grades correct answers).

Tool II: Nurses' practices observational checklist:

This tool was adapted from (**Renton, et al., 2020**) to assess nurses' level of practice regarding caring for critically ill patients with digital chest drainage system. It was consisted of 72 steps divided into;

- Following infection control measures (5 steps)
 - Assessment the patient's respiratory status (5 steps)
 - Obtaining pain assessment & note suction level as prescribed (4 steps)
 - Assessment and providing care for chest tube & draining system (25 steps)
 - Changing the digital chest drainage system as prescribed (31 steps).
 - Documenting & reporting nursing intervention in nursing notes (2 steps)

Scoring system:

The total score of nurses' practices was 72 marks, each step done correctly was given one mark and zero for the step which was not done or done incorrectly. It was considered that:

- $\geq 85\%$ was satisfactory level of the practice (≥ 61 correct actions).

- $< 85\%$ was unsatisfactory level of the practice ($61 <$ correct actions).

Validity and Reliability:

Testing validity of the tools was reviewed by a panel of five experts in the critical care and emergency nursing faculty staff to ascertain their clarity, relevance, comprehensiveness, simplicity and applicability; no modification was done. Testing reliability of proposed tools was done statistically by alpha Cronbach test for nurses' knowledge was 0.781 and for nurses' practices

was 0.876 that indicate high reliability of the used tool.

Ethical Considerations

Official approval was obtained from scientific research ethics committee in faculty of nursing Ain shams university on 12/2/2023 for conducting the current study with number (23.04.57). Then the researchers explain the aim of the study to the hospital director to apply this study for nurses included in the study. The researchers approached the nurses individually for explaining the purpose of the study, and the importance of the educational guidelines to improve their level of performance regarding caring of patients with digital chest drainage system and to take their oral approval to participate in the current study. Nurses were informed that they allowed choosing to participate or not in the study and they had the right to withdraw from the study at any time without giving any reasons. Confidentially of all information was secured.

Pilot study:

It was carried out on 10% nurses of the study sample to test the applicability, clarity, and efficacy of the study tools. There were no modifications on tools were done, so that, the nurses who included in the pilot study were included in the current study.

Field Work

All the study phases were taken six months started from (March 2023 till the end of August 2023).

Assessment and planning phase

This phase started by interviewing the nurses who met the inclusion criteria and explaining the aim and nature of the study as well as obtaining their approval to participate in the study prior to data collection.

The baseline data were assessed from the nurses in pre-educational guidelines implementation by using the previously mentioned study tools including (nurses' structured self-administrated questionnaire & nurses' practices observational checklist.

The total number of the studied nurses was about 60 nurses, they were divided into ten groups; each group about 6 nurses and the educational guidelines was implemented for each group separately.

The tools took about 30-45 minutes to be filled form every nurse during their free time. The researchers were available 3 day per week and met around 6 nurses per day.

Implementation phase:

Based on the studied nurses' needs, the researcher developed educational guidelines after reviewing recent related literature in the form of instructional illustrated booklet in Arabic simple language. The methods of teaching used were lecturing followed by focus group discussion in addition to audiovisual materials as computer and board.

Educational guidelines sessions were conducted by the researchers which are included four sessions (first & second sessions for theoretical knowledge and third & fourth sessions for the practical skills). The sessions conducted in the morning and afternoon shifts. Each one took 30- 45 minutes.

The content of educational guidelines booklet in Arabic language was extracted from recent medical and nursing knowledge derived from literatures (**Urden et al., 2019; Renton et al., 2020 & Wongkarnjana et al., 2023**) it gives insight for nurses regarding caring of critically ill patients with digital chest drainage.

The sessions of an educational guidelines were directed toward caring of critically ill patients with digital chest drainage system as the following:

- **The first session:** it was concerned with knowledge regarding; anatomy of chest cavity, purpose, structures of digital chest drainage system and proper suction pressure of digital chest drainage system.
- **The second session:** it was included indications of digital chest drainage system, complications associated with chest drain, guidelines for safe use of digital chest drainage system.
- **The third session:** focused on nurses' practices include: following infection

control measures, assessment the patient's respiratory status and obtaining pain assessment.

▪ **The fourth session:** it concerned with last nursing practices throughout the shift as and providing care for chest tube & draining system, changing the digital chest drainage system if needed and documenting & reporting nursing intervention in nursing notes.

Evaluation Phase:

The researchers evaluated the effect of educational guidelines, by comparing the improvement on nurses' performance regarding caring of critical ill patients with digital chest drainage system pre and immediately post of the educational guidelines implementation and post 2 months later (follow up) by the same used tools.

Statistical design:

All data were collected, coded, tabulated and subjected to statistical analysis. Statistical analysis is performed by statistical package SPSS version 20, also Microsoft office Excel is used for data handling and graphical presentation. Qualitative categorical variables are described by percentage and proportions. Descriptive statistics are used to analyze the response to individual items and the respondents' characteristics. Chi-square and correlation coefficient tests used to measure study variables.

Results

According to the characteristics of the studied nurses, 53.4% of the them their age range between 30 - <40 years with mean 22.3 ± 5.21 years. Regarding to gender of the studied nurses 68.3% were females. Related to qualification of the studied nurses 53.4% of them had technical nursing degree. 66.7 of them were married. Also, 33.3% of the studied nurses had years of experience from 10 year to less than 15 years with mean 14.75 ± 7.2 year.

Moreover, 86.7% of the studied nurses didn't attend training course about digital chest drainage system, as mentioned in **table (1)**.

Data in **table (2)** shows that, there was statistically significant improvement in the studied nurses' knowledge post and follow up educational guidelines implementation than pre-educational guidelines implementation with (P value ≤ 0.05).

Table 3 shows that, there was improvement in practice of the studied nurses regarding digital chest drainage system post and follow up the educational guidelines implementation than pre-educational guidelines implementation with statistically significant difference at ($P \leq 0.05$).

Figure 1 shows that 71.7 % of the studied nurses had unsatisfactory level of knowledge regarding digital chest drainage system at pre-educational guidelines implementation. While, 91.7% of them had satisfactory level of post educational guidelines implementation Also, 83.3 % of them had satisfactory score of knowledge at follow up of educational guidelines implementation.

Figure 2 shows that 70.7 % of the studied nurses had unsatisfactory level of practice regarding caring of patients with digital chest drainage system at pre-educational guidelines implementation. While, 96.7 % of them had satisfactory level of practice post educational guidelines implementation. Also, 81.7 % of them had satisfactory level of practice at follow up of educational guidelines implementation.

Table 4 illustrates that, there was a positive correlation between total knowledge and total practice of the studied nurses regarding caring of patients with digital chest drainage system $r = 0.541$.

Table (1): Distribution of the studied nurses regarding their characteristics (n= 60).

Characteristics	N	%
Age (year)		
20 - <30	17	28.3
30 - <40	32	53.4
≥ 40	11	18.3
Mean ±S.D	22.3 ± 5.21	
Gender		
Male	19	31.7
Female	41	68.3
Qualification		
Secondary nursing school	8	13.3
Technical nursing institute	32	53.4
Bachelor nursing degree	15	25.0
Postgraduate studies	5	8.3
Marital Status		
Married	40	66.7
Single	20	33.3
Years of Experience (year)		
< 5	16	26.7
5 - <10	13	21.7
10 - <15	20	33.3
≥15	11	18.3
Mean ± S.D	14.75 ± 7.2	
Training Courses about digital chest tube drainage system		
Yes	8	13.3
No	52	86.7

Table (2): Total satisfactory level of nurses' knowledge regarding digital chest drainage system pre, post and follow up the implementation of educational guideline (n= 50).

Total knowledge	Pre		Post		Follow up		chi-square test(χ^2)	p. value
	Satisfactory		Satisfactory		Satisfactory			
	No	%	No	%	No	%		
Anatomy of the chest cavity that relevant to chest tube placement	16	26.7	56	93.3	50	83.3	13.3	.000**
Meaning & purpose of digital chest drainage system	19	31.7	58	96.7	49	81.7	8.07	.000**
Structure of digital chest drainage system	16	26.7	56	93.3	53	88.3	7.38	.001**
Indications & benefits of digital chest drainage system	20	33.3	55	91.7	50	83.3	8.02	.009**
Complications associated with chest drain.	13	21.7	53	88.3	47	78.3	7.00	.003**
Guidelines for caring patients with digital chest drainage system	17	28.3	56	93.3	52	86.7	7.16	.000**

*P ≤ 0.05 Significant, **P ≤ 0.01 High Significant.

Table (3): Total satisfactory level of nurses’ practices regarding caring of patients with chest tube pre, post and follow up the educational guideline implementation (n= 60).

Total practice	Pre		Post		follow up		chi-square test (χ^2)	P. value
	Satisfactory		Satisfactory		Satisfactory			
	No	%	No	%	No	%		
Following infection control measures	23	38.3	56	93.3	50	83.3	8.07	.012*
Assessment the patient’s respiratory status	17	28.3	53	88.3	49	81.7	6.03	.000**
Obtaining pain assessment	16	26.7	55	91.7	46	76.7	9.01	.003**
providing care for chest tube & draining system	20	33.3	58	96.7	53	88.3	7.33	.021*
Changing the digital chest drainage system as prescribed	19	31.7	49	81.7	46	76.7	6.08	.003**
Documenting & reporting nursing intervention in nursing notes	22	36.7	52	86.7	44	73.3	8.06	.012*

*P≤ 0.05 Significant, **P≤ 0.01 High Significant

Figure (1): Distribution of the total level of nurses’ knowledge regarding caring for patients with digital chest drainage system pre, post and follow up phases (n=60).

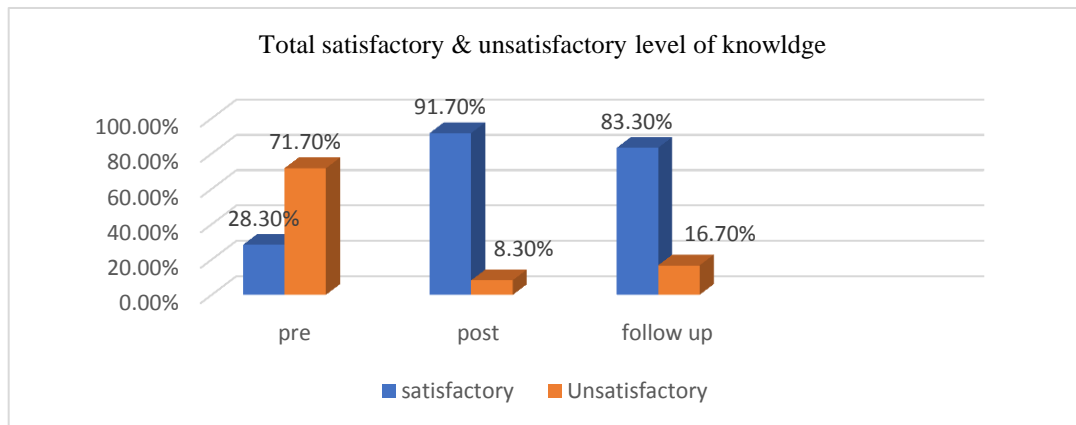


Figure (2): Distribution of the total level of nurses’ practice regarding caring for patients with digital chest drainage system pre, post and follow up phases (n=60).

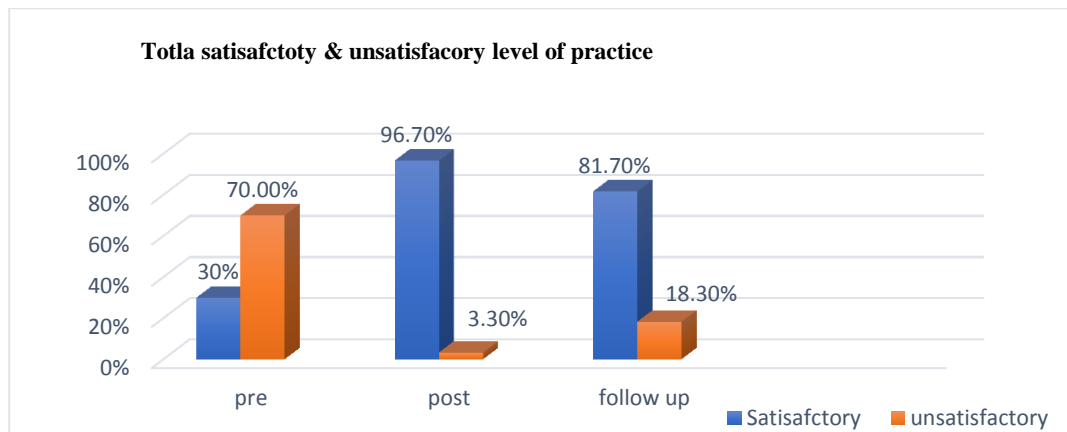


Table (4): Correlation between total level of nurses' knowledge and their practice post educational guidelines implementation.

Item	Total practice	
	r.	P value
Total Knowledge	0.541	0.001**

(**) Statistically significant at $p \leq 0.01$

Discussion

Critically ill patients treated with chest drain are at risk for the common following complications include drain blockage, accidental dislodgement, haemothorax, infections, and re-expansion pulmonary oedema. In this context, nurses must have access to updated information, learning resources, and continuous educational opportunities in this very specific and complex area (Stephen et al., 2020). So that, this study aimed to assess the effect of an educational guidelines on nurses' performance for caring of critically ill patients with digital chest drainage system.

Regarding the study nurses' characteristics, the results of the present study revealed that more than half of the studied nurses' age were between 30 and 40 years old. This explains that they are adult, old graduated, tolerate the nature of the work and most of the study nurses were technical nursing degree. This finding is consistent with what was reported by Saha (2020) who mentioned that most of nurses who working in intensive care unit and anesthesia are between 30 and 40 years old.

Related to gender, the present results showed that, more than two third of the study nurses were females. This is may be due to the greater fraction of the nurse in Egypt was female and my also related to the studying of nursing in Egypt were exclusive for female only till few years ago. This finding is in consistent with Mehrabi et al., (2023), who reported that most of their study group was female that may be due to elevated number of nurses among female. As regards nurses' marital status, about two thirds of the subjects were married.

Concerning to educational level, the present study results indicated that, more than half of the study nurses were had technical nursing degree. This might elaborate the current

condition of nursing qualification in Egypt. This result is contradicted with Sabry et al., (2020) who reported that the majority of the study subjects were having bachelor degree.

Regarding years of experience in intensive care unit (ICU), the current study showed that near one third of the studied nurses had experience from 10 years to less than 15 years. This finding was contradicted with Zhou et al., 2018 who reported that more than two thirds of the study subjects' years of experience in ICU ranged between 1-5years.

It was found that about less than three quarter of the study nurses had unsatisfactory score regarding their total level of knowledge at pre-educational guidelines implementation phase which may be due to unavailability of booklets and training courses. While, nurses' level of satisfactory score was improved post educational guidelines implementation then this improvement lowered slightly in the follow up phase. This finding contraindicated with Evan et al., 2019 who found that majority of the studied nurses had satisfactory level of knowledge regarding chest drain.

The finding of the current study revealed that more than two thrid of the studied nurses had unsatisfactory level of practice regarding caring for chest tube and changing digtial chest drainage system at pre-educational guideline implementation phase. This might be due to absence of standard of nursing care related to chest tube care & changing digtial chest drainage system. The nurses' level of the satisfactory score was improved post educational guideline implementation and follow up phase. This finding goes in the same line with Arai et al., (2018) who reported that each medical organization and profession must set standards and objectives to guide team and practitioners in performing safe and effective care. Also, not only must standards exist, but leader and managers also must see that subordinates know and understand the standards and employee must be aware that their performance will be

measured in terms of their ability to meet the established standards to provide quality of care.

The previous study finding also is consistent with **Salime, et al. (2021)** who stated that all health professionals must continually update their theoretical knowledge and clinical skills by developing their ability to combine the use of the assessment tools with good practical skills and closely observing their patients.

There was statistically significant correlation between total knowledge and practice of study sample. This might be due to the educational guideline improved level of nurses' knowledge which affecting positively on their practice regarding caring for patients with digital chest drainage system. This finding was conducted previously by **Evans, et al. (2019)** mentioned that, there was significant direct correlations between knowledge and practice among the studied nurses.

In summary, the results of this study revealed that, there is a need to focus on development of nursing staff knowledge and practice regarding caring for critically ill patients with digital chest drainage system for avoidance the occurrence of complications, so effort should be directed towards enhancing nurses' performance.

Conclusion

This study concluded that the educational guidelines was effective in improving the studied nurses' performance (knowledge & practice) regarding caring for critical ill patients with digital chest drainage system.

Recommendations

-Conducting periodic in-service training advanced care programs for nurses in critical care units for improving their performance and quality of care that provided to critically ill patients treated with digital chest drainage system.

-Implementing the educational guidelines on a wider field including all governmental hospitals is necessary to raise the efficiency of nursing care given for patients with digital chest drainage system.

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