

Effect of Educational Intervention on Nurses' Performance Regarding Care of Critically Ill Children with Pneumothorax

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Abstract:

Background: Pneumothorax is an urgent and undesirable state of air penetration into the virtual space between two lists of pleura resulting in a collapsed lung and loss of negative intrathoracic pressure. The nurse must be equipped with appropriate knowledge and skills to meet the needs of children with pneumothorax safely and competently. **This study aimed to:** Evaluate effect of educational intervention on nurses' performance regarding care of critically ill children with pneumothorax. **Design:** A quasi- experimental design was used in the current study. **Setting:** The present study was conducted at Pediatric Intensive Care Unit, Cardiothoracic Intensive Care Unit and Emergency Intensive Care Unit at Benha University Hospital **Subjects:** A convenient sample of (100) nurses who working at the previously mentioned setting included in the study and a purposive sample of (70) child who suffering from pneumothorax. **Tools of data collection: Tool (I): A structured interviewing questionnaire sheet** consists of **part (1):** Personal data of the studied nurses and **part (2):** Nurses' knowledge regarding care of critically ill children with pneumothorax. **Tool (II): Attitudes Likert** scale to assess nurses' attitudes regarding care of critically ill children with pneumothorax. **Tool (III): Observational checklists** to assess nurses' practices regarding care of critically ill children with pneumothorax. **Tool (IV): Chest tube associated complications assessment sheet** to assess chest tube associated complications. **Results:** This study revealed that, the majority of the studied nurses had good knowledge, positive attitudes and competent practices in post educational intervention. **Conclusion:** Educational intervention had positive effect on the nurses' performance (knowledge, attitudes and practices) and reducing chest tube associated complications. **Recommendation:** Providing up-to-dated, regular and continuous in-services training programs about pneumothorax and chest tube for nurses.

Keywords: Critically Ill, Children, Educational Intervention, Nurses' Performance, Pneumothorax.

Introduction

Pneumothorax is a collection of air outside the lung but within the pleural cavity. It occurs when air accumulates between the parietal and visceral pleurae inside the chest. The air accumulation can apply pressure on the lung and make it collapse. The degree of collapse determines the clinical presentation of pneumothorax. Air can enter the pleural space by two mechanisms, either by trauma causing communication through the chest wall or from

the lung by rupture of the visceral pleura (McKnight & Burns, 2022).

The most common symptoms of pneumothorax are dyspnea, pleuritic chest pain, shortness of breath and cough. Signs may be minor and include silent lung sounds, hypertympany on percussion on the side of the pneumothorax or tracheal displacement to the contralateral side. Tension pneumothorax usually accompanied by rapidly progressive

dyspnea, hypotension, signs of hypoxemia (cyanosis, tachypnea, tachycardia) and cardiac arrest (**Wongkarnjana et al., 2023**).

There are several types of pneumothoraxes classified according to the cause as tension pneumothorax, traumatic pneumothorax, bilateral pneumothorax, iatrogenic pneumothorax, primary spontaneous pneumothorax and secondary spontaneous pneumothorax. Any type of pneumothorax can progress to tension pneumothorax, which is a life-threatening variant of pneumothorax and occurs when the intrapleural pressure greater than the atmospheric pressure (**Huan et al., 2021**).

Several complications can be caused from pneumothorax such as respiratory failure, empyema, re-expansion pulmonary edema, pneumopericardium, pneumoperitoneum, bronchopulmonary fistula and pneumohemothorax. Complications of chest tube insertion include tube malposition, lung injury, diaphragmatic perforation, intercostal artery bleeding, injury to abdominal organs, perforation of the lungs and local infection in site of insertion. Serious complications can be prevented through proper observation and expert consultation during both procedural and maintenance of thoracic procedures (**Campisi et al., 2020**).

Chest tubes and chest drainage units are a complex and critical nursing function. Learning about their components and techniques about them will protect the child 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 child 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**).

Significance of the study:

Pneumothorax is a life-threatening condition and chest drains are frequently inserted to children with pneumothorax (**Kilgman et al., 2022**). It has been found from the researcher's experience as specialized nurse in Benha University Hospital that most of hospitalized children with pneumothorax and undergoing chest tube may have many complications from improper nursing care.

Chest tube malposition or kinked resulting in poor drainage, poor fixation of the chest tube may result in accidental displacement or dislodgement, improper filling of the reservoir (under water seal) with sterile solution so that the outlet tube is not beneath the water column may result in pneumothorax, raising the reservoir above the level of the chest may result in drainage of the collected material back into the thoracic cavity and clamping the chest tube while shifting or mobilizing the child may result in tension pneumothorax. The outlet of the reservoir should be kept open at all times (**Campisi et al., 2020**).

Aim of the study:

The aim of the current was to evaluate the effect of educational intervention on nurses' performance regarding care of critically ill children with pneumothorax.

Research hypotheses:

- 1- Educational intervention would exhibit an improvement in nurses' knowledge, attitudes and practices regarding care of critically ill children with pneumothorax.
- 2- The critically ill children would be expected to have less chest tube associated complications

Subject and methods

Research design:

A quasi-experimental design was utilized to conduct this study.

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Study setting:

The study was conducted at at Benha University Hospital in Pediatric Intensive Care Unit which consists of 12 beds, Cardiothoracic Intensive Care Unit which consists of 6 beds and Emergency Intensive Care Unit which contain 10 beds.

Research Subject:

Sample (I): A convenient sample of all available nurses (n=100) working in the above mentioned setting regardless of their characteristics were involved in the study through (7) months from beginning of the study and willing to participate in the study.

Sample (II): A purposive sample of critically ill children (n=70) with pneumothorax throughout the period of data collection according to the following criteria.

Inclusion criteria of children:

- Children rang of age 5:12 years old.
- Both genders (male and female).
- Hospitalized critically ill children suffering from pneumothorax and have chest tube.

Exclusion criteria of children:

- Children suffering from congenital anomalies
- Children diagnosed with bleeding disorder

Tools of data collection

Data of the current study was collected by using the following three tools:

Tool (I): A structured interviewing questionnaire sheet:

This tool was developed by the researcher under supervision in the light of current relevant studies and research. It was written in English language and translated into Arabic language; it was composed of two parts:

Part (1): Personal data of the studied nurses includes: age, gender, level of education, years of experience, place of work and attending training program about pneumothorax and chest tube.

Part (2): Nurses' knowledge regarding pneumothorax in critically ill children. It was included (28) question in the following subparts:

(A) Nurses' knowledge about pneumothorax such as (definition of pleural cavity, definition of pneumothorax, types of pneumothorax, causes of pneumothorax, sign & symptoms of pneumothorax, diagnosis of pneumothorax, management of pneumothorax and complication of pneumothorax and chest tube) It was included 8 question.

(B) Nurses' knowledge about chest tube such as (definition of chest tube, aim of chest tube, type of chest tube, indications of chest tube and types of chest drainage systems) It was included 5 question.

(C) Nurses' knowledge about chest tube installation such as (insertion sites of the chest tube, the size of the chest tube needed for children, necessary precautions before chest tube installation and component of chest tube) It was included 4 question.

(D) Nurses' knowledge after chest tube insertion such as (care of chest tube, assembly of chest tube's bottle, accidental pull of chest tube, change chest tube's bottle , wound care, method to ensure the tube inside the pleural cavity and method to avoid complication after chest tube insertion) It was included 7 questions.

(E) Nurses' knowledge about chest tube removal such as (causes for chest tube removal, clamping chest tube before removal, maneuver during chest tube removal and the nurse role after chest tube removal). It was included 4 questions.

Scoring system of the knowledge

The studied nurses' answers were compared with the model key answer, where for each knowledge item, complete correct response was scored (2); incomplete correct response was

scored (1) and don't know or incorrect response was scored (0). So, the total knowledge scores of 28 questions were ranged from (0-56) scores. The total scores of nurses' knowledge were categorized as the following:

- Poor level (< 60%).
- Average level (60% < 85%).
- Good level (85% ≤ 100%).
- Answer ranged from 0- 56 scores
- Maximum score was 56 for complete correct answer.
- Score 0 < 34 was considered poor level of knowledge.
- Score 34 < 48 was considered average level of knowledge.
- Score 48 ≤ 56 was considered good level of knowledge.

Tool (II): Attitudes Likert scale:

It was adapted from **Abdel Mohsen, (2019)** to assess nurses' attitudes regarding care of critically ill children with pneumothorax by adding the questions (The movement of fluid inside the tubing cross ponding to inspiration and expiration is called oscillation, continuous bubbling chest drain may indicate an air leak and nurses have important role in pneumothorax intervention) and omitting the questions (Restrict the movement of child undergoing mechanical ventilation, quiet environment reduce child nervousness and offering luxury styles when providing nursing care) didn't related to nurses' performance regarding care of critically ill children with pneumothorax. It was included 12 questions about:-

- The insertion of chest drain in the pleural cavity helps the collapsed lung to re-inflate
- Regular analgesia can decrease development of severe pain from chest tube site
- The movement of fluid inside the tubing cross ponding to inspiration and expiration is called oscillation

- Continuous bubbling chest drain may indicate an air leak
- Deep breathing speed recovery
- Milking chest tube don't prevent occultation of chest tube
- Child's hyperactivity effect on the presence of the chest tube in its proper place
- Mother's presence during child care
- Balanced small amounts of food reduce breathing rate and quick recovery
- Sterilization protect child from complications & chest tube is sterile procedure
- Work possibilities help in control of infection
- Nurses have important role in pneumothorax intervention

Scoring system for nurses' attitudes

For each attitudes items, agree was scored (3), neutral was scored (2) and disagree was scored (1). The total attitudes scores of 12 statements were 36 scores. ranged from (12-36) scores. The total scores of nurses' attitudes were categorized as the following:

- Negative attitudes (< 60%).
- Positive attitudes (60 % ≤ 100%).
- Answer ranged from 12- 36 scores
- Maximum score was 36 scores
- Score 12 < 22 was considered negative attitudes
- Score 22 ≤ 36 was considered positive attitudes

Tool III: Observational checklists:

It was adapted from guideline on the care of children with chest drains (**Tiernan et al., 2018**) and text book (**Thomas, 2020**) and modified by the researcher to assess nurses' practices regarding pneumothorax and chest tube intervention as well as evaluating the effect of implementing educational intervention on nurses' practices. It contained 70 steps grouped under eight checklists that included child assessment (8 steps), assessment of chest drainage system patency (10 steps), changing

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dressings for the site of chest tube insertion (11 steps), assessment for signs that reveal lung expansion and preparation for chest tube removal (12 steps), child assessment after removal of chest tube (7 steps), documentation (9 steps), health teaching (5 steps) and safety measures (8 steps)

Scoring system for nurses' practices

The studied nurses' practices were compared with the observational checklists sheet where (1) scores were given for each step completely and correctly done and (0) score for step incorrectly done or not done. It includes 70 steps. The total scores were ranged from (0-70) scores and classified into 2 categories

- Incompetent practices (< 85%).
- Competent practices (85% ≤ 100%).
- Answer ranged from 0 - 70 scores.
- Maximum score was 70 for completely and correctly done.
- Score 0 < 60 was considered Incompetent practices.
- Score 60 ≤ 70 was considered competent practices.

Tool (IV): Chest tube associated complications assessment sheet to assess chest tube associated complications. It was adapted from (Hassanin & Mohammed, 2016) to assess chest tube associated complications such as:

- Improper filling of the reservoir (under water seal) with sterile water
- Twisting of chest tube
- Impaired physical mobility of the upper extremities
- 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 .

Scoring system for chest tube associated complications:

Each item will be observed, categorized and scored into :

- Present = 1
- Not present = zero

Validity of the study tools:

Tools of data collection were investigated for their content validity by panel of three experts in Pediatric Nursing specialty from the Faculty of Nursing Benha University. They are selected to test content validity of the study tools and to judge its clarity, relevance, understanding, comprehensiveness and applicability. The opinion was elicited regarding the layout, format and sequence of the questions and all of their remarks were taken into consideration and the tools were regarded as a valid from the experts' point of view.

Reliability of the study tools:

Reliability for tools was applied by the researcher for testing the internal consistency of the tools by administering of the same tool to the same subjects under similar condition. Reliability of the tools was checked by testing its internal consistency using Cronbach's alpha coefficient test.

- Knowledge reliability statistics Cronbach's alpha = 0.945
- Attitude reliability statistics Cronbach's alpha = 0.786
- Practice reliability statistics Cronbach's alpha = 0.854.

This indicates a high degree of reliability for the study tools.

Ethical considerations:

The approval of the ethics committee of Faculty of Nursing, Benha University was obtained. Nurses' oral and written consents were obtained before data collection with ensuring complete privacy and total confidentially, complete description of the

purpose and nature of the study was approached and confidentially was assured to nurses. All nurses informed that they have the right to withdraw at any time from the study without explanation of their rationale and their data is secured.

Pilot study:

A pilot study was carried out during October 2021 (1 month), involved 10% of sample size (10) nurses caring for (7) critically ill children suffering from pneumothorax at the previously mentioned setting to test the reliability and applicability of the study tools and estimate the proper time required for answering the questionnaire. All participants in the pilot study were included in the sample as where no radical modifications were carried out in the study tools as revealed from the pilot study.

Filed work:

(1) Before data collection, the researcher welcomes each nurse and informed them about the title, aim, tools, the study technique and the outcomes of the study to obtain their approval and cooperation which is needed for conducting this study.

(2) The following phases were adopted to achieve the aim of the current study; assessment, planning, implementation and evaluation phases. These phases covering period of 7 months (from the beginning of November 2021 to the end of May 2022). It was collected according to the policy of the study setting. Data were collected 3 days/week (Saturday, Monday and Wednesday) from 8 A.M until 8 P.M in all pervious mentioned departments at Benha University Hospital.

Assessment phase:

Data collected in this phase before implementing the educational intervention. At the beginning of interview; the researcher welcomed nurses, explained the purpose,

duration of the study and take their oral and written approval to participate in the study. The questionnaire sheets were distributed to all nurses individually to assess nurses' performance and determine nurses' needs regarding pneumothorax using the previous study tools.

The time needed for filling all data collection tools were 45-70 minutes, the average time needed to answer personal data and knowledge questions (**Tool I**) are 10-15 minutes, the average time needed to assess nurses' attitudes questions (**Tool II**) are 5-10 minutes and the average time needed to assess nurses' practices (**Tool III**) and chest tube associated complications (**Tool IV**) assessment sheet are 30-45 minutes. The period of assessment phase (pre-test) took 2 month (from the beginning of November 2021 to the end of December 2021). An average of 4-5 nurses were interviewed per/day, 3 days weekly at Benha University Hospital.

Planning phase

This phase included analysis of the assessment phase (pre-test) findings and identification of the actual needs of the studied nurses. Accordingly, the educational intervention on nurses' performance was designed by the researcher using simple Arabic language and pictures in order to facilitate nurses' understanding.

Different methods of teaching were used as lecture, group discussion and role play, videos, suitable teaching media were included a hand out as well as audio visual aids to help understanding of content by nurses.

Educational intervention constructed statements objectives:

General objectives:

The educational intervention aimed to improve nurses' knowledge, attitudes and practices regarding care of critically ill children

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with pneumothorax based on fulfilling their needs of knowledge, attitudes and practices. The critically ill children would be expected to have less chest tube associated complications

The specific objectives

At the end of the educational intervention implementation

- The nurses should have good level of knowledge about (pneumothorax, chest tube, chest tube installation, care after chest tube installation and chest tube removal).
- The nurses should be acquainted positive attitudes and have better values and feeling about: (The chest tube helps the collapsed lung to re-inflate, regular analgesia, the movement of fluid inside the tubing (oscillation), continuous bubbling chest drain, deep breathing, milking chest tube, child's hyperactivity, mother's presence during child care, balanced small amounts of food, sterilization, work possibilities and nurses role in pneumothorax intervention).
- The nurses will have competent practices regarding pneumothorax and chest tube intervention about the following procedure
 - Demonstrate steps of child assessment for pneumothorax.
 - Perform measures assessment of chest drainage system patency
 - perform dressing for the site of chest tube insertion
 - Apply assessment for signs that reveal lung expansion and preparation for chest tube removal
 - Perform child assessment after removal of chest tube.
 - Apply accurate documentation in child care.
 - Provide health teaching to the child and family
 - Utilize safety measures

Implementation phase:

General and specific objectives of educational intervention were stated and implemented to satisfy the actual needs of the studied nurses regarding pneumothorax. It was achieved through 8 sessions at a period of 3 days/week. Each session started by a summary of the previous session and objectiveness of new one. Take into consideration, the use of the Arabic language that suits the nurses' educational level. During session, nurses and researcher sits together in circle and take turns sharing; every nurse had an opportunity to ask questions and share information with each other.

The total numbers of sessions were 8 sessions; each session was taken 45 - 60 minutes at a period of 3 months beginning from (January 2022 until the end of March 2022). Moreover, 8 sessions containing the study objectives and carried out through (5 sessions for the theoretical part, 1 session for attitudes part and 2 sessions for the practical part) with different teaching methods and media .

A schedule suitable for nurses developed including date, time, place, topics and duration of each session. It was challenging to take whole nurses at the same time; so, they divided into 10 groups of 10 nurses in each session take into consideration precautionary measures. Each nurse was supplemented with a copy of educational intervention.

- **The first theoretical session** included introduction of educational intervention, objectives and its expected outcomes and overview of pneumothorax as identify pleural cavity and pneumothorax, types of pneumothoraxes, causes of pneumothorax, signs and symptoms of pneumothorax, diagnostic measures of pneumothorax, method

of pneumothorax treatment and enumerate the complications of pneumothorax and chest tube.

- **The second theoretical session** of educational intervention included overview about chest tube definition, aim, type, indications and types of chest drainage systems

- **The third theoretical session** of educational intervention included insertion sites of chest tube, the size of the chest tube needed for children, necessary precautions taken before installing chest tube and components of the chest tube

- **The fourth theoretical session** of educational intervention included care of chest tube after installation, how to assembly chest tube's bottle, the nurse role after accidental pulls of chest tube, causes of changing chest tube's bottle, changing wound dressing, method to ensure the tube inside the pleural cavity and method to avoid complication after chest tube insertion

- **The fifth theoretical session** of educational intervention included causes of chest tube removal, the cause of clamping chest tube before removal, maneuver during chest tube removal and the nurse role after chest tube removal.

- **The sixth attitudes session** of educational intervention included health education to improve nurses' attitudes regarding pneumothorax such as (The chest tube helps the collapsed lung to re-inflate, regular analgesia, the movement of fluid inside the tubing (oscillation), continuous bubbling chest drain, deep breathing, milking chest tube, child's hyperactivity, mother's presence during child care, balanced small amounts of food, sterilization, work possibilities and nurses role in pneumothorax intervention).

- **The seventh practical session** of educational intervention about steps of child assessment for pneumothorax, assessment of chest drainage

system patency, changing dressing for the site of chest tube insertion.

- **The eighth practical session** of educational intervention about assessment for signs that reveal lung expansion, preparation for chest tube removal, perform child assessment after removal of chest tube, apply documentation in child care, health teaching for the child and family and utilize safety measures.

Evaluation phase:

After the implementation of educational intervention for nurses' knowledge, attitudes and practices regarding care of critically ill children with pneumothorax, an immediate posttest was carried out to assess nurses' performance, using the same forms of the pre-test. The results were compared to the pre-test results to evaluate the effect of the implemented educational intervention on nurses' performance and chest tube associated complications. The period of posttest took 2 months (from the beginning of April 2022 to the end of May 2022).

Statistical analysis:

The collected data was coded and transformed into specially designed form to be suitable for computer entry process. Data was entered and analyzed by SPSS (Statistical Package of Social Science) version 20. Software graphics were done by using micro soft office excel program version 2010. Quantitative data was presented by mean and standard deviation. Qualitative data was presented in the form of frequency distribution tables, number and percentage, it was analyzed by Chi-square (X²) test. Level of significance was set as a highly statistical significance difference ($P \leq 0.001$), A statistical significance difference ($P > 0.05$) and No statistically significance difference at ($P > 0.05$).

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Results :

Table (1): Shows that, more than half (53.0%) of the studied nurses were in the age group of 25 <30 years and mean age was 24.91 ± 2.782 years. Regarding nurses' gender, nearly two thirds (63.0%) were females and more than three quarters (77.0%) of the studied nurses had Nursing Technical Institute certification. In relation to years of experience, more than two thirds (65.0%) of the studied nurses had less than 5 years, the Mean \pm SD (3.77 ± 2.704). Also, concerning place of work, half (50.0%) of the studied nurses worked in the pediatric intensive care unit. Moreover, all of the studied nurses (100 %) didn't attend any previous training program about pneumothorax and chest tube.

Figure (1): Clarifies that, the majority (86.0%) of the studied nurses had good knowledge in post educational intervention implementation as compared to the minority (2.0%) of them had good knowledge in pre- educational intervention implementation.

Figure (2): Clears that, the majority (92.0%) of the studied nurses had positive attitudes in post educational intervention as compared to (43.0%) pre-educational intervention implementation.

Figure (3): Shows that, the majority (87.0%) of the studied nurses had competent practices in post educational intervention implementation as compared to (24.0%) of them in pre-educational intervention implementation.

Table (2): Portrays that, (14.2%, 22.8%, 20.0%, 15.7% & 18.5%) of the studied children had impaired physical mobility of the upper extremities, drain tubing disconnected, leakage from chest tube site , blockage of chest

tube and local site of chest tube infection in pre- educational intervention implementation as compared to (0.0%, 0.0%, 0.0%, 2.8% & 0.0%) in post educational intervention implementation respectively. There was a highly statistical significance difference in all chest tube associated complications in post educational intervention implementation as compared to pre- educational intervention implementation except in the complications improper filling of the reservoir with water, twisting of chest tube and accidental removal of chest tube.

Table (3): Indicates that, there was strong positive correlation between nurses' total knowledge and total practices in pre & post educational intervention. Meanwhile, there were weak positive correlation between nurses' total practices and total attitudes in pre & post educational intervention. Whereas, there was positive correlation between nurses' total knowledge and total attitudes regarding care of critically ill children with pneumothorax in pre- educational intervention and no correlation between nurses' total knowledge and total attitudes post educational intervention.

Table (1): Frequency distribution of the studied nurses regarding their personal data (n=100).

Nurses' data	Studied nurses (n=100)	
	No.	%
Age (years)		
- < 25	42	42.0
- 25 < 30	53	53.0
- 30 < 40	5	5.0
- ≥ 40	0	0.0
Min-Max	21-30	
Mean ±SD	24.91 ± 2.782	
Gender		
- Female	63	63.0%
- Male	37	37.0%
Level of education		
- Nursing diploma	0	0.0
- Nursing technical Institute	77	77.0
- Bachelor of nursing	23	23.0
- Postgraduate degree	0	0.0
Years of experience		
- Less than 5 years	65	65.0
- 5 : 10	30	30.0
- More than 10 years	5	5.0
Min-Max	1-10	
Mean ±SD	3.77 ± 2.704	
Place of work		
- Pediatric intensive care unit	50	50.0
- Emergency intensive care unit	35	35.0
- Cardiothoracic intensive care unit	15	15.0
Attended previous training program about pneumothorax and chest tube		
- Yes	0	0.0
- No	100	100.0

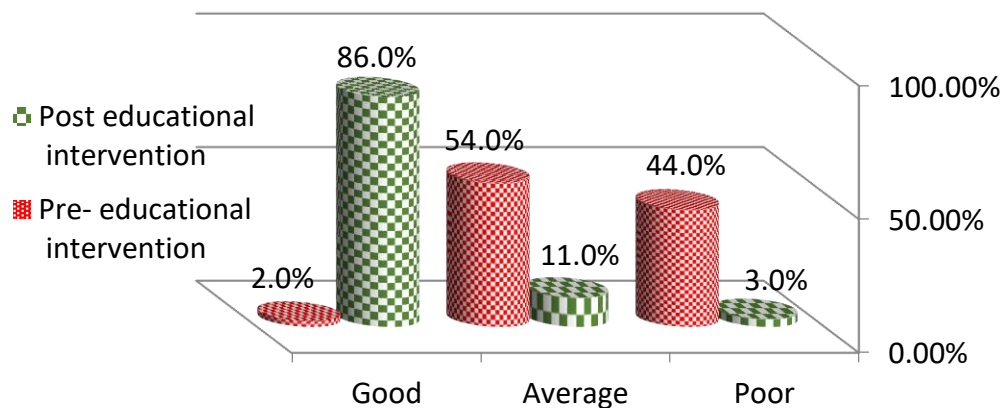


Figure (1): Percentage distribution of the studied nurses' total nurses' knowledge regarding care of critically ill children with pneumothorax in pre & post educational intervention implementation (n=100).

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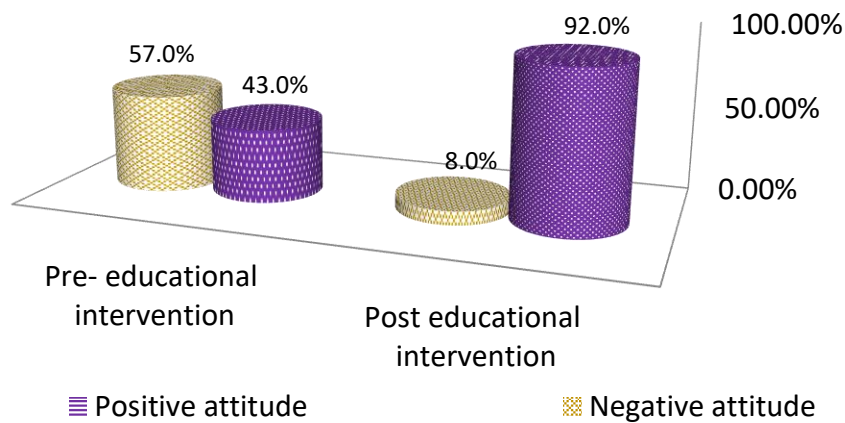


Figure (2): Percentage distribution of the studied nurses' total attitudes regarding care of critically ill children with pneumothorax in pre and post educational intervention implementation (n=100).

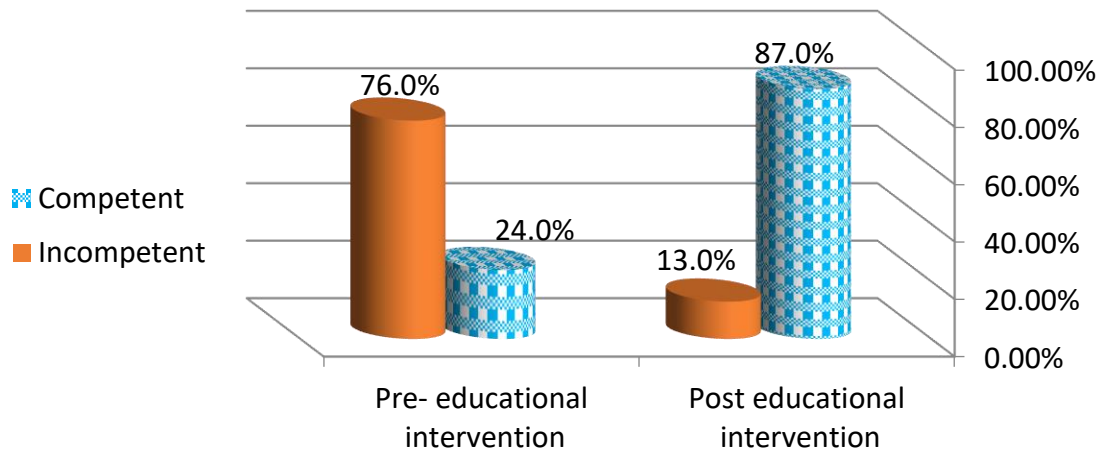


Figure (3): Percentage distribution of the studied nurses' total practices regarding care of critically ill children with pneumothorax in pre & post educational intervention implementation. (n=100).

Table (2): Percentage distribution of chest tube associated complications of the studied children in pre and post educational intervention implementation (n=70).

Child chest tube associated complications	Studied children (n=70)								X ²	P - value
	Pre- educational intervention				Post educational intervention					
	Present complication		Not present complication		Present complication		Not present complication			
	No.	%	No.	%	No.	%	No.	%		
- Improper filling of the reservoir (under water seal) with sterile water	1	1.4	69	98.6	0	0.0	70	100.0	1.005	.316
- Twisting of chest tube	3	4.2	67	95.8	1	1.4	69	98.6	1.846	.174
- Impaired physical mobility of the upper extremities.	10	14.2	60	85.8	0	0.0	70	100.0	15.054	.000**
- Drain tubing disconnected.	16	22.8	54	77.2	0	0.0	70	100.0	25.989	.000**
- Leakage from chest tube site.	14	20.0	56	80.0	0	0.0	70	100.0	22.222	.000**
- Blockage of chest tube.	11	15.7	59	84.3	2	2.8	68	97.2	9.828	.002*
- Accidental removal of chest tube.	2	2.8	68	97.2	0	0.0	70	100.0	3.046	.081
- Local site of chest tube infection.	13	18.5	57	81.5	0	0.0	70	100.0	19.780	.000**

Table (3): Correlation matrix between nurses' total knowledge, attitudes and practices regarding care of critically ill children with pneumothorax in pre & post educational intervention implementation (n=100).

Variables		Studied nurses (n=100)					
		Pre- educational intervention (n=100)			Post educational intervention (n=100)		
		Total knowledge	Total practices	Total attitudes	Total knowledge	Total practices	Total attitudes
Total knowledge	r	1	.726	.457	1	.384	.145
	P -value		.000**	.000**		.000**	.151
Total practices	r	.726	1	.269	.384	1	.273
	P -value	.000**		.007*	.000**		.006*
Total attitudes	r	.457	.269	1	.145	.273	1
	P -value	.000**	.007*		.151	.006*	

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Discussion:

Pneumothorax is a common clinical worldwide problem. Pneumothorax is a presence of air in the pleural cavity. It can develop secondary to diverse etiologies including traumatic, inflammatory, infective, malignant and genetic causes. The severity of clinical manifestations in a child range from asymptomatic to life threatening and may be disproportionate to pneumothorax size (**Richard, 2023**). Chest tubes improve breathing pattern by removing accumulation of air from the pleural space. It is a safe and effective procedure associated with significant major and many minor complications (**Patidar et al., 2021**).

Nurses are responsible for managing the chest tube and drainage system after inserting a chest tube. Inter-professional nursing team should be provided a holistic and integrated approach to the care of children with a chest tube to obtain the best possible outcomes and minimizing complications (**Anjum, 2020**).

Regarding personal data of the studied nurses the current study revealed that, more than half of the studied nurses were in the age group of 25 < 30 years with mean age was 24.91 ± 2.782 years. This result was congruent with **Sharma, (2021)**, the study entitled "A pre-experimental study to assess the effectiveness of a structured interventional program on knowledge regarding care of patients with chest tube drainage among staff nurses in IGMC and hospital, Shimla, Himachal Pradesh" and stated that, (47.5%) of nurses' staff lies in the age group 26-30 years old.

Concerning gender of the studied nurses, the current study revealed that, nearly two thirds of the studied nurses were females. This finding is agree with **Kaur et al.,(2019)** the study entitled "A study to assess the efficacy of self-instructional module (SIM) on the knowledge regarding nursing management of patients with chest drainage among staff nurses of selected hospitals of Malwa region of Punjab" and stated that, most of the studied nurses were females.

The results of the current study represented that, more than three quarter of the studied nurses had Nursing Technical Institute. This finding agree with **AL- gabri et al., (2019)** the study entitled "Assessment of nurses' performance regarding care of chest trauma patients at trauma emergency unit" and stated that, (67, 5%) of the nurses had Technical Institute of Nursing.

Regarding place of work of studied nurses, half of the studied nurses were worked in pediatric intensive care unit (**Table 1**). The researcher points view this result because the flow rate of critically ill children with pneumothorax due to poly trauma was admitted to pediatric intensive care unit. This finding is similar to results of **Manager et al., (2017)** entitled "Nurses' knowledge of chest drain management in an Irish Children's Hospital", who found that over half of nurses (54%) worked in pediatric intensive care unit (PICU).

Regarding nurses' years of experience, more than two thirds of the studied nurses had less than 5 years of experience with Mean \pm SD (3.77 ± 2.704). The researcher point views this may be attributed to most of newly nurses worked in pediatric intensive care unit. This result was supported by **Tufail et al., (2018)** the study entitled "Knowledge of nurses regarding chest drain care at public tertiary care hospital Lahore", who stated that, more than two fifth 45.3% of nurses had experience ranging from 6:10 years .

As regard nurses' attending training program regarding care of critically ill children with pneumothorax. It is obvious from the current study that, all of the studied nurses didn't attend any training program about pneumothorax and chest tube. From the researcher point view, this results because the training program about pneumothorax and chest tube wasn't included in training programs of the hospital. This finding was agreed with **Maarouf & Ameen, (2021)** the study entitled, "Influence of care protocol on nurses' performance and clinical outcomes for

patients with tube thoracostomy" who reported that, 100.0% of the nurses hadn't training courses regarding caring of patients with tube thoracostomy and didn't attend any workshop about chest tube drainage.

The results of the current study represented that, the majority of the studied nurses had good knowledge post educational intervention implementation as compared to the minority of the studied nurses had good knowledge pre-educational intervention implementation. The researcher point views this may be related to the studied nurses didn't attend any training program about pneumothorax and chest tube. This indicated that educational intervention was effective to increase the level of nurses' knowledge. In this respect, **Mohamed, & Ibrahim, (2021)** the study entitled "Effect of self-learning module on nurses' performance regarding care of patients with chest tube " and found that total nurses' knowledge level were 4% satisfactory pre SLM intervention and 96% satisfactory post intervention.

Additionally, the majority of the studied nurses had positive attitudes post educational intervention implementation as compared to pre-educational intervention implementation. The researcher point views the improvement in nurses' knowledge and practices effect positively on nurses' attitudes. This finding was supported by the finding of study by **Abdel Mohsen, (2019)** the study entailed "Assessment of nurses' performance toward care of children undergoing chest tube", who reported that, the majority of the studied nurses had positive attitude toward care of children undergoing chest tube and there is a highly statistical significant difference between nurses' total attitude and their age (p value < .001).

The current study illustrated that, the majority of the studied nurses had competent practices in post educational intervention implementation as compared to the quarter of the studied nurses had competent practices in pre- educational intervention implementation. The researcher

suggested that, the nurses receive appropriate educational intervention in the management of pneumothorax and chest tube ensure that children are cared safely and competently. So, this underlines the requirement of continuous educational training programs should be conducted for all nurses in healthcare institutions to maintain efficient nurses' performance. This finding goes in the same line with **Hamel & Ahmed, (2020)** the study entitled "Effectiveness of an educational program on nurses' knowledge and practices regarding nursing interventions of chest tube drainage system in Ibn Alnafees teaching hospital "that there is a highly significant differences related to nurses' knowledge and practices regarding nursing interventions for chest drainage system post educational program.

In relation to child chest tube associated complication the critically ill children with pneumothorax have less chest tube associated complication in post educational intervention implementation with a highly statistical significance differences. The researcher indicates that the nurses' clinical reasoning abilities and self-directed learning improved with implementation of the educational intervention thus improve child's care outcomes. This finding contrary with **Salime et al., (2021)** who conducted a study about "Effectiveness of implementation of evidence-based educational intervention regarding chest tube on clinical patient's outcomes in cardiothoracic care unit" who reported that there was a statistically significant positive effect of nurses' evidence-based educational intervention regarding the chest tube on clinical patient's outcomes in intensive cardiothoracic care .

The current study revealed that, there was strong positive correlation between nurses' total knowledge and total practices regarding care of critically ill children with pneumothorax in pre & post educational intervention. Meanwhile, there was weak positive correlation between nurses' total practices and total attitudes regarding care of critically ill children with pneumothorax in pre &

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post educational intervention. This reflects nurses had poor knowledge also had incompetent practices and the opposite. The researcher point views the knowledge is necessary for nurses to improve incompetent practices and negative attitudes that potentially reduce and limits nurses' observations and intervention. This finding is in harmony with **chege et al., (2018)** who conducted a study about "Evaluation of the nursing management for patients on underwater chest drainage at Kenyatta national hospital" who reported that, the attitude of nurses on the perceived importance of nursing management in UWCD affects the nurses' knowledge and competence. Also, **El- Senousy et al., (2020)** the study entitled "Educational guidelines for nurses' competence level caring for patients with accidental chest trauma during emergency period" revealed that there was a highly statistically significant difference between level of nurses' knowledge, practice and attitude pre and post educational guidelines implementation and there were a highly statistically significant relation between total level of nurses' knowledge and their practice at pre and follow phases. Meanwhile, there was statistically significant relation between their knowledge and their practice at post guidelines implementation .

Conclusion:

The educational intervention had positive effect on the nurses' performance (knowledge, attitudes and practices) and reducing chest tube associated complications. So, the present study highlighted the effect of educational intervention on nurses' performance regarding care of critically ill children with pneumothorax.

Recommendations :

1. Providing up-to-dated, regular, continuous in-services training programs about pneumothorax and chest tube for nurses.
2. Developing manual booklet and pamphlets to refresh nursing knowledge and practices relates to pneumothorax and chest tube care

3. Replicating the study with more nurses and at several setting to determine measurable outcomes of nurses' performance toward care of children suffering from pneumothorax and undergoing chest tube to generalize the result.

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تأثير تدخل تمريض علي أداء التمريض تجاه رعاية الحالات الحرجة للأطفال الذين يعانون من الإسترواح الصدري

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استرواح الصدر هو حالة ملحة وغير مرغوب فيها لاختراق الهواء في التجويف البللورى مما يؤدي إلى انهيار الرئة وفقدان الضغط الصدري السلبي. يجب أن يكون التمريض مجهز بالمعرفة والمهارات المناسبة لتلبية احتياجات الأطفال المصابين باسترواح الصدر بأمان وكفاءة. لذا هدفت الدراسة إلى تقييم تأثير تدخل تمريض علي أداء التمريض تجاه رعاية الحالات الحرجة للأطفال الذين يعانون من الإسترواح الصدري. تم استخدام تصميم شبه تجريبي (قبل الاختبار / بعد الاختبار) لإجراء هذه الدراسة. وقد اجريت الدراسة فى العناية المركزة للأطفال، عناية الطوارئ وعناية قلب وصدر بمستشفى بنها الجامعى على عينة هادفة من 100 ممرض وممرضة و70 من الأطفال الذين يعانون من الإسترواح الصدري ويخضعون للأنبوبة الصدرية. وأوضحت هذه الدراسة أن غالبية التمريض المدروس يتمتع بمعرفة جيدة، واتجاهات إيجابية وكفاءة عالية في ممارساتهم تجاه رعاية الحالات الحرجة للأطفال الذين يعانون من الإسترواح الصدري بعد تنفيذ التدخلات التمريضية. كما خلصت الدراسة إلى أن فرضية الدراسة الحالية تم دعمها حيث أثبتت الدراسة أن التدخلات التمريضية لها أثر ايجابي فى تحسين أداء التمريض الذين يقدمون الرعاية التمريضية للحالات الحرجة للأطفال الذين يعانون من الأسترواح الصدري بالإضافة الى تقليل حدوث المضاعفات المصاحبة للأنبوبة الصدرية. واهتت الدراسة بتقديم برامج تعليمية دورية ومحدثة عن كيفية العناية بالأطفال الذين يعانون من الاسترواح الصدري وكيفية العناية بالأنبوبة الصدرية.