Upgrading Nurses' Performance Regarding Care of Neonates Suffering from Pneumothorax

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Abstract

Background: Pneumothorax is a critical illness that can cause a serious complication. So, early recognition and management of pneumothorax are crucial to avoid serious life-threatening issues. **Aim:** This study aimed to upgrade nurses' performance regarding care of neonates suffering from pneumothorax. **Design**: Quasi-experimental design was utilized. **Setting**: Neonatal intensive care unit at Tanta Main University Hospital and El-Mabra Hospital at El-Mahalla. **Sample**: Sixty nurses who provided direct nursing care for neonates 30 from each setting. **Tools**: Tool I: Nurses' Knowledge Questionnaire Regarding Pneumothorax, Tool II: Pneumothorax Care Observational Checklists and Tool III: Endotracheal Tube Suction Observational Checklists. **Results:** Preprogram less than half of nurses 43.3% had satisfactory practice compared to 91.7% and 85% immediately and one month post educational program respectively. There was positive correlation between nurses' knowledge and practices about care of neonates with pneumothorax post the educational program. **Conclusion**: Nurses' performance regarding care of neonates with pneumothorax is upgraded post implementation of educational program and there was significant improvement in nurses' overall knowledge and practice. **Recommendation**: Ongoing education should be provided to nurses regarding care of neonates with pneumothorax.

Keywords: Neonates, Nurses, Performance, Pneumothorax.

Introduction

Pneumothorax remains a common respiratory complication that contributes to an increase in perinatal morbidities, and mortality, especially in preterm infants and critically ill newborns, however improvements in newborn critical care, including the use of prenatal steroids, and surfactant replacement therapy **(Jovandaric, Milenkovic, Dotlic, 2023).** Neonatal pneumothorax is defined as the abnormal accumulation of air between visceral and parietal pleura of the lungs in infants who have not completed the first 28 days post birth. The incidence of neonatal pneumothorax is between 0.8 and 1.9 per 1000 live births. Pneumothorax is more common in newborns, particularly in the first three days of life, compared to all other age groups (**Abed, Al-Ani & Shitran, 2022).**

According to statistical records of El-Mabra Hospital at El-Mahalla, about 30 and 35 neonates diagnosed with pneumothorax in 2023 and 2024 respectively **(Medical Statistical Records of Neonatal lntensive Care Unit at El-Mabra Hospital at El-Mahalla**. **2023-2024)**. Pneumothorax is more frequent in the neonatal period, and its frequency is higher in newborns with concomitant underlying lung disease or who require mechanical ventilation. Other risk factors include preterm neonates, at as much as 5% - 7% in newborns weighting less than 1500 g, males, cesarean delivery, amniotic fluid stained with meconium, and invasive and noninvasive respiratory support **(Acun, et al., 2021)**. According to reports, the incidence of spontaneous symptomatic pneumothorax ranged from 0.05% to 1%, while it was between 2.8% and 9% in NICU **(Ghenu, et al., 2023).**

Depending on its cause, pneumothorax is categorized as either primary or secondary. Presenting spontaneously shortly post birth without severe underlying lung illness or the presence of risk factors like preterm or invasive or noninvasive ventilation is known as primary pneumothorax. **(Halibullah, et al., 2023).** The use of positive pressure ventilation during resuscitation, surfactant treatment, endotracheal suctioning, pulmonary hypoplasia, congenital lung malformations, meconium aspiration syndrome, , congenital pneumonia, and traumatic injury to the pleura are risk factors for secondary pneumothorax **(Awad, Wahdan, Al-Metyazidy , Weheida.2021)**.

Iatrogenic pneumothorax can happen following operations such thoracentesis, positive-pressure mechanical breathing, and central venous catheterization. Traumatic pneumothorax is typically blunt and

penetrating traumas. Diagnosis of pneumothorax can be achieved by chest X-ray or computed tomography. **(Batra, et al 2022).** Nonspecific respiratory symptoms, such as respiratory distress, tachypnea, increased retraction, increased oxygen or pressure demand, and increased anterior–posterior chest diameter in infants on mechanical ventilators, were indicative of neonatal pneumothorax in infants admitted to the neonatal lntensive care unit. Pneumothorax was also taken into consideration in the delivery room, particularly for infants who did not react to resuscitation. An x-ray of the chest was taken of those neonates **(Aranguren, Ferrón, Ruiz et al., 2019)**.

In addition to being linked to intraventricular hemorrhage, extended hospital stays, and death, pneumothorax can impair breathing and hemodynamics. Based on the degree of respiratory support needed, radiographic features, comorbidities, and the severity of clinical symptoms, clinicians choose a course of treatment **(Osman, Reffat, Meawad, 2023).** As a result, early identification and treatment are essential. Neonatal pneumothorax can be treated conservatively without drainage, definitively with chest tube implantation until the air leak is fixed, or with drainage and needle aspiration, which involves temporarily inserting a needle into the pleural cavity **(Engin, Gülden & Kılıçaslan, 2022).**

Chest tube care may seem complex, but in order to improve outcomes and lower the risk of problems, so it is crucial to have accurate understanding of the fundamentals of drain placement and system operation. Medical or surgical teams with experience caring for neonates with chest drains should provide care. To be competent nurse in providing care for this neonate, they must have undergone continuous training and education **(Kastein, Coe, Gephart & Newnam, 2023)**.

Chest tube care represents a complex and critical procedure. Serious complications, including lung perforation and local infection at the insertion site, can be avoided through careful monitoring and expert consultation during both the procedure and the ongoing management **(Campisi, et al., 2022).** The nurses must assess patency of the chest drainage system by observing respiratory fluctuations of the fluid in the water-seal chamber when the neonate 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 hospital policy **(Batra, et al., 2022).**

Significance of the study:

Neonate pneumothorax mortality rates range from 16% to 65%. One of the more difficult tasks for nurses is caring for a neonate with a chest tube. It has been estimated that up to 30% of neonateS with chest tubes experience difficulties **(Kim and Lee 2019),** there is a considerable avoidable morbidity associated with this operation. Insufficient training or experience can lead to complications. A delayed or insufficient evacuation of the accumulated air or fluid in the pleural space, as well as a delayed re-expansion of the collapsed lung, can result from improper management of the chest tube and its drainage systems **(Awad, et al., 2021).**

Nurses who possess sufficient knowledge and experience in the management of the condition in question can minimize the occurrence of severe complications and ensure optimal outcomes for neonates with chest tube. Nurse practitioners must possess a comprehensive understanding of the anatomical structure of the chest. Their scope of practice encompasses several critical components, including the assessment of the chest tube site to prevent dislodgement and infection, the management of effective suction and drainage, the administration of pain relief, the monitoring of respiratory status, and provision of comprehensive supportive care **(Ravi & Chavan 2022).** Therefore, this study is Focusing on upgrading nurses' performance regarding care of neonates suffering from pneumothorax.

Aim of the Study

Upgrade nurses' performance regarding care of neonates suffering from pneumothorax

Research hypothesis

Implementing an educational program on the care of neonates with pneumothorax is expected to enhance nurses' performance.

Research design:

A quasi-experimental research design was used in the present study.

Setting:

The present study was carried out at two settings:

1-**Neonatal Intensive Care Unit at Tanta Main University Hospital** which affiliated to Ministry of Higher Education and Scientific Research. It consists of three rooms, room one has five incubators, room two has twelve incubators and room three has seven incubators.

2- Neonatal Intensive Care Unit of El-Mabra Hospital at El-Mahalla which affiliated to Ministry of Health and Population. It consists of three rooms, room one has six incubators,

room two has eight incubators and room three has seven incubators.

Subjects: -

All nurses sixty nurses (n = 60), 30 nurses from each of the two previously mentioned settings who provided nursing care for neonates suffering from pneumothorax.

Tools of data collection

Three tools were utilized for the collection of data:

Tool (I): Nurses' Knowledge Questionnaire Regarding Pneumothorax: It was developed by the researcher post reviewing pertinent researches **(Acun, et al., 2021; Kim &Lee 2019).** It included:

Part (1): Bio-socio-demographic Characteristics of the Studied Nurses: It included age, sex, level of education, experience and previous attendance of pneumothorax training sessions.

Part (2): Nurses' Knowledge Questionnaire: It included two parts:

A- Nurses' knowledge regarding pneumothorax: It included 9 questions as meaning of pleural cavity and pneumothorax, types, causes, sign & symptoms, diagnosis, management and complication of pneumothorax.

B-Nurses' knowledge regarding chest tube: It was included 11 questions such as meaning of chest tube, aim, insertion sites, types and component of chest drainage system, site of insertion, tests done before insertion, needed equipment, nursing care, and complication of chest tube.

Scoring system of the knowledge:

- Complete correct answer was scored (2)
- Incomplete correct answer was scored (1)
- Don't know or incorrect answer was scored (0).

The total scores of nurses' knowledge were categorized as the following:

- Low level ≤ 60%
- Moderate level 60% - 80%
- High level ≥80%

Tool (II): Pneumothorax Care Observational Checklists: It was developed by the researcher post reviewing the relevant literatures **(Abdel-Mohsen, Shafik, & Abdel Esalam, 2023; Thomas, Rahman, Maskell, Lee, 2020; Aranguren, et al., 2019).** It included the following:

A: Nurses' practice before chest tube insertion included the following:

It included assessment of neonates; prepare the equipment of chest tube and drainage system and assisting physician during insertion of chest tube.

B: Nurses' practice post chest tube insertion:

It included routine care of chest tube, nurses' practice regarding change chest

tube's bottle (collection system), and nurses' practice regarding wound care

Nurses' practice during chest tube removal:

It included preparation of neonates' equipment and procedure such as clamping chest tube before removal, and the nursing role after removal of chest tube.

Scoring system for nurses' practice:

- Correctly done was scored (1)
- Incorrectly done or not done was scored (0)

The total scores were categorized as the following:

- Unsatisfactory practice ≤80%
- Satisfactory practice ≥80%

Tool (III): Endotracheal Tube Suctioning (ETTS) Observational Checklists. The researcher developed the scale following a comprehensive review of the existing literatures (**Tomaszek, Pawlik, Mazurek & Mędrzycka, 2021).** The instrument was utilized to evaluate nurses' practices concerning the use of ETTS for neonates diagnosed with pneumothorax by using observational checklists. This procedure included preparation, procedure and after procedure.

Scoring system for nurses' practices:

- Correctly done was scored (1)
- Incorrectly done or not done was scored (0)

The total scores were categorized as the following:

- Satisfactory practice ≤ 80%
- Unsatisfactory practice ≥80%

Method

1-Administrative process:

An official permission clarifying the purpose of the study was obtained from the Faculty of Nursing and was submitted to the responsible authorities of the selected setting for permission to carry out the study.

2- Ethical consideration:

a- Approval of the Faculty of Nursing scientific research ethical committee was obtained No. **(360-1-2024).**

b- All participants were informed about the purpose of the study.

c- Informed consent was obtained from each participant, with assurance of their right to withdraw from the study at any time and the study posed no harm on them.

3- Tools of the study were developed by researcher based on related literatures and translated into Arabic language.

4- The tools were evaluated for **content validity** and relevance by a panel of five experts in the field, achieving a content validity index of 98.5%.

5- Reliability of tools was tested by using Cronbach's Alpha Coefficient Factor; values were 0.973, 0.893 and 0.897 for tool I, II and III respectively.

6- **A pilot study** was conducted on 10% of the nurses (6 nurses) to test the clarity and applicability of the tools, and they were not excluded from the total study sample to maximize overall benefit.

Phases of the study: The study was conducted as follow:

Phase (I) Assessment phase:

The researcher formally introduced herself to the selected nurses and provided a concise overview of the study's objective. Subsequently, written consent was obtained from each nurse.

The researcher met with each nurse in the nurses' room to conduct the interviews, subsequently documenting the results on the designated interview sheets. The average time required for researcher to complete the form for each nurse was between 20 and 30 minutes. The researcher conducted observations of nurses' practices during chest tube management and ETTS to complete practice checklist sheets for the nurses under study. These assessments were conducted to evaluate the nurses' baseline knowledge and practices regarding pneumothorax,

Phase (II) Planning phase:

- This phase included the assessment of the studied nurses to plan the program according to their needs as the following:

Developing nursing educational program through

-Setting objectives and preparation of the content to achieve the objective

-A simplified, colored Arabic booklet was developed for nurses to facilitate understanding of pneumothorax, chest tubes, and their management.

Phase (III): Implementation phase:

-The educational program was carried out in the mentioned settings within the schedule of nurses working hours.

-The nurses (n=60) were divided into 10 groups, each group consist of 6 nurses, The program included six sessions; that were obtained through 2 weeks, each session took about 30- 45 minutes.

-Diverse teaching methods were used during the sessions including; group discussion, demonstration & re-demonstration, pictures, printed booklets, and actual nursing care on the neonates.

-It took 6 months from May to the end of October 2024. The educational sessions were carried out as follow:

First session: It focused on theoretical knowledge about pleural cavity, overview of pneumothorax as pneumothorax meaning, types, causes, signs and symptoms, diagnostic measures, management and complications through using power point presentation, simple explanation, and group discussion.

Second session: It was centered on chest tube such as meaning, aim, indications and types of chest drainage system, equipment needed, site of insertion, tests done before insertion, nursing care.

Third session: It included nurses' practice before chest tube insertion such as preparation of equipment and neonate, their role during insertion, assessment of chest drainage system patency and signs that reveals lung expansion.

Fourth session: It was centered on nurses' practice post chest tube insertion such as care of chest tube, change chest tube's bottle, bubbling assessment, wound care, method to ensure the tube inside the pleural cavity and method to avoid complication post chest tube insertion.

Fifth session: It included nurses' practice during chest tube removal such as clamping chest tube before removal, maneuver during chest tube removal and the nurse role post chest tube removal.

Sixth session: It included nurses' practice regarding ETTS of neonates with pneumothorax. Each session was ended by a summary of its content and the nurses give their feedback.

4) Evaluation phase:

The evaluation of nurses' knowledge and practice was carried out using the study tools. Immediately following the implementation of the program and subsequently one month later, each nurse was evaluated individually. These two evaluations were then compared to the pretest results to ascertain the impact of the program on the knowledge and practices of the nurses.

Statistical analysis:

The collected data were then organized, tabulated, and statistically analyzed using SPSS software (Statistical Package for the Social Sciences, version 20.0). Quantitative data were described using number and percent, and mean and standard deviations were calculated. For qualitative data, a comparison between two groups and more was conducted using the Chi-square test (X_2) for comparison between more than two means of parametric data. For the purpose of interpreting the results of statistical tests, the significance level was established at $p < 0.05$. **(White 2019).**

Results

Table (1): Reveal distribution of the studied nurses according to their socio-demographic characteristics. It was observed that the mean ± SD of nurses' age was 32.97±7.23. It was observed that 85% of nurses were females. Most of the nurses (83.3%) were lived in rural areas and 80% of them were married. Regarding nurses'

educational level, it was found that more than half of them (58.4%) had technical institute of nursing while one third of nurses (33.3%) of had Bachelor of nursing science .

Table (2): Illustrates distribution of the studied nurses' total knowledge about care of neonates with pneumothorax pre, immediately post and one month post educational program. It was observed that one quarter (25%) of nurses had high level of knowledge regarding pneumothorax preprogram that became 93.3% & 88.3% immediately and one month post the educational program respectively. Regarding nurses' knowledge about chest tube, it was noticed that 18.3% of nurses had high level of knowledge preprogram that was improved to 95% & 91.7% immediately post and one month post the educational program. There were statistical significant difference regarding nurses' total knowledge and knowledge's parts pre & immediately post educational program and also pre & one month post educational program, while there was no statistical significant difference regarding nurses' total knowledge and knowledge's parts immediately & one month post educational program. It shows that there was a highly significant improvement regarding total nurses' knowledge where majority of nurses (93.3% & 90%) had high level of knowledge immediately and one month post educational program respectively compared to 20% preprogram.

Figure (1): Shows nurses' total level of practices regarding care of neonates with pneumothorax. It reveals that preprogram less than half of nurses 43.3% had satisfactory practice compared to 91.7% and 85% immediately post and one month post educational program respectively regarding nurses' total level of practices' parts toward care of neonates with pneumothorax.

Figure (2): Explains nurses' total level of practices regarding endotracheal tube suctioning of neonates with pneumothorax

It indicates that less than half of nurses (45%) of nurses had satisfactory practice regarding ETTS preprogram compared to 95% & 88.3% respectively immediately post and post one month of educational program.

Table (3): Represents relation between nurses' total knowledge and their socio-demographic characteristics pre, immediately and one month post educational program. It was evident that there was statistically positive relation between nurses' total knowledge and their age (p=0.000, p=0.007& p=0.000) respectively pre,

immediately post and one month post educational program. No statistically significant relation was detected between total nurses' knowledge and sex or residence pre, immediately & one month post educational program. It was observed that there was positive highly significant relation between total nurses' knowledge and their educational level and their years of experience pre, immediately and one month post awareness program (p =0.000).

Table (4): Demonstrates relation between nurses' total practice regarding neonates suffering from pneumothorax and their socio-demographic characteristics pre, immediately and one month post the educational program. It was observed that there was positive highly significant relation between total nurses' knowledge and their age pre, immediately post and one month post awareness program (p =0.000). This tale also revealed that there were no significant relation between nurses' total practice regarding neonates suffering from pneumothorax, sex & residence pre, immediately and one month post educational program. Also, it was cleared that there were positive significant relation between nurses' total practice regarding neonates suffering from pneumothorax with their educational level and years of experience pre, immediately & one month post educational program p=0.000**.**

Table (5): Demonstrates correlation between nurses' total knowledge and practice pre, immediately & one month post the educational program. It was obvious that there were highly statistically positive correlation between nurses' total knowledge, nurses' practice regarding pneumothorax and endotracheal tube suction pre, immediately & one month post the educational program (p=0.000).

Table (1): Distribution of the studied nurses according to their Socio-demographic characteristics (n=60).

Bio-socio-demographic characteristics	No.	%
Age/ years		
20<25	11	18.3
25<30	10	16.7
30<35	11	18.3
35<40	13	21.7
≥40	15	25.0
Mean ±SD	**32.97±7.234**	
Sex		
Male	9	15.0
Female	51	85.0
Residence		
Rural	50	83.3
Urban	10	16.7
Marital Status		
Single	12	20.0
Married	48	80.0
Educational level		
Diplom of nursing	5	8.3
Technical institute of nursing	35	58.4
Bachelor of nursing science	20	33.3
Years of experience in working		
1<3	4	6.7
3<5	13	21.6
5<10	25	41.7
>10	18	30.0
Mean ±SD	**8.9±4.546**	
Previous training courses regarding pneumothorax		
No	60	100

Table (2): Distribution of Total Nurses' Knowledge's about Care of Neonates with Pneumothorax Pre, Immediately Post and one Month post Educational Program (n=60).

Nurses' Total Knowledge's	Pre						Immediately post						Post one month						Chi-square test		
	Low		Moderate		High		low		Moderate		High		low		Moderate		High		$X^2$1 P 1	$X^2$2 P 2	X^2 3 P 3
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	No.	%	No.			
Pneumothorax	26	43.3	19	31.7	15	25.0	2	3.3	2	3.3	56	93.3	3	5.0	4	6.7	53	88.3	3.866 0.049*	10.363 0.035*	1.351 0.182
Chest tube	24	40.0	25	41.7	11	18.3	1	1.7	2	3.3	57	95.0	2	3.3	3	5.0	55	91.7	10.751 0.000**	9.857 0.043*	1.762 0.083
Total	25	41.7	23	38.3	12	20.0	2	3.3	2	3.3	56	93.3	3	5.0	3	5.0	54	90.0	4.056 0.044*	11.456 0.022*	1.762 0.083

Chi-square test, * statistically significance p≤ 0.05, **highly statistically significance p≤ 0.001

P1 = between pretest & immediately post program

P2 = between pretest & post one month program

P3 = between immediately posttest & post one month program

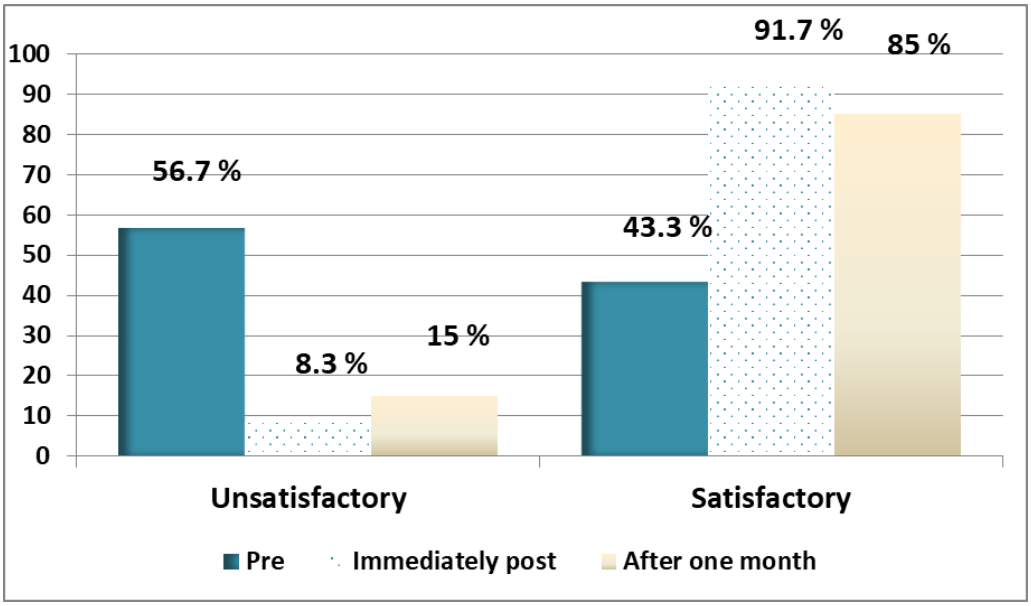

Figure (1): Nurses' Total Level of Practices Regarding Care of Neonates with Pneumothorax

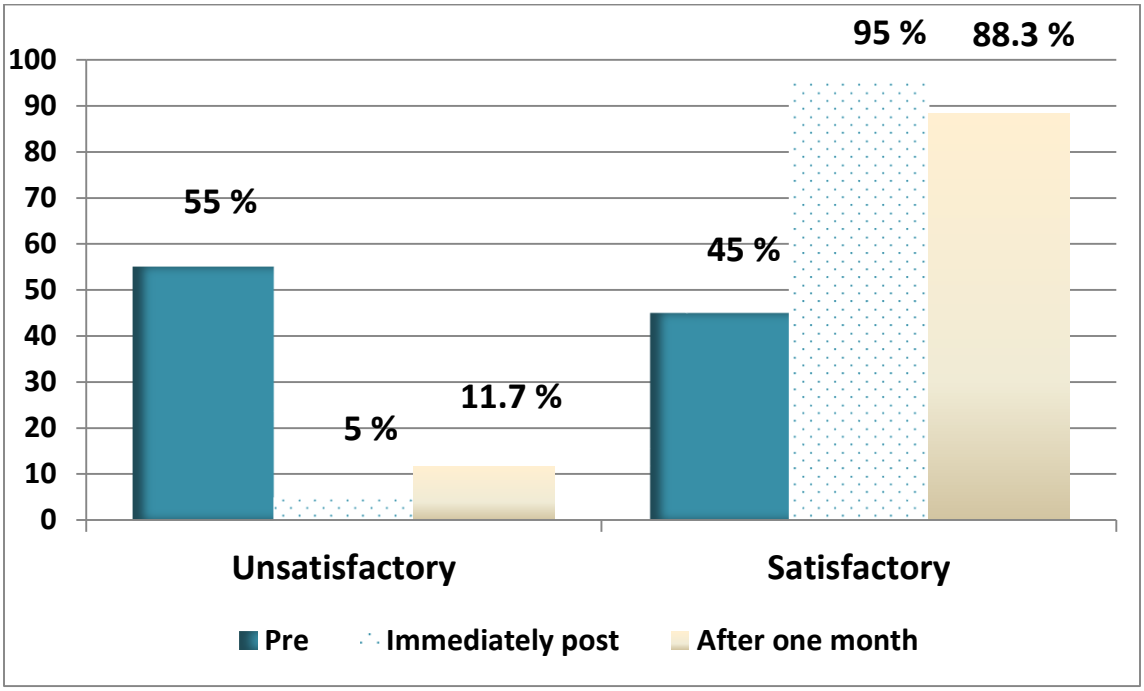

Figure (2): Nurses' Total Level of Practices Regarding Endotracheal Tube Suctioning of Neonates with Pneumothorax

Table (3): Relation between Nurses' Total Knowledge and their Socio-Demographic Characteristics

Nurses' characteristics	Nurses' ' knowledge		
	Pre	Immediately	Post one month
	Mean ±SD	Mean ±SD	Mean ±SD
Age/ years			
20-<25	15.00±6.914	35.36±10.102	31.09±11.493
25-<30	23.90±4.784	40.80±1.476	39.10±1.853
30-<35	26.73±4.714	41.45±0.934	40.64±1.206
35<40	26.69±5.692	41.46±0.967	40.92±1.038
>40	34.60±5.235	41.07±1.335	41.33±0.724
Test of sig (p-value)	F=21.433(0.000**)	F=3.927(0.007*)	F=8.392(0.000**)
Educational level			
Diplom of nursing	11.40±8.849	29.80±12.988	26.20±16.084
Technical institute of nursing	23.89±5.251	41.06±1.765	39.31±2.763
Bachelor of nursing science	33.55±8.334	41.10±1.294	41.25±0.910
Test of sig (p-value)	F=38.785(0.000**)	F=20.431(0.000**)	F=20.076(0.000**)
Years of experience in working			
1<3	7.00±4.243	24.50±9.574	19.25±10.905
3<5	20.15±1.625	41.69±0.630	38.69±3.093
5<10	26.64±4.680	41.36±0.860	40.60±1.291
>10	33.78±5.418	40.78±1.592	40.94±1.305
Test of sig (p-value)	F=50.209(0.000**)	F=57.774(0.000**)	F=58.45590.000**)

t- test/ ANOVA,* statistically significance p≤ 0.05 , highly statistically significance p≤ 0.001**

Table (4): Relation between Nurses' Total Practice Regarding Neonates Suffering from Pneumothorax and their Socio-Demographic Characteristics.

Nurses' Socio-Demographic Characteristics	Nurses' practice regarding neonates suffering from pneumothorax		
	Pre	Immediately	Post one month
	Mean ±SD	Mean ±SD	Mean ±SD
Age/ years			
20-<25	3.91±4.061	46.27±33.130	2.32.18±35.162
25-<30	37.70±26.688	76.60±2.757	72.60±14.983
30-<35	42.73±20.977	76.82±1.079	76.82±1.079
35<40	44.08±29.056	77.15±1.994	77.31±1.702
>40	75.93±1.163	77.80±0.414	77.87±0.352
Test of sig (p-value)	F=21.718(0.000**)	F=10.626(0.000**)	F=16.921(0.000**)
Educational level			
Diplom of nursing	3.40±4.669	32.60±41.543	31.80±42.192
Technical institute of nursing	38.29±28.997	73.89±11.318	68.43±22.221
Bachelor of nursing science	62.25±22.706	77.05±1.605	77.20±1.399
Test of sig (p-value)	F=11.870(0.000**)	F=21.124(0.000**)	F=9.814(0.000**)
Years of experience in working			
1<3	0.25±0.500	6.50±8.963	1.00±1.414
3<5	6.69±3.614	72.46±9.315	59.08±27.969
5<10	52.24±22.784	77.32±1.547	77.40±1.354
>10	67.11±16.869	77.17±0.857	77.28±0.826
Test of sig (p-value)	F=39.61290.000**)	F=253.139(0.000**)	F=44.94390.000**)

t- test/ ANOVA,* statistically significance p≤ 0.05 ,** highly statistically significance p≤ 0.001

Table (5): Correlation between Nurses' Total Knowledge and Practice Pre, Immediately & One Month post Educational Program.

Variables		Pre- program			Immediately			Post one month		
		Nurses' knowledge	Nurses' practice (pneumothorax)	Nurses' practice (ETT)	Nurses' knowledge	Nurses' practice (pneumothorax)	Nurses' practice (ETT)	Nurses' knowledge	Nurses' practice (pneumothorax)	Nurses' practice (ETT)
Nurses' knowledge	r	-	0.786	0.792	-	0.838	0.908	-	0.749	0.865
	p-value	-	0.000**	0.000**	-	0.000**	0.000**	-	0.000**	0.000*
Nurses' practice (pneumothorax	r	0.786	-	0.967	0.838	-	0.761	0.749	-	0.865
	p-value	0.000**	-	0.000**	0.000**	-	0.000**	0.000**	-	0.000**
Nurses' practice (ETT)	r	0.792	0.967	-	0.908	0.761	-	0.865	0.865	-
	p-value	0.000**	0.000**	-	0.000**	0.000**	-	0.000**	0.000**	-

Pearson Correlation Coefficient,

* Statistically significance $p \leq 0.05$,** Highly statistically significance $p \leq 0.001$

Discussion

Pneumothorax in neonates, rare, presents a significant challenge in neonatal care due to the delicate nature of this vulnerable population. The incidence of neonatal pneumothorax has been increasing, particularly in preterm infants and those with underlying respiratory conditions. Effective management of this condition is critical, as it can lead to compromised respiratory function and increased morbidity. **(Joshi, Kumar, Rebekah, Santhanam, 2022).** Enhancing the performance of nurses in the care of neonates suffering from pneumothorax is essential to improve clinical outcomes, reduction in the long-term impacts associated with this condition and ensuring neonatal safety **(Hendy, et al., 2024).** This study aimed to upgrade nurses' performance regarding care of neonates suffering from pneumothorax.

This study presented that majority of nurses had correct complete answer about causes, and diagnosis of pneumothorax during follow up post program application compared to nearly one third and more than third of them pre-program respectively. This may be explained on the basis that that preprogram; the nurses participated in the study did not receive training in the

management of pneumothorax. However, following the implementation of the program, there was a significant improvement in their knowledge.

The current study revealed that majority of the nurses had correct complete answer regarding meaning, and medical management of pneumothorax immediately post and one month post educational program compared to less than one quarter of them pre-program.

These results were congruent with **Abdel-Mohsen, et al (2023)** who conducted a study entitled "Effect of educational intervention on nurses' performance regarding care of critically ill children with pneumothorax" and reported that most of nurses had complete correct answer about definition, causes, diagnosis, complication, and treatment of pneumothorax post-educational intervention compared to pre-educational intervention.

Moreover, these findings were compatible with **Dhakeel & Hassan (2021)** who concluded that majority of nurses had correct answer about definition, causes, and management of pneumothorax post-educational program compared to preprogram.

A statistically significant difference was noted in nurses' knowledge levels about chest tubes immediately after and one month following the completion of the program. The majority of nurses demonstrated a high degree of accuracy in their responses, correctly identifying the significance and potential complications associated with chest tube removal, both immediately post program and one month thereafter. In contrast, less than one quarter of the nurses exhibited this level of accuracy prior to the program. This finding can be attributed to the training program's effectiveness in enhancing nurses' knowledge, which was subsequently reflected in the improvement of their practices.

These results were parallel with **Hamel & Ahmed (2020)** who indicated that there was high significant difference between nurses' knowledge about meaning, and complication pre-test and post-test regarding chest tube.

These findings were in the same direction with **Jabar & Aziz (2021)** who mentioned that only less than one third of participant know meaning of chest tube pretest compared to majority of them posttest and during follow up respectively.

Concerning nurses' knowledge about chest tube, the current study demonstrated that there was a significant difference between nurses' knowledge regarding all items of chest tube pre and immediately post program and also pre and one month post program. Also, majority of them had complete correct answer about site of insertion and

complication during insertion immediately and one month post program implementation compared to less than third of them pre-program. From the researcher's perspective, the findings indicate the efficacy of the implemented program in enhancing nurses' knowledge regarding chest tubes. However, a decline in subsequent knowledge retention was observed, a phenomenon that tends to wane over time in the absence of ongoing reinforcement and periodic review.

The current result also was in the same line with **Yadav, Sahu, Tripathi, Vineeth, Naik Chakraborty, (2023)** who stated that the correct answer of the meaning, complication, and site of insertion of chest tube improved post-program with significant difference between pretest and posttest.

These results were in harmony with **Alaswad & Bahnsawy (2023)** who mentioned that nurses' correct answer about meaning, types, insertion techniques of chest tube, and complication improved post instruction than before implementation.

The present study demonstrated a significant difference in nurses' overall knowledge between the pre-program phase and both the immediate and one-month post-program phases, with notable improvements in their knowledge about pneumothorax following the program's implementation. This result was in accordance with **Dhakheel & Hassan (2021)** who mentioned that nurses' knowledge about pneumothorax was improved post application of program.

The current study concluded that nurses' knowledge regarding chest tubes significantly improved both immediately and one month after the program's completion. This finding was matched with **Mohamed & Ibrahim (2021)** who reported that the total nurses' knowledge level about chest tube improved significantly post the intervention from 4% to 96%. Also, with **Yadav et al. (2023)** who stated that the overall level of knowledge regarding chest tubes was significantly higher after the posttest than before.

The present study showed a statistically significant improvement in nurses' overall knowledge concerning the care of neonates with pneumothorax. The majority of nurses demonstrated a high level of knowledge during both post-program assessments, compared to fewer than a quarter who achieved this level before the program. This outcome can be attributed to strong statistical evidence indicating that the training program effectively enhanced nurses' knowledge. Moreover, the program content was delivered efficiently, and nurses exhibited a quick ability to absorb and retain the information.

This finding were in agreement with conclusions reported by **Abdel-Mohsen et al. (2023),** who indicated that nurses' comprehensive understanding of neonatal care for pneumothorax cases was enhanced following the implementation of an intervention. Also, this result was agreed with **Dhakeel &Hassan (2021)** who reported a statistically significant improvement in nurses' overall knowledge immediately and one month after the program regarding pneumothorax compared to before the program's implementation.

The present study examined nurses' practices prior to chest tube insertion. The findings indicated that approximately half of the nurses performed the assessment of respiratory status correctly and observed the alarms of mechanical ventilation. Additionally, they positioned the neonates according to the indicated insertion site. The results showed that the majority of nurses performed preprogram in comparison to the immediate and post-one-month results. This discrepancy may be attributed to the effectiveness of the program in enhancing the practical skills of nurses in this domain.

This result was matched with **Mahmoud, Ahmed, Ahmed, Abd Esalam, (2023)** who revealed that most of nurses monitor and observe respiration correctly post program implementation. Also, **Bedier, Abu-Elata, Ibrahim, (2024)** who supported this finding and revealed that none of the nurses assess respiratory status preprogram compared to all of them assess respiration immediately post program and two third of them three months post-intervention.

Moreover, these results were in accordance with **Mostafa, Bahgat, Dawood (2023)** who concluded that less than tenth of nurses done the following step "Place the neonate in proper position" pre- guidelines program compared to majority immediately and one month post guidelines program. Also, less than tenth of them measure and record respiratory rate preprogram compared to nurses immediately and one month post program.

The present study demonstrated that nurses' practice exhibited significant enhancement after the implementation of the educational program in comparison to preprogram. This enhancement was accompanied by a statistically significant difference in nurses' total practices' of care for neonates with pneumothorax. This can be attributed to the efficacy of the educational program in enhancing nurses' practices and facilitating the retention of knowledge regarding the care of neonates with pneumothorax.

These findings were consistent with **Ibrahim & Elshemy (2020)** who concluded that there was significant

improvement in the nurses' practice immediately and at follow-up post the educational program implementation. Results were compatible with **Arafa et al., (2022)** who reported that the mean of daily routine care of neonate with pneumothorax, changing drainage bottle, removal of chest tube and total score of practice to chest tube care were improved post educational program.

Practice regarding endotracheal tube suctioning of neonates suffering from pneumothorax.

The present study explained that less than half of nurses auscultated gurgling sound during respiration and observed presence of secretion in the endotracheal tube that became majority of them at immediately and one month post educational program with statistically significant difference between preprogram and immediate phase and between preprogram and one month post program. This may be due to effectiveness of educational program in improving nurses' practice regarding prevention and management of secretion accumulation in ETT.

This result was parallel with **Ali, Abu Salem, Amin (2023)** who reported that 40% of nurses assess neonatal need for suctioning pre-intervention compared to 100% and 93.3% immediately and 3 months post intervention respectively, and 50% of them observed presence of secretion in the endotracheal tube pre-intervention compared to 100% and 95% immediately and 3 months post intervention respectively. Moreover, these findings were in congruent with **Ahmed & Hattab (2022)** found that nurses' practices of Endotracheal Tube Suction (ETTS) were poor in the pre-test; they improved significantly in the post-test.

This study demonstrated that the majority of nurses achieved a satisfactory level immediately and one month after the educational program implementation, compared to their performance regarding total level of ETTS before the program. This may due to that that the observed changes in practice levels are unlikely to have occurred by chance and suggest a strong relationship between the educational program and the improvement in nursing practices, in which continued evaluation and follow-up training lead to solidify these gains and address any persisting knowledge gaps or practices that need reinforcement.

This finding was in accordance with **Yas & Hattam (2022)** who conducted a study about nurses' practice toward neonatal ETTS procedure" and concluded that all nurses had an inadequate level of practice pretest, compared to posttest with high significant difference. Also, with **Ebrahim, (2018)** who concluded that the total score of ETT suctioning by

nurses were high post-program compared preprogram score.

The current study confirmed that there was a strong correlation between nurses' knowledge and their age prior to, immediately following, and one month after the program, as well as between nurses' knowledge and their sociodemographic features regarding the management of newborns with pneumothorax.

Additionally, there was a strong correlation between nurses' overall knowledge and their years of experience, education, and pre-, immediate-, and post-program knowledge. According to the researcher's perspective, this could be because nurses with more years of experience tend to know more than those with less, and their involvement in the care of these neonates has influenced their knowledge and practice. High educated nurses also acquired more information, basic practice and knowledge related pneumothorax and chest tube and more training than nurses who had diplom or technical institute of nursing.

Elsayed, Hassanin, and Mohammed (2016) were disagreed with these results and reported that there is no statistically significant correlation between the basic knowledge of nurses and their age, education, and years of experience. Also, these findings were inconsistent with **Jabar & Aziz (2021)** who found that there were no relation between nurses' total knowledge about care of chest tube in children and their age, educational level, and year of experience.

Regarding relation between nurses' practice about care of neonates with pneumothorax, and their socio-demographic characteristics, The current study showed a significant relation between the practice of nurses, their years of experience, age, and educational attainment prior to, during, and one month post the program.

This may be due to nurses who are high qualified and with substantial practical experience were able to integrate the newly acquired information more effectively into their daily routines, showcasing the importance of experiential learning in the nursing profession and can apply this knowledge into care of the neonates with pneumothorax and this will improved more with age and years of experience.

These results were consistent with **Mahmoud, Ahmed, and Abd-Elsalam (2023)** who reported that there were a significant relation between nurses' total practice and their age, qualification, and years of experience. While, the current findings were incompatible with **Elsayed et al. (2023)** who mentioned that that there was no statistical significant relation between nurses 'age,

qualifications, experience years, and nurses' basic practice**.**

Regarding the correlation between overall knowledge and practices, the current study found a strong positive relationship between nurses' total knowledge and their overall practices related to pneumothorax and endotracheal tube suctioning**.** This may be explained on the basis that the nurses, who received the program, applied what they learned in their practice so this reinforcement of knowledge deeply enhances their clinical skills and confidence.

These findings were in the same line with **Mohamed et al. (2023)** who reported that there were a strong positive correlation between nurses' knowledge, and practices pre & post educational intervention implementation. Also, these findings were in harmony with **Chege, Mwaura, Kirui, (2018)** who reported that, nurses' awareness of the perceived significance of nursing management in underwater chest drainage has a demonstrable impact on their professional practice and the quality of their performance.

Furthermore, these results were congruent with **El-Senousy, Mahrous, and Abd-Al Salam (2020)** posited that a statistically significant correlation exists between the level of nurses' total knowledge and practice after program completion.

Conclusion: Nurses' performance regarding care of neonates with pneumothorax is upgraded post immediate and after one-month post-program and there was significant improvement in nurses' overall knowledge and practice.

Recommendations: The following recommendations were suggested:

- Frequent, ongoing education should be provided to nurses regarding care of neonates with pneumothorax.
- Designing handbooks and educational booklets to update nursing practices and information regarding chest tube and pneumothorax neonatal care.

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