Effect of Nursing Guidelines Regarding Safe Procedure of Thoracentesis on Patients' Outcomes

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Abstract

Thoracentesis is a procedure that is used to drain and collect fluid from the pleural cavity. Fluid removal can either be done to alleviate the problems in the patient, to collect a sample to diagnose the underlying condition causing the need for the procedure. Aim: to evaluate the effect of nursing guidelines regarding safe procedure of thoracentesis on patients' outcomes. Research design: A quasi experimental design. Setting: Thoracic Diseases Department and Thoracic Intensive Care Units affiliated to Ain Shams University Hospital. Subject: 60 patients (control & study groups) undergoing thoracentesis and 30 nurses was worked at the previously mentioned setting at the time of data collection. Tools of the study: Patients' Assessment Questionnaire and Nurses' Assessment Questionnaire. Results: There is positive correlation between total knowledge post program and total practice post program. Also there is positive correlation between total nurses' practice regarding caring of patients undergoing thoracentesis, patients' satisfaction level, and patients' physiological parameters post guidelines implementation and there was positive correlation between total nurses' knowledge regarding caring of patients undergoing thoracentesis and patients' satisfaction level, and patients' complications post designed guidelines implementation, Conclusion: It was concluded from this study that nursing guidelines regarding safe procedure of thoracentesis affect positively on patients' outcomes. Recommendations: This study recommended that developing periodical nurses' evaluation system to determine their knowledge and enhancing their practice, and conducting the study on a large sample.

Keywords: *Nursing guidelines, patients' outcomes, safe procedure, thoracentesis.*

INTRODUCTION

Pleural effusion is the most common disease among all the pleural disease and affects 1.5 million patients per year in the United States. A wide variety of diseases can present with pleural effusions like diseases primarily involving the lung like pneumonia, asbestos exposure, primarily systemic diseases like lupus, rheumatoid arthritis, or maybe the pleural manifestation of diseases which primarily affect other organs like congestive heart failure, pancreatitis, or diseases local to the pleura like pleural infections and mesothelioma (Dancel, et al., 2018).

Thoracentesis is a common diagnostic and therapeutic procedure, in which a percutaneously introduced needle is used to remove fluid from the pleural space. Clinically, the most common post-thoracentesis complication is pneumothorax, with an incidence of 3–30%. Important and potentially fatal diagnoses such as pleural infection or empyema can be missed without pleural fluid analysis, and thoracentesis can change the presumptive diagnosis of the cause of effusion in up to 45% of patients (Fysh, et al., 2020).

The safety of thoracentesis has been directly associated with the technical skills of the operator. Within the past several years, system and procedural variables, including a lack of real-time ultrasound imaging, operator inexperience, drainage of large volumes of fluid, and repeated thoracentesis, have been shown to increase the likelihood of complications. Critical care nurse is playing an a very important role in the care of the patient undergoing thoracentesis includes accurate and frequent assessment of arterial blood gas analysis, pulmonary care, coughing and incentive spirometry, early mobilization and control of pain and shivering for the prevention of atelectasis (Sole, et al., 2020).

Significance of the study

The incidence of pleural disease in the general adult population is increasing, annually affecting over 3,000 people per million populations. Thoracentesis can provide significant symptom relief and improvement in physiologic parameters including dyspnea, exercise, and sleep. According to the statistical records of Ain Shams University Hospital, the number of patients with pleural effusion who were treated with thoracentesis at Thoracic Diseases Department and Thoracic Intensive Care Unit in the year of 2019 was 2500 patients

(Statistical Department, Ain Shams University Hospital, 2019).

As nurses have vital role in prevention of thoracentesis associated complications by assessing patient and evaluate their physiological status, so nurses who provide direct care for patient undergoing thoracentesis should be knowledgeable and skillful about the procedure and safety measures to participate in promoting effective patients' outcomes.

Aim of the Study

The present study aim to evaluate the effect of nursing guidelines regarding safe procedure of thoracentesis on patients' outcomes through:

1.   Assessing patient's physiological parameters before, during and post thoracentesis.

2.   Assessing patients' expected complications after thoracentesis.

3.   Assessing patients' level of satisfaction regarding thoracentesis procedure.

4.   Assessing nurses' level of knowledge regarding thoracentesis.

5.   Assessing nurses' level of practice regarding thoracentesis.

6.   Developing and implement nursing guidelines regarding thoracentesis based on needs assessment.

7.   Evaluating the effect of nursing guidelines on the level of:

a.   Patient's physiological parameters, and expected complications.

b.   Patient's level of satisfaction.

c.   Nurses' level of knowledge regarding thoracentesis.

d.   Nurses' level of practice regarding thoracentesis procedure.

Research hypotheses:

This study hypothized that:

1.   The nursing guidelines regarding safe procedure of thoracentesis will improve nurses' level of knowledge and practice.

2.   The nursing guidelines regarding safe procedure of thoracentesis will significantly improve patients' outcomes.

SUBJECTS AND METHODS

The study was portrayed under the four main designs as follows:

I.   Technical design.

II.   Operational design.

III.   Administrative design.

IV.   Statistical design.

I.   Technical design: includes research design, setting, subjects and tools for data collection.

A-   Research Design: A quasi experimental design was utilized to test the study hypotheses.

B-   Setting:

This study was conducted in Thoracic Diseases Department and Thoracic Intensive Care Units affiliated to Ain Shams University Hospital; The Thoracic Diseases Department, consisted of (20) beds, the thoracocentesis room for thoracentesis procedure has one bed, ultrasound device, and thoracentesis supplies. And intermediate chest ICU consisted of six beds. Also, Thoracic Intensive Care Unit separated into two halls each hall has seven beds with total 14 beds, physicians' office, nurses' office, and central counter between the two halls, and a counter in the center of each hall.

C-   Subjects: The subject of this study was composed of 2 groups, patients (control & study groups) and nurses as follow:

Patients:

A purposive sample of 60 patients with pleural effusion and who were undergoing thoracentesis were recruited in this study according to the number of patients with pleural effusion in Ain Shams University Hospital last year (2019) 2500 cases, based on power analysis. Patients' group will be divided into 2 equal homogeneous groups randomly as study group and control group. Patients were selected according to the following criteria: Adult patient with both sexes regardless educational level, free from respiratory problems that need ventilator, free from auditory disabilities and visual or neurological disorders, fully conscious patient with GCS (15).

The nurses:

The nurses ` group was composed of 30 nurses working at the previously mentioned selected settings were included in the study, from both sexes, different age groups, different levels of qualification and different level of experiences as follow; 5 nurses from the Thoracic Diseases Department, 5 nurses from intermediate chest ICU, and 20 nurses from Thoracic Intensive Care Unit. The same subject group was tested in pre and post nursing guidelines program.

D-   Tools of Data Collection:

Three tools were used in the study for data collection including the following:

Tool (I): Patients' Assessment Questionnaire:

It was used for assessing the studied patients' outcomes regarding complication occurrence

rate and satisfaction level in both study and control groups. It was developed by the researcher after reviewing the related literature (Kalanjeri & Pastores, 2022; Krishna and Rudrappa, 2020; Lentz et al., 2020). It was written by the researcher in simple Arabic language. It was filled by the researcher.

This questionnaire was divided into five parts as follow:

Part 1. Patients' Demographic Data: This concerned with data collection about demographic characteristics of the patients under study such as patients' age, gender, and level of education.

Part 2. Patients' Clinical Data Assessment record: it was developed by the researcher based on related literature (Ault et al., 2018). It was included (9) questions about patients' past medical history and present medical history such as; Current diagnosis, Cause of PE, Site of thoracentesis, Method of O2 administration, Nature of tapped fluid, if the patient have thoracentesis previously, taking medications that cause blood thinning, and having a chronic disorder.

Part 3. Patients' Physiological Parameters record: It was used to assess patient's (study and control group) physiological condition eg; "Vital signs, Dyspnea intensity, Chest pain intensity". This tool was adapted from (Gift & Narsavage, 1998) and (Erin et al., 2018) and developed by the researcher according to the aim of the study and include; vital signs (P, SBP, DBP, T, R), O2 saturation, Difficulty of breathing intensity (Dyspnea) using Dyspnea Numerical Rating Scale , and level of chest pain intensity using Pain Numerical Rating Scale. And it was measured three times; pre procedure, during procedure and after 15 minutes from the procedure.

Part 4. Expected Patients' Complications record:

It is concerned with the assessment of signs and symptoms of expected complications among the studied patients undergoing thoracentesis procedure in both groups (study & control groups) which can occur during or immediately after the procedure. This tool was developed by the researcher based on literature review (Urden et al., 2019; Ojeda & Hipskind, 2020) and included (18) questions. These complications may be hypotension, bradycardia, puncture site bleeding, hematoma, pleuritic pain, transient O2 desaturation, significant cough, gasping, hemoptysis, persistent bleeding, pneumothorax, heamothorax, visceral injury, re-expansion pulmonary edema, and death.

Scoring system of expected patients' complications

Each complication occurred was given one score and if absent was given zero.

Part 5. Patient's level of Satisfaction Scale:

This questionnaire was adapted from(Awad, 2018) and (Mourad et al., 2020), in Arabic language after reviewing the recent related literatures (to assess the effect of nursing guidelines on patient satisfaction in study group post nursing guidelines implementation through using standardized scale (patient satisfaction sheet).

Scoring system:

It is likert scale, the answer was divided as (satisfied, not sure, not satisfied), the total score of patient' satisfaction was (29 marks); each satisfactory answer was given one mark, not sure answer was given 2 marks, and unsatisfactory answer was given 3 marks.

The total score was distributed as the following:

☐ Total satisfaction level

☐ Satisfied = (≥ 75%)

☐ Unsatisfied = (< 75%)

Tool (II): Nurses' Assessment Questionnaire:

This questionnaire was designed by the researcher based on literature review in Arabic language, and filled by studied nurses to assess the following:

A. Nurses' Demographic data: They include, age, gender, qualification, and years of experience in thoracic department.

B. Nurses' knowledge regarding thoracentesis: It included 29 MCQ questions and 16 true or false questions with total 45 questions. This questionnaire was guided by three references

B.1. Nurses' knowledge regarding safety measures of thoracentesis procedure:

It was used to assess nurses' level of knowledge regarding safety measures of thoracentesis procedure pre and post the designed guidelines implementation. It was developed by the researcher after reviewing the related literature (Moorhead et al., 2018; Lu et al., 2020). And it was written in Arabic simple language and included 15 MCQ questions and 19 true or false questions.

Scoring system:

The nurses' questionnaire sheet consisted of 79 questions in the form of multiple choice questions and true or false questions, related to safe procedure of thoracentesis each correct answer was given one mark and incorrect answer was given zero. The total score of questionnaire sheet was 79 marks distributed as following:

B: contained (45 items) for assessing the nurses' knowledge regarding thoracentesis.

B.1: contained (34 questions 15 MCQ questions and 19 true or false questions) for assessing the nurses' knowledge regarding safety measures of thoracentesis procedure.

Evaluation was considered as follow:

• ≥ 90%= (67) correct answers were considered satisfactory level of knowledge.

• <90%= (67) correct answers were considered unsatisfactory level of knowledge.

Tool III- Nurses' Observational checklist:

It was used to assess nurses' level of practice regarding thoracentesis procedure pre and post the designed guidelines implementation. It was developed by the researcher after reviewing the related literature (Wiegand, 2017), and (Nettina, (2019), and written in English language (87 items).

This tool was divided into three sections as the following:

The 1st section: contained (25 steps) for assessing the care of the patient with thoracentesis before the procedure distributed as the following; evaluate patient (8 steps) and prepare patient (16 steps).

The 2nd section: involved (21 steps) for assessing the care of the patient with thoracentesis during procedure.

The 3rd section: covered (41 steps) for assessing the care of the patient with thoracentesis after procedure and distributed as the following: maintain patient condition (17 steps), follow up patient condition after the procedure (5 steps), wound care (Place a sterile bandage on the insertion site) (14 steps) and documentation after the procedure (5 steps)

Scoring system:

The total score of practice was (87 marks); each correct step was given one mark and zero for the step which was not done.

Evaluation was considered as follow:

• $\geq$ 90%=$\geq$ (78) correct actions were considered satisfactory level of the practice.

•   < 90%=<(78) correct actions were considered unsatisfactory level of the practice.

II-   Operational design:

The operational design includes preparatory phase, validity, reliability, pilot study and field work.

A)   Preparatory phase:

The first step of this phase was concerned with reviewing current and past, local and international related literature and theoretical knowledge of various aspects of the study using books, articles, internet, periodicals and magazines to develop tools for data collection.

The second step of this phase was concerned with assessment of experts' opinions about aspects of the developed tools, and the various parts of the proposed nursing guidelines for patients with pleural effusion undergoing thoracentesis.

B)   Content Validity:

It was established by a panel of seven expertises who reviewed the tools, for clarity, relevance, comprehensiveness, understanding, and easiness for administration was established, minor modifications were required, Experts group consisting of seven members, (2) Lecturers, (2) Assistant Professors and (3) Professors of Medical Surgical Nursing department at Ain-Shams University.

C)   Content Reliability:

Alpha Chronbach test was used to measure the internal consistency of the tools (reliability of the used tool or instrument). These showed high reliability scores for the following tools:

        Patients' assessment questionnaire (0.819).

        Nurses' assessment questionnaire (0.936).

        Nurses' Observational checklist (0.964).

D)   Pilot study:

A pilot study was carried out on 10 % of study subjects (3 nurses, and 6 patients) to test clarity and applicability of the tools and to estimate the time needed for filling questionnaire. The study subjects who included in the pilot study were included in the main study group because, there aren't modifications on the tools were done after the pilot study.

•   Ethical Considerations

Prior to the conduction of the study, approval was obtained from the Scientific Research Ethical Committee of faculty of nursing at Ain Shams University. As well, a written consent from participants who were assured that anonymity and confidentiality would be guaranteed and that, they have the right to withdraw from the study at any time without giving any reason. The aim of the study was explained for the nurses' prior data collection. The researcher assured that the data collected and information will be treated confidentially by using serial number for every nurse.

E)   Field work:

To carry out the study, an approval was obtained from the hospital and nursing directors at Ain-Shams University Hospital in

order to obtain their permission and cooperation. The researcher interviewed all the studied nurses for explaining the aim of the study and took their approval to participate in the study prior to data collection.

Data were collected in six months from beginning of September 2021 to the end of March 2022. The researcher was available at the study setting for three days weekly. The researcher filled the observational checklist in the morning and afternoon shifts during actual nurse's work and documented steps of care for the patients checklist it took about 30-45 minutes

The observational checklist was used prior to administration of the questionnaire to ensure the maximal realistic observations of the nurse's performance and minimize the possibility of bias.Then, the self-administered questionnaire sheet was filled by the nurses who providing care for patients it took about 30-35 minutes. The answers were recorded by the nurse's themselves.

During this phase a purposive sample of 60 patients undergoing thoracentesis were recruited and divided as a control group and a study group pre the designed guidelines implementation, which selected according to inclusion criteria, and explaining simply the aim and nature of the study as well as taking their approval to participate in the study prior to data collection for assessing their physiological parameters, their satisfaction, and the complications occurrences rate using tool (I) which was filled by the researcher for each patient. It took about (20 -30 minutes). This occurs in the same time during nursing assessment phase.

The educational nursing guidelines was developed in Arabic language based on nurse's needs assessment from the results of the data

analysis of the questionnaire and observation checklist after the reviewing of the literature which related to the information and skills necessary for performing safe procedure of thoracentesis. The designed educational nursing guidelines included the following: firstly; theoretical part wich include: anatomy and physiology of the respiratory system, pleural effusion, thoracocentesis, and safety measures for thoracentesis procedure. Secondly; the practical part that encompasses the nursing role in caring for patient undergoing thoracentesis (pre, during and post) thoracentesis procedure. Educational principles were reviewed for the development of the educational nursing guidelines.

Planned nursing guidelines program sessions were conducted by the researcher for all the studied nurses based on their needs' assessment. Total number of the planned nursing guidelines program sessions were (7 sessions, (4) for theory and (3) practice) each time took about 30 minutes for covering its content. The training program was conducted at the nursing office in each section 2 times; first time at the morning shift from 1-2 pm over 2 days/ week (Saturday and Thursday) for group of nurses (n=5), so 10 nurses received the four training program sessions in two weeks. The same manner followed by the researcher for the six groups of nurses in the selected setting (n=30), so the training program took (6 weeks).

Administrative Design

To carry out the study, the necessary approvals were obtained from the Director and Nursing Director of Ain-Shams University Hospital. Official letters were issued to them from the Faculty of Nursing Ain-Shams University explaining the aim of the study to obtain permission for collection of data. Written consent was taken from nurses who agreed to

participate in the research process. Permission was taken from the administrative personnel and the head nurses/supervisors of CCU and medical departments. After the permission was granted to precede with study, the head nurse of the CCU and medicine departments were oriented about the objective of the study, to ensure maximum cooperation from the nurses in the study group.

III-   Statistical design:

The collected data were organized, categorized, tabulated and statistically analyzed using the Statistical Package for Social Science (SPSS), version 15, to evaluate the change for nurses under the study (pre and post Self Learning Module and after three months. Data were presented in tables and charts using numbers and percentages. The statistical analysis included percentage (%), mean and standard

deviation (SD), range, Chi-square (X2), ANOVA test (F-test) and Pearson coefficient (r). The observed differences, and associations were considered statistically significant at P < 0.05.

Significance of results was described as follows:

☐   Non significant (NS) difference obtained at p > 0.05.

☐   Significant (S) difference obtained at P < 0.05.

☐   Highly significant (HS) difference obtained at P<0.001.

RESULT

Part (I):   Demographic characteristics and history of studied patients

Table (1): Frequency and percentage distribution of the studied patients (study and control group) according to their demographic characteristics (n=60).

Demographic characteristics	Study group (n=30)		Control group (n=30)		Test of significance	
	No	%	No	%	χ^2	P value
Age (years)						
18- < 35	4	13.4	4	13.3		
35-< 45	1	3.3	1	3.3	0.272	0.791
45-< 55	7	23.3	6	20.0		
55+ more	18	60.0	19	63.4		
Mean ± SD	56.06±14.89		57.86±16.42			
Department						
Chest word	18	60.0	18	60.0		
Chest Intermediate care unit	6	20.0	5	16.7	0.168	0.920
Chest ICU	6	20.0	7	23.3		
Gender						
Male	18	60.0	18	60.0	0.000	1.000
Female	12	40.0	12	40.0		
Educational level						
Uneducated	8	26.7	5	16.7		
Read and write	5	16.7	4	13.3	3.225	0.027*
Diplome	13	43.3	16	53.3		
	4	13.3	5	16.7		

High education						
Smoking	16	53.3	17	57.7		
Smoker					**0.067**	**1.000**
Not smoker	14	46.7	13	43.3		
Inhalation of chemical materials	9	30.0	6	20.0		
Yes	21	70.0	24	80.0	**4.780**	**0.012***
No						

(* A statistical significant difference P ≤ 0.05) (No statistical significant difference (P value >0.05).

Table (1) representes that the mean ages of the study and control groups are ± SD 56.06±14.89 57.86±16.42 respectively. Regarding gender, 60.0% of control and study groups are males. As regard hospital department 60% of the studied patient from study and control group are from chest word. Regarding patients educational level 43.3% and 53.3% in study and control groups respectively had diploma education. In relation to smoking 53.3% and 57.7% of patients in study and control groups respectively are smockers. In relation to occupational exposure 30% and 20% of study and control groups were exposed to inhalation of chemical materials. There was no statistical significant difference regarding age, department, gender, and smoking at P value (0.791, 0.920, 1.000, 1.000) respectively, while there was statistical significant difference regarding Educational level and Inhalation of chemical materials at P value (0.027, 0.012) respectively.

Part (III): Physiological parameters in both groups (study and control groups) (table 3-3A).

Table (3): Vital signs' parameters in both groups (study and control groups) pre/post the designed guidelines implementation (n=60).

	Pre Guidelines		Post Guidelines	
Items	Study &Control groups (N=30)		Study &Control groups (N=30)	
	F -test	**P value1**	**F-test**	**P value2**
1- **Pulse rate**	0.23	0.668	6.779	0.011*
2- **Respiratory rate**	0.89	0.331	4.321	0.013*
3- **Temperature**	1.31	0.840	0.010	0.922
4- **Systolic BP**	1.03	0.779	0.016	0.915
5- **Diastolic BP**	1.81	0.093	18.180	0.000**
6- **O2 saturation**	0.35	0.846	5.800	0.019*

(* A statistical significant difference P ≤ 0.05 **, A highly statistical significant difference P ≤ 0. 001).

X2 & P Value Test (1): between study and control group Pre program. X2 & P Value Test (2): between study and control group Post Program

Table (3): represents that there was no statistical significant difference between study and control groups Pre guidelines implementation regarding pulse rate,

respiratory rate, temperature, systolic BP, diastolic BP, and O2 saturation at P value (0.668, 0.331, 0.840, 0.779, 0.093, 0.846) respectively. While there was statistical significant difference between study and control groups post guidelines implementation as regards pulse rate, respiratory rate and O2 saturation at p value (0.011, 0.013, 0.019) respectively and a highly statistical significant difference as regards diastolic BP at P value (0.000), but there was no statistical significant differences as regards temperature, and systolic BP at P value (0.922, 0.915) respectively.

Table (3-A): Dyspnea and Pain intensity level in study and control groups Pre and post implementing the designed guidelines (n=60).

Variables	Pre Guidelines		Post Guidelines	
	Study & control groups (N=60)		Control & control group (N=60)	
	$\chi 2$	P value1	$\chi 2$	P value2
Dyspnea intensity level				
None (0) **Mild pain (1-4)** **Moderate pain (5-6)** **Sever pain (7-10)**	2.480	0.746	6.405	0.013*
Chest pain level				
None (0) **Mild pain (1-4)** **Moderate pain (5-6)** **Sever pain (7-10)**	1.470	0.538	22.556	0.000**

(* A statistical significant difference P $\leqslant$ 0.05 **, A highly statistical significant difference P $\leqslant$ 0. 001).

X2 & P Value Test (1): between study and control group Pre program. X2 & P Value Test (2): between study and control group Post Program

Table (3-A) shows that There was no statistical significant difference regarding dyspnea intensity level and chest pain level between study & control groups pre guidelines implementation at P value (0.746, 0.538) respectively. While there was a statistical significant difference regarding dyspnea intensity level at P value (0.013), and highly statistical significant difference as regards chest pain level at P value (0.000) between study and control group Post Program.

Part IV: Expected patients' complications (Table 4):

Table (4): Expected patients' complications in both groups (study and control groups) pre/post guidelines implementation (n=60).

Items	Pre Guidelines		Post Guidelines	
	Study & Control groups (N=60)		Study & Control groups (N=60)	
	$\chi 2$	P value1	$\chi 2$	P value
1. Bleeding at insertion site	0.149	0.448	7.177	0.007**
2. Hematoma at insertion site	0.126	0.519	5.711	0.016*
3. Wound at insertion site	0.403	0.359	9.643	0.002**
4. Change in deep of respiration	2.456	0.117	18.468	0.000**
5. Increase in RR more than 1st reading	6.323	0.012*	21.991	0.000**
6. Decrease in RR less than 1st reading	2.074	0.137	1.176	0.236
7. Sever chest pain	1.142	0.294	23.721	0.000**
8. Temporary decrease in O2 Sat	0.560	0.344	9.320	0.002*
9. Sever cough	1.326	0.187	5.406	0.019*
10. Decrease or absent breath sound in affected side	0.894	0.248	6.239	0.013*
11. Subcutaneous emphysema	1.003	0.233	5.192	0.026*
12. Decrease in BP than 1st reading	1.324	0.186	36.274	0.000**
13. Vasovagal reflex	0.317	0.513	2.069	0.246
14. Irregular heart beat	4.643	0.031*	38.400	0.000**
15. Tracheal deviation to the affected side	0.00	1.000	0.00	1.000
16. Dilated neck vein	0.00	1.000	0.00	1.000
17. Death	0.00	1.000	0.00	1.000

(* A statistical significant difference P $\leqslant$ 0.05 **, A highly statistical significant difference P $\leqslant$ 0. 001).

X2 & P Value Test (1): between study and control group Pre program. X2 & P Value Test (2): between study and control group Post Program

Table (4) represents that there was no statistical significant differences between study and control groups regarding expected patient's complications pre implementing guidelines, except regarding increase in respiratory rate more than 1st reading and irregular heart beat at P value (0.012, 0.031) respectively. While there was a highly statistical significant differences between study and control groups post guidelines implementation as regards bleeding at insertion site, Wound at insertion site, Change in deep of respiration, Sever chest pain, Increase in respiratory rate more than 1st reading, Decrease in BP less than 1st reading, and Irregular heart beat at P value (0.007, 0.002, 0.000, 0.000, 0.000, 0.000, 0.000) respectively. And a statistically significant differences as regards Hematoma at insertion site, Temporary decrease in O2 Sat, Sever cough, Decrease or absent breath sound in affected side, and Subcutaneous emphysema at P value (0.016, 0.002, 0.019, 0.013, 0.026)

respectively, but there was no statistical significant differences regarding Bloody sputum, Decrease in respiratory rate less than 1st reading, Vasovagal reflex, Tracheal deviation to the affected side, Dilated neck vein, and Death.

Part (VII): The studied Nurses' level of knowledge satisfactory level regarding management of patient undergoing thoracentesis: (Figure 1-2).

Figure (1): Percentage distribution of the studied nurses` total level of knowledge of as regards thoracentesis procedure pre / post guidelines implementation. (n=30).
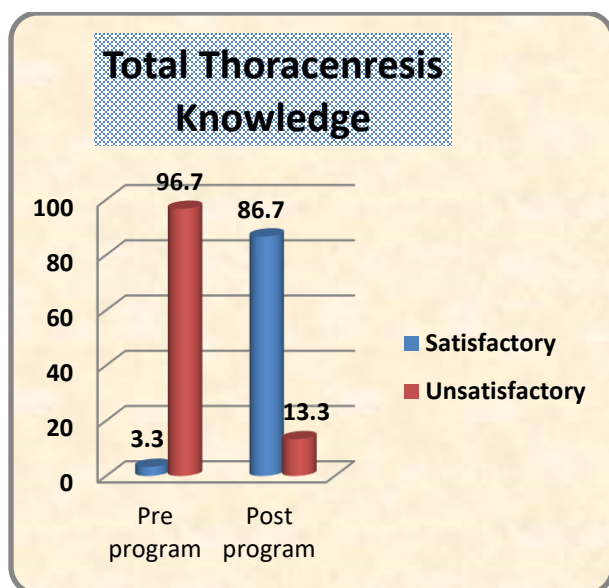
Figure (1) illustrates that the studied nurses` total knowledge satisfactory level pre the designed nursing guidelines implementation was 3.3%, while it was 90% post the designed nursing guidelines implementation.

Figure (2): Percentage distribution of the total level of knowledge of studied nurses as regards patient's safety measures, pre/post guidelines implementation (n=30).

Figure (2) shows that 6.7% of the studied nurses have satisfactory level of knowledge before implementing the designed guidelines implementation, while 83.3 % of them have satisfactory level of knowledge after implementing the designed guidelines implementation.

Part VIII: Studied Nurses' level of practice satisfactory level regarding management of patients undergoing thoracentesis: figure (3).

Figure (3): Percentage distribution of nurses` total practice satisfactory level pre and post designed nursing guidelines implementation (n=30).
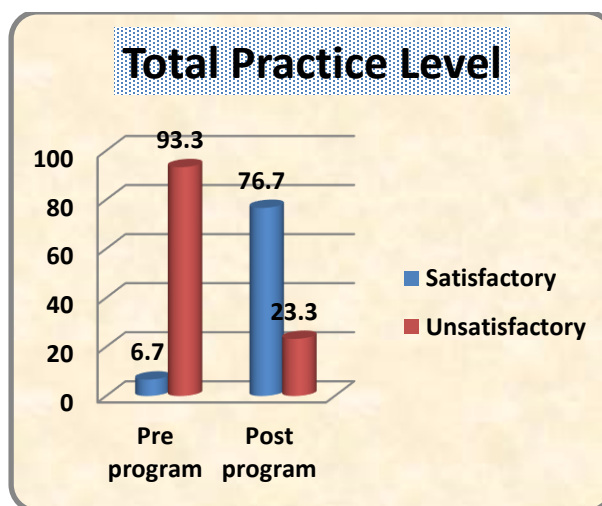
Figure (3) illustrates that 6.7% of the studied nurses have total satisfactory practice level before implementing the designed nursing guidelines, while 76.7 of them have satisfactory practice level after implementing the designed nursing guidelines.

Part (X): Correlation between the studied variables (tables 6-15):

Table (6): Correlation between Total nurses` practice satisfactory level regarding caring of patients undergoing thoracentesis and patient outcomes (expected complications, physiological parameters and patient' satisfaction) pre / post the guidelines implementation:

Variables	Total nurses` practice			
	Pre guidelines		Post guidelines	
	Pearson Correlation	P-value	Pearson Correlation	P-value
Patients` expected complication	-0.014	0.943	-0.024	0.856
Patients` physiological parameters	0.010	0.958	0.531	0.018*
Patients` satisfaction	0.334	0.071	0.648	0.001**

Table (6) shows that there was positive corelation between total nurses' practice regarding caring of patients undergoing thoracentesis and patients' satisfaction level, and patients' physiological parameters post guidelines implementation, while there was negative correlation between total nurses' practice regarding caring of patients undergoing thoracentesis and patients' complications pre and post designed guidelines implementation.

Table (7): Correlation between Total nurses` knowlege satisfactory level regarding caring of patients undergoing thoracentesis and patient outcomes (expected complications, physiological parameters and satisfaction) pre /post the designed guidelines implementation:

Variables	Total nurses` knowledge			
	Pre guidelines		Post guidelines	
	Pearson Correlation	P-value	Pearson Correlation	P-value
Patients` complication	-0.301	0.106	-0.957	0.000**
Patients` parameters	0.258	0.169	0.039	0.839
Patients` satisfaction	0.077	0.685	0.369	0.045*

Table (7) shows that there was positive corelation between total nurses' knowledge regarding caring of patients undergoing thoracentesis and patients' satisfaction level, and patients' complications post designed guidelines implementation, while there was negative correlation between total nurses' knowlege regarding caring of patients undergoing thoracentesis and patients' physiological parameters pre and post designed guidelines implementation.

DISCUSSION

The discussion of the findings covered main parts:

Part 1: Demographic characteristics of the studied patients'

The present study revealed that the mean age of the studied patients (the study and control groups) are (56.06±14.89, 57.86±16.42) respectively. This result is in conformity with Krishna et al., (2021) who studied about complications of therapeutic thoracentesis with respect to time and reported that there are about two thirds of the studied patients are more than 50 years old, but disagreed with Shechtman et al., (2020) who conducted a study entitled as "Incidence and risk factors of pneumothorax following pre-procedural ultrasound-guided thoracentesis" and founded that The mean age of the patients was 66.8 (±15) years.

Concerning gender, the current study stated that about two thirds of control and study groups are males. This is in the same line with Shechtman et al., (2020) who founded that about two thirds of the studied patients are males, but contradicted with Sagar et al., (2020) who conducted a study on complications following symptom limited thoracentesis using suction and founded that 55% of the studied patients are females. From the researcher point of view that may be due to the prevalence of chest disorders is more in men than women for many reasons related to smoking, kind of work and so on.

As regards hospital department, about two thirds of the studied patients from study and control groups are from chest word. This contradicted with Galante, (2016) who studied about bed side thoracentesis among non-ventilated patients with respiratory instability and demonstrated that about two thirds of the studied patients are ICU patients.

Regarding patients' educational level, the recent study indicated that only few patients in study and control groups had high educational level and the majority of the studied patients are between not educated and low educational level. From the researcher point of view that supports the idea about increasing incidence of respiratory disorders among low socioeconomic section of the society and that relates to exposing to dust and smoke in the environment surrounding them and also poor housing and sanitation.

In relation to smoking more than half of patients in the current study in study and control groups are smokers. This finding is in the same line with Beltagy et al., (2022) who carried out a study on effect of inspiratory muscle training program on health outcomes among patients with thoracic surgery, and demonstrated that half of the studied patients are smokers. Also Tewatia et al., (2020) who studied about tobacco smoking as a risk factor for tuberculous pleural effusion: a case-control study, and reported that about three fourths of the studied sample were smokers. Also Tian et al., (2021) who carry out a study entitled "Prevalence, Causes, and Health Care Burden of Pleural Effusions among Hospitalized Adults in China" and demonstrated that smokers were more likely than nonsmokers to have malignant PE.

In relation to occupational exposure, the current study indicated that about one third of study group and one fifth of control group were exposed to inhalation of chemical materials. This is in the same line with Bielsa et al., (2022) who conducted a study about "Some pleural effusions labeled as idiopathic could be produced by the inhalation of silica" and showed that more than one third of study group and more than one fifth of controls were deemed to be exposed to silica. Occupational settings where inhalation of silica may occur include brickwork or any exposure to sand, crushed stone, paints, ceramics, abrasive powders, cements, or industrial/paint aerosols.

At baseline, this study revealed that there was no statistical significant differences between study and control patient groups regarding; age, Department, gender, and Smoking. This is in the same line with Hassaballa et al., (2022) who studied about Pleural manometry during thoracocentesis in patients with malignant pleural effusion and reported that there was no significant difference in age and sex between study and control groups.

Patients' physiological parameters:

Regarding patients' vital signs' parameters pre and post implementing the guidelines, the findings of this study revealed that there was statistical significant difference between control and study groups post implementing the designed guidelines as regards pulse and respiratory rates, this agreed with Muruganandan et al., (2020) who carried out a study on "The Pleural Effusion And Symptom Evaluation (PLEASE) study of breathlessness in patients with a symptomatic pleural effusion" and demonstrated that heart and respiratory rates showed modest decreases post-drainage that were of statistical clinical significance at p value p<0.0001.

But contradicted with Zielinska-Krawczyk et al., (2018) who found that there was a significant increase between RR at baseline and the last measurement point at (p = 0.0097) and asserted that thoracentesis resulted in a transient but significant increase in RR directly after the procedure. Also Zerahn et al., (1999) carried out a study on the effect of thoracentesis on lung function and transthoracic electrical bioimpedance and reported that there were no changes in HR apart from a temporary decrease after aspiration of the first 500 ml of thoracic fluid among his study groups.

As regards studied patients temperature; the recent study shows that there was no statistical significant differences as regards temperature between study and control group post guidelines implementations, from the researcher point of view that may be due to vital signs were assessed 30 minutes after the procedure and that may not reflect any observational changes in temperature. These results agreed with Kull, (2015) who conducted a study entitled "Thoracentesis in Cardiac Surgery Patients with Non-Specific Pleural Effusion: A Case-Control Study" and reported no cases of fever >38.3 0c among study or control group patients, also demonstrated no statistical significant differences between study and control groups regarding their body temperature.

Regarding Systolic and diastolic BP, the present study showed that there was statistical significant difference between study and control groups post guidelines implementation as regards diastolic BP, while there is no statistical significant difference regarding systolic BP, which contradicted with Grabczak et al., (2020) who studied about pleural pressure pulse in patients with pleural effusion: a new phenomenon registered during thoracentesis with pleural manometry, and demonstrated that there was no statistical significant differences between studied groups as regards systolic and diastolic BP. Also Zerahn et al., (1999) asserted that there was a statistical significant difference in systolic BP, while there was no statistical significant difference regarding diastolic BP.

As regards O2 saturation, this study revealed that there was statistical significant difference between control and study groups post implementing the guidelines, this agreed with Hassaballa et al., (2022) who reported a significance difference between study and control group regarding O2 saturation post thoracentesis procedure. Also, Lima, et al.,

(2020) reported a statistical significant improvement in O2 saturation of the studied patients regardless of the diagnosis.

Different results were reported by Muruganandan et al., (2020) who founded that there was no statistical significant difference at p value =0.29, also Grabczak et al., (2020) reported that there was no statistical significant difference between studied groups as regards O2 saturation. Also Taylor et al., (2021) who studied about the impact of thoracentesis on post procedure pulse oximetry, and reports that there is a small and clinically insignificant change in oxygen saturation as assessed via pulse oximetry 24 hours after thoracentesis.

Regarding dyspnea intensity level, this study shows that there was a statistical significant difference at P value (0.013), from the researcher point of view, symptomatic improvement after thoracentesis is generally correlated with increasing volumes of pleural fluid removed, that the relief of dyspnea following thoracentesis primarily is due to a reduction in the volume of the thoracic cage allowing the inspiratory muscles to operate at a more advantageous part of their length-tension curve. This result is in the same line with Muruganandan et al., (2020) who demonstrated that there was a significant improvement in dyspnea intensity level after procedure.

Same results reported by Hassaballa et al., (2022) who demonstrated that there was a statistical significant difference between study and control groups as regards to dyspnea and cough. And contradicted with Hansen et al., (2017) who studied about 'Early, dedicated follow-up and treatment of pleural effusions enhance the recovery rate after open cardiac surgery: results from a randomized, clinical trial" and found that there was no statistical significant difference regarding dyspnea level.

According to chest pain intensity level, the current study demonstrated that there was highly statistical significant difference as regards chest pain level at P value (0.000) between study and control group post guidelines implementation. This agreed with Maldonado, (2019) who conducted a study on "Impact of Pleural Manometry on Chest Discomfort after Therapeutic Thoracentesis" and reported that there was change in chest discomfort scores from pre-procedure to post-procedure.

This result disagreed with Dahlberg et al., (2020) who conducted a study on minimal clinically important difference for chest discomfort in patients undergoing pleural interventions, and reported that more than half of patients experienced either no improvement in chest discomfort or a 'small but significant increase' or a 'large or moderate increase' in discomfort following thoracentesis.

Expected patients' complications

This study revealed that there were statistical significant differences between study and control groups post guidelines implementation as regard expected patients' complications, this result agreed with Zhao et al., (2021) who carried out a study entitled "Analysis of the effect of infection prevention nursing on drainage of malignant pleural effusion with indwelling central venous catheter" and reported that there was a statistically significant difference at (P<0.05) between study and control group.

Regarding bleeding, hematoma, and wound at insertion site, this study revealed that there was a highly statistical significantdifference pre and post implementing the guidelines. Ault et al., (2018) identified only few bleeding complications post-thoracentesis procedures, only five of which were hemothoraxes (0.01%),

also Puchalski et al., (2021) found that the incidence of bleeding with thoracentesis was not any higher even in the presence of multiple bleeding risks such as elevated INR, thrombocytopenia, or use of anticoagulants.

This disagreed with the resent study results, from the researcher point of view, that is due to lack of experience of the physicians who carry out the procedure, in spite of using ultrasound that is considered to be the biggest contributor to the reduced incidence of bleeding complications. And it is recommended that physicians who carry out thoracentesis have to talk excessive training courses about the procedure recent guidelines. Guidelines now recommend the routine use of thoracic ultrasound guidance for most pleural procedures.

Regarding occurrence of change in deep or rate of respiration, decrease or absent breath sound in affected side, and sever chest pain, there was a highly statistical significant between study and control group post implementing the guidelines, this disagreed with Williams and Lerner, (2021) who carry out a study about "Managing complications of pleural procedures" Pain is reported following thoracentesis in anywhere from 5–39% of patients, and found no differences in the pain caused by the interventions evaluated.

Regarding irregular heartbeat, current study demonstrated that there was a statistical significant difference between study and control groups pre designed guidelines implementation, and a highly statistical difference between study and control groups post designed guidelines implementation, this this disagreed with Kull, (2015) who reported no statistical significance between study and control groups regarding irregular heartbeat.

Regarding Temporary decrease in O2 Sat, the current study revealed that there was a statistical significance between study and control group post guidelines implementation, this disagreed with Taylor et al., (2021) who founded that there was no significant improvement regarding SpO2 within-subject difference in 24 hours post procedure SpO2 compared with pre procedure SpO2. Also Hassaballa et al., (2022) reported asignificant decrease in Spo2 between study and control groups post procedure illustrated by a significant difference in post-procedural oxygen saturation between the control and case groups (94.7 ± 33.4 vs 92.3 ± 63.1) (p-value 0.001).

Concerning cough, current study revealed that there was statistical difference between study and control groups post guidelines implementation, this agreed with Hassaballa et al., (2022) who founded that there was a statistical significant differences between study and control groups as regards cough. Also, Dahlberg et al., (2020), who reported that only few of the studied patients needed to stop procedure due to cough, different results were reported by Stecka et al., (2022), who studied about "The impact of spontaneous cough on pleural pressure changes during therapeutic thoracentesis" and reported that majority of his study sample have experienced cough.

From the researcher point of view the patient should also be told how to minimize the risks; i.e., by proper position and remaining still. In the context of our results, we can hypothesize that cough during therapeutic thoracentesis can be perceived not only as an adverse effect of pleural fluid withdrawal but also as a factor contributing to a mechanism preventing the rapid and excessive decline of Ppl. The onset of chest discomfort, rather than coughing, was related with lower closure pleural pressures and

should be regarded as an indication to discontinue continued thoracentesis.

Regarding vasovagal reflex, this study reported non statistical significant differences between study and control groups pre and post guidelines implementation, this is in the same line with Dahlberg et al., (2020), who reported only few of his study sample experience vasovagal reflex. Any change in vital signs or patient condition should warrant immediate investigation for potential procedural complications. Same results were reported by Sagar et al., (2020) who indicated only few of the study sample experience vasovagal reflex.

Regarding subcutaneous emphysema, the current study revealed that there was statistical significant difference between study and control groups post implementing the designed guidelines, our results agreed with Wan et al., (2019) who studied about Safety and complications of medical thoracoscopy in the management on pleural diseases and reported only 3.3% of his study sample have subcutaneous emphysema.

Regarding occurrence of tracheal deviation to the affected side, dilated neck vein or death, the current study demonstrated no deaths, tracheal deviation to the affected and no dilated neck vein among study sample (study and control) groups as a complication of thoracentesis. This agreed with Wan et al., (2019) who reported only one case (0.1%) mortality among his study sample. Also Kull, (2015), repoted no mortality cases among his study sample. This result disagreed with Wahidi et al., (2017) who conducted a study about "Randomized Trial of Pleural Fluid Drainage Frequency in Patients with Malignant Pleural Effusions", and reported that about one fourth of the studied sample died before the end of the study.

Overall researcher point of view is that thoracentesis complication rates remain uncomfortably high, and attention must be placed on training and assessment of staff in this basic procedure. Ault et al., (2018) in a review of 9320 thoracentesis procedures, highlights the importance of operator experience, as well as several other patient and procedural factors that are associated with complications of thoracentesis.

Level of knowledge of studied nurses as regards thoracentesis procedure:

Concerning the studied nurses` total level of knowledge as regards thoracentesis procedure, this study illustrated that minority of the studied nurses had satisfactory level of knowledge pre the guidelines implementation, while the majority had satisfactory level of knowledge post the guidelines implementation. This indicates that the designed guidelines were significantly effective in improving the knowledge regarding care of thoracentesis among study subjects. Also, same results reported by Anjum, (2020) who found that more than three fourths of the studied nurses had good knowledge post implementing self-instructional module. The results raised the importance of training health care staff regarding care of patient undergoing thoracentesis.

This agreed with Chege, Mwaura & Kirui, (2018) who carried out a study entitled as "Evaluation of the Nursing Management for Patients on Underwater Chest Drainage at Kenyatta National Hospital and found that, Majority of the respondents were not aware of any guidelines in underwater chest drainage nursing management. Also, agreed with Hamada, (2020) who clarified that the studied nurses had unsatisfactory level of knowledge regarding Definition, contraindication,

complication of thoracentesis, pressure in pleural cavity, and improved post protocol intervention. It may indicate that lack of evidence-based nursing care and insufficient training has resulted in uncertainty and knowledge deficit in important aspects of thoracentesis care. It can be concluded that nurses receive training needs and training protocols about thoracentesis management. Seyma, Meral and Atiye, (2021) carried out a study entitled as "Nurses' Knowledge Levels About the Care of the Patients with Chest Tube" and recommended to develop a standardized procedure/protocol for the care of patients with chest tubes in order for nurses to provide a holistic nursing care to the patients.

Level of knowledge of studied nurses as regards patient's safety measures:

The recent study showed that majority of the studied nurses have unsatisfactory level of knowledge before guidelines implementation that reflects that there is an urgent need to train them so as to improve the safety nursing care of patients managed with thoracentesis while more than three fourths of them have satisfactory level of knowledge after implementing the guidelines. This is agreed with (Schildhouse et al., 2018) who demonstrated that appropriate training is central to procedural safety, and both simulation and direct observation by procedural experts have been shown by multiple investigators to improve knowledge and skill.

Also, James et al., (2021) who studied about a training program for ward based respiratory nurses on chest drain care and management and reported that participants' perceived ability to maintain patient safety improved from about half of participants before the course to almost all afterwards. And Mamdouh, Mohamed and

Abdelatief, (2020) study which indicated that about more than half of the study nurses had unsatisfactory knowledge regarding implementation of patient safety measures in intensive care units. But this result disagreed with Biresaw, Asfaw, and Zewdu (2020) who studied about knowledge and attitude of nurses towards patient safety and its associated factors, and reported that about half of his study sample was found to have good knowledge regarding patient safety.

It may due to lack of patient safety courses, although the majority of studied nurses had training courses that may be not updated and not continuous planned patient safety courses, this result might be attributed to the most of studied nurses didn't attended any in-service training program especially related to nursing management of patient recieved thoracentesis. The majority of the studied nurses were diploma graduates, and their knowledge gained during their study school years might be insufficient for such a specialized service. In addition to, there was a lack of supervision and regular evaluation system for nurse students during their clinical training practice.

These results are agreed with Yilmaz & Goris, (2015) who stated in the context entitled for" Determination of the patient safety culture among nurses working at intensive care units" reported that about two thirds of the study sample had unsatisfactory knowledge about patient safety rules and regulation. Also, this study consisted with patient safety authority (2015) which recommended that the majority of incidents reported were related to pressure sores, infection control, patient miss identification, patient falling and medication error due to defect in nurses knowledge.

As regards Studied Nurses' level of practice satisfactory level regarding management of

patients undergoing thoracentesis, this study illustrates that minority of the studied nurses have total satisfactory practice level before implementing the designed nursing guidelines, while majority of them have satisfactory practice level after implementing the guidelines. This result may be due to that the years of experience of most studied nurses were less than five years. And also represents that there was a highly statistical significant improvement in the nurses' satisfactory level of practice as regards the care of patients undergoing thoracentesis post the designed guidelines implementation compared to pre with (Mean ± SD= 83.801±1.584 versus 52.866±8.807 respectively) with statistically significant differences at P value (0.000).

This result agreed with Ibrahim & Elshemy, (2016) who reported that there are significance differences between pre and posttest in relation to nurses' practice. This is agreed with Schildhouse et al., (2018) who asserted that supplemental training outside of residency is useful to develop and maintain skills for thoracentesis, such as simulation with direct observation in a zero-risk environment.

An appropriate evidenced-base clinical guidelines and protocols should be developed for safe clinical practices. This result asserted that the identification of nurse's educational needs regarding chest drains care is urgently required to improve clinical practice and reducing unnecessary complications.

This agreed with Hamada, (2020) who demonstrated that there was a high statistical significant differences in practice scores of nurses related to all items of evaluation pre and post intervention of nursing protocol. this result might be due to using adequate sessions, different teaching strategies as discussion, lecture, demonstration and re-demonstration,

using media as handout including pictures and knowledge as well as availability of sufficient materials and supplies needed for achievement of the work, this motivated the studied nurses to achieve the desired objectives through rewarding and acknowledgement of positive attitude and discouragement of negative attitudes. All nurses participated in the program had received a handout of the program content. Also, continue reinforcement for both knowledge and practice was done in each session. This results asserts that most nurses require referring to the guidelines and or assistance by a more competent colleague to bridge their competence gap.

Correlation between the studied variables:

These results asserted that that the practice of nurses improved thorough theoretical knowledge that increase nurses" ability to prioritize interventions and all kinds of knowledge must be used in order to ensure professionally safe practice of the discipline

As regards correlation between total satisfactory level of nurses` practice regarding caring of patients undergoing thoracentesis and patient outcomes, this study illustrated that there was positive correlation between total nurses' practice regarding caring of patients undergoing thoracentesis and patients' satisfaction level, and patients' physiological parameters post designed guidelines implementation, from the researcher point of view that is nurses practices such as assuring patients, relieving stresses and controlling pain which had been asserted duiring implementing the guidelines reflected on the patient physiological status such as respiratory and heart rate, and for sure affects his satisfaction level regarding the procedure.

This results in the same line with Kersu, et al., (2020), who studied about "Determination of

The Relationship Between Perception of Nursing Quality and Satisfaction Status of Patients Hospitalized in Surgical Services" and founded that there was a significant positive correlation was found between the total score of the patients' care scale and the total score of nursing care satisfaction (p <0.05). But disagreed with Soliman, (2015), who carried out a study entitled "Correlation Between Patients Satisfaction And Nurses Caring Behaviors" and demonstrated that there was negative correlation between nurses' caring behaviors (performance) and patients' satisfaction. (r= 0.06, p > 0.05.

while there was negative correlation between total nurses' practice regarding caring of patients undergoing thoracentesis and patients 'complications post designed guidelines implementation and that from the researcher point of view reflects the importance of involving physicians in guidelines implementation as the procedure mainly done by them.

As regards correlation between total nurses` knowledge satisfactory level regarding caring of patients undergoing thoracentesis and patient outcomes (expected complications, physiological parameters and satisfaction), this study shows that there was positive correlation between total nurses' knowledge regarding caring of patients undergoing thoracentesis and patients' satisfaction level, and patients' physiological parameters post guidelines implementation, while there was negative correlation between total nurses' knowledge regarding caring of patients undergoing thoracentesis and patients 'complications pre and post designed guidelines implementation.

Conclusion

According to the results of this study, it was concluded that the nursing guidelines documented a positive impact on the patient outcomes. Also there was positive correlation between total nurses' practice regarding caring of patients undergoing thoracentesis and patients' satisfaction level, and patients' physiological parameters post guidelines implementation. And there was positive correlation between total nurses' knowledge regarding caring of patients undergoing thoracentesis and patients' satisfaction level, and patients' complications post designed guidelines implementation.

Also the nursing guidelines had appositive effect on nurses' level of knowledge and practice post the designed guidelines implementation, and there is positive correlation between total knowledge and total practice post implementing the guidelines.

Recommendations

Based on the results of the current research, the following suggestions for future research and practice are proposed:

(I)   : In services:

☐   Routine supportive supervision of nursing staff working in the chest care units after training and focusing on knowledge and practice provides feedback about the effectiveness of educational programs.

☐   Develop nurses' job description that include all their responsibilities toward patient's care starting from history taking and ended by explaining how nurses work collaboratively with the general practice team to meet the patient's needs, supported by policy and procedures, and providing nurse leadership as required.

☐   Finding out the factors that hinder the nurses in providing care for patients with thoracentesis among staff nurses should be

maintained in an exploratory study to find out the difficulties experienced by the nurses in providing care to the patient undergoing thoracentesis.

(II): In Education

☐   Periodically updating the knowledge of Health care personnel

☐   Conduction of periodic training sessions to improve practices about assessment and management of patients undergoing thoracentesis will improve nurses' level of performance regarding care of patient with AMI during the golden hours.

(III): In Research

☐   The findings of the study have added to the existing body of the knowledge in the care of patients undergoing thoracentesis.

☐   The suggestions and recommendations for conducting further study can be utilized by other researchers.

☐   The study on a large sample required from different hospitals should be maintained, in different geographical area in Egypt.

☐   Nurse's educational needs regarding thoracentesis care should be assessed to improve clinical practice and reducing unnecessary complications.

(IV): Recommendations for Future Studies

☐   Replication of this study on a larger probability sample from the different geographical locations at the Arab Republic of Egypt and further research to explore why nurses do not always have the appropriate knowledge or skills regarding thoracentesis.

☐   Further researches are recommended periodically to be carrying out new approaches in the area of management of thoracentesis and

evaluating its reflection on patients' outcomes taking into consideration factors affecting nurses' performance.

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