

Nurses' Performance Regarding Patients Undergoing Therapeutic Plasma Exchange

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Abstract

Background: Therapeutic plasma exchange is a procedure which removes plasma that contains circulating pathogenic substances, such as auto reactive antibodies, immune complexes, paraproteins, lipoproteins, inflammatory mediators like cytokines and return of the patient's blood components along with replacement fluid such as 5% albumin, fresh frozen plasma (FFP) or a combination of a crystalloid and colloid solution. **Aim of the study:** Assess nurses' performance regarding patients undergoing therapeutic plasma exchange. **Research design:** A descriptive exploratory design was utilized. **Setting:** The study was conducted at the therapeutic plasma exchange room in the combined dialysis unit affiliated to Ain Shams University Hospitals. **Subjects:** A convenience sample of all available nurses (no= 35) who are working in the previously mentioned setting. **Tools:** Two tools were used in the current study: Tool 1) self-administrated questionnaire and tool 2) observational checklist. **Results:** More than three quarters of the studied nurses had unsatisfactory level of total knowledge and had incompetent level of total practice regarding the patients undergoing therapeutic plasma exchange. There was a highly statistically significant relation between total nurses' education level, attendance of training courses for therapeutic plasma exchange and nurses' level of knowledge and practice. **Conclusion:** It can be concluded that the majority of studied nurses had poor nurses' performance (knowledge and practice) and there was positive correlation between total knowledge score and total practices score regarding care of patients undergoing therapeutic plasma exchange. **Recommendations:** Nursing educators and clinical facilitators must incorporate strategies using learning opportunities to raise awareness of nursing staff about topics of TPE' knowledge and practice. Ongoing and regular in-service training regarding basic procedures as: pre procedure, during procedure and post procedure of TPE.

Keywords: Nurses' performance, Patient, Therapeutic plasma exchange (TPE).

Introduction:

Therapeutic plasma exchange (TPE) is a procedure carried out for various life-threatening diseases as principal mode of treatment or as an adjunct with other therapies. It is a process involving extracorporeal removal of plasma from other components of blood, discarding and replacing plasma with physiological fluids such as (albumin or fresh frozen plasma) or a combination of crystalloids/colloid solution. (Walsh et al., 2020)

Therapeutic plasma exchange is a procedure in which blood of the patient is passed through a medical device which separates plasma

from other components of blood to remove large molecular weight substances bound to plasma proteins (pathogenic auto-antibodies, immunocomplexes, endotoxins, endogenous toxins or exogenous poisoning and cholesterol containing lipoproteins). (seyhanli et al., 2022).

The effectiveness of the treatment depends on the volume of blood being processed, the volume of the plasma exchanged in each process, the number of operations performed, the frequency of exchange, and the rate of mobilization, stabilization, and re-synthesis of cells or plasma components. (seyhanli et al., 2022).

The role of nurse is very important and multiple in managing patients undergoing TPE, as the nurse should assist the patient to get information, maintain safety, and obtain appropriate care inside the framework of nursing process. Also, the clinical responsibilities of the nurse include adherence to quality assurance criteria aiming to provide high quality healthcare services. (Hamza et al., 2019).

Therapeutic plasma exchange` nurses should have knowledge about blood plasma , indication and contraindications of TPE , difficulties and risks of procedures, formula to estimate plasma volume, types of replacement solution according to the diagnosis, average duration of each TPE session, replacement therapy for electrolytes deficiency (calcium, phosphorus, magnesium, potassium and others), complications (hypocalcaemia, hypomagnesaemia, hypokalemia, hypophosphatemia, cardiac arrhythmia, allergic reaction and others . (Hassan et al., 2022).

Before the beginning of therapeutic TPE, the nurse is in charge for the confirmation of the identity of the patient, the patient's informed consent to perform the treatment, taking a full patient history, the preparation of TPE machine, liquids of substitution and set of venipuncture but also the effective use of TPE equipment. Nurses should assess of patient's I.V line or internal venous catheter, size, patency, assess patient's history for allergy (medication or food), diabetes mellitus and hypertension, assess vital signs, lab investigation, prepare the substitute liquid fresh frozen plasma (FFP), albumin 5% + 400 Normal saline 0.9%. (Golsorkhi et al., 2022).

During TPE procedure, the role of nurse is focused in monitoring of the patient's care sheet (vital signs, side effects, medication administered, blood flow, blood pump, amounts of ingested and secreted substitution, replacement fluids and anticoagulants used). Patient's monitoring includes a series of repetitive or continuous observations concerning any symptoms such as flushing, itching, nausea, vomiting, diarrhea, fever, chills, headache, back pain, fall in blood pressure, bleeding, hypocalcemia, hypokalemia or signs of infection, bleeding or hematoma at sites of venipuncture and documentation of the

physiological state of the patient during TPE . (Kong et al., 2020)

After the completion of TPE session and the removal of the needles, great care should be paid to the management of venous access and carefully inspection for any bleeding. Also, nurse should apply post procedure reassessment, intake and output chart, vital signs monitoring, post procedure health teaching, dealing with complications if occurred. The patient is informed about the feeling of tiredness for one or two days, recommend the patient to rest and avoid tedious activities and to avoid crowding and close contact with people who are sick. (Hamza et al., 2019)

Aim of the Study

This study aimed to:

Assess nurses' performance regarding Patients undergoing therapeutic plasma exchange through the following:-

1. Assess nurses' level of knowledge regarding patients undergoing therapeutic plasma exchange.
2. Assess nurses' level of practice regarding patients undergoing therapeutic plasma exchange.

Operational definition of Nurses' Performance: is concerned with nurses` knowledge and practice regarding patients undergoing therapeutic plasma exchange.

Study questions:

The study was conducted to answer the following questions:-

1. What is the nurses' level of knowledge regarding patients undergoing therapeutic plasma exchange?
2. What is the nurses' level of practice regarding patients undergoing therapeutic plasma exchange?

Subjects and Methods:

Study design: A descriptive exploratory research design was utilized to achieve the aim of the present study.

This design is concerned with description of phenomenon of interested

focuses on a single group or population characteristics without trying to make interference (Leavy, 2017).

Study Setting: The study was conducted at the therapeutic plasma exchange room in the combined dialysis unit affiliated to Ain Shams University Hospitals. Therapeutic plasma exchange room contains 6 Fresenius therapeutic plasma exchange machines including 2 (Hepatitis C Virus) HCV machines and 1 SICHUAN Nigale machine, 6 chairs for patients, 1 oxygen cylinder, emergency medicine trolley, and Cardio Pulmonary Resuscitation (CPR) equipment, 3 blood pressure measurement devices, 3 pulse Oximeters, 2 water basins, 1 refrigerator for plasma, weight and height measurement scale, 6 insulating curtains, 1 electric heater and cupboard for all tools of unit.

Subjects: A convenience sample of all available nurses (no= 35) who are working in the previously mentioned setting and providing care for patients undergoing therapeutic plasma exchange were recruited in this study.

Study tools: Two tools were used in current study for data collection as following:

Tool I: Nurses' Self-Administered Questionnaire

It was developed by the investigator in a simple Arabic language after reviewing the recent related literatures and it composed of the following 2 parts:

* **Part one:** Is concerned with demographic characteristics of nurses under study such as age, gender, level of education, training course for TPE, availability of a written policy in the unit regarding TPE and years of experience.

* **Part two:** Nurses' Knowledge Questionnaire : This part was developed by the investigator in an Arabic language to evaluate nurses' level of knowledge regarding patients undergoing therapeutic plasma exchange, it was guided by (Reddy,2021), (Sergent& Ashurst, 2022), (Transfusion and Apheresis Science, 2019) ,(International Society for

Apheresis, 2019), (National Health Service blood and transplant, 2019), (Neyrinck & Vrielink, 2019) ,(Zantek et al ., 2019) it consisted of 45 questions in the form of multiple choices question (MCQ) ,which divided into 4 sections:

* **First section:** Is concerned with general knowledge about therapeutic plasma exchange that was included 19 question in the form of multiple choices question (MCQ), this section is consisted of 12 subsections.

* **Second section:** Deals with the role of the nurse before starting the therapeutic plasma exchange procedure that was included 9 question MCQ, this section was consisted of 2 subsections.

* **Third section:** It includes the role of the nurse during the therapeutic plasma exchange procedure that was included 9 question MCQ, this section was consisted of 3 subsections.

* **Fourth section:** concerned with the role of the nurse after the therapeutic plasma exchange procedure that was included 8 MCQ, this section was consisted of 3 subsections.

❖ The scoring system

Scoring system of nurses' knowledge regarding therapeutic plasma exchange was 45 grades. The correct answer scored (1grade) and incorrect or unanswered questions scored (zero).The total score of the knowledge assessment for every nurse was summed-up, and then converted to percentage score. The total level of nurses' knowledge score categorized as following:-

- More than or equal 80% (≥ 36 grades) was considered satisfactory level of knowledge.
- Less than 80% (<36 grades) was considered un-satisfactory level of knowledge.

Tool II: Nurses' practice Observational Checklist

This tool was adapted from (Sergent & Ashurst, 2022), (National Health Service blood and transplant, 2019), (Kozier et al., 2019), (Lister et al., 2018), (Berman et al.,

2017), (Carol &patricia., 2016), to evaluate nurses' practice regarding patients undergoing therapeutic plasma exchange (pre, during and post procedures) and modified by the investigator after reviewing the related literature and reviewed by supervisors to achieve aim of this study. It composed of three sections:

***First section:** Pre procedure of therapeutic plasma exchange, 37 steps composed of (No 1- 15 steps) in patient's preparation and from (No 16-37 steps) in machine's preparation.

***Second section:** During the procedure of therapeutic plasma exchange, included 29 steps from (No 1-29 steps).

***Third section:** Post procedure of therapeutic plasma exchange, included 13 steps from (No 1- 13 steps).

❖ Scoring system

The total score for practice observational checklist was (79) score, graded into (1) mark was given for correctly done, while (zero) not done step. It was graded into:

- More than or equal 80% (≥ 63 score) was considered competent level of practice.
- Less than 80% (< 63 score) was considered incompetent level of practice.

Operational design:

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

A- Preparatory Phase:

It includes reviewing of current and past local and international available related literature and theoretical knowledge of various aspects of the study using books, articles, internet periodicals and magazine in order to develop the data collection tool.

B- Tools Validity:

Face and Content validity was conducted to test the tool for appropriateness, relevance, correction and clearance through a

jury of (7) experts, two professors , four assistant professor and one lecturer from the medical surgical nursing staff at the Faculty of Nursing Ain Shams University. The experts reviewed the tools for format, clarity, relevance, simplicity, accuracy, comprehensiveness, and applicability, and minor modification was done.

C-Tools Reliability: It was referred to the extent to which the same answers can be obtained by using the same instruments more than one time (*Grove et al., 2014*); Testing reliability of the proposed tools was done statistically by Cronbach alpha test.

Testing the reliability of the tools.

Testing reliability of the proposed tools was done statistically by Cronbach alpha test.

Cronbach alpha for Tool I: Nurses' Self-Administered Questionnaire was 0.821 and Cronbach alpha for Tool II: Nurses' practice Observational Checklist was 0.847

D-Pilot Study:

Before performing the actual study, a pilot study was carried out on (6nurses) 20% of the nurses from the study subjects to test the clarity, applicability and feasibility of the constructed tools .The pilot has also served to estimate the time needed for each subject to fill the questionnaire. According to the results of the pilot, no corrections and no omissions of items were performed, so the pilot subjects were included in the main study sample.

E-Field work:

1. An approval was obtained from the Dean of Faculty of Nursing, Ain Shams University.
2. An Approval was obtained from hospital director and nurse director of Ain Shams University hospital.
3. An Approval of the nurses was obtained written before collecting data and after explaining the purpose of the study.
4. The Purpose of the study was simply explained to the nurses under study prior to any data collection.
5. Self-administered questionnaire was distributed to the nurses in their work place,

after finishing from the procedure with the patients. Sometimes the self-administered questionnaire was distributed to the nurses before beginning of the procedure. The two parts of self-administered questionnaire (demographic data & nurses' knowledge questionnaire) were filled by the nurses themselves. It was taken 20-30 minutes to fill it by each nurse in the presence of the investigator.

6. Nurses observational checklist filled by investigator during nurses work in the morning and afternoon shifts, 3 days every week in different days, meeting about 1-2 nurse each time.

F-Ethical considerations:

The following study ethics were considered and maintained during the study:

- A written approval was obtained from scientific ethical committee in Faculty of Nursing at Ain Shams University to carry out this study.
- The investigator clarified the objective and aim of the study to the nurses included in the study.
- Nurses were informed that they allowed to choose either to participate or not in the study and that they have the right to withdraw from the study at any time.
- The investigator assured maintaining anonymity and confidentiality of the nurses included in the study.

3- Administrative design

To carry out this study in the selected setting, official letters were issued from the Faculty of Nursing Ain Shams University explaining the aim of the study to obtain the permission for collecting of the data; this letters were submitted to the hospital director and the director of dialysis unit at Ain Shams University Hospital.

4- Statistical design

The statistical analysis of data was done by using the computer software of Microsoft Excel Program and Statistical Package for Social Science (SPSS) version 25. Data were presented using descriptive statistics in the form of frequencies and percentage for categorical data,

the arithmetic mean (\bar{X}) and standard deviation (SD) for quantitative data. Qualitative variables were compared using chi square test (χ^2), P-value to test association between two variables and Pearson correlation test (r- test) to the correlation between the study variables.

Degrees of significance of results were considered as follows:

- P-value > 0.05 Not significant (NS)
- P-value \leq 0.05 Significant (S)
- P-value \leq 0.01 Highly Significant (HS).

Results:

Table (1): shows that, 42.8% of the studied nurses their age ranged between 20-<30 years, the Mean \pm SD of age is 33.7 \pm 8.09 years. As regard to gender, 68.6% of them were female. Also, 42.9% and 31.4% of the studied nurses have nursing diploma and nursing technical institute, respectively. Also, 48.6% of the studied nurses had 5-< 10 years of experience in therapeutic plasma exchange, the Mean \pm SD of years of experience is 7.48 \pm 4.01 years. Moreover, 31.4% of them had training courses for therapeutic plasma exchange, 81.8% of them had one course. In addition, 91.4% of them stated that there is a written policy (written guidelines and posters on the walls of the unit) regarding therapeutic plasma exchange, 84.4% of them read it.

Table (2): shows that, **80.0% and 85.7%** of the studied nurses had unsatisfactory level of total knowledge regarding the general knowledge about therapeutic plasma exchange and the nurse's role before therapeutic plasma exchange, respectively. Also, **77.1% and 65.7%** of them had unsatisfactory level of total knowledge regarding the nurse's role during and after therapeutic plasma exchange, respectively. Also, the total score of mean and standard deviation of total knowledge is **(31.40 \pm 4.57)**. In which the highest level of Mean \pm SD is for General knowledge about therapeutic plasma exchange **(12.85 \pm 2.42)**. While lowest level of Mean \pm SD is for Nurse's role before therapeutic plasma exchange **(5.88 \pm 1.30)**.

Table (3): clarifies that, **77.1% and 80.0%** of the studied nurses had incompetent level of total practice regarding nurse's role before beginning and during therapeutic plasma exchange's procedure, respectively. Also, **68.6%** of them had incompetent level of total practice

regarding the nurse's role after finishing from procedure of therapeutic plasma exchange, respectively. Also, shows the total score of mean and standard deviation of total practice is (57.64 ± 5.79). In which the highest level of Mean ± SD is for pre procedure of therapeutic plasma exchange (25.48 ± 3.53).

Table (4): displays that, there is a highly statistically significant relation between total nurses' knowledge with their education level and attendance of training courses for therapeutic plasma exchange (P=0.001 and 0.000) respectively. Also, there is statistically significant relation between total nurses' knowledge with their years of experience and availability of a written policy in the unit regarding therapeutic plasma exchange (P=0.048 and 0.035) respectively. While, there is no statistically significant relation between total nurses' knowledge with their age and gender (P=0.741 and 0.619) respectively.

Table (5): shows that, there is a highly statistically significant relation between total nurses' practices with their education level and attendance of training courses for therapeutic plasma exchange (P= 0.001 and 0.003)

Table (1): Frequency distribution of the studied nurses according to their **demographic data** (n=35).

Items	N	%
Age (year)		
20-<30	15	42.8
30-<40	12	34.3
≥40	8	22.9
Mean ± SD	33.7 ± 8.09	
Gender		
Male	11	31.4
Female	24	68.6
Educational level		
Nursing diploma	15	42.9%
Nursing technical institute	11	31.4%
Bachelor of nursing	9	25.7%
Number of years of experience in therapeutic plasma exchange		
1-< 5	14	40.0
5-< 10	17	48.6
≥ 10	4	11.4
Mean ± SD	7.48 ± 4.01	
Attending training courses for therapeutic plasma exchange		
Yes	11	31.4
Number of courses (n=11)		
One	9	81.8
Two	2	18.2
A written policy in the unit regarding therapeutic plasma exchange.		
Yes	32	91.4
Read therapeutic plasma exchange policy (n=32)		
Yes	27	84.4

respectively. Also, there is statistically significant relation between total nurses' practice with their years of experience and availability of a written policy in the unit regarding therapeutic plasma exchange (P= 0.046 and 0.027) respectively. While, there is no statistically significant relation between total nurses' practice with their age and gender (P= 0.821 and 0.503) respectively.

Table (6): indicates that, there was highly significant positive correlation between total knowledge score and total practices score regarding patients undergoing therapeutic plasma exchange among the studied nurses (P= 0.000).

Figure (1): shows that, 80.0% of the studied nurses had unsatisfactory level of total knowledge regarding the therapeutic plasma exchange. While, 20.0% of them had satisfactory level of total knowledge.

Figure (2): shows that, 77.1% of the studied nurses had incompetent level of total practice regarding patients undergoing therapeutic plasma exchange. While, 22.9% of them had competent level of total practice.

Table (2): Frequency distribution of the studied nurses according to **total knowledge** subscales regarding therapeutic plasma exchange (**n=35**).

XItems	Satisfactory		Unsatisfactory		Mean ± SD
	N	%	N	%	
General knowledge about therapeutic plasma exchange	7	20.0	28	80.0	12.85 ± 2.42
Nurse's role before therapeutic plasma exchange	5	14.3	30	85.7	5.88 ± 1.30
Nurse's role during therapeutic plasma exchange	8	22.9	27	77.1	6.51 ± 1.37
Nurse's role after therapeutic plasma exchange	12	34.3	23	65.7	6.14 ± 1.14
Total score of Mean ± SD = 31.40 ± 4.57					

Table (3): Frequency distribution of the studied nurses according to their **total practice subscales** regarding patients undergoing therapeutic plasma exchange (**n=35**).

Items	Competent		Incompetent		Mean ± SD
	N	%	N	%	
Pre procedure of therapeutic plasma exchange	8	22.9	27	77.1	25.48 ± 3.53
During the procedure of therapeutic plasma exchange	7	20.0	28	80.0	23.02 ± 1.97
Post procedure of therapeutic plasma exchange	11	31.4	24	68.6	9.14 ± 1.08
Total score of Mean ± SD = 57.64 ± 5.79					

Table (4): Relation between demographic data of the studied nurses and their total knowledge regarding therapeutic plasma exchange (**n=35**).

Demographic data		Levels of total knowledge				X ²	P-Value
		Satisfactory (n=7)		Unsatisfactory (n=28)			
		N	%	N	%		
Age (years)	20-<30	4	57.1	11	39.3	1.250	0.741
	30-<40	2	28.6	10	35.7		
	≥40	1	14.3	7	25		
Gender	Male	2	28.6	9	32.1	1.000	0.619
	Female	5	71.4	19	67.9		
Education level	Nursing Diploma	0	0.0	15	53.6	13.96	0.001**
	Nursing Technical Institute	1	14.3	10	35.7		
	Bachelor of Nursing	6	85.7	3	10.7		
Number of years of experience	1-<5	4	57.1	10	35.7	5.011	0.048*
	5-<10	1	14.3	16	57.2		
	≥ 10	2	28.6	2	7.1		
Attending training courses for therapeutic plasma exchange	Yes	7	100.0	4	14.3	15.57	0.000**
	No	0	0.0	24	85.7		
Availability of a written policy in the unit regarding therapeutic plasma exchange	Yes	7	100.0	25	89.3	4.466	0.035*
	No	0	0	3	10.7		

No significant at $p > 0.05$. *Significant at $p < 0.05$. **highly significant at $p < 0.01$.

Table (5): Relation between demographic data of the studied nurses and their total practice regarding patients undergoing therapeutic plasma exchange (n=35).

Demographic data	Levels of total practice				X ²	P-Value	
	Competent (n=8)		Incompetent (n=27)				
	N	%	N	%			
Age (years)	20-<30	2	25.0	13	48.2	0.725	0.821
	30-<40	4	50.0	8	29.6		
	≥40	2	25.0	6	22.2		
Gender	Male	3	37.5	8	29.6	1.000	0.503
	Female	5	62.5	19	70.4		
Education level	Nursing Diploma	0	0.0	15	55.6	17.93	0.001**
	Nursing Technical Institute	2	25.0	9	33.3		
	Bachelor of Nursing	6	75.0	3	11.1		
Number of years of experience	1-<5	1	12.5	13	48.2	7.769	0.046*
	5-<10	5	62.5	12	44.4		
	≥ 10	2	25.0	2	7.4		
Attending training courses for therapeutic plasma exchange	Yes	8	100.0	3	11.1	14.63	0.003**
	No	0	0.0	24	88.9		
Availability of a written policy in the unit regarding therapeutic plasma exchange	Yes	8	100.0	24	88.9	8.2274	0.027*
	No	0	0.0	3	11.1		

No significant at p > 0.05. *Significant at p < 0.05. **highly significant at p < 0.01.

Table (6): Correlation between total knowledge score and total practices score regarding patients undergoing therapeutic plasma exchange among the studied nurses (n=35).

Items	Total knowledge	
	R	P-Value
Total practices	0.572	0.000**

r= correlation coefficient test. **highly significant correlation at p < 0.01.

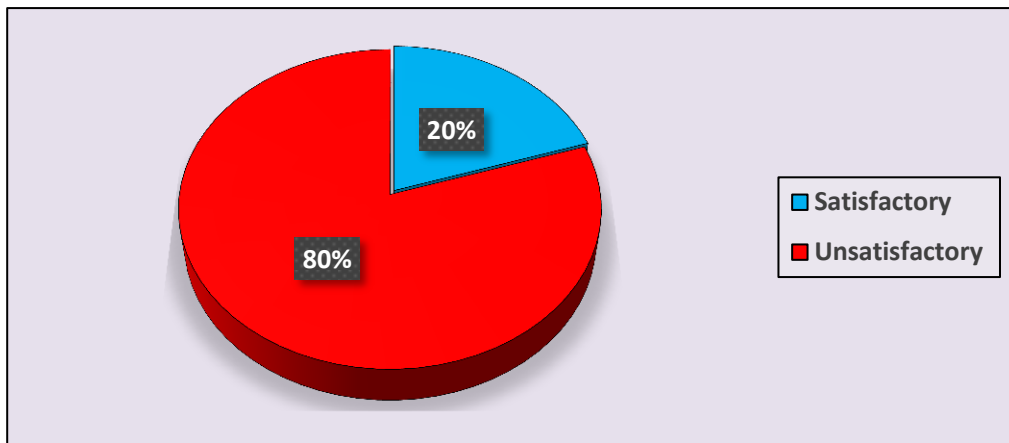


Figure (1): Percentage distribution of the studied nurses according to their total knowledge regarding therapeutic plasma exchange (n=35).

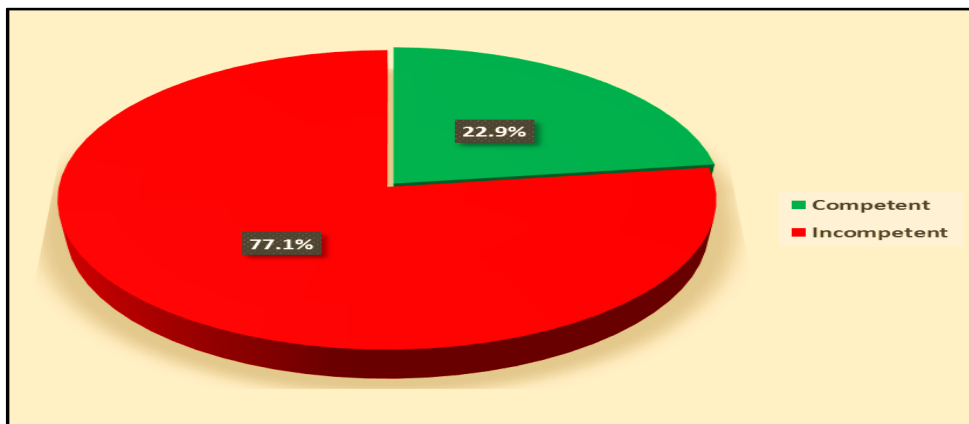


Figure (2): Percentage distribution of the studied nurses according to their total practice regarding patients undergoing therapeutic plasma exchange (n=35).

Discussion:

Therapeutic plasma exchange procedure is an advanced, established, safe, rapid, and effective extracorporeal procedure which used in the treatment and management of various diseases and is achieved through removing toxins, destructive antibodies, medications, and clotting factors from the circulation. (Hamza et al., 2019).

The role of clinical practice, nurse responsible about TPE to be an effective practitioner able to establish and maintain high quality evidence-based nursing services and to work with the multi-disciplinary team to ensure that patients receiving plasma exchange have access to specialist care, knowledge able and expertise. (Sergent & Ashurst, 2021). Nurses responsible about continuous evaluation for patients undergoing TPE through physical examination, analysis and interpretation of the results of laboratory tests, evaluation before the first TPE session and assessment of each session (before, after and during it). (Huang et al., 2018).

The current study was conducted to assess nurses' performance regarding Patients undergoing therapeutic plasma exchange. This aim was achieved through the following: (1) Assess nurses' level of knowledge regarding patients undergoing therapeutic plasma exchange. (2) Assess nurses' level of practice

regarding patients undergoing therapeutic plasma exchange.

Discussing the findings of the current study is categorized under four main parts. **The first part** is concerned with demographic data of the studied nurses, **the second part** deals with Nurses' knowledge regarding patients undergoing therapeutic plasma exchange, **the third part** includes Nurses' practice regarding patients undergoing therapeutic plasma exchange, **the fourth part** is concerned with relationship between studied variables and **the fifth part** is concerned with correlation between studied variables.

Part I: Demographic characteristics of the studied nurses.

Regarding the age of the nurses, the results of current study revealed that more than one third of the studied nurses were their age ranged between 20-<30 years, the Mean \pm SD of age is 33.7 ± 8.09 years. This finding was in agreement with (Hassan et al., 2022) who conducted a study about "Nurses' Knowledge and Practices toward Patients Undergoing Plasmapheresis" who indicated that more than half of the studied nurses were from 20 years old to less than 30 years old. This explains that most of nurses were newly graduated and young.

Regarding the gender, the present study showed that, more than two third of the studied

nurses were females. This findings was consistent with the study carried by (**Hassan et al., 2022**) who indicated that nearly three quarters of the studied nurses were females. From the investigators' point of view, it could be justified with most of nurses were in various countries are females, by the nature of femininity of this job.

Regarding the educational level, the present study results indicated that less than half of the studied nurses had nursing diploma. This finding was on the same line with (**Hadi& Alreda, 2021**) who conducted study entitled "Assessment of Nurses' knowledge and Practices Concerning Hemodialysis Adequacy Guideline in Baghdad Teaching Hospitals" who reported that near to half of studied nurses had nursing diploma. This might be due to a lot of nurses in governmental hospital had nursing diploma.

Regarding years of experiences, the present study result found that near to half of studied nurses having 5-<10 years of experience. This finding was in accordance with (**Yones et al., 2019**) who conducted a study which entitled "Assessment of nurses' performance regarding caring of patients on anticoagulant therapy in port-said hospitals" who reported that near to half of studied nurses having 5-<10 years of experience.

This findings was disagreed with (**Hassan et al., 2022**) who reported that more than half having 1-5 years of experiences, also this finding was contrary with (**Elbashir, 2017**) who conducted a study which entitled " Nurses' knowledge Regarding Nursing Care of Venous Access" which revealed that near to half having 1-5 years of experience.

Regarding attending courses, the present study results showed that near to one third attended courses about therapeutic plasma exchange and that majority of them attended one course. This finding was in disagreement with (**Hassan et al., 2022**) who revealed that the majority of the studied nurses didn't attend any courses. Moreover, was disagreed with (**Elbashir, 2017**) who reported that more than three quarter didn't attend courses about venous

access management. This finding was refer to that two third of studied nurses didn't interested in attending courses and didn't have the desire to learning evidence care practice.

Regarding total knowledge, the results of the current study indicated that more than three quarter of the studied nurses had unsatisfactory level of total knowledge regarding patients undergoing therapeutic plasma exchange. This finding was agreed with (**Hassan et al., 2022**) who reported that more than half of studied nurses had unsatisfactory level of knowledge. Also, this finding was in agreement with (**Yones et al., 2019**) who reported that two third of studied nurses had unsatisfactory level of knowledge toward anticoagulant management.

The reason from the investigator's point of view, this inadequacy of nurses' knowledge reflects the fact that one third of the studied nurses were their age ranged between 20-<30 years, recently graduated and they are not prepared or knowledgeable enough to provide evidence based experience or specialty nursing care. Also, these finding may be due to not attending training courses, near to half of studied nurses had nursing diploma degree , high turnover of nurses and annual leaves for child care that effect on number of nurses.

Regarding total practice, the results of the current study indicated that more than three quarter of the studied nurses had incompetent level of total practice regarding the patients undergoing therapeutic plasma exchange. This finding was agreed with (**Hassan et al., 2022**) who reported that majority of studied nurses had low level of practice. Also, this finding was in agreement with (**Yones et al., 2019**) who reported that less than three quarter of studied nurses had unsatisfactory level of practice.

The reason from the investigator's point of view, this inadequacy of nurses' practice reflects the fact more than three quarter of them had un-satisfactory level of knowledge, not attending of training programs for practical procedure, lack of awareness of the importance of attending courses programs, written policy

and near to half of studied nurses had nursing diploma degree.

Regarding relation between total level of nurses` knowledge and demographic data.

The present study results showed that there was a highly statistically significant relation between total nurses' knowledge with their education level and attendance of training courses for therapeutic plasma exchange. This finding was in agreement with **(Raynak et al., 2020)** who conducted study about "Nurses' knowledge on routine care and maintenance of adult vascular access devices" who reported that there was significant relation between educational level and their knowledge level.

This finding was contrary with **(Yones et al., 2019)** who reported that there was no statistically significant between nurses` knowledge and nurse's educational qualifications and attendance of training courses. The reason from the investigator's point of view, that nurses with a bachelor's degree have better information and work more scientifically and accurately than nurses with a diploma or technical institute. Also, the more attendance of educational courses and programs, has positively effects on the nurses' information and performance

Regarding relation between total level of nurses' practice and demographic data.

The present study results showed that there was a highly statistically significant relation between total nurses' practices with their education level and attendance of training courses for therapeutic plasma exchange. This finding was agreed with **Saleh et al., 2018** who reported that there was highly statistically significant relation between nurse's qualification and their performance.

This finding was disagreed with **(Hassan et al., 2022)** who reported that there was no a statistically significant between nurse's educational level, training courses and their performance. This finding was inconsistency with **(Yones et al., 2019)** who reported that there was no statistically significant between nurse's educational level, training courses and their practice.

Regarding Correlation between total knowledge score and total practices score.

The present study results showed that, there was highly significant positive correlation between total knowledge score and total practices score regarding patients undergoing therapeutic plasma exchange among the studied nurses.

This finding was in agreement with **H** who reported that there was a strong positive correlation between nurses' knowledge and their performance. Also, this finding was in agreement with **(Hendy et al., 2018)** who revealed that there was significant correlation between nurses' knowledge and their practice. In addition to, a study was done by **(Yones et al., 2019)** who reported that there was highly statistically significant positive correlation between total nurses' knowledge and practice.

This finding was disagreed with **(Hassan et al., 2022)** who conducted a study about " Nurses' Knowledge and Practices toward Patients Undergoing Plasmapheresis" who reported that there was no significant relation between nurses' knowledge and practice. This strong positive correlation suggests knowledge and performance were related in this study. Whereas, nurses who got unsatisfactory knowledge had unsatisfactory practice, this means that the level of nurses' performance depend on the nurses' knowledge, this may be due to lack of training program to provide nurses' with continuous professional development and knowledge to make nurses aware about how to deal with patients undergoing TPE.

Conclusion

Based on the findings of this study it can be concluded that More than three quarters of the studied nurses had unsatisfactory level of total knowledge and had incompetent level of total practice regarding the patients undergoing therapeutic plasma exchange.

As well as, there was a highly statistically significant relation between total nurses' education level, attendance of training courses for therapeutic plasma exchange and nurses` knowledge and practice. There was highly significant positive correlation between total

knowledge score and total practices score regarding patients undergoing therapeutic plasma exchange among the studied nurses.

Recommendation:

Based on the results of the present study, the following recommendations are suggested in relation to nursing education, nursing practice and further nursing research:

Nursing education:

1. Nursing educators and clinical facilitators must incorporate strategies using learning opportunities to raise awareness of nursing staff about topics of TPE` knowledge and practice.
2. Developing simplified and comprehensive booklet including basic information about TPE and nurses' performance.
3. Regular staff meetings and training workshops about TPE should be conducted regularly and must be obligatory for all nurses

Nursing practice:

- 1- In service training and educational program prior to the work in TPE room, nursing staff must be knowledgeable and skillful in providing professional care for patients undergoing TPE.
- 2- Ongoing and regular in-service training regarding basic procedures as: pre procedure, during procedure and post procedure of TPE.
- 3- Unit protocols regarding TPE procedures should be reviewed regularly and updated.

Further nursing research

- 1- The study should be replicated on large samples and in different hospital setting in order to generalize the results
- 2- Further research should be conducted to examine TPE nurses` knowledge and practice before and after implementation of an educational program regarding patients undergoing therapeut plasma exchange.

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