

# Nurses' Knowledge and Practices toward Patients Undergoing Plasmapheresis

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## **Abstract**

**Background:** Plasmapheresis could be considered as a relatively safe method of treatment for patients, so nurses should provide continuous observation and proper monitoring of patients to ensure their safety which is an essential part of care as professional trained personnel. **Objective:** To assess nurses' knowledge and practices toward Patients Undergoing Plasmapheresis. **Settings:** The study was carried out at Hemodialysis Unit of The Main University Hospital which affiliated to Alexandria University. **Subjects:** A convenient sample of 35 nurses working at the above-mentioned setting. **Tools:** Two tools were used for data collection. **The first tool** was plasmapheresis nurses' knowledge schedule interview. **The second tool** was plasmapheresis nurses' practices Observational Checklist. **Results:** Findings of the present study revealed that the majority of the studied nurses had low level in both knowledge and practice. In addition, there was no significant relation between the studied nurses' sociodemographic data and their level of practice, while a significant relation was noticed between age of the studied nurses and their knowledge level where  $P = 0,000$ . **Conclusion:** The study concluded that majority of the studied nurses had low level in both knowledge and practice. **Recommendations:** Training workshops about plasmapheresis should be conducted regularly and must be obligatory for all nurses.

**Keywords:** Plasmapheresis, nurses' knowledge, nurses' Practices.

## **Introduction**

Plasmapheresis, apheresis and therapeutic plasma exchange (TPE) are terms often used synonymously, which means separation and removal of the plasma from a patient's blood while simultaneously giving back a replacement fluid prescribed by the physician according to patient's disease or disorder (Durdu et al., 2018).

Plasmapheresis could be achieved through two different techniques; the first

one is separation with centrifugal forces which means separating substances with different specific gravities with a device that separates particles from a solution where the particles will then sediment at the rate that is proportional to the centrifugal force applied to it. While the second one is separation with a filter membrane-based apparatus which is a physical separation method that is characterized by the ability to separate molecules of different sizes and characteristics with a driving force that is resulted from a difference in pressure

between the two sides of a special membrane (Sergent & Ashurst, 2020).

These could be applied through two different techniques vascular access which is obtained through arterio-venous fistulas (AVF), arterio-venous grafts (AVG) or central venous catheter (CVC) (Harris, Meiselman, Moriarty, Metzger, & Malkovsky, 2018; Schwartz et al., 2016). According to the records of Main University hospital, Alexandria, Egypt, it has been estimated that about 160 patients performed plasmapheresis starting from January to September in 2019, and 190 patients on 2020 till now it's noticed that there is an increase in the cases as shown.

In relation to replacement solutions (RS) that might be uses in plasmapheresis, there are two types: human albumin 5% and fresh frozen plasma (FFP). Regarding vascular access types, there are three types: arterio-venous fistula (AVF), arterio-venous graft (AVG) and non-tunneled and tunneled vascular access.

### ***Aims of the Study***

This study aims to assess the nurses' knowledge and practices toward patients undergoing plasmapheresis

### ***Research Questions***

1. What is the level of nurses' Knowledge toward patients undergoing plasmapheresis?
2. What are the levels of nurses' practices toward patients undergoing plasmapheresis?

### ***Materials and Method***

#### ***Materials***

***Design:*** A descriptive research design was utilized for this study.

***Settings:*** This study was conducted at the Hemodialysis (HD) Unit of The Main University Hospital which affiliated to Alexandria University. It receives patients from Alexandria Governorate.

***Subjects:*** This study comprised all the available nurses (35) working at the above-mentioned setting.

***Inclusion criteria:*** Nurses were worked in the plasmapheresis unit at least for not less than 3 months, and had secondary school of nursing.

***Tools:*** Two tools were used to collect data of the study:

***Tool I:*** Plasmapheresis nurses' knowledge schedule interview. This tool was developed by the researcher based on relevant literature to assess baseline knowledge of nurses about Plasmapheresis. It was translated into Arabic. The tool consisted of two parts: **Part 1:** Nurse's socio-demographic data: This part was included items related to sociodemographic data to identify personal data of nurses such as: age, gender, level of education, marital status, and years of experience in plasmapheresis unit, as well as, attendance of pre-service and/or in-service training programs about plasmapheresis. **Part 2:** Plasmapheresis nurses' knowledge schedule interview: This part was developed by the researcher after a thourally review of literature to collect data regarding basic knowledge of nurses about plasmapheresis procedure. It comprised two items: **Part 2.a: Nurses' knowledge regarding plasmapheresis.** This part included basic hematology information as characteristics, kinetics and physiology of blood cells, criteria for plasmapheresis donors such as blood group and rhesus factor compatibility, difficulties and risks of procedures; as inappropriate use of anticoagulant, indications of plasmapheresis, formula to estimate plasma volume, types of replacement solution according to the diagnosis, average duration of each plasmapheresis session, replacement therapy for electrolytes deficiency (calcium, phosphorus, magnesium, potassium and others), patient's common

complications (hypocalcemia, hypomagnesemia, hypokalemia, hypophosphatemia, cardiac arrhythmia, allergic reaction and others. **Part 2.b:** Nurses' practices regarding plasmapheresis. This part included the mechanism of the machine parameters (prescribed blood pump flow is 100-150 ml/min, plasma removal and substitution fluid rates adjustment, trans-membrane pressure (TMP) need to be at 50 mmHg ) troubleshooting alarms ( TMP above 50 mmHg, blood pump more than 150 ml/min, arterial pressure is kept between 200 mmHg and 300 mmHg, venous pressure is kept between 450 mmHg to 10 mmHg), effective priming, vascular access problems (access catheters for not being kinked or clotted, arterio-venous fistulas (AVF) or arterio-venous graft (AVG) is assessed for thrill, I.V access patency and others ), patient monitoring for vital signs ( heart rate, blood pressure, respiratory rate, temperature), symptoms reported by the patient during therapy such as( muscle cramps, hypotension, drowsiness, arrhythmia, urticaria, chest pain, allergic reaction, tachypnea, palpitation and others).

**Tool II: Plasmapheresis nurses' practices Observational Checklist.** This observational checklist was developed by the researcher based on relevant literature to assess nurses' practice of plasmapheresis procedures. It included two parts. **Part 1:** Regarding the machine. **Part 1.a:** Regarding the machine supplies. It included items; regarding to how did nurses operate the plasmapheresis supplies (dialyzer, blood circuit, anticoagulant, syringes, plasma discharged container, I.V set, hemo.set, and others). **Part 1.b:** Regarding the machine preparations. Before plasmapheresis (inspect the proper parameters; check for proper priming (starting with the blood circuit and dialyzer wetting with normal saline 0.9% till ending with complete evacuation of air

from blood circuit and dialyzer), inspect the blood pump by keeping it between 100-150 c/m). During plasmapheresis (continuous inspect of the blood pump by keeping it between 100-150 c/m). After plasmapheresis (check the trans-membrane pressure (TMP) which is not more than 50mmHg, venous pressure is kept between 450 mmHg to 10 mmHg, arterial pressure is kept between 200 mmHg to 300 mmHg and machine disinfection (discard the blood circuit and all the unnecessary supplies as mentioned). **Part 2: Regarding to the patient:** This part was divided into three phases, Before plasmapheresis procedure: this phase included assessment of patient's I.V line or internal venous catheter, size, patency, others, assess patient's history for allergy (medication or food), diabetes mellitus, hypertension, others, assess patient's weight by using Kaplan's calculation  $[0.065 \times \text{body weight (kg)}] \times (1 - \text{Hct})$ , assess vital signs (heart rate, blood pressure, respiratory rate, temperature), lab investigation CBC, hemoglobin, Platelets), coagulation profile, INR, PT and PTT, albumin, serum electrolytes: phosphorus, magnesium, potassium, calcium, others. Assess intravenous access for Site ( jugular, femoral or others), patency of the vascular access, types of the vascular access; arterio-venous fistulas (AVF), arterio-venous graft (AVG), catheter (tunneled – non-tunneled), others, prepare the substitute liquid fresh frozen plasma (FFP), albumin 5% + 400 Normal saline 0.9%.

During plasmapheresis procedure: this phase included that the nurse should ensure the complete thawing of FFP or albumin preparation, monitor the patient's condition, allergy, elevated temperature, chills, arrhythmia, low blood pressure, increased respiratory rate, others, monitor the plasma intake and output chart through plasma removal was volumetrically balanced with replacement fluids, allowing the filtered plasma to go directly to a drain

or container, monitor the vital signs ( heart rate, blood pressure, respiratory rate, temperature), administer the appropriate dose of prescribed medications required as (calcium gluconate, potassium, magnesium, phosphorus and If needed corticosteroid), appropriate anticoagulant according to the hospital policy as citrate, heparin. After plasmapheresis procedure: this phase included applying the post care of vascular access, proper closure of access, disinfection the site (dressing application), correct technique for applying appropriate pressure. others, post procedure reassessment, intake and output chart, vital signs monitoring, post procedure health teaching complications as;” hemolytic transfusion reaction for nurse as (hypotension, fever, chills), arterial hypotension vascular access dysfunction, others”.

### **Method**

- **Written approval:** •Approval of the Ethical Research Committee, Faculty of Nursing. Alexandria University was obtained. •An official letter was issued from the faculty of nursing, Alexandria University to the study setting to obtain their permission to collect necessary data. •An official permission was obtained from the directors and head of the departments of the selected hospital setting after explanation of the aim of the study.
- **Tools of study:** 1-Tool I and Tool II were developed by the researcher after review of relevant related literature. 2-The developed tools were translated into Arabic language by the researcher to suit its utilization in Egyptian culture and to assure consistency among study participants. 3-The tools were tested for content validity by 5 experts in the field of Medical Surgical Nursing.3- **Reliability:** The reliability of the tools was

tested using Cronbach Alpha Test. Reliability coefficient for tool I and tool II were 0.86. 4- **Pilot study:** A pilot study was conducted on (5%) of the subject study from nurses for (2 nurses) to test the feasibility and the applicability of the developed tools and necessary modifications were done accordingly; and they were excluded from the sample. 5- **Data collection:** -Nurses available at the time of data collection and who matched the -The researcher explained the purpose of the study after introducing himself. -Every nurse was interviewed individually for half an hour at his/ her break time to collect data regarding plasmapheresis knowledge using tool I and was observed for his/ her practices (before, during and after) plasmapheresis procedure through indirect observation using tool II. **Statistical analysis:** Data were fed to the computer and analyzed using IBM SPSS software package version 20.0. -The used tests were: - Student t-test, F Test (Anova) and Cronbach's Alpha.

### **Ethical considerations:**

- Written informed consent from the study subjects, witness written consent from the head nurse for observation, Confidentiality of the data and Anonymity of the study subjects were obtained after explaining the aim of the study.

### **Statistical Analysis**

The collected data were organized, tabulated and statically analyzed using the statistical package for social studies (SPSS) Version 25.0. Qualitative data were described using number and percent. Quantitative data were described mean  $\pm$  standard deviation. Finally analysis and interpretation of data were conducted. P-

values of 0.05 or less were considered statistically significant.

### Results

**Table (1): Shows distribution of the studied nurses according to bio sociodemographic data:** Regarding the gender of the studied nurses, it was obvious that nearly three quarters of them 74.3% were females. Concerning age and marital status, it was found that, more than half of the studied nurses (51.4% and 54.3%) respectively, were from 20 years old to less than 30 years old and married. In relation to level of education, it was noticed that, nearly half of the studied nurses 48.6% had technical degree. Concerning years of experience in plasmapheresis unit, it was evident that, more than half of the studied nurses 54.3% had 1 year to more than 5 years of experiences. According to the pre-service and/or in-service training programs attendance or workshops about plasmapheresis, it was noticed that, the majority of the studied nurses 91.4% didn't attend any workshops

**Table (2): Shows the relation between the studied nurses' knowledge levels and their sociodemographic data:** The table showed no significant difference between the nurses' level of knowledge and their sociodemographic data except a significance relation between nurses' level of knowledge and age  $P = 0,000$ . Regarding age from  $20 < 30$  years, it was obvious that, more than two third of studied nurses 31.4% had fair knowledge, in addition, less than two third of the studied nurses 20% had poor knowledge.

**Table (3): Shows the relation between the studied nurse's practice levels and their sociodemographic data:** The table showed no significant relation between the studied nurses' sociodemographic data and their level of practice.

**Table (4): Shows the relation between the studied nurse's knowledge levels and their practice level and mean scores:**

This table shows that, there was no significant relation between nurses' knowledge and nurses' practices.

### Discussion

Plasmapheresis procedure has to follow a regular protocol starting from vascular access presence Two Technique of plasmapheresis that will be used as centrifugation or Membrane Plasma Separation (MPS) and substitution fluids. In terms of vascular access, it is necessary to have it prior to the plasmapheresis process in order to the blood to flow out the patient's body and return after passing through a filter that removes the old plasma that contains pathogenic antibodies (Sergent & Ashurst, 2020).

Bio socio demographic data of the studied nurses: Regarding age, the current study revealed that more than half of the studied nurses were from 20 years old to less than 30 years old. this may be interpreted by that age is most suitable to offer nursing service for the patients, as they are in this age more active. Regarding gender, the current study revealed that nearly three quarters of the studied nurses were females. This was in line with (Nobahar & Raeisdana, 2020), as they reported that most of nurses were females. It could be justified with most of nurses were in various countries are females, by the nature of femininity of this job. Nurse's knowledge regarding plasmapheresis: Concerning plasmapheresis definition and the plasmapheresis formula to estimate the plasma volume, this study revealed that, more than three quarters of the studied nurses had incorrect and don't know answer. These finding may be related to the absence of training programs, unavailable time for expertise to provide the appropriate knowledge to nurses and the lower knowledge level in more than half of the studied sample. Nurse's practice

for plasmapheresis regarding machine supplies: Regarding the machine preparation supplies which include dialyzer, blood circuit, syringes, plasma discharged container and I.V set, this study revealed that, all the studied nurses had satisfactory levels. These finding may be related to the availability of plasmapheresis supplies by the patients' relatives or a charity organization, especially both dialyzer and blood circuit as they cost too much.

Concerning the anticoagulant usage, it was noticed that, the majority of the studied nurses had satisfactory levels. These findings may be related to the afford of anticoagulant used by plasmapheresis unit, while hemo-set usage, it is observed that, more than half of the studied nurses 42.9% had unsatisfactory levels. These findings may be related to the unavailability of hemo-set regularly. Hemo-set which help in transfuse FFP in a correct way to prevent the passage of plasma clots which may cause massive complications as pulmonary embolism if it passes. Nurse's practice for plasmapheresis regarding patient preparations. Concerning the physician order revision and potassium I.V injection, this study revealed that, all the studied nurses had satisfactory level. While the majority of the studied nurses had unsatisfactory level in the patient's history for both medication and food allergy, the assessment of patient's weight for replacement solution by using Kaplan's calculation and maintaining patient's position according to the access site, as well as medication and electrolytes replacement as albumin, phosphorus and magnesium, in addition heart rate. These findings may be related to low knowledge level of the studied nurses and the presence of low resources in plasmapheresis unit.

The relation between the studied nurse's knowledge levels and their sociodemographic data: The study illustrated that there is a relation between age of the studied nurses and their knowledge level where  $P = 0,000$ .

Distribution of the studied nurses according to their level of knowledge about plasmapheresis. The study illustrated that more than half of the studied nurses had low level of knowledge. These finding may be related to the majority of educational level of the studied nurses were technical nurses' degree.

### **Conclusion**

Based upon the findings of the current study, it could be concluded that, the majority of the studied nurses had low level in both knowledge and practice. In addition, there was no significant relation between the studied nurses' sociodemographic data and their level of practice, while a significant relation was noticed between age of the studied nurses and their knowledge level.

### **Recommendations**

*In line with the findings of the study, the following recommendations are made:*

- Adequate and appropriate adherence with plasmapheresis procedure steps should be ensured for all nurses at all time.
- Regular staff meetings and training workshops about plasmapheresis should be conducted regularly and must be obligatory for all nurses.
- In-service training program should be conducted and available to all nursing staff about plasmapheresis' patients' preparations and methods of applications

**Table (1): Distribution of the studied nurses according to bio-sociodemographic data (n=35):**

Nurses' bio-sociodemographic data	Studied nurses(n=35)	
	No	%
<b>Sex:</b>		
Male	9	25.7
Female	<b>26</b>	<b>74.3</b>
<b>Age (years):</b>		
20> 30 years	<b>18</b>	<b>51.4</b>
30> 40 years	10	28.6
40> 50 years	5	14.3
50> 60years	2	5.7
<b>Marital status:</b>		
Single	16	45.7
Married	<b>19</b>	<b>54.3</b>
Divorced	0	0
Widowed	0	0
<b>Educational level:</b>		
Diploma	13	37.1
Technical nursing	<b>17</b>	<b>48.6</b>
Bachelor of nursing	5	14.3
Post graduate degree	0	0
<b>Years of experience in plasmapheresis unit:</b>		
3 month > 1 year	12	34.3
1 year > 5years	<b>19</b>	<b>54.3</b>
5years > 10 years	4	11.4
10years > 15 years	0	0
15years ≥ 20 years	0	0
<b>Plasmapheresis' training programs or workshops?</b>		
Yes	3	8.6
No	<b>32</b>	<b>91.4</b>

**Table (2): The relation between the studied nurse's knowledge levels and their sociodemographic data:**

Nurse's sociodemographic data	Knowledge levels						Total N=35		Test of significance
	Low (N=18)		Fair (N=16)		Good (N=1)				
	No	%	No	%	No	%	No	%	
<b>Sex:</b>									
Male	3	8.6%	6	17.7%	0	0.0%	9	25.7%	X <sup>2</sup> = 2.281 P=0.319
Female	15	42.9%	10	28.6%	1	2.9%	26	74.3%	
<b>Age (years):</b>									
20-<30 years	7	20.0%	11	31.4%	0	0.0%	18	51.4%	X <sup>2</sup> = 23.814 P= <b>0.000565</b>
30-<40 years	6	17.1%	4	11.4%	0	0.0%	10	28.6%	
40-50 years	5	14.3%	0	0.0%	0	0.0%	5	14.3%	
50 > 60 years	0	0.0%	1	2.9%	1	2.9%	2	5.7%	
<b>Marital status:</b>									
Single	7	20.0%	9	25.7%	0	0.0%	16	45.7%	X <sup>2</sup> = 1.896 P=0.388
Married	11	31.4%	7	20.0%	1	2.9%	19	54.3%	
<b>Level of education:</b>									
Diploma of Secondary School	5	14.3%	7	20.0%	1	2.9%	13	37.1%	X <sup>2</sup> = 6.753 P= 0.150
Technical Institute of Nursing	12	34.3%	5	14.3%	0	0.0%	17	48.6%	
Bachelor degree	1	2.9%	4	11.4%	0	0.0%	5	14.3%	
<b>Years of experiences:</b>									
3 month > 1 year	7	20.0%	5	14.3%	0	0.0%	12	34.3%	X <sup>2</sup> = 2.324 P=0.676412
1 year > 5 years	8	22.9%	10	28.6%	1	2.9%	19	54.3%	
5years > 10 years	3	8.6%	1	2.9%	0	0.0%	4	11.4%	
<b>Have you ever attended a pre-service and/or in-service training programs or workshops about plasmapheresis?</b>									
Yes	0	0.0%	3	8.6%	0	0.0%	3	8.6%	X <sup>2</sup> = 3.896 P=0.142524
No	18	51.4%	13	37.1%	1	2.9%	32	<b>91.4%</b>	

X<sup>2</sup> Chi Square Test \* Statistically significant at P ≤0.05



**Table (3): The relation between the studied nurse's practice levels and their sociodemographic data:**

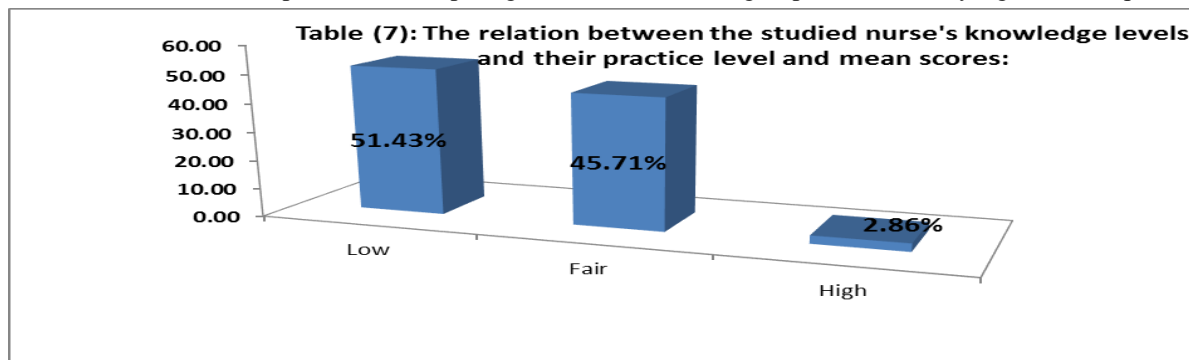
Nurses sociodemographic Data	Practice levels				Total N=25		Test of Significance
	Unsatisfactory (N=18)		Satisfactory (N=7)				
	No	%	No	%	No	%	
<b>Sex:</b>							
Male	4	11.4%	5	14.3%	9	25.7%	X <sup>2</sup> = 0.798 P= 0.372
Female	16	45.7%	10	28.6%	26	74.3%	
<b>Age (years):</b>							
21 > 30years	9	25.7%	9	25.7%	18	51.4%	X <sup>2</sup> = 6.825 P= 0.078
30 >40 years	6	17.1%	4	11.4%	10	28.6%	
40 > 50 years	0	0.0%	2	5.7%	2	5.7%	
<b>Marital status:</b>							
Single	10	28.6%	6	17.1%	16	45.7%	X <sup>2</sup> = 0.345 P=0.557
Married	10	28.6%	9	25.7%	19	54.3%	
<b>Level of education:</b>							
Bachelor degree	8	22.9%	5	14.3%	13	37.1%	X <sup>2</sup> = 0.242 P= 0.886
Technical Institute of nursing	9	25.7%	8	22.9%	17	48.6%	
Diploma of Secondary School	3	8.6%	2	5.7%	5	14.3%	
<b>Years of experiences:</b>							
3 month > 1 year	7	20.0%	5	14.3%	12	34.3%	X <sup>2</sup> = 0.686 P= 0.710
1 year > 5years	10	28.6%	9	25.7%	19	54.3%	
5years > 10 years	3	8.6%	1	2.9%	4	11.4%	
<b>Plasmapheresis' training programs or workshops?</b>							
Yes	1	2.9%	2	5.7%	3	8.6%	X <sup>2</sup> = 0.760 P= 0.383
No	19	54.3%	13	37.1%	32	91.4%	

X<sup>2</sup> Chi Square Test \* Statistically significant at P ≤0.05

**Table (4): The relation between the studied nurse's knowledge levels and their practice level and mean scores:**

Items	No	%	Practice Mean Score Mean ± S. D	Test of significance
Knowledge levels				
- Low	18	51.4	1.6333± 0.09497	F = 1.654 P = 0.207
- Fair	16	45.71	1.6083± 0.06660	
- High	1	2.85	1.7556± 0	

F: F for ANOVA test P: p value for comparing between the studied groups \*: statistically significant at p ≤0.05



**Figure (1): The relation between the studied nurse's knowledge levels and their practice level and mean scores:**

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