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Effect of Educational Guidelines on Nurses' Performance Regarding Complications Associated plasmapheresis and Patients' Outcome with Autoimmune Disorders

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Abstract

Plasmapheresis is extracorpeal removal of plasma from other blood components, discarding and replacing plasma with physiological fluids. Plasmapheresis nurse should be an effective practitioner to ensure that patients recieving specialist care to improve their outcomes. This study aimed to evaluate the effect of educational guidelines on nurses' performance regarding complications associated plasmapheresis and patients' outcome with autoimmune disorders. A quasi experimental design was utilized in this study. Data was collected from intensive neurological care unit, hemodialysis unit and neurology unit at Zagazig university hospitals. The study was conducted on convenience sample of 40 nurses in previous setting and purposive sample of 40 patient undergoing plasmapheresis with autoimmune disorders**.** Three tools were used for collection of data, first, structured interview questionnaire for nurses, Second tool was an observational check list to assess nurses' practice regarding plasmapheresis, and third tool was patient's outcomes assessment questionnaire**.** In pre intervention only five% of studied nurses had total satisfactory knowledge regarding plasmapheresis compared to 87.5% in post intervention, ten % had total satisfactory practice in pre intervention compared to 92.5% in post intervention and the patients' outcome post intervention compared to pre intervention was improved including decreased complications and abnormality of laboratory tests besides improved signs and symptoms with highly statistical significant difference. It can be concluded that the educational guidelines significantly improved nurses' knowledge and practice regarding plasmapheresis with a sustained improvement in the patients' outcomes and reducing complications. Applying educational guidelines on large sample of nurses and patients undergoing plasmapheresis.

Keywords: Educational Guidelines, Nurses' Performance, Complications, plasmapheresis, Patient's Outcome.

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1. Introduction

Plasmapheresis also known as therapeutic plasma exchange (TPE), is a procedure that separates plasma from whole blood, therefore effectively removing abnormal circulating antibodies and other pathogenic factors contributing to autoimmune diseases. Based on this principle and mechanism of action, a wide variety of immune-mediated diseases can be treated with TPE. In the recent years, there is growing interest among adult neurologists in using TPE for various antibody-mediated central nervous system and peripheral nervous system disorders [1]. Autoimmune neurological conditions are mediated by autoantibodies that cause cellular injury to various components of the nervous system. Majority of the patients present with focal neurological deficits such as motor weakness, hyporeflexia, altered pain perception, stroke and seizures. Delays in initiating appropriate treatment may result in irreversible neurological injuries and permanent impairment of function. TPE is also employed in treatment of connective tissue diseases, hematological, nephrological, endocrinological and metabolic disorders [2]**.** Plasmapheresis could be achieved through two different techniques; first one is separation with centrifugal forces called centrifugation therapeutic plasma exchange (c TPE)

which means separating substances with different specific gravities with a device that separates particles from a solution where particles will then sediment at rate that is proportional to the centrifugal force applied to it. While the second one is separation with a filter membrane-based apparatus called membrane therapeutic plasma exchange (mTPE) 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 [3]. TPE is an invasive procedure, but when performed by properly trained and qualified staff, it is relatively safe. Life-threatening episodes like shock (anaphylactic or septic), hypotension requiring vasopressor drugs or bleeding are rare. The most frequent, but not very severe complications are urticaria, pruritus, hypocalcaemia and mild hypovolemia. Adverse effects are associated more commonly with administration of fresh-frozen plasma (FFP) used as a replacement solution compared to human albumin solutions [4]. Nurses should be knowledgeable about patients' requirements to give best nursing interventions to maintain patient safety, enhance patients' health and ultimately improve patients' life quality throughout intervention. To increase standard of healthcare and to gain new information and abilities, nursing staff personnel must be taught and trained. Education standards are thought of as a way to give nurses theoretical and technical knowledge required to learn new skills and continuously enhance nursing practice. Encourage nurses to take on the responsibility for their professional development as well [5].

1.1. Significance of the study

Autoimmune diseases were estimated by the National Institutes of Health as the most prevalent in the USA, affecting up to 23.5 million Americans, but the American Autoimmune Related Disease Association (AARDA) said that 50 million americans suffer from autoimmune disease. Autoimmune diseases can affect virtually every site in body, including the endocrine system, connective tissue, gastrointestinal tract, heart, skin, and kidneys [6]. Plasmapheresis has been used for three decades in the treatment of various disease and scope of diseases treated with it has broadened greatly in the past decade. It has emerged as a powerful therapeutic modality in the treatment of autoimmune mediated neurological disorders [7]. Plasmapheresis is a relatively unfamiliar area of nursing practice. It requires a particular set of technical skills and specialized knowledge to avoid complications. All nurses must be appropriately qualified and trained in the procedures that regularly perform. Level of nurses' performance and patient knowledge regarding plasmapheresis will effect on the incidence and severity of complications [8]. So, there is a need to determine the potential effect of education on prevention and management of complications associated with plasmapheresis. Therefore, the current study was designed to update nursing staff performance and aid them in the establishing comprehensive management plan for patients undergoing plasmapheresis with autoimmune disorders. Which reflected on the positive and satisfying patients' outcome.

1.2. Aim of the study

It was to evaluate the effect of educational guidelines on nurses' performance regarding complications associated plasmapheresis and patients' outcome with autoimmune disorders.

1.3. Research Hypothesis

- Nurses' knowledge score post educational guidelines will be improved than pre-educational guidelines.
-Nurses' practice level regarding plasmapheresis will improve post educational guidelines than pre-educational guidelines.
- Design, implement and evaluate the effect of educational guidelines on nurses' performance and patients' outcomes.

1.4. Research design

A quasi experimental design was conducted to achieve the aim of the study.

1.5. Setting

The study was conducted in intensive neurological care unit at intensive care building with payment, hemodialysis unit at internal medicine hospital and neurology unit at new surgery hospital at Zagazig university hospitals.

2. Subjects and Methods

Convenient sample of all available nurses with 6 months of experience working in the above-mentioned setting (40 nurses) and a purposive sample of 40 patient undergoing plasmapheresis with autoimmune disorders.

2.1. Tools of data collection

Tool I: A Structured interview questionnaire for Nurses [9-12]**:** (pre- post-test): was designed by the researcher after revising of related literature and opinions of expertise for content of validity to assess nurses' knowledge regarding complications associated plasmapheresis. And consisted of the following parts:

Part 1: Demographic characteristics of nurses: seven closed ended questions covered (age, gender, social status, academic qualifications, department, and years of experience in plasmapheresis and attending previous courses and training). This part was used only once because the included nurses in the pre-test were the same in the post-test.

Part 2: Nurses' knowledge regarding plasmapheresis (pre/ post-test): It was included (81) questions in the form of MCQ questions, it was covered the following five sections:-

First section: Nurses knowledge regarding autoimmune diseases. It was consisted of nine questions about: definition of autoimmunity, causes, risk factors, common types, common signs and symptoms, treatment, complications and prevention.

Second section: Nurses Knowledge regarding plasmapheresis process. It consisted of 29 questions about; Composition of blood, largest percentage of blood components, definition, percentage, basic components and function of plasma, definition, aims, indications, contraindications and methods of plasmapheresis, as well effective preparation for separation process, evaluation of vascular catheterization, adjusting parameters of machine, causes of troubleshooting alarms, number of sessions patient needs per week, average duration of each session , number of cycles during one session , type and caution of replacement fluids, discontinued and factors affect patient's response.

Third section:- Nurses' knowledge regarding complications associated plasmapheresis process, its care and prevention It was consisted of 22 questions about; the complications during and after plasmapheresis, life-threatening complications, , vascular access complications, cause of hypotension, cause of an allergic reaction, cause of muscle spasm and pain, cause of immunodeficiency and risk of infection, the nursing care to hypotension, allergic reaction, nausea and vomiting, bleeding at catheter site, and hypocalcemia, care and preventive measures to previous complications

Fourth section: - Nurses' knowledge regarding nursing care of patient with autoimmune disease undergoing plasmapheresis process. It consisted of 11 questions about; items nursing care before, the correct position, Patient evaluated before procedure, Preparation of the machine, setting the machine parameters, Patient's psychological support, nursing care during the procedure, frequency of patient evaluation during the procedure, continuous follow-up, monitoring the machine and nursing care after procedure.

Fifth section: nurses' knowledge about necessary guidelines about plasmapheresis that given to patient. It consisted of 10 questions about; instructions before the procedure, the patient's diet, and the foods decreased or avoid a few days before the procedure, instructions pre and during the procedure, during the separation process the patient should avoid and instructions after the procedure.

- ***The scoring system***

The rating scale was graded according the items of interviewing questionnaire. The answers of respondents nurses were evaluated using model key answer prepared by the researcher, total score of knowledge was 100% graded. The total knowledge score was classified as the following: each correct answer =one (1) and incorrect answer and don't know=zero (0). Basd on statistical analysis the scores then transformed into score percent as the following:

Score % = (the observed score / the maximum score) x 100

The score % of knowledge then transformed into categories as the following:

Unsatisfactory level of knowledge: for those who had score % < 70% of the maximum score.

Satisfactory level of knowledge: for those who had score % ≥ 70% of the maximum score.

Tool II: Observational Checklist to Assess Nurses' Practice regarding patients with autoimmune disorders undergoing plasmapheresis [13-16]: It included three parts; (pre/ posttest)

• The first part was about nursing intervention steps to patients before plasmapheresis procedure, it included 16 steps about: Confirm physician's order, introduce herself to the patient, identify patient correctly, place patient on comfortable position, keep patient privacy, explains the procedure to the patient, prepare needed equipment, ensures that consent is obtained, prepare the patient, prepares machine, prepare the substitute liquid, washes hands, wear personal protective equipment, set the machine parameter, check and prime of plasma filter carefully.

• The second part was about the nursing intervention steps to patients during plasmapheresis procedure. It consisted of six steps about: Adjusting blood pump and trans-membrane pressure, adjusting venous pressure and arterial pressure, ensure the complete thawing of fresh frozen plasma or albumin preparation, administers replacement fluid as needed, monitor the patient`s condition and reassessment every 30 minutes till the end of session.

• Third part was about nursing intervention steps to patients after plasmapheresis procedure. It consisted of five steps about: monitor access site, machine disinfection, discard blood circuit and all unnecessary supplies according to west disposal management, wash hands and documents required data such as conditions of vascular access, vital signs, unexpected outcomes and fluid replacement type/amount.

- ***Scoring System***

AS for knowledge, also score 1 was given if the nurse correctly did the practice and score 0 if not. The scores then transformed into score percent based on statistical analysis as the following:

Score % = (the observed score / the maximum score) x 100

The score % of practice then transformed into categories based on statistical analysis as the following:

1. Unsatisfactory level of practice: for those who had score % < 70% of the maximum score.
2. Satisfactory level of practice: for those who had score % ≥ 70% of the maximum score.

Tool III: Patient's Outcomes Assessment Questionnaire (pre /post test): It was adapted from [2-17-18] and developed by researcher to assess the effect of educational guidelines on outcomes and complications of the patients with autoimmune disease undergoing plasmapheresis. It included three parts:

Part I: It included sociodemographic characteristic of patients, consisted of eight closed ended questions about: (age, gender, and marital status, level of education, occupation, smoking habit, hospital and department).

Part II: It included patient's history, consisted of four closed ended questions about: (Family history, past medical and surgical history and present medical history).

Part III: It included patients' outcome, it used to assess effect of educational guidelines for nurses regarding plasmapheresis on patients's outcome. It included three parts as following:

Section1: patients' complications of the plasmapheresis: it was used to assess patients' complications associated with plasmapheresis for patients with autoimmune disease such as (fainting, hypotension, rash, bleeding itching, fatigue and tired, cramps, dyspnea, numbness, joint pain), It included three parts with totally 26 point covered patients complication related to the plasmapheresis procedure: three points, covered mild complications; 17 points, covered moderate complications and six points covered severe complications.

Section2: irregularities of laboratory tests covered anemia, leukopenia, elevated leukocytosis, thrombocytopenia, hypokalemia, hypernatremia, hypocalcaemia, lowered fibrinogen concentration, reduced total protein level, reduced the albumin level, and increased the CRP and INR.

Section3: Signs and symptoms of patient that improved after plasmapheresis.

2.2. Administrative and ethical consideration

An official permission was obtained from the dean

of the faculty of nursing and from the director of Zagazig university hospital before conducting the study. Then Permission to carry out the study was obtained from the head of mentioned setting. After explaining the purpose of the study Additional oral consents were taken from the nurses and patients who participated in the study after explaining its purpose. They were given an opportunity to refuse the participation, and they were assured that the information would be used for research purposes only. All ethical issues were taken into consideration during all phases of the study. The ethical research considerations in this study included the following: The research approval was obtained before intervention guidelines implementation, the objectives and the aims of the study were explained to the participants, the researcher confirmed the anonymity and confidentiality of subjects, and subjects were allowed to choose to participate or not and they had the right to withdraw from the study at any time without penalty. The researcher confirmed that the data and information collected would be confidential.

2.3. Pilot study

A pilot study was carried out in order to test whether the tools are clear, understandable, feasible, applicable, and time consuming. Ten percent from the total sample size that equal four nurses and four patients were selected within selected criteria to participate in testing of the tools. The time required for ending the questionnaire was ranged between 20 to 30 minutes for nurses and 15 to 20 minutes for patients. The results of the data obtained from the pilot study helped in modification of the tools, items were then corrected or added as needed. Those nurses and patients were excluded from the main study sample.

2.4. Field work

After an official permission was taken from the dean of the faculty of nursing, from the manager of Zagazig University Hospitals and from the head of internal medicine, new surgery and ICU with ager hospitals, the implementation phase for data collection started as following: The selection of nurses and patients, the collection of data, and the implementation of the intervention guidelines lasted over a period of 11 months, began from Mars 2023 to the end of January 2024. The questionnaire was designed by the researcher. Data used was collected where the researcher was available from Sunday to Thursday weekly from 9 am to 5 pm where educational guidelines implemented. According to finding of the pilot study time was shortage to fillout the interviewing questionnaire so increase to 30-45 min and some questions modified accordingly. Nurses grouped; each group included 4-5 nurses while each patient interviewed individually. It was necessary for researcher to introduce herself for nurses and patients and explain purpose of study.

- ***Assessment phase***

The researcher started to recruit sample according to eligibility criteria. Those who agreed to participate interviewed individually using data collection form. Information obtained served as baseline data or pretest, and guided researcher in preparation to educational guidelines booklet.

- ***Planning phase***

Using the assessment data and related literature, the researcher developed educational guidelines according to nurses' needs and deficiencies in their performance to train nurses and improve their knowledge, practice and outcomes of patients. Educational guidelines included a theoretical and a practical part. Researcher prepared an illustrated guideline booklet in simple Arabic language to help nurses assimilate and refresh the information provided to achieve aim of study.

- ***Implementation phase***

The intervention guidelines consisted of 21 sessions; one third of the sessions (8) were theoretical, and (13) were practical. Each interview took approximately 30 minutes in each theoretical session and 30-45 minutes in each practical session. The data was collected in a simplified Arabic language, with motivation and reinforcement to enhance learning. The sessions began with one session for assessment of nurses' condition (interviewing the nurses regarding demographic characteristics and identification), and one session for demonstrating the importance of the educational guidelines and for assessing the nurses' knowledge and practice by filling questionnaire of knowledge and observational checklist and patient assessment before the intervention guidelines. In each session, ten minutes pre and post are directed for re-demonstration and implanted in simplified way by using pictures and booklet, through group discussion, to identify self-reflection, evaluate with feedback and oral exam. In the practical session as the same with implementation and in the 20^{th} session (post-test) included the reassessment of nurses' knowledge, practice and patient outcome after applying the intervention guidelines. Questionnaires were filled by the nurses and observation of practice, patients' assessment sheets were filled by the researcher in pre and post phase.

- ***Evaluation phase***

Each nurse and patient in study was evaluated two times using same data collection tools. This was done upon recruitment (pre-test), immediately after end of educational guidelines (post-test). To evaluate improvements in level of knowledge and practice also outcomes among patients with autoimmune disease undergoing plasmapheresis before and after implementation of educational guidelines comparing results of pre, posttests to assess continuous effect of educational guidelines.

2.5. Content validity& Reliability

Content validity was used for the modified tools and the designed booklet to determine whether the tools covered the aim or not. It developed by a jury of five experts in medical surgical nursing, college of nursing, Zagazig University. Reliability was done by using Cronbach test and retest. It was used to examine whether the questionnaire had internal consistency or not. The knowledge and practice tools had good internal consistency or not, the test was done. The agreement percentage for structured interview questionnaire was 75% and for observational checklist was 96% and patient assessment questionnaire was 84%.

2.6. Statistical analysis

All data collected, tabulated and statistically analyzed using SPSS 20.0 for windows (SPSS Inc., Chicago, IL, USA 2011). Quantitative data were expressed as the mean ± SD

and qualitative data were expressed as absolute frequencies (number) & relative frequencies (percentage). Mc nemar test was used to compare between two dependent groups of categorical data. Paired t-test was used to compare between two dependent groups of normally distributed variables. While, Wilcoxon Signed Ranks Test was used to compare between two dependent groups of not normally distributed variables. Percent of categorical variables were compared using Chi-square test or Fisher's exact test when appropriate. ANOVA (One way analysis of variance) test was used for comparison between more than two different groups of quantitative data which normally distributed. While, Kruskal Wallis Test was used for comparison between more than two different groups of quantitative data which were not normally distributed. The student "t" test was used for comparison of means of two independent groups of quantitative data which normally distributed. While, The Mann-Whitney U test was used for comparison of means of two independent groups of quantitative data which not normally distributed Spearman correlation coefficient was calculated to assess relationship between study variables, (+) sign indicate direct correlation & (-) sign indicate inverse correlation. Multiple linear regression (step-wise) also used to predict factors which affect practice score. Cronbach alpha coefficient calculated to assess reliability of scales through their internal consistency. P-value < 0.05 considered statistically significant, p-value < 0.001 considered highly statistically significant, and p-value ≥ 0.05 considered statistically non-significant.

3. Results and discussion

3.1. Results

The demographic characteristics of the nurses in the study sample Table 1: Revealed that Illustrated demographic characteristic of the studied nurses. More than half of the studied nurses (52.5%) aged from 30-40 years with mean ± SD (36.72 ±8.81) year, three quarters were female, 72.5% were married, as well, half had diploma in nursing, more than half (55.0%) worked at renal dialysis, with more than half (57.5%) had less than three year experience with plasmapheresis. Additionally, all nurses didn't have training course on plasmapheresis and its complications. Table 2: As regard to total nurses' knowledge and practice, there was increase in satisfactory nurses' knowledge and the practice post Intervention compared to pre intervention. Also, table shows a highly statistically significant difference in nurses' knowledge and practice pre and post intervention with (P< 0.001). Table 3: Illustrates that near to half (47.5%) of studied patients age was from 30 to 50 years with mean ± SD 41.30±13.92 year. More than half (60%) were female. As regards marital status three quarter were married. As well, about two thirds (62.5 %) of studied patients were unemployed. While, nearly one fifth had primary education, three quarter were non-smoker. Additionally, more than one third (37.5%) were in new surgical hospital and near to half (47.5) were in ICU department.

Table 4: represents that, highest percentage of patients medical diagnosis (32.5%) was myelitis , followed by (GBS), (TTP), (CIDB), (MG), (SLE) and (ADEM) (20.0%, 17.5%, 12.5%, 7.5%, 7.5% and 2.5%) respectively, most of patients (87.5%) had plasmapheresis by centrifugation method, also two fifth of them (40.0%) had 8 session of plasmapheresis. As well, amount of replacement fluid range from 1700-2800ml, while more than half of patients (52.5%) received <2000 mL of replacement fluid with Mean ±SD 2140±336.49. In addition, plasma + normal saline were used for nearly half of patients (45.0%) as replacement fluid, furthermore, Mean ±SD of patients weight and height was (80.55±12.457& 167.35±8.15) respectively, as regards BMI (45.0%) of patients were obese, additionally, more than half of patients (60%) received Immunosuppressive drugs with plasmapheresis. Table 5: Regarding patient complications associated with plasmapheresis, Table showed that, in pre intervention phase majority of studied patients (87.5%) had anxiety, more than two thirds (70.0%) had pain at catheter site, about two thirds (67.5%) had nausea and vomiting, more than half of them (60.0%) had paresthesia, and half of them had hypotention with plasma turning followed by headach and chills from allergic reactions (47.5%). While in post intervention phase all previous patient complications improved to (32.5%, 12.5%, 10.0%, 15.0%, 27.5%, 25%, 15%). Lastly, there was statistically significant improvement in most complications of patients associated with plasmapheresis in post intervention phase with P. value was<0.001.

Table 6: Concerning laboratory tests of studied patients, it showed in pre procedure phase majority of studied patients (80%) had hypocalcemia, three quarter (75%) had anemia, more than two thirds (67.5%) had decrease in albumin level, and more than half (65%) had hyponatremia, while in post procedure phase based on medical management and nurses performance all previously mentioned abnormalities in laboratory tests of studied patients improved to (25.0%, 40.0%, 30.0%, 25.0%) respectively. In addition, there was statistically significant improvement in most of laboratory tests of studied patients in post procedure phase with P. value p<0.001. As regard to improved signs and symptoms of studied patients, percentage of patients' signs and symptoms that improved after plasmapheresis increased from 52.5% to 90% post procedure. Also, there was highly statistically significant difference between improved signs and symptoms of patients in pre and post procedure with P. value <0.001. Table 7: Reveals that there was statistically positive correlation between total scores of nurses' knowledge and practice throughout Study Phases with P. value (0 .031). Table 8: Reveals that there was statistically positive relation between total scores of nurses' knowledge and outcome of studied patients with P. value was <0.001, while there was negative correlation between nurses knowledge and nurses practice and patients outcomes.

3.2. Discussion

Regarding demographic characteristics, results of the present study revealed that more than half of the studied nurses aged from 30-40 years with mean ± SD (36.72 ±8.81) this agree with Haza'a, et al. [19] in the study of "Knowledge of nurses regarding blood transfusion at public hospitals in Sana'a City-Yemen" the author found that the mean age of studied nurses was 31.52 ± 5.54years. Related to Gender, results of the present study showed that three quarters of studied nurses were female. It could be justified with most of nurses were in various countries are female, by the nature of femininity of this job. The present study is consistent with [20] in study of "Knowledge of health

professionals in transfusion and transfusion safety in Morocco" found that more than two thirds of the nurses were female. These findings are at same line with Abdelmonem, et al. [21] in the study of "Effect of teaching Program on Nurse`s Performance Regarding Guillian Barre Syndrome Patients at Neurological Care Unit." Found that all studied nurses were female. Related to marital status, the present study revealed that nearly three quarter of studied nurses were married. This finding agree with Yones, et al. [22] in study of "Assessment of nurses performance regarding caring of patients on anticoagulant therapy in port-said hospitals" found that nearly three quarter of studied nurses married.

These findings are matched with Mohamed, et al. [23] in study of "Nurses ' Performance regarding the Care of Patients with Multiple Sclerosis Relapse: A Suggested Guideline" found that majority of studied nurses were married. Regarding to academic qualifications, the current study revealed that half of studied nurses had diploma in nursing with 10% had bachelor in nursing this can be due to one quarter of studied nurses aged more than 40 years old and most of this age group had only diploma in nursing. The present study is consistent with Mohd Noor, et al. [24] in study of "Blood transfusion knowledge among nurses in Malaysia: a university hospital experience" found that majority of studied nurses possess a diploma in nursing, with only 8.0% holding a bachelor in nursing. The present study revealed that more than half of studied nurses worked at renal dialysis, with nearly two thirds had less than three year experience with plasmapheresis. The present study is consistent with Hassan, et al. [25] in study of "Nurses' Knowledge and Practices toward Patients Undergoing Plasmapheresis" that all nurses worked at hemodialysis unit and more than half of studied nurses had one year to more than five years of experiences with plasmapheresis. Regarding attending training courses on plasmapheresis, the current study revealed that all nurses didn't have training course on plasmapheresis.

This finding can be due to lack of training programs related to this area in nursing. Also, this result might be because of shortage of nursing staff which might influence on attending training courses to prevent interruption of the work or this might be due to lacking of nurses' motivation as they felt that attending the training courses had no value for them and not affecting their salary. In contrast with Farag, et al. [26] in the study about "Nine-I investigators. Research priorities for therapeutic plasma exchange in critically ill patients" found that majority of studied nurses need attending training courses on plasmapheresis. Concerning nurses' total knowledge about plasmapheresis pre implementation of educational guidelines, majority of nurses had unsatisfied knowledge about plasmapheresis. This lack of nurses knowledge in this important critical area might be as result of half of studied nurses had diploma in nursing and most of books are written in English and their schooling in Arabic, this motive a hassle for them to learn, nearly two thirds had less than three years of experience, and all studied nurses didn't attend training courses about plasmapheresis. In my opinion other causes can include unfamiliarity of this area in nursing, lack of pre-employment orientation program and nurses' exhaustion due to increased work load because of shortage of nursing staff in comparison to the number of patients which may hinder their ability to read and update their knowledge.

Characteristics" found that more than three quarters of the studied nurses had unsatisfactory level of total knowledge regarding plasmapheresis. Regarding post-implementation of educational guidelines, the results of the current study showed that majority of the studied nurses had satisfied total knowledge score and the minority of them had unsatisfactory knowledge. This improvement in nurses' knowledge may be due to the use of different teaching strategies as lecture, discussion, a colored booklet, and video playing, in addition to researcher's reinforcement of information received at end of each session and pre next session together with adherence of subjects to the given instructions regarding plasmaphersis. Moreover, education for nurses have a perceptive effect on their knowledge and understanding the complications associated with plasmapheresis. Furthermore, these improvements in total knowledge were statistically highly significant ($p<0.001$). This finding was similar to Abolwafa, et al. [27] on study of "Effect of Instructional Based Nursing Intervention Program on Nurses Performance of Exchange Transfusion for Neonates" who reported that there was statistically significant difference between nurses' knowledge in pre-test and post-test with (P. 0.02).

The current study revealed that majority of studied nurse had unsatisfactory level practice regarding plasmapheresis pre implementation of educational guidelines. This could be attributed to lack of nurses' knowledge, which reflects on their practice, inadequate continuous training program, sometimes insufficient equipment and lack of guidelines. This agree with [28] found that more than three quarter of studied nurses had incompetent level of total practice at pre evidence based guidelines phase. Regarding post-implementation of educational guidelines, the current study revealed that there was highly statistically significant increase in satisfactory nurses' practice before, during and after procedure of plasmapheresis post intervention, with highly statistically significant difference in total score of nurses practice with P. value was<0.001. This positive outcome suggests that the educational guidelines effectively enhanced nurses' proficiency and practice regarding plasmapheresis procedures. The use of diverse educational methods including lectures, demonstrations, and audiovisual aids contributed to these promising results. Further, implementation of direct bedside teaching with immediate corrective feedback might have provided valuable learning opportunities.

This findings is agreed with Mohamed, et al. [29] in the study of "Effectiveness of an Educational Program on Nurses' Knowledge Regarding Neonatal Sepsis: A Quasi-experimental Study" found comparable improvement of nurses skills and practice following an educational intervention. This reinforces the evidence supporting the beneficial impact of structured learning programs in enhancing healthcare professionals' clinical practice.

Regarding demographic characteristics, results of the present study revealed that the near to half of studied patients age was from 30 to 50 years with mean 41.30 years old. This can be explained by the fact that the risk for autoimmune diseases increases with age. The finding of the present study is supported with Afzali, et al. [30] in the

study of "Complications of therapeutic plasma exchange in patients with neurological disorders" the author found that the mean age of the studied patients was 40.0 years old. These finding were in same line of Ara, et al. [31] in study of "Complications of Therapeutic Plasma Exchange in Patient with Neurological Disorders" found that a mean age of patients were 37.14±13.79 years.

Related to Gender, results of the present study showed that more than half of the patients were females. This can be explained by the fact that autoimmune diseases are more common in female than male. The present study is consistent with Ozkan, et al. [32] in the study of "Therapeutic Plasma Exchange Indications, Complications and Responses: A Single Center, The Retrospective Analysis" found that more than half of patients were females. Moreover, Fernández-Fournier, et al. [33] in study of "Therapeutic plasma exchange for myasthenia gravis, Guillain-Barre syndrome, and other immune-mediated neurological diseases, over a 40-year experience" found that more than half of the studied patients were females. While the present finding is inconsistent with Kohli, et al. [34] in study of "Effect on haemostasis of different replacement fluids during therapeutic plasma exchange—A comparative multicentre observational study" stated that more than half of the patients were males. Regarding marital status, the current study revealed that three quarter of studied patients were married. This finding is supported by Mohamed, et al. [35] in study of " Effect of the Nursing Education on Knowledge and Self Care for Patients with Systemic Lupus Erythematosus" reported that more than half of studied patients married.

Related to occupation, the present study revealed that about two thirds of studied patients were unemployed. This finding can be explained that age of about one third of studied patients were more than 50 years old and more than half of them were female. This finding agrees with Ahmed, et al. [36] in study of "Needs Assessment for Patients Undergoing Plasmapheresis: Suggested Guidelines" who found that about two thirds of studied patients were not working. Regarding level of education, the current study revealed that about one fifth of studied patients had primary education and one third had university. In the same line Hamza, et al. [8] in study of "Effect of Applying Guideline for Patients Undergoing Plasmapheresis Outcomes at Mansoura University Hospital" found that most of studied patients were secondary and university educated. Present study revealed that three quarter of studied patients were nonsmokers. The result of the present study is consistent with Abbas, et al. [37] in study of "Plasmapheresis In The Treatment Of Guillain-Barre Syndrome; Outcomes And Complications" found that most of patients were nonsmokers, this might be due to majority of studied patients were female and smoking isn't favorable to female. Related to department, the current study revealed that nearly half of studied nurses were in intensive care unit (ICU). This finding agree with François, et al. [38] in study of "Adverse Events and Infectious Complications in the Critically Ill Treated by Plasma Exchange: A Five-Year Multicenter Cohort Study" who conducted his study on patients in ICU.

Related to present medical history of studied patients, the current study reavealed that most common diagnosis of studied patients were myelitis, Guillain-Barré syndrome (GBS), Thrombotic thrombocytopenic purpura (TTP) and chronic inflammatory demyelinating polyneuropathy (CIDP),respectively. These findings were consistent with Nieto Aristizábal, et al. [39] in study of "Therapeutic Plasma Exchange as a Treatment for Autoimmune neurological diseases" found that patients included with following diagnoses: myasthenia gravis (MG), (GBS), neuromyelitis optica spectrum disorders (NMOSD), (CIDP), and autoimmune encephalitis respectively. In Same line with Lin, et al. [40] in study of "Real-world application of plasmapheresis for neurological disease: Results from Japan-Plasmapheresis Outcome and Practice Patterns Study" reported that most frequent disease among patients treated with plasmapheresis was GBS, autoimmune encephalitis/encephalopathy, MS, NMOSD, CIDP, and MG respectively. Furthermore this findings agree with Ghonemy, et al. [41] in study of "Outcomes of therapeutic plasma exchange; one year single center experience" found most studied patients referred for GBS, CIDP and MG. Regarding methods of plasmapheresis, present study revealed most of patients had plasmapheresis by centrifugation method, this finding is same line with Lemaire, et al. [42] "Plasma exchange in the intensive care unit: technical aspects and complications" found centrifugation technique used for about two thirds of procedures and filtration for more than third of procedures.

This study supported by Keklik, et al. [43] in study about "Comparison of centrifugal and membrane filtration modalities on therapeutic plasma exchange. Journal of Clinical Apheresis" found that there were 29 patients in cTPE group and 22 patients in mTPE group, respectively. These findings matched with Coirier, et al. [44] found that plasmapheresis technique used exclusively was centrifugation, regardless of indication. It was chosen because of higher efficiency of plasma extraction relative to filtration and the possibility of using peripheral venous access. In contrary Paglialonga, et al. [45] in study of "Indications, technique, and outcome of therapeutic apheresis in European pediatric nephrology units" stated membrane filtration, most common technique used in plasmapheresis. Regarding number of sessions of plasnapheresis, the current study revealed that two fifth of them had 8 session of plasmapheresis. This finding was matched with Ara, et al. [31] who stated in study of "Complications of Therapeutic Plasma Exchange in Patient with Neurological Disorders" that total number of TPE sessions was performed with the median of 4 sessions per patient (range 1 to 9). This variation can be interpreted that the number and frequency of TPE procedure depended upon the clinical scenario and economic status of the patient. Related to amount of replacement fluid, present study revealed that amount of replacement fluid range from 1700-2800ml, with mean ±SD 2140±336.49. These findings are consistent with Kes, et al. [46] in study of "A randomized crossover study comparing membrane and centrifugal therapeutic plasma exchange procedures" found that mean ±SD of amount of replacement fluid was 3.624±658. The findings of current study revealed that types of replacement fluid used with plasmapheresis included plasma, plasma + normal saline and plasma+ringer and albumin not used because of its high cost for patients. Also the recent study revealed that plasma+ saline were used for nearly half of studied patients followed by plasma for nearly one third of studied patients as replacement fluid .these findings are in

same line of Ince, et al. [47] in study of "Ab0791 Evaluation Of The Efficacy And Complications Of Plasma Exchange In Anca-Associated Vasculitis: Results Of Propensity Score Matching Analysis In High-Risk Patients" who reported that fresh frozen plasma was used in (66.6%) of patients and albumin was used in (33.3%) of patients.

These findings supported by FARIA, et al. [48] in study of "Therapeutic Plasmapheresis: Seven Year Experience of an Intensive Care Unit in Portugal" found that most of used replacement solutions were fresh frozen plasma (34.4%), and albumin/fresh frozen plasma (19.2%). These findings are in consistence with Paglialonga, et al. [45] who reported that albumin most frequently used substitution fluid, followed by plasma then albumin +plasma. These variations in type of replacement fluid can be explained by that main factors for choosing a replacement fluid during TPE are dependent on availability of fluid type and its cost, patient's baseline bleeding risk, and underlying disease condition. Regarding weight and height of studied patients, current study indicated that Mean ±SD of patients weight and height was (80.55±12.457& 167.35±8.15) respectively. These findings are supported by Bharti, et al. [49] in study of "Complications During Therapeutic Plasma Exchange" reported that mean of patients' weight and height was 57.39& 164.92 respectively. Also these results matched with Kes, et al. [46] reported that patient weight and height were, respectively,71.6614.5 kg and 171.869.3 cm (mean ±SD). Related to body mass index (BMI) of studied patients, current study revealed BMI of nearly half of studied patients was ≥30. This agree with [49] who found that BMI was >30 in majority of studied patients.

These findings are consistent with [50] in study of "The Relationship of Lifestyle with Disease Activity among Patients with Systemic Lupus Erythematosus: A Descriptive-Correlational Study" found mean ±SD of BMI of patients was 25.69±4.64. Regarding to use of immunosuppressive medications with the plasmapheresis, current study revealed that more than half of patients received Immunosuppressive drugs with plasmapheresis. This finding agree with the Guptill, et al. [51] in study of "Effect of therapeutic plasma exchange on immunoglobulins in myasthenia gravis" found that most of patients on immunosuppressive therapy with plasmapheresis. This also agree with Hindawi, et al. [52] in study of "Outcomes of therapeutic plasma exchange: a 15-year tertiary center experience" reported immunosuppressant given in almost 80% of cases. These findings are in same line with [53] in study of "A regimen with caplacizumab, immunosuppression, and plasma exchange prevents unfavorable outcomes in immune-mediated TTP" found patients received treatment regimen associating therapeutic plasma exchange (TPE), and immunosuppression, these findings can explained by addition of an immunosuppressive drug has suggested as a means to prevent excessive production of autoantibodies and clinical worsening.

Regarding patients complications associated with plasmapheresis, current study revealed in pre intervention phase majority of studied patients had anxiety, more than two thirds had pain at catheter site, about two thirds had nausea and vomiting, more than half of them had Paresthesia, and half had hypotention with plasma seperation followed by headach and chills from allergic reactions. In addition, the most complications mild and moderate. These findings are in same line with [54] in study of "Adverse events in apheresis: An update of WAA registry data" found that the most common complications were pain at access site, tingling, nausea and vomiting, access problems, urticarial from allergic reaction and hypotension respectively. Also, reported that most complications were mild and moderate. These findings also agree with Gala-Błądzińska, et al. [18] in study of "Safety and tolerability of therapeutic plasma exchange in autoimmune neurological diseases — a retrospective single-centre analysis" found complications of TPE were hypotension with plasma turning, dyspnea and technical problems with filter and catheter respectively. Moreover, these resulted matched with Gafoor, et al. [55] in study of "Plasmapheresis in neurological disorders: Experience from a tertiary care hospital in South India" who reported that complications associated with plasmapheresis were paraethesias, cramps and hypotention respectively.

These findings are in same line with Bobati, et al. [56] in study of "Therapeutic plasma exchange-an emerging treatment modality in patients with neurologic and non-neurologic diseases" found that most common complications were hypotension, followed by fever with chills, nausea and allergic reactions. Current study revealed that central access site bleeding occurred minimally with plasmapheresis, in contrary Jagdish,et al. [57] in study of "Effect of double filtration plasmapheresis on various plasma components and patient safety: a prospective observational cohort study" found bleeding occur as second most common complications after hypotention. In post intervention phase all previous patient complications improved and there was statistically significant improvement in most complications of patients associated with plasmapheresis in post intervention phase with P. value was<0.001. These findings might be due to improve nurses' level of knowledge and practice regarding plasmapheresis that reflected in to decreasing patients complications. These findings agree with [58] in study of "Effect of Educational Package on Complications Associated with Plasmapheresis among Patients with Autoimmune Disorders" found there a statistical significant decline in report of plasmapheresis associated complications after implementing educational package. Concerning abnormalities of laboratory tests of studied patients, current study demonstrated in pre procedure phase majority of studied patients had hypocalcemia, three quarter had anemia, more than two thirds had decrease in albumin level, and more than half had hyponatremia. These findings are in same line with [18] reported most common abnormality in lab test hypocalcemia. In post procedure phase based on medical management and improved nurses' performance there was statistically significant improvement in most of laboratory tests of studied patients in post procedure phase with P. value p<0.001. This agree with [58] found significant improvement in all abnormalities of laboratory tests including, hyponatremia, hypocalcemia, leukocytopenia, thrombocytopenia, anemia and hypokalemia respectively in post procedure phase with P. value p<0.04. As regard to improved signs and symptoms of studied patients, % of patients' signs and symptoms improved after plasmapheresis increased from 52.5% to 90% post procedure.

Table 1: Frequency and Percentage Distribution of Demographic Characteristics of the Studied Nurses (n=40).

Demographic characteristics	NO	%
Age (year)		
≤30	9	22.5
>30-40	21	52.5
>40	10	25.0
Mean ±SD	36.72 ±8.81	
Range	20-57	
Sex		
Male	10	25.0
Female	30	75.0
Marital status		
Married	29	72.5
unmarried	11	27.5
Academic qualification		
Diploma	20	50.0
Technical Institute	16	40.0
Bachelor	4	10.0
The department		
Renal dialysis department	22	55.0
Department of intensive care	18	45.0
Years of experience in plasmapheresis		
<3	23	57.5
3-5	14	35.0
>5	3	7.5
Have you attended training courses on plasmapheresis and its complications		
Yes	0	0.0
No	40	100.0

Table 2: Frequency and Percentage Distribution of Total Satisfactory Scores of Nurse Knowledge and practice throughout Study Phases (n=40).

Nurses' knowledge Practice &	**Nurses' knowledge**				**Nurses' Practice**				**MC p**
	Pre		**Post**		**Pre**		**Post**		
	No.	**%**	**No.**	**%**	**No.**	**%**	**No.**	**%**	
Satisfactory	2	5.0	35	87.5	4	10.0	37	92.5	<0.001**
Unsatisfactory	38	95.0	5	12.5	36	90.0	3	7.5	
Mean± SD	31.05±13.48		65.97±9.02		26.27±7.99		47.97±6.34		

MC: Mcnemar test **: statistically highly significant (p<0.001)

Table 3: Frequency and Percentage Distribution of Socio-demographic Characteristics of the Studied Patients (n=40).

Demographic Characteristics	NO.	%
Age (years)		
<30	8	20.0
30-50	19	47.5
>50	13	32.5
Mean ±SD	41.30±13.92	
Gender		
Male	16	40.0
Female	24	60.0
Marital status		
Married	30	75.0
Not married	10	25.0
Occupation		
Employed	15	37.5
Unemployed	25	62.5
Level of education		
Primary	7	17.5
Secondary	9	22.5
University	12	30.0
Un educated	12	30.0
Smoking habit		
Smoker	10	25.0
Non smoker	30	75.0
Hospital		
ICU with agree	14	35.0
Internal medicine hospital	11	27.5
New surgical hospital	15	37.5
Department		
ICU	19	47.5
Hemodialysis department	16	40.0
Neurology department	5	12.5

Table 4: Frequency and Percentage Distribution of Present Medical History of the Studied Patients (n=40).

Present Medical History Items	NO.	%
Diagnosis		
Acute disseminated encephalomyelitis (ADEM)	1	2.5
Chronic inflammatory demyelinating polyneuropathy (CIDB)	5	12.5
Guillain-Barré syndrome (GBS)	8	20.0
Myasthenia gravis (MG)	3	7.5
Myelitis	13	32.5
Systemic lupus erythematosus (SLE)	3	7.5
Thrombotic thrombocytopenic purpura (TTP)	7	17.5
methods of plasmapheresis		
Centrifugation	35	87.5
Filtration	5	12.5
Number of sessions		
5 sessions	9	22.5
8 sessions	16	40.0
10 sessions	14	35.0
12 sessions	1	2.5
Amount of replacement fluid		
<2000 mL	21	52.5
2000-2500 mL	15	37.5
>2500 mL	4	10.0
Mean ±SD	2140±336.49	
Range	1700-2800	
Type of replacement fluid		
Plasma	13	32.5
plasma &normal saline	18	45.0
Plasma& ringer	9	22.5
Weight of patient (Mean ±SD)	80.55±12.457	
Height of patient (Mean ±SD)	167.35±8.15	
BMI		
18.5-24.9	10	25.0
25-29.9	12	30.0
≥30	18	45.0
Immunosuppressive drugs		
Yes	24	60.0
No	16	40.0

Table 5: Frequency and Percentage Distribution of Patient Complications throughout Study Phases (n=40).

patient complications	Pre-Intervention		Post- Intervention		MCP-value
	NO	%	NO	%	
Mild					
Hypotension not requiring replacement of pressure amines	7	17.5	1	2.5	0.058
Technical problems with the catheter	28	70.0	5	12.5	<0.001**
Pain					
Redness	17	42.5	4	10.0	<0.001**
blood leak	7	17.5	4	10.0	0.215
Hemolysis	17	42.5	2	5.0	<0.001**
Moderate					
Trans membrane pressure (TMP) increase or coagulation in the filter	7	17.5	6	15.0	0.987
Hypotension associated with plasma turning	20	50.0	11	27.5	<0.001**
Dyspnoea	16	40.0	6	15.0	<0.001**
Paresthesia	24	60.0	6	15.0	<0.001**
Chest pain	16	40.0	5	12.5	<0.001**
Headache	19	47.5	10	25.0	<0.001**
Back pain (spine)	5	12.5	5	12.5	----
Fever	9	22.5	4	10.0	0.075
Chills	19	47.5	6	15.0	<0.001**
Urticaria	7	17.5	4	10.0	0.231
Abdominal pain	13	32.5	5	12.5	0.023*
Lower limb cramp	16	40.0	6	15.0	<0.001**
Eye irritation	11	27.5	6	15.0	0.065
Tears	10	25.0	8	20.0	0.897
Arrythmia	5	12.5	4	10.0	0.877
Anxiety	35	87.5	13	32.5	<0.001**
Nausea, vomiting	27	67.5	10	25.0	<0.001**
Severe					
Transfusion-related acute lung injury(TRALI)	1	2.5	0	0.0	0.876
Acute anaphylactic reaction	5	12.5	0	0.0	0.075
Heparin-induced thrombocytopenia type II	1	2.5	0	0.0	0.987
Central access site bleeding	2	5.0	0	0.0	0.877
Central access site thrombosis	7	17.5	1	2.5	0.049*

MC: McNemar test, non-significant (p>0.05), *: statistically significant (p<0.05), **: statistically highly significant (p<0.001).

Table 6: Frequency and Percentage Distribution of Irregularities in Laboratory Tests and Improved Signs and Symptoms of Studied Patients throughout Study Phases (n=40).

Patients parameters	Pre-Procedure		Post- Procedure		MCP-value
	NO	%	NO	%	
Type of irregularity in laboratory tests					
Anemia	30	75.0	16	40.0	<0.001**
Leukopnea	1	2.5	2	5.0	0.987
Thrompocytopenia	9	22.5	6	15.0	0.234
Elevated 1289eukocytosis (leukocyte count > 11,000/μ)	20	50.0	2	5.0	<0.001**
Hypokalemia	8	20.0	3	7.5	0.087
Hyponatremia	26	65.0	10	25.0	<0.001**
Hypocalcemia	32	80.0	10	25.0	<0.001**
Lowered fibrinogen concentration	18	45.0	11	27.5	0.047*
Reduced total protein level	23	57.5	8	20.0	<0.001**
Decreased albumin level	27	67.5	12	30.0	<0.001**
Increased CRP	0	0.0	1	2.5	0.986
INR< 0.8 or > 1.2	10	25.0	6	15.0	0.125
Improved signs and symptoms					
Yes	21	52.5	36	90.0	<0.001**
No	19	47.5	4	10.0	

MC: McNemar test, non-significant (p>0.05), *: statistically significant (p<0.05), **: statistically highly significant (p<0.001).

Table 7: Correlation Coefficient between total knowledge and Practice level of Studied Nurses throughout Study Phases. (n =40).

Pre-intervention	Practice		Post-intervention	Practice	
	R	P		R	P
Knowledge	0 .295	0 .064	Knowledge	0 .341	0 .031*

Non-significant (p>0.05), *: statistically significant (p<0.05), r: correlation coefficient

Table 8: Correlation Coefficient between Total Knowledge and Practice of Studied Nurses and Outcome of Patients throughout Study Phases.

Pre-intervention	Patient outcome		Post-intervention	Patient outcome	
	R	P		R	P
Knowledge	-0.162	0 .317	Knowledge	-0.805	<0.001**
Practice	-0.263	0 .101	Practice	-0.033	0 .839

Non- significant (p>0.05), **: highly significant (p<0.001), r: correlation coefficient

Also, there was highly statistically significant difference between improved signs and symptoms of patients in pre and post procedure with P. value <0.001. This can be due to medical management, decreased antibody levels post procedures and improvement of nurses' knowledge and practice after educational guidelines reflected into decreasing complications and abnormalities of laboratory tests thus improving signs and symptoms after TPE. These findings agree with Nieto-Aristizábal, et al. [39] found that there was improvement of patient signs and symptoms and condition as statistically significant difference noted b/w median modified ranking scale (mRS) scores before and after TPE. These findings agree with [59] in study entitled "Experience of therapeutic plasma exchange in rheumatic diseases: Albumin may be a suitable substitute for plasma" found that there was clinical improvement of patients' condition, signs and symptoms after TPE treatment. Regarding Correlation Coefficient between total knowledge and Practice level of Studied Nurses throughout Study Phases, the current study revealed that there was statistically positive correlation between total scores of nurses' knowledge and practice throughout Study Phases with P. value (0 .031). 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 level of nurses' practice depend on nurses' knowledge, so training programs are recommended to provide nurses' with continuous professional development and knowledge to make nurses aware about how to deal with patients undergoing TPE. These findings agree with Mohamed, et al. [29] stated that there was strong, positive correlation between nurses' knowledge and their practice, both before and after the educational and training program. In contrary Ahamed& Sallam [60] in study of "The effect of nursing instructions on nurses' knowledge, practice and suggestions regarding adverse events in hemodialysis" found that there no correlation between total level of knowledge and total competence level of practice pre and post intervention. Related to Correlation Coefficient between Total Knowledge and Practice of Studied Nurses and Outcome of Patients throughout Study Phases present study revealed that there was statistically positive relation between total scores of nurses' knowledge and outcome of studied patients with P. value was <0.001. This means that when nurses' knowledge improved after educational guidelines reflected on improvement of patients' outcomes and decrease complications.

These findings agree with Ahmed& Elderriny [58] noticed that there was statistically positive relation between nurses' knowledge and outcome of studied patients thus there was a statistically significant decline in the report of plasmapheresis associated complications post-educational intervention. Current study demonstrated that, there was negative correlation between nurses' knowledge and nurses' practice and patients' outcomes. This negative correlation indicate that as level of nurses knowledge and practice increased after educational guidelines patient outcomes which include complications and abnormalities of lab test associated with plasmapheresis were decreased that reflect efficacy of educational guidelines in improving nurses performance and fostering professional development in specialized areas like plasmapheresis thus improving patients outcomes. Finally, findings of present study supported research hypothesis that nurses' knowledge score post educational guidelines was improved than pre-educational guidelines, nurses' practice level regarding plasmapheresis was improve post educational guidelines than pre-educational guidelines and patient's outcome was improve post educational guidelines than pre-educational guidelines.

4. Conclusions

Based on the findings of the present study it can be concluded that the educational guidelines significantly improved nurses' knowledge and practice regarding complications associated with plasmapheresis. With a sustained improvement in the patients' outcomes. In addition to, the majority of studied patients were free from complications of plasmapheresis, decreased abnormalities of laboratory tests, and improved signs and symptoms of their disease condition follow educational guidelines than before.

Recommendations

In view of the main results of the study the following recommendations were derived and suggested, Lectures and seminars should be organized about plasmapheresis with the help of consultants and professors for nurses, complete manual procedures should be in Arabic language, easily used and available to all nurses., knowledge and competence of nursing staff should be periodically

evaluated, documented and up to date if necessary., periodic evaluation and validation of the training given and training programs should be included both theoretical and practical, and Replication of the study on a larger probability sample from different geographical areas for generalization of the results.

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