Effect of Evidence Based Guidelines on Nurses' Performance and attitude Regarding Care of Children Undergoing Plasmapheresis

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Abstract

Background: Plasmapheresis is a procedure performed for different life-threatening and debilitating diseases as a principle 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. **The study aim** was to evaluate the effect of evidence based guidelines on nurses' performance regarding care of children undergoing plasmaphresis **Study design:** A quasi- experimental approach with pre and post intervention. **Sample:** A convenient sample of all available nurses (n=64) and purposive sample of children undergoing plasmaphresis (n=64) at Pediatric Hemodialysis Department of Benha University Hospital. **Tools of data collection: Tool (I): Nurses' knowledge regarding plasmaphresis at Pediatric Hemodialysis Unit**. **A structured Interviewing Questionnaire Sheet;** It included **Part 1:** Personal characteristics of the studied nurses, **Part 2:** Personal characteristics of the studied children, **Part 3: Nurses' knowledge regarding** evidence based practice and nurses' knowledge regarding plasmaphresis**. Tool II: Plasmaphresis observational checklists:** It was used to assess nurses' practice regarding care of children undergoing plasmaphresis used to assess nurses' practice regarding care of children undergoing plasmaphresis. **Tool III: Nurses' attitude regarding care of children undergoing plasmaphresis. Result:** Shows that, there are a highly statistical significance differences in all items of nurses' knowledge and practice related to plasmaphresis procedure and management of plasmaphresis complications in post implementation of evidence-based guidelines as compared to pre-implementation ($P \leq 0.00$).**. Conclusion:** implementation of evidence based had strengthened nurses' performance and attitude regarding care of children undergoing plasmaphresis. **Recommendations:** Continuing educational programs must be conducted to improve nurses' knowledge, practice and attitude regarding care of children undergoing plasmaphresis

Key Words: Evidence based guidelines, Plasmaphresis, Nurses' performance, children

Introduction

Plasmapheresis or therapeutic plasma exchange (TPE), it means separation and removal of the plasma from children's blood while simultaneously or at the same time giving back a replacement fluid prescribedaccording to children's disease or condition. Plasmapheresis is safe, fast, and powerful for emergent management of children chronic disease. Plasmapheresis is used to remove destructive antibodies, toxins , medications, , and clotting factors from the circulation. **(1)**

Plasmapheresis is the treatment of choice for renal, hematological, neurological, and immunological diseases. Plasmapheresis; it is used as a therapeutic management in a wide range of conditions. Plasmapheresis is used when a substance as a part of plasma, such as; immunoglobulin, is intensely harmful and can be proficiently evacuated. Several conditions fall under this classification, including hematologic, neurologic, renal diseases, metabolic, dermatologic, rheumatologic, and, as well as intoxications, that can be treated with plasmaphresis. **(2)**

Plasmapheresis is a relatively unfamiliar part of nursing practice. It requires a particular set of specialized knowledge and technical skills. All nurses must be appropriately qualified and trained in the procedures they regularly perform. **(3)** The crucial role of nurse in the process of plasmaphresis is various and is great in clinical, educational, inquiring and advisory. Nurses main duties are establishing, maintaining and improving standards of nursing care for children undergoing plasmaphresis**. (4)**

Plasmapheresis nurse has to be an effective practitioner able to maintain and establish high quality evidence based nursing practices and coordinate with the multi-disciplinary team to ensure that children receiving plasma exchange procedure have access to specialist care, proficienlist and expertise. Also, Plasmapheresis nurse has to ensure children and their parents have an understanding natural of their disease, treatment of choice and support services in conjunction with the responsible physician and provide effective coordination for children undergoing plasma exchange within the hospital. (5)

Before starting of therapeutic plasmaphresis, the nurse is in charge for the confirmed of the identity of right child, informed consent should be obtaining before beginning treatment, taking a full child's history, preparation of plasmaphresis machine, liquids of substitution and set of venipuncture but also the effective use of plasmaphresis equipment and supplies . Also, before the first session, the plasmaphresis nurse is responsible for taking blood sample for testing; hematocrit level , viral infections, biochemical indicators, antibodies and checking for an appropriate vascular access. Before the first plasmaphresis procedure, the nurse has to inform the child and their parents about the process of plasmaphresis, the need to secure and maintain one or two peripheral veins and in its absence the replacement of central venous line. In addition, the nephrology – hematology nurse encourage the child to obtain a light meal before the treatment, reduces children's anxiety and tries to ensure warm environment, heating the replacement fluids, especially in winter months**.** (6)

After the connection of the child to the plasmaphresis device, the nurse’s vital role is the immediate intervention in case of febrile fever or reaction, hypotension, or allergic - hemolytic reactions. During the healing process, the role of nurse is focused in monitoring of the child and the plasmaphresis machine with regular taken of physiological measurement, updates of the children care sheet including; vital signs, medication taken, side effects, blood pump, blood flow, amounts of ingested and

secreted substitution, replacement fluids and anticoagulants used) and appropriately dealing with any potential complications of the treatment**.** [7]

Evidence-based practice (EBP); it means a problem-solving approach to the delivery of healthcare that incorporates the best available evidence, clinicians' expertise in making decisions about children care. It also can be defined as systematically developed statements based on the best evidence of recommended practice in a specific clinical or health work environment. The EBP is a vital part of enhancing critical care nursing practice, which is essential for providing high quality of care to children. and reducing costs of hospital stay and complications. [8]

Evidence-based practice (EBP), the integration of the best available research with clinical expertise in the context of children characteristics, culture, and preferences, has been considered an effective strategy for improving the quality of care. Evidence-based practice represents a new paradigm in nursing; recent advances in clinical practice and research methodology as well as new information technologies have made implementation of evidence-based decision-making both feasible and desirable for nursing practice. [9]

The evidence based process is to identify a problem in current practice which would represent a trigger for change in practice. The first step is followed by the second step which entails a review and critique of relevant literature. The third step is to identify research evidence that supports the change in clinical practice. The final step is to implement the change in practice and monitor the outcomes. Process of evidence based practice Similar to the components of the nursing process which include: Identifying the clinical practice question or problem; Assessing the clinical appraisal components; Planning the implementation; Implementing the practice change; and evaluating the practice change **.** [10]

Evidence-based practice enables nurses to provide a high-quality child care based on research and established knowledge. [11]

Significance of the study

Plasmaphresis has become increasingly popular and effective therapy for renal and immunological diseases and has proved to be lifesaving in certain conditions. The clinical responsibilities of nurse regarding care of children undergoing plasmaphresis including; infection control in plasmaphresis unit with careful antiseptic technique in the entry of the needle, early detection of risk factors and establishment of quality assurance criteria with the goal of providing high quality healthcare intervention. At the same time, promoting safe and a quiet environment prepared staff, providing psychological support to the children, information and education about the process of plasmaphresis and collaboration with the interdisciplinary team providing specialized care to the children. In addition, performing at expert level of vascular access for plasmaphresis procedure, compliance with the guidelines and nursing care protocols, safe keeping of children's' records and ensuring medical confidentiality are of high importance nursing responsibilities**.** [4]So, this study aimed to evaluate the effect of evidence based guidelines on nurses'

performance and attitude regarding care of children undergoing plasmaphresis.

Aim of the Study

The aim of this study was to evaluate the effect of evidence based guidelines on nurses' performance regarding care of children undergoing plasmaphresis through the following.

1. Assessing nurses' knowledge, attitude and practice regarding care of children undergoing plasmaphresis.
2. Designing, implementation and evaluate the evidence based guidelines to improve nurses' performance regarding care of children undergoing plasmaphresis.

The research hypothesis:

The research hypothesis was as follows: Implementation of evidence based guideline expected to be improved nurses' performance regarding care of children undergoing plasmaphresis is expected to be improved after implementation of EB guidelines..

Subjects and Methods

I. Study design

The technical design for the study includes research design, setting of the study, subject and tools for data collection.

Study Design

A quasi-experimental research design was utilized for conducting the study.

Setting

The study was conducted at Pediatric Hemodialysis Department at Benha University Hospital affiliated to Ministry of Higher Education and Research. Is located in fourth floor and includes three rooms, two rooms each room had 8 beds with 8 hemodialysis machine and one room had 9 beds with 9 hemodialysis machine. Hemodialysis machine (17) for hemodialysis children and (8) A Nikkiso hemodialysis machine use filters for plasma exchange. Total hemodialysis machine (25) for hemodialysis and plasma exchange for children.

Study subjects

The subjects included in the study consisted of two types of samples.

I: A convenient sample (n=64) of all available nurses regardless their personal characteristic, who were working at the previously described setting.

II: A purposive sample (n=64) of children from the previously described setting throughout the study period

The sample size will based on the following parameters confidence level error 5% type I error 0.05%and power of test 95%

Inclusion criteria

- Age range from 6 to 15 year.
- Children undergoing plasmaphresis and agree to participate in the study
- Free from psychological and emotional problems.

Tools of data collection

Tool (I): Nurses' knowledge regarding plasmaphresis at Pediatric Hemodialysis Unit. **A structured Interviewing Questionnaire Sheet:** this tool was created by researchers based up on scientific literature review to collect data and written in a simple Arabic language. It consisted of the following:

Part 1: Personal characteristics of studied nurses: Age, sex, educational level, years of experience, the attainment of previous training program regarding care of children undergoing plasmaphresis and attendance of

previous training courses related to evidence based performance.

Part 2: Personal characteristics of children: It includes age, gender, educational level, child ranking and residences.

Part 3: Medical data for children: It includes: diagnosis, duration of illness, Number of Plasmapheresis sessions, number of plasma transfusion at day and laboratory investigations), vital signs and weight. The researchers collected medical data of studied children from the medical record.

Part 4: Nurses' knowledge regarding evidence based practice: It was designed by the researchers based on **Huett, A. and MacMillan, D. (2011)**, [12] to assess nurses' knowledge evidence based practice related to Care of children. It comprises 6 questions in a form of multiple choice questions such as; Definition of evidence based guidelines, benefits, components, stages, challenges and obstacles facing the application of EBG and ways to support and facilitate EBG.

Part 5: Nurses' knowledge regarding blood and blood component.

It adapted from **Mathew, Sankar and Varacallo. (2023),** [13] to assess nurse's knowledge about blood and blood component and comprises 10 questions in a form of multiple choice questions such as; definition, function, components of blood, definition of plasma, function of plasma, uses of blood plasma, definition of a plasma transfusion, type of plasma description, precautions for plasma transfusion and storage of plasma

Part 6: Nurses' knowledge regarding plasmaphresis.

It adapted from **Oto et al. (2022),** [14]to assess nurse's knowledge about plasmaphresis and comprises 5 questions in a form of multiple choice questions such as; definition, goal, therapeutic apheresis modality, complications and management of plasmaphresis complication before, during and after the procedure its include(fever-hypertension-hypotension and allergic reaction).

Nurses' knowledge will be scored as follows

The studied nurses' answers were compared with model key answers, where scored as two grades for correct and complete answer, one grade for correct and incomplete answer and zero for incorrect or don't know answer.

The total scores of nurses' knowledge will be calculated as following

- Less than 60% will be considered low level of knowledge.
- From 60-80 % will be considered moderate level of knowledge.
- From 80% will be considered high level of knowledge.

Tool (II) Plasmaphresis observational checklists

This tool was adapted from **Nicabi, Dogah and Burberry, (2023)** [15]**, used** to assess Nurses' actual practices before, during and after care of children undergoing plasmaphresis therapy. This tool included 123 steps under grouped 9 main procedures about nursing practice including: **hand washing** (13steps), **axillary temperature**(15 steps), **pulse (**13 steps), **respiration** (9steps) **blood pressure** (13steps) **drug administration**(18 steps) measuring weight (8steps) and **skin care** (11steps) and **preparation of the child**

before, during and after plasmaphresis session (23 steps).

The Scoring system of nursing practice

The studied nurses' answers were compared with model key answers, each item was checked as score (1) for practice done and score (0) for not done or incorrect practice. The scores of all items were summed up and total was (123) divided by number of the items, giving a mean score for the part.

The total scores of nurses' practice will be calculated as following

- Incompetent: <80% of total nurses' practice score, ranged from (0- 97) points.

Tool (III): Nurses' attitude regarding care of children undergoing plasmaphresis

It is adapted from **Camedda et al. (2023)** [16]**,** to assess nurses' attitude regarding care of children undergoing plasmaphresis. It is 3-point Likert Scale translated to Arabic to suit nurses understanding and included (18) items regarding care of children undergoing plasmaphresis, such as (during care become helpful to children and their parents, during care show to children bad tempered behavior, during care protect and observe the child' rights, check if their medications soothe their symptoms, know what to do in situations where one must act quickly, help them to recognize the means to efficiently solve their problems, encourage them to be hopeful, when it was appropriate and during care continuously using standard precaution to prevent the spread of infections.

Scoring system of nurses' attitude

The studied nurses' answers were compared with model key answers, nurses scored as agree had score 2, neutral had score 1 and disagree had score 0. Total score of nurses' attitude ranged from (0-36) points.

- **Negative attitudes** (< 60%)
- **Positive attitudes** (60 % ≤ 100%)

Method

Operational design

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

a. Preparatory Phase

Using textbooks, papers, journals, and scientific periodicals, a review of the relevant historical and present national and international literatures were conducted in order to be acquainted with the several elements of the current study, and design data gathering tools.

b. Content Validity

It was judged by a jury of three experts (two experts from Faculty of Nursing Benha University & one expert from Faculty of Nursing Tanta University) in the field of Pediatric Nursing. The experts evaluated the study tools for the clarity, objectivity, relevance, comprehensiveness, simplicity and applicability. The experts agreed on content, but their opinion was elicited regarding the format, paraphrasing and accuracy of the tools and recommended minor language changes that make the statement and questions clearer and more precise. The necessary modifications were done accordingly.

Reliability

Reliability of these tools was applied by the researchers for testing the internal consistency of the tools by administrating of the same tool to the same subjects under similar condition. Internal consistency

reliability of all items of the tools was assessed using Cronbach's alpha coefficient. It was (0.88) for nurses' knowledge assessment sheet, (0.91) for the nurses' practices and attitude scale confirmed with a Cronbach's alpha reliability coefficient of (0.78).

Ethical Considerations

Ethics approval granted from the Scientific Research Ethical Committee of Faculty of Nursing, Benha University. Informed consent was obtained from the studied nurses prior to data collection. The nurses were informed about the purpose and the expected outcomes of the study. Also, the nurses were assured that the study was harmless, their participation was voluntary, and they have the right to withdraw from the study at any time without giving any reason. Nurses were also assured that anonymity and confidentiality will be guaranteed as well, the collected data will be used for the research purpose only. The ethics, values, culture, and beliefs of the studied nurses were respected. Children and their parent consent was obtained before data collection ensuring that the study is harmless, and all data obtained was treated with complete privacy and confidentially for research purpose only.

Pilot Study

A pilot study was carried out involving (10%) from the study subjects (6 nurses and 6 children) to test the clarity, applicability, feasibility & relevance of the tools used and to determine the needed time for the application of each one. The pilot study were included in the study sample because no radical modification was done.

Field of work

The following phases were implemented to achieve the aim of the current study; assessment, planning, implementation and evaluation phases. These phases were conveyed from the earliest starting point of March 2023 to the end of August 2023 covering 6 months.

A-Assessment phase

Nurses were interviewed to gather baseline data during this phase were conducted during the assessment phase to gather baseline data. The researchers were Available three days/week on a rotating basis; (Saturday, Monday, Tuesday) beginning at 11 am and continuing until 1:30 pm. The researchers greeted each nurse, discussed the goals, timeline, activities of the study, and obtained written consent before the interview ever began. Researchers took approximately 15 minutes to gather data on each child from their medical file. Tool I & Tool III were distributed to the studied nurses, and they took 20 minutes to complete questionnaire that measured their knowledge and 10 minutes for Likert scale sheet that used to measure their attitude regarding care of children undergoing plasmaphresis. Researchers observed each nurse Using Tool II during their actual practice of procedures to evaluate their practice level in relation to care of children undergoing plasmaphresis at pediatric hemodialysis department and it took 30 minutes. This period of pretest took 4 weeks (from the beginning of March to the end of March, 2023).

Process of evidence-based guideline development:

Determination of needs and scope of the guideline, care of children undergoing

plasmaphresis was chosen as part of core management strategy for children undergoing plasmaphresis in Egypt. Needs and scope of the present evidence-based guidelines were identified through assessing the current knowledge and performance of the intended nurses and the end point beneficiaries of children undergoing plasmaphresis. Nurses and children undergoing plasmaphresis were involved also to fulfill the requirement of the evidence-based guideline.

Steps of Evidence-Based Guidelines implementation

Step 0: Planting a spirit of inquiry. Evidence based practice performance begins by cultivating a spirit of inquiry. Clinical inquiry becomes a routine part of practice and ongoing curiosity is fostered.

Step 1: Stating clinical search questions. Fife clinical search questions were constructed by using the PICOT

(P) Patient population of interest.

(I) Intervention or area of interest.

(C) Comparison intervention or group.

(O) Outcome.

(T) Time.

Clinical search questions

-What are the assessment methods of children undergoing plasmaphresis?

-How do nurses diagnose health needs and complications in children undergoing plasmaphresis?

-What are the principles of treatment of children undergoing plasmaphresis?

-What is the role of nurse in managing of children undergoing plasmaphresis?

Step 2: Search for the best evidence

The PICOT framework guides the search for relevant evidence to answer the clinical question. Database searches using key words or phrases enable to identify articles to inform practice on the topic of interest. A literature search was undertaken to identify potentially relevant evidence to develop the intended evidence-based guideline. The researchers reviewed a set of primary and secondary researches and evidence-based guidelines for children undergoing plasmaphresis. Review of the literature was conducted from electronic bibliographic database and only English language was utilized during the search. The searched bibliographic database is illustrated in the following:

- Guideline for Disinfection and Sterilization in Health care Facilities Accessible version: https://www.cdc. gov/infection control /guidelines /disinfection/
- Guideline for Isolation Precautions: Preventing Transmission of Infectious Agents in Healthcare Settings Accessible version: https://www. cdc.gov/infection control /guidelines/isolation/index.html - Management of Multidrug-Resistant Organisms in Healthcare Settings - Interim Guidance for Infection Control Within Healthcare Settings When Caring for Confirmed Cases, Probable Cases, and Cases Under Investigation for Infection with Novel Influenza AViruses Associated with Severe Disease -Bloodborne Pathogens and Needlestick Prevention. (https:// www. osha.gov /SLTC /bloodbornepathogens/index.html accessed May2016).
- National Institute for Occupational Health and Safety - Preventing Needle stick

Injuries in Health Care Settings (https://www.cdc.gov/niosh/docs/2000-108/accessed May 2016)
National Institute for Occupational Health and Safety- Safer Medical Device Implementation in Health Care Facilities(https:// www. cdc.gov/niosh/topics/bbp/safer/ accessed May 2016) About the Workbook for Designing, Implementing & Evaluating a Sharps Injury Prevention Program (https://www.cdc.gov/sharpssafety/resources .html accessed May 2016)
-Evidence-Based Practice. UNA Center for Writing Excellence. pp1-7.Avaialble at: https:// www.cochrane.org.
-Educational Modules on Clinical use of blood.pp1-7.Available at: https:// www.wipo.int/amc/en/mediation/rules/).
-Therapeutic Plasma Exchange in Critically Ill Pediatric Patients. International Journal of Medical Science and Clinical Invention. Vol. 9 (11). Available at: https://doi.org/10.18535/ijmsci/v9i11.07
-Hyperthermia (Fever) Nursing Care Plan and Management. Global Threat Report.PP1-3. Available at: https://www. nurses labs .com.
-Hypotension: Nursing Diagnoses & Care Plans. Nurse Together. Available at: https://www.nursetogether.com/about/

The search terms that were used for answering the clinical questions are:

- Assessment of children undergoing plasmaphresis.
- Nursing role in caring of children undergoing plasmaphresis
- Evidence-based guidelines for children undergoing plasmaphresis
- Adherence and compliance to treatment complication of children undergoing plasmaphresis.
- Health education for parents having children undergoing plasmaphresis.

Step 3: Critically appraise the evidence.

The retrieved studies were appraised by Scottish Intercollegiate Guideline Network (SIGN) System; included three main steps to evaluate evidence and grade the guideline recommendations, namely; study validity rating, determination level of evidence and finally the grade of recommendation.

First step: Study validity rating

All primary studies and reviews addressing the relevant topic were appraised by using SIGN checklist that was appropriate to the study design, and then were individually rated for internal validity using the system.

Table (a) Rating of the internal validity

Rating	Description
++	All or most of the criteria have been fulfilled
+	Some of the criteria have been fulfilled
-	Few or no criteria fulfilled

Second step: determination level of evidence

The study design is assigned by numerical prefix using the level of evidence.

Table (b) Level of evidence

Level of evidence	Type of Evidence
1++	High quality meta-analysis systematic reviews of randomized control trials with a very low risk of bias
1+	Well conducted meta-analysis systematic reviews or randomized control trials with a low risk of bias
1-	Meta-analysis, systematic reviews, or randomized control trials with a high risk of bias
2++	High quality systemic reviewers of case-control or cohort studies with a very low risk of bias and a high probability that the relationship is causal
2+	Well conducted case-control or cohort studies with a low risk of bias and a moderate probability that the relationship is causal
2-	Case-control or cohort studies with a high risk of bias and a significant risk that the relationship is not causal
3	Non-analytic studies, e.g., case reports, case series
4	Expert opinion

Third step: Grade of recommendation

The detailed results of each study were considered in the formulation of each guideline recommendation which was then graded using the following system

Table (c) Grading system of the guideline recommendations

Grade	Recommendation
A	At least one meta-analysis, systematic review, or RCT rated as 1++. And directly applicable to the target population, or a body of evidence consisting principally of studies rated as 1+, directly applicable to the target population and demonstrating overall consistency of results
B	A body of evidence including studies rated as 2++, directly applicable to the target population and demonstrating overall consistency of result, or extrapolated evidence from studies rated as 1++ or 1+
C	A body of evidence including studies rated as 2+, directly applicable to the target population and demonstrating overall consistency of result, or extrapolated evidence from studies rated as 2++
D	Evidence level 3 or 4, or extrapolated evidence from studies rated as 2+

Step 4: Integrating the evidence sourced

Integrating the evidence sourced along with clinical expertise and patient preferences in making the best clinical decisions. Formulation of guideline, a guideline including pathway of children undergoing plasmaphresis. The results of the assessment of the intended users of the guideline (nurses) and end-point beneficiaries of children undergoing plasmaphresis were considered during

stating the guideline recommendation statements.

Step 5: Evaluate the outcomes.

Practice change after implementing an evidence-based guideline through evaluation of the outcomes to determine the effect of the guidelines.

Step 6: Disseminating the outcomes.

Integrate and maintain change in practice enable others to learn and develop their practice, sharing recommendations about the new practice with stakeholders, incorporating the new practice into the standards of care, monitoring the process and outcome indicators, and celebrating and disseminating results of the research.

B- Planning phase

The evidence-based guidelines were created by the researchers using baseline data from pre-test assessment and relevant literature review. The evidence-based guidelines were created in accordance with identified needs and an assessment of relevant studies. Evidence based guidelines were constructed in a form of printed Arabic form and included different topics to enhance nurses' knowledge and practice in relation to care of children undergoing plasmaphresis at Pediatric hemodialysis department. Several techniques were used for teaching as modified lecture, brainstorming sessions, demonstration, re-demonstration, and group discussion. In order to ensure that the nurses fully understood the aims and content of the evidence-based guidelines, appropriate teaching materials were used, including handouts, audio-visual aids, role playing, and real equipment.

C- Implementation phase

Regarding the start of the program sessions, the studied nurses motivated for educational guidelines and notified of the time and location of sessions which were carried out at the pediatric lecture room at hospital. The studied nurses were divided into 10 groups, each group consisted of (6-7) nurses, distributed as the following; (3) sessions for theoretical part each session consumed 30-45 minutes and (6) sessions for practical part, each session consumed 60-90 minutes, 3 days/week in the morning shift. Theoretical part: consists of 3 sessions, each session contain (21) nurses. The first session included knowledge related to evidence based practice caring of children. such as; Definition of evidence based guidelines, benefits, components, stages, challenges and obstacles facing the application of evidence based guidelines and ways to support and facilitate evidence based guidelines. The second session included knowledge regarding blood and blood component such as; definition, function, components of blood, definition of plasma, function of plasma, uses of blood plasma, definition of a plasma transfusion, type of plasma description, precautions for plasma transfusion and storage of plasma. The third session included knowledge regarding plasmaphresis such as; definition, goal, therapeutic apheresis modality, complications and management of plasmaphresis complication before, during and after the procedure it includes (fever-hypertension-hypotension and allergic reaction). Practical part: was carried out in 6 session to be (21) nurses. The first session included nursing practice regarding hand

washing and weight. The second session included nursing practice regarding measuring axillary temperature, pulse, respiration and blood pressure. The third session included nursing practice regarding drug administration. The fourth session included nursing practice regarding skin care and care of child during fever. The fifth session included nursing practice regarding care of child during hypertension and hypotension. The sixth session: included nursing practice regarding care of child pre, during and after plasmaphresis procedure. This phase took four months from the beginning of April, 2023 to the end of July, 2023.

D- Evaluation phase

The effectiveness of the evidence based guidelines was assessed at this phase. The identical tools that were utilized before to the guidelines were applied for the immediate post evidence based guidelines evaluation for all subjects. This phase took one month (Beginning to the end of August, 2023).

Administrative Design

Prior to data collection, a written permission to carry out the study was obtained from hospital administrator of Benha University Hospital and head of department of the previously mentioned setting after submitting an official letter from the dean of the Faculty of Nursing at Benha University, explaining the purpose of the study, methods of data collection and the expected outcomes.

Statistical Design

The Statistical Package for Social Science (SPSS) version 21 for Windows, operating on an IBM compatible computer, was used to arrange, tabulate, and statistically analyze the acquired data. The use of descriptive statistics (e.g., frequency, percentages, mean and standard deviation). Tests of significance include the Chi-square test (X2), which is used to measure significant of qualitative variables and correlation coefficient (r) used for quantitative variables that were normally distributed or when one of the variables is qualitative. These tests were applied to test the study hypothesis. Reliability of the study tools was done using Cronbach's Alpha. A highly significant level value was considered when $p < 0.001$, a significant level value was considered when $p < 0.05$ and. No statistical significance difference was considered when $p > 0.05$.

Results

In the present study, It was observed that more than two thirds (67.2%) of the studied nurses were aged between 25-<30 years with the mean age 28.98±4.07 years. Regarding nurses' education, more than half (56.3%) of the studied nurses had technical institute of nursing. Also, less than two thirds (62.5%) had 5 < 10 years of experience in plasmaphresis unit with mean ± SD years of experience 7.17±3.0 year.

According to children age, less than half (42.0%) of studied children their age were from 8< 12 years with mean ± SD 9.1563±.67185. In relation to children's education, less than three quarters (70.0%) of studied children had primary education. Meanwhile, less than two third (60.0%) of them were living in rural area.

Figure (1): Illustrates that, more than two thirds (71.9%) of the studied nurses were females.

Figure (2): Clarifies that, the majority (85.9%) of the studied nurses hadn't attend training courses regarding to care children undergoing plasmaphresis

Table (1): Shows that less than two third (64.0%) of studied children had duration of disease less than 5 years. In relation to number of sessions, almost half (49.0%) of studied children had taken about 10 to 15 Plasmapheresis session Also, less than three quarters (72.0%) of the studied children their body weight were ranged from 30<40 kg, with mean ±SD 32.109±4.469. Meanwhile, less than one third (32.8%,31.4% & 23.4%) of studied children suffered from hypertension, hypotension and fever occur due to plasmaphresis respectively.

Figure (3): Shows that, less than one third(34.0%,31.0%) of the studied children were diagnosed with hemolytic uremic syndrome (HUS) and rapidly progressive germulonephritis while, hemophilia was found in 5.0% of them.

Table (2): shows mean score and SD of the studied children's vital signs in pre and post of evidence-based guidelines. It was found that, the mean of temperature of children were 37.742 ±0.867 and 37.2625±0.062 in pre and post of evidence-based guidelines, respectively. Also, the mean of the respiration of children were 23.484 ± 6.921and 19.7969± 2.205 in pre and post of evidence-based guidelines, respectively. While the mean heart rate of children were 101.234 ± 10.756 beat /minute and 97.218± 4.785 beat /minute in pre and post of evidence-based guidelines respectively. Meanwhile, the mean of the systolic blood pressure of children were 140.10±8.04mmH and 112.21±11.22mmH in pre and post of evidence-based guidelines, respectively. While diastolic blood pressure of children were 92.42±9.60mmH and 70.36±9.59 mmH in pre and post of evidence-based guidelines, respectively. This table shows that there were highly statistically significant differences between mean± SD of vital signs in pre and post of evidence-based guidelines.

Table (3): Portrays that, there are a highly statistical significance differences in all items of nurses' knowledge related to evidence-based guidelines in post implementation of evidence-based guidelines as compared to pre-implementation($P \leq 0.00$).

Figure (4): Clarifies that, majority (86.4%) of the studied nurses had satisfactory level of total knowledge in post-implementation of evidence-based guidelines as compared to (6.0%) of the studied nurses had satisfactory in pre-implementation of evidence-based guidelines.

Table (4): Illustrates that, there are a highly statistical significance differences in all items of nurses' knowledge related to blood and blood component in post implementation of evidence-based guidelines as compared to pre-implementation($P \leq 0.00$).

Table (5): Shows that, there are a highly statistical significance differences in all items of nurses' knowledge related to plasmaphresis procedure and management of plasmaphresis complications in post implementation of evidence-based guidelines as compared to pre-implementation($P \leq 0.00$).

Table (6): Reveals that, there is a highly statistically significance in all items of studied nurses' practices regarding care of children

undergoing plasmaphresis at pre and post evidence-based guidelines phases (p<0 .001).

Figure (5): Showes that, majority (90.6%) of them had competent practice regarding care of children undergoing plasmapheresis at post evidence based guidelines as compared to more than three quarter (76.7%) of studied nurses had incompetent level of total practice at pre evidence based guidelines phase.

Figure (6): Clarifies that, most (93.7%) of them had positive attitudes regarding care of children undergoing plasmapheresis in post evidence based guidelines phases.While, majority (85.9%) of studied nurses had negative attitudes in pre evidence based guidelines phase.

Table (7): Reflects that, there is a positive significant improvement of the studied nurses' total knowledge, attitude and practice regarding care of children undergoing plasmaphresis in post implementing evidence based guideline.

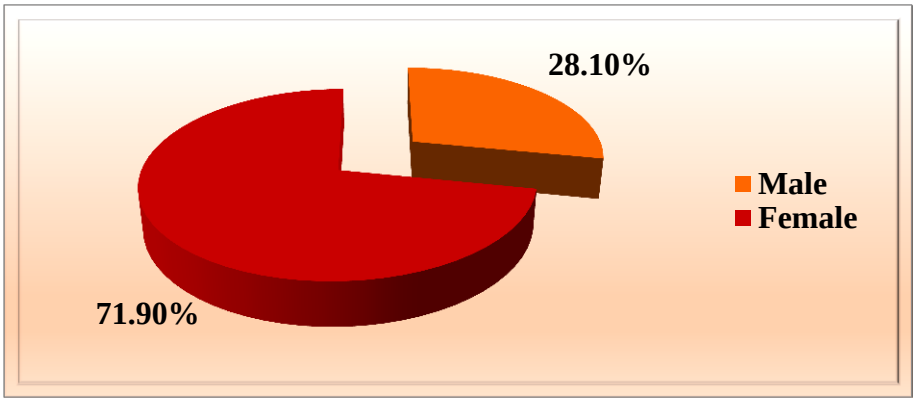

Figure (1): Distribution of the studied nurses according to their gender (n=64).

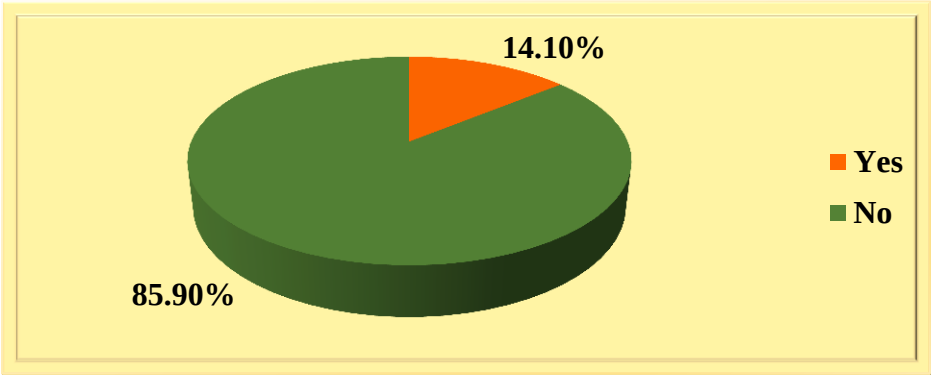

Figure (2): Distribution of the studied nurses according to their Attendance of training courses related to care children undergoing Plasmapheresis (n=64).

Table (1): Distribution of the studied children according to their medical data (n=64).

Medical data	Studied children	
	N.	%
Duration of disease (Years)		
>1year	19	29.7
>5 years	41	64.0
< 5years	4	6.3
Number of Plasmapheresis sessions		
1-5	2	**3.0**
5-10	23	36.0
10-15	31	**49.0**
15-20	7	10.0
More than 20 session	1	2.0
Child weight		
20<30kg	13	20.0
30<40 kg	46	72.0
40<50 kg	5	8.0
More than 50 kg	0	0.0
Mean ±SD	32.109±4.469	
Most common complication occur during plasmaphresis		
Hypotension	20	**31.3**
Fever	15	**23.4**
Allergic reaction	8	12.5
Hypertension	21	**32.8**

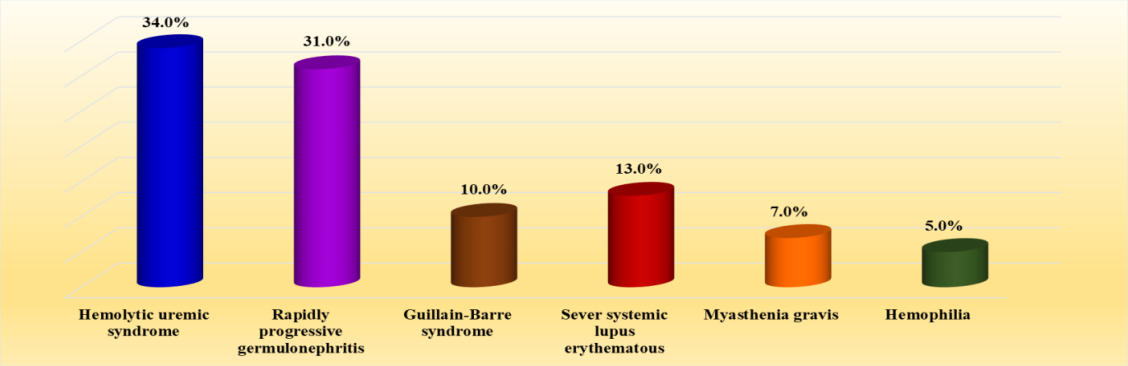

Fig (3): Distribution of the studied children according to medical diagnosis (n=64).

Table (2): Mean and standard deviation of vital signs of children pre/post-implementation of evidence-based guidelines (n=64).

Vital signs	Pre- evidence based guidelines	Post- evidence based guidelines	t	p-value
	Mean ±SD	Mean ±SD		
Temperature	37.742 ±0.867	37.2625±0.062	29.110	0.00
Respiration rate	23.484 ± 6.921	19.7969± 2.205	44.739	0.00
Heart rate	101.234 ± 10.756	97.218± 4.785	45.174	0.00
-Systolic pressure	140.10±8.04	112.21±11.22	45.739	0.00
-Diastolic pressure	95.42±9.60	70.36±9.59	53.33	0.00

Table (3): Distribution of the studied nurses' knowledge pre/post-implementation ofevidence based -guidlines

Nurses' knowledge about evidence-based guidelines	Pre-implementation of evidence-based guidelines						Post-implementation of evidence-based guidelines						X^2	p-value
	Complete Correct answer		Incomplete Correct answer		Don't know		Complete Correct answer		Incomplete Correct answer		Don't know			
	N.	%	N.	%	N.	%	N.	%	N.	%	N.	%		
- Definition of evidence-based guidelines	7	**10.0**	8	14.0	49	**76.0**	60	**93.8**	4	6.2	0	0.0	45.17	0.00
- Benefits of evidence-based guidelines	18	28.0	19	29.7	27	42.3	52	82.0	12	18.0	0	0.0	31.40	0.00
- Components of evidence-based guidelines	0	0.0	18	28.0	46	**72.0**	52	81.3	10	15.6	2	3.1	33.49	0.00
- Stages of applying evidence-based guidelines	19	29.7	19	29.7	26	40.6	51	79.7	13	20.3	0	0.0	31.40	0.00
- Challenges and obstacles facing the application of evidence-based guidelines	17	27	13	20.0	34	**53.0**	52	81.3	10	15.6	2	3.1	40.67	0.00
- Ways to support and facilitate evidence-based guidelines	0	0.0	32	50.0	32	50.0	50	78.1	10	15.6	4	6.3	31.01	0.00

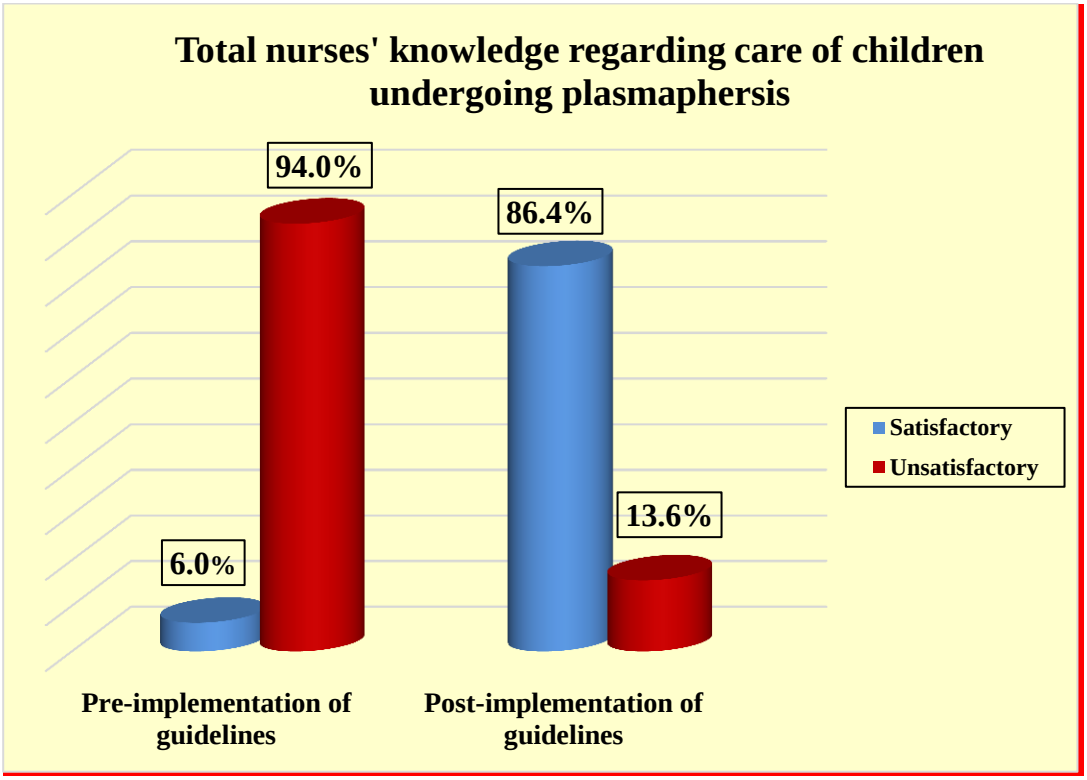

Figure (4): Distribution of total nurses' knowledge regarding care of children undergoing plasmaphresis (n=64).

Table (4): Distributions of the studied nurses knowelge regarding blood and blood component pre/ post

Nurses' knowledge regarding blood and blood component	Pre-implementation of evidence-based guidelines						Post- implementation of evidence-based guidelines						X^2	P-value
	Complete Correct answer		Incomplete Correct answer		Don't know		Complete Correct answer		Incomplete Correct answer		Don't know			
	N.	%	N.	%	N.	%	N.	%	N.	%	N.	%		
- Definition of blood	8	12.2	56	**87.5**	0	0.0	64	**100**	0	0.0	0	0.0	41.25	0.00
- Functions of blood	12	18.7	52	81.3	0	0.0	58	90.6	6	9.4	0	0.0	39.14	0.00
- Components of blood	9	14.2	54	**85.8**	0	0.0	60	93.8	4	6.2	0	0.0	34.37	0.00
- Definition of plasma	11	**17.2**	31	48.4	22	34.4	55	**85.9**	9	14.1	0	0.0	28.17	0.00
- Function of plasma	12	18.0	32	**50.0**	21	32.0	54	84.0	10	16.0	0	0.0	37.87	0.00
- Uses of plasma	15	**23.4**	49	**76.6**	0	0.0	60	93.8	4	6.2	0	0.0	34.37	0.00
- Definition of plasma transfusion	7	11.0	49	77.0	8	12.0	63	**98.0**	1	2.0	0	0.0	39.67	0.00
- Type of plasma description	6	9.4	54	84.3	4	**6.3**	55	85.9	9	14.1	0	0.0	40.01	0.00
- Precautions for plasma transfusion	8	12.5	50	78.2	6	9.3	55	85.9	9	14.1	0	0.0	20.43	0.00
- Storage of plasma	8	12.5	51	79.7	5	**7.8**	60	**93.8**	4	6.2	0	0.0	31.07	0.00

Table (5): Distribution of the studied nurses' knowledge regarding plasmaphresis and management of plasmaphresis complication pre/post-implementation of evidence-based guidelines (n=64).

Nurses' knowledge regarding plasma and plasmaphresis	Pre-implementation of evidence-based guidelines						Post-implementation of evidence-based guidelines						X^2	p-value
	Complete Correct answer		Incomplete Correct answer		Don't know		Complete Correct answer		Incomplete Correct answer		Don't know			
	N.	%	N.	%	N.	%	N.	%	N.	%	N.	%		
Definition of plasmaphresis	0	0.0	19	**29.6**	45	70.4	50	78.1	12	18.8	2	3.1	47.31	0.00
Goal of plasmaphresis	15	23.4	23	35.0	**26**	**40.6**	60	**93.8**	4	6.2	0	0.0	28.74	0.00
Therapeutic apheresis modality	7	10.9	6	9.4	**51**	**79.7**	53	**82.8**	11	17.2	0	0.0	24.37	0.00
Complication of plasmaphresis	18	29.0	40	63.0	5	8.0	62	**96.8**	2	3.4	0	0.0	29.14	0.00
Prescription of therapeutic plasmaphresis	9	14.1	5	7.8	50	78.1	55	85.9	9	14.1	0	0.0	31.33	0.00
Management of plasmaphresis complication :-														
- Management of fever	20	31.4	30	46.8	14	21.8	54	84.6	7	10.4	3	4.6	46.18	0.00
- Management of hypertension	8	12.5	42	**65.6**	12	18.75	49	**76.5**	13	20.3	2	3.2	40.01	0.00
- Management hypotension	12	18.75	38	**59.3**	14	21.8	45	70.3	13	20.3	6	9.3	31.34	0.00
- Management of hypersensitivity reaction	15	23.4	36	**56.2**	13	**20.3**	55	86.0	9	30.0	0	0.0	27.094	0.00

Table (6): Distribution of the studied nurses according to their practice regarding care of children undergoing plasmaphresis at pre and post evidence-based guidelines phases (n=64)

Items	Pre- evidence based guidelines (n=64)				Post evidence-based guidelines (n=64)				X^2 FEET	p-value
	Competent		Incompetent		Competent		Incompetent			
	N.	%	N.	%	N.	%	N.	%		
Hand washing	10	15.6	54	84.4	55	85.9	9	14.1	63.06	0.00
Measuring axillary temperature	19	29.7	45	70.3	56	**87.5**	8	12.5	46.56	0.00
Measuring pulse rate	8	12.5	56	**87.5**	58	**90.6**	6	9.4	52.00	0.00
Measuring respiratory rate	6	9.4	58	**90.6**	59	**92.1**	5	7.9	64.56	0.00
Measuring blood pressure rate	9	14.1	55	85.9	49	76.6	15	23.4	51.62	0.00
Drug administration	13	20.3	51	79.7	57	**89.1**	7	10.9	61.62	0.00
Measuring weight	15	23.4	49	76.6	58	**90.6**	6	9.4	60.25	0.00
Skin care	11	17.2	53	**82.8**	55	85.9	9	14.1	66.52	0.00
Preparation child before plasmaphresis	13	20.3	51	79.7	57	**89.1**	7	10.9	61.65	0.00
Nurse role during plasmaphresis	14	21.8	50	78.2	53	82.8	11	17.2	49.56	0.00
Nurse role after plasmaphresis	16	25.0	48	75.0	55	85.9	9	14.1	49.66	0.00

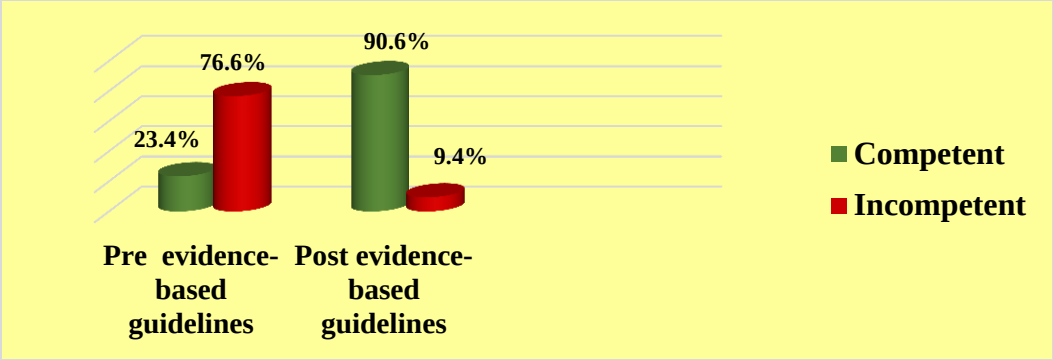

Figure (5): Distribution of studied nurses' total practice score regarding care of children undergoing plasmaphresis at pre and post evidence-based guidelines phases (n=64).

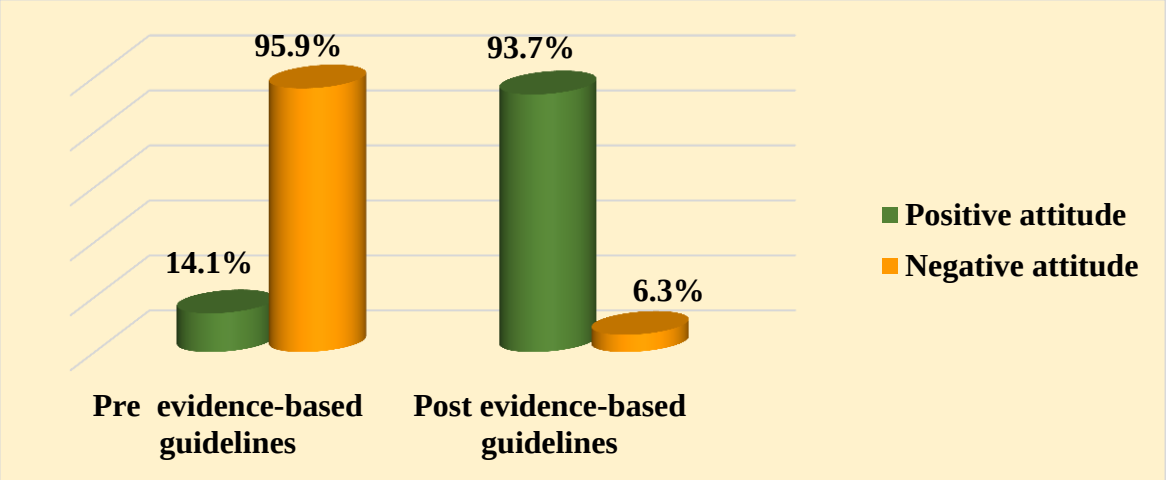

Figure (6): Distribution of studied nurses' total score attitudes regarding care of children undergoing plasmaphresis at pre and post evidence-based guidelines phases (n=64).

Table (7): Correlation between studied nurses' total knowledge, total attitude score and total practice score regarding care of children undergoing plasmaphresis at pre and post evidence based guidelines phases (n=64).

Total scores	Pre- evidence based guidelines		Post- evidence based guidelines	
	R	p-value	r	p -value
Knowledge – practice	0.633	0.00	0.975	0.00
Knowledge – attitude	0.584	0.00	0.864	0.00
Attitude – practice	0.542	0.00	0.766	0.00

Discussion

Plasmapheresis is a procedure carried out for various life-threatening and debilitating diseases as a principle method of treatment or as an adjunct with other therapies. [17] Plasmapheresis is the treatment of choice for hematological, neurological, renal and immunological diseases. The process of plasmaphresis is performed mainly within the renal or hematological units of hospitals or in Apheresis unit, an appropriate designed place for children **(Bauer et al., 2022).** [18]

More than two thirds of the studied nurses were aged ranged between 25-<30 years, it may contributing to the police of the hospital to employee the young age of nurses at critical unit because they more active .Regarding to nurses' education, more than half of the studied nurses had technical institute of nursing. Also, less than two thirds had 5 < 10 years of experience in plasmaphresis unit .This findings context with **Abdel Hakeem et al. (2020)** [19]**,** who found that, most of the Studied nurses were in the age group of (20->30) years old. Also more than half of them didn't attend any training courses about syndrome or plasmaphresis session. Also, this finding In accordance with **Hassan, et al. (2022),** [20] who revealed that, more than half of the studied nurses 54.3% had 1 year to more than 5 years of experiences. Also, it was noticed that, the majority of the studied nurses didn't attend any workshop. This may be due the most of nurses were in various setting not aware with the importance of attending conference and benefits from scientific training .

According to children age, less than half of studied children were aged ranged from 8< 12 years. In relation to sex, less than two third of the studied children were females. This study accordance with **Mandal, and Sinha, (2021)** [21] who founded that, less than half 45.8% were of age group 6 to 12 years and 49.3 % were females. Also, this study agreement with **Ahmed and Kaplan, (2020),** [6] who showed that, majority of children ages were 8.07 years, 57.1% were female. Meanwhile, this study accordance with **Lu, et al. (2019)** [22]**,** who showed that, about half of females (54.5%) with median age was 9.16 years, with a range from 3 to 14 years.

As regards, duration of disease, this study revealed that, less than two third of studied children undergoing plasmaphresis had duration of disease less than 5 years. In relation to

number of plasmaphresis sessions, almost half of studied children had taken about 10 to 15 sessions. This study in the same line with **Atay, et al. (2021)** [23]**,** who explained that, the most of children had 1 or 1.5 times their total plasma volume administered, using fresh frozen plasma in TPE. Also, this study in accordance with **Maxted, et al. (2020),** [24] who illustrated that, the children had a median of 6 to 15 sessions.

According to children's diagnosis, the present study showed that, less than one third of the studied children were diagnosed with hemolytic uremic syndrome (HUS) and rapidly progressive germulonephritis. This study accordance with **El-Anwar, et al. (2019),** [25] who founded that 60% of children were hemolytic uremic syndrome, 30.7% of them were with severe rapidly progressive germulonephritis, and 28% had severe autoimmune hemolytic anemia children. Also, this study In agreement with **Nikkhah, et al. (2023),** [26]who explained that, 22% of children had hemolytic uremic syndrome rapidly progressive, germulonephritis 22% , Meanwhile, this study Congruent with , **Ozturk,et al. (2022),** [27]who showed that, atypical HUS was most common and present in three quarter of children .

As regard, children's weight and complications secondary to plasmaphresis, this study illustrated that, less than three quarters of the studied children had body weight ranged from 30<40 kg, Also, less than one third of studied children suffered from hypertension, hypotension and fever occur due to plasmaphresis. This study in agreement with **Özsoylu, et al. (2021),** [28] they illustrated that, TPE sessions were performed in 40 children the median body weight was 32 kg. Also, this study agreement with **Tutun, et al.(2022)** [29], who reported that, more than half of them (56.3%) weighed 30~50 kg. Also, This study accordance with **Fateen, et al. (2023),** [30] they founded that, the most common complications are; hypertension (59%), hypotension (44%), (22%) fever and urticaria (9%), Also, this study in accordance with most common complication was hypotension (44.9%), Meanwhile, this study accordance with **Mazahir, et al.(2021),** [31] who explained that, the most commonly hypotension in (18.75%), fever and chills were seen in (20.5%) and urticaria (6.25%). This may be due to the complications in children at different ages and weights was significantly different (P<.05).

This table shows that there were highly statistically significant differences between children vital signs pre and post implementation of evidence-based guidelines. This study in agreement with **Pan, et al.(2022),** [32] who clarified that, 20.75%, children developed chest tightness and palpitations during plasma exchange, and blood pressure dropped to 62/44 mmHg, (11.5%) children developed fever during plasma exchange, and (6.3%) children developed pruritus and erythema on the face and neck during plasma exchange.

As regard nurses knowledge regarding evidence based guideline, the current study illustrated that, there are a highly statistical significance differences in all items of nurses' knowledge related to evidence-based guidelines in post implementation of evidence-based guidelines as compared to pre-implementation($P \leq 0.00$). This study in accordance With **Ford and Melnyk, (2022)** [33] they clarified that**,** 78.09% of the studied nurse had correct answer about evidence based guideline in post program implementation.

According to, nurses knowledge about blood and component of blood, the present study showed

that, there are a highly statistical significance differences in all items of nurses' knowledge related to blood and blood component in post implementation of evidence-based guidelines as compared to pre-implementation($P \leq 0.00$).This study accordance with **Abdalla, and Idris, (2022)** [34] they reported that, 91.49% of the participants had correct answer about blood, component and uses of blood plasma and storage of plasma after program intervention.

As regard**,** nurses knowledge about plasmaphresis procedure and management of plasmaphresis complication, there are a highly statistical significance differences in all items of nurses' knowledge related to plasmaphresis procedure and management of plasmaphresis complication in post implementation of evidence-based guidelines as compared to pre-implementation($P \leq 0.00$). This study agreement with **Beydoun, et al. (2020),** [35]they illustrated that, 69% of the nurses had unsatisfactory knowledge and skills in plasmaphresis in preprogram. while (78.0%) of them had satisfactory knowledge regarding plasmaphresis in post program implementation. This may be due to great motivation to improve their knowledge and the development of their skills in the field of transfusion and training programs improve their knowledge and ensure the safety and quality of blood transfusions. Also, this study accordance with **Neyrinck, and Vrielink, (2019)** [36]who reported that, majority 89.36% of nurses had correct answer regarding care of children during fever, hypotension and hypertension in post program implementation. Also, this study accordance with, **Al Hamdani, et al. (2019),** [37] they clarified that, a large percentage of nurses about three-quarter (74.7%) reported inadequate knowledge regarding care of children during plasmaphresis preprogram. While 86% of nurses had adequate knowledge regarding care of children during plasmaphresis in post program. There was a significant improvement of the knowledge of the studied nurses about plasmaphresis and significant increase the awareness of the studied nurses about complications of plasmaphresis procedure

As regard nurses total knowledge regarding plasmaphresis, this study revealed that, majority of the studied nurses had satisfactory level of total knowledge in post-implementation of evidence-based guidelines as compared to less than one third had satisfactory level of total knowledge in pre-implementation of evidence-based guidelines. This study in accordance with **Hassan et al. (2022),** [20] they explained that, the majority of the studied nurses had low level in both knowledge and practice regarding plasmaphresis. In addition, a significant relation was noticed between age of the studied nurses and their knowledge level where P = 0,00. Also, This study accordance with **Baldwin and Todd, (2022)** [38]who showed that**,** majority of nurses had insufficient knowledge and skill regarding providing TPE and different care models regarding care of children during plasmaphresis. This may be due to nurses need more knowledge and training regarding responsibility during plasmaphresis, the plasma replacement volume prescribing for children with critical illness, important considerations for TPE with respect to anticoagulation, machine settings and associated nursing management.

As regard, nurses total attitude, most of them had positive attitudes regarding care of children undergoing plasmapheresis in post evidence based guidelines phases.While, majority of studied nurses had negative attitudes in pre

evidence based guidelines phase. This study accordance with **Neyrinck. and Vrielink, (2019)** [36] who illustrated that, 72.0% of nurses had negative attitude level at preprogram, while (81.0%) had high positive attitude level at post of implementation of educational program.

Concerning, studied nurse's total practice, the majority of them had competent practice regarding care of children undergoing plasmapheresis in post evidence based guidelines as compared to more than three quarters of studied nurses had incompetent level of total practice in pre evidence based guidelines phase.These results agreed with **EL Mehdaoui, et al.(2021),** [39] they founded that, the most of the study nurses had competent level of practice regarding care of children undergoing plasmaphresis. There was a highly statistical significant difference (p <0.00) in the overall practical score for care of children undergoining plasmaphresis in post program. Also, this finding supported by **AbdelHakeem et al. (2020),** [19] who found that, more than three quarters of studied nurses had competent practice regarding to plasmaphresis session.

As regards relation between total knowledge, total attitude and total practice, this study demonstrated that, there are a positive significant improvement of the studied nurses' total knowledge, attitude and practice regarding care of children undergoing plasmaphresis in post implementing evidence based guideline. This result agreed with **Atay. and Demirkol, (2021)** [40]who represented that, there was a strong positive relationship between nurses knowledge, attitude and their performance in the pre and posttests at (P< 0.001). This may be due to the implementation of evidence based guidelines had strengthened effect on nurses' performance regarding care of children undergoing plasmaphresis.

Conclusion

Based upon the findings of the current study, plasmaphresis is enlarging to varying indications and showing to be more effective on a lot of disorders in children. The majority of the studied nurses had satisfactory knowledge level, positive attitudes and competent practice regarding care of children undergoing plasmaphresis in post evidence based guidelines phases. Also, there was a highly statistically significant positive correlation between total nurses' knowledge, attitude and practice toward care of children undergoing plasmaphresis at pre , post evidence based guidelines phases (P < 0.001).

Recommendations

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

1-Designing and distributing Arabic booklets to all nurses who are working in plasmaphresis units for children including all the knowledge and practice related to the care of children undergoing plasmaphresis and how to comply it without complications.

2- Provision of continuing education programs in order to update nurses' knowledge and enhance their practice level regarding to care of children undergoing plasmaphresis.

3- Similar studies should be conducted on a larger sample of children with different age and regions for generalization of the results.

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