بسم الله الرحمن الرحيم

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Effect of Application of Hemodialysis Nursing Guidelines on Nurses Knowledge and Practice at River Nile State hemodialysis centers 2019

Athesis submitted for requirement of PhD degree in medical surgical *nursing*

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الآيـــــة

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قال تعالى:

﴿ إنَّ في خلْقِ السَّمواتِ والأرضِ واختلافِ اللَّيلِ والنَّهارِ لآياتٍ لأولي الألباب * الَّذين يَذْكُرونَ الله قياماً وقعوداً وعلى جُنوبهم ويتفَكَّرونَ في خلْقِ السَّمواتِ والأرضِ ربَّنا ما خلَقْت هذا باطلاً سبحانَك فَقِنَا عذابَ النَّارِ ﴾

(آل عمران آية 190-191)

صدق الله العظيم

Dedication

I dedicate this study to my dear husband, my kind mother, to spirit of my father, to my bony daughters, to my brothers and my sisters, to my prefer friends, to my colleagues, to my family and relatives.

Acknowledgement

My gratitude first and last goes to Allah for supporting me throughout this research.

There is no single word that is enough to express my appreciation and gratefulness to my supervisor:

Prof: Yousif Mohammed Yousif

For his diligent supervision, unlimited guidance and support throughout my work; it would be extremely difficult without his genuine interest.

My special thanks to:

Dr: Higazi Mohammed Ahmed Abdallah Awad

For the precious time he gave me and for offering me the best of his experience that lightened my way.

I wish to extent my special thanks to:

Dr: Sondos Abd Elmelik

For helping with patience throughout this study

My thanks also extent to all nursing staff in River Nile state hemodialysis centers

I would like to thank:

Us: Fatima Osman, Esraa, Nagia, Nura, Hana

For their support and cooperation.

ملخص الدراسة

الخلفية: يعتبر الدليل التمريضى بمثابة البوصلة لمعرفة وممارسة الممرضين ،كما يلعب دورا هاما فى توجيه وتنفيذ وتقييم أداء الممرضين فى مراكز الاستصفاء الدموى.

الهدف من الدراسة: تقييم فعالية تطبيق الدليل التمريضي فى معرفة وممارسة الممرضين فى مراكز الاستصفاء الدموي بولاية نهر النيل.

المنهجية: تم إجراء دراسة تجريبية تدخلية في مراكز الاستصفاء الدموى بولاية نهر النيل في الفترة من فبراير2016 إلى ديسمبر 2018 وقد تم جمع عينة شاملة من (50) ممرض من مراكز الاستصفاء الدموى بولاية نهر النيل ، وتم جمع البيانات من خلال استخدام استبانة تم إنشاؤها ، تتكون من ستة أجزاء ، وقائمة تحقق تتكون من 11 قسمًا (86)جزءا ، تم إجراء التحليل الإحصائي الوصفي و التحليل الاستنتاجي باستخدام برنامج الحزم الاحصائية للحلول الخدمية لتحليل البيانات(SPSS 22) .

النتائج: أثبتت نتائج الدراسة أن تطبيق الدليل التمريضى لممرضى الاستصفاء الدموى كان فعالا ، وتحسنت معرفة الممرضين عن عملية الاستصفاء الدموى فى الاختبار البعدى وكان متوسط نسبة معرفتهم (62%) ،كما كان متوسط نسبة معرفتهم عن المدخل الوعائي الدموى للاستصفاء الدموى(66%) ، كان متوسط نسبة معرفتهمم عن الرعاية التمريضية(85%)، وكان متوسط نسبة المعرفة حول تعليم المرضى(71.5%) ، كما ان متوسط نسبة معرفتهمم عن مضاعفات الاستصفاء الدموى(74.3%)، كما تحسنت ممارسة الممرضين ومهاراتهم بعد تطبيق البرنامج الارشادى مقارنة مع الاختبار التمهيدي للبرنامج التوجيهى.

الخلاصة: تحسن مستوى المجموعة حول الاستصفاء الدموى في المرحلة الثانية للبرنامج ، وكان لدى مجموعة الدراسة مستوى مقبول وتطور الاداء في المرحلة الثانية للبرنامج.

وأشارت الدراسة إلى أن البرامج التعليمية المستمرة فعالة في زيادة المعرفة وتحسين ممارسة الممرضين، ويمكن تطبيق هذه البرامج فى جميع مراكز الاستصفاء الدموى بالسودان. وقد أوصت الدراسة بتوفيروتطوير برامج التوجيه التمريضى حول الاستصفاء الكلوى باللغتين العربية و الانجليزية ومراجعته وتنقيحه سنويا.

Abstract

Background: Nurses guidelines act as compass for their knowledge, practice and skills, it is play an important role to direct, implement and evaluate hemodialysis nurses practice.

Aim: to evaluate the effect of hemodialysis nursing guideline on nurses knowledge and practice at River Nile State hemodialysis centers.

Methodology: A quasi-experimental, study was carried out at River Nile State Hemodialysis Centers started from August to December 2018, total coverage sample of (50) nurse who were worked in hemodialysis centers, the data were collected through well constructed questionnaire, which consist of six parts, and hemodialysis nurses practice check list consist of 11 sections of (86) items, validity of the study was determined through the panel of three experts and the reliability of the study questionnaire through the pilot study, descriptive statistical analysis and inferential analysis was used, data analyzed using SPSS version 22.

Results: The findings of the study indicated that the implementation of nursing guideline for hemodialysis nurses was effective, the knowledge of nurses improved about hemodialysis management in **Phase II**, the mean of knowledge was (62%), the mean of knowledge about vascular access for hemodialysis was (66%), the mean of knowledge about nursing care was (85%), the mean of knowledge about patient education was (71.5%), and the mean of knowledge about hemodialysis complication was (74,4%), also their practice was improved in **Phase II** as compared with the **Phase I** of the practice guideline test with significant results.

Conclusion: The study revealed that knowledge about hemodialysis was improved, the study group had acceptable level of practice improved in **Phase II**.

The study reported that sessions of continuous educational program were effective in increasing knowledge and improving practice of hemodialysis nurses,

and these programs can be applied all over the country. The study recommended that the developed guidelines for nurses regarding hemodialysis management must be available in all hemodialysis centers and must be revised and updated annually.

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Abbreviations	Meaning
ACE	Angiotensin converting enzymes
AKI	Acute Kidney injury
ALP	Alkaline Phosphatase
ARF	Acute Renal Failure
ASN	American Society of Nephrology
BUN	Blood urea nitrogen
CKD	Chronic kidney disease
CO2P	Carbon Dioxide Pressure
CRRT	Continuous Renal Replacement Therapy
ESA	Erythropoiesis-stimulating agent
ESRD	End-stage renal disease
EU	European
GFR	glomerular filtration rate
HBV	Hepatitis B Virus
HCV	Hepatitis C Virus
HD	Hemodialysis
HHD	Home Hemodialysis
IHD	In-Center Intermittent Hemodialysis
K/DOQI	Kidney Disease Outcomes Quality Initiative
kcal	kilogram calorie
mEq	Milliequivalent
PD	Peritoneal Dialysis
PTH	parathyroid hormone
NKF	National Kidney Foundation
PH	potential hydrogen
RD	Registered Dietitian
RRT	Renal replacement therapy
SGOT	Serum glutamic oxaloacetic transaminase
SGPT	Serum glutamic pyruvic transaminase
UF	Ultra filtration
UK	United Kingdom
UKM	Urea kinetic modeling
URR	Urea reduction ratio
US	United States
USA	United States of America

1. Introduction:

Dialysis is a therapy that aims to remove waste and excess fluid from the body. This method replaces the main function of the kidney. Two types of dialysis are known, namely Peritoneal Dialysis, and Hemodialysis. Patients with long lasting kidney failure are faced with these two treatment options. Both types of dialysis therapy have a risk of complications during the treatment period. [(1)]

Chronic kidney disease (CKD) and end-stage renal disease (ESRD) are two main global health concerns with prevalence as high as 11–13% and 0.1% in the general population, respectively. [(2)] According to the 2015 US Renal Data System Annual Data Report, in 2014, 87.9% of all incident cases began renal replacement therapy with hemodialysis, 9.3% started with peritoneal dialysis, and 2.6%received a pre-emptive kidney transplant. [(3)] The incidence and prevalence of end-stage renal disease (ESRD) is rising worldwide, in part due to increasing rates of diabetes, hypertension and an ageing population. Incidence rates of patients commencing renal replacement therapy are estimated at 109 and 354 per million populations per year in the UK and US respectively, with the highest incidence seen in patients' over75 years of age. [(4)] Internationally the numbers are staggering. Estimates are that 2 million people worldwide suffer from ESRD, and the number of patients diagnosed with the disease continues to increase at a rate of 5-7% per year [(5)]. Patients receiving this form of treatment have high hospitalization rates with a long duration of stay. The survival rates have not improved in the past two decades, mainly owing to the inadequacy of this treatment. It is clear that, with such high costs, patients should be receiving a higher quality of HD. [(6)]

Sudan has witnessed in the last decade expansion of renal services both in the capital and regional hospitals. Yet the deficit in needs remain high and the demand for transplantation services is even higher. The incidence of end-stage renal disease (ESRD) is not known but it is estimated that more than 300 per million populations

worldwide are affected due to the high prevalence of communicable diseases and the recognized rise in non- communicable diseases namely diabetes mellitus and hypertension1. Few data in literature are available on the causes of renal diseases in Sudan. Over 1.1 million patients are estimated to have ESRD worldwide, with an addition of 7% new cases every year. In USA, the incidence and prevalence counts are expected to increase from 2000 to 2015 by 44 and 85%, respectively. There the incidence and prevalence rates per million inhabitants are 32 and 70. An average incidence of ESRD in the Middle East is 93 per million populations. The estimated incidence for new cases in Sudan is about 70-140/million inhabitants/year. (5)

Total number of patients requiring renal replacement therapy has been growing dramatically. Patient registry and statistical evaluation of patients with ESRD are useful to clarify the characteristics of ESRD patients and dialysis therapy, as well as the complications or results based on scientific evidence, to improve the quality of dialysis therapy. (6) End-stage renal disease is a serious illness with major consequences in both health and healthcare expenditures. The growing number of patients with end-stage renal disease in developing countries will consume a greater proportion of healthcare budget. The annual cost of hemodialysis in Sudan was found to be US $ 6847.00. (7)

Hemodialysis is the most common method used to treat advanced and permanent kidney failure (8). According to the National Kidney Foundation NKF, there are 468,000 Americans on dialysis,(9) and the European Renal Care Providers Association reports that 350,000 people in the EU are on dialysis and the numbers continue to grow each year. (10)

“The prevalence of dialysis therapy for kidney failure is increasing faster than population growth in most parts of the world” - American Society of Nephrology. (11)

Therefore the use of renal replacement therapy becomes necessary when the kidney can no longer be able to remove wastes, maintain electrolytes, and regulate fluid balance. This can occur rapidly or over a long period of time and there for the need for replacement therapy can be acute or chronic. The main renal replacement therapies include the various types of dialysis such as (hemodialysis & peritoneal dialysis) in addition to kidney transplantation. [12]

A dialysis nurse is a registered nurse who specializes in caring for patients undergoing hemodialysis or peritoneal dialysis, both of which are life-saving procedures for those with severely impaired kidney function. Dialysis nurses fall into the general category of nephrology nursing, the branch of nursing specializing in care for patients with kidney disorders and diseases, and assist patients with both forms of dialysis, although peritoneal dialysis requires nurses who make in-home visits.[13]

1.2 Problem statement and rational:

Patient undergoing hemodialysis procedure requires special nursing care. This has created the need for high skilled personnel trained in the art of hemodialysis procedure. Nurses working in dialysis unit should comply with the occupational safety and health administration standards. [14]

Nursing responsibility is to assess the patients' condition, teach patients how to do peritoneal dialysis or hemodialysis in the unit setting, consider the patients' learning needs and provide education about their treatment, make a training plan for each patient, give the patients the medications ordered by doctors, evaluate the patients' ability to perform their dialysis treatments and take all doctor-prescribed medications, help patients follow-up with their transplant centre, review the patients' lab work, home medications and activities and let the doctors know about changes in patients' conditions.[15] .

Professional standards ensure that the highest level of quality nursing care is promoted. Excellent nursing practice is reflection of sound ethical standard, client care requires more than just the application of scientific knowledge. A nurse must be able to think critically, solve problem and find best solution for clients' need to assist clients in maintaining or improving their health.

Hemodialysis nursing is a specialized area of nursing practice focusing on needs of patients with renal failure and their families across the lifespan. This specialized care requires the nurse to promote competent, safe, ethical care, and demonstrate current specialty knowledge and practice. The quality of nursing care has highest level when is provided and promoted based on professional and practical guidelines. Nursing practice perfection or good is result of implementation of ethical standards, application of scientific knowledge helps to provide patient care and needs to provide more than just that. A nurse qualification needs to critical thinking, problem solving approach and find best solution for patients' and his/her family need to assist patients in maintaining or improving their health. [16, 17] Over 30,000 Canadians have kidney failure requiring dialysis or transplant to stay alive. [18] While the incidence of end-stage renal disease (ESRD) in the United States has increased by almost 8% per year for the past 5 years, with more than 300,000 patients being treated. [19]

End –stage renal disease are a therapeutic challenge because of the chronicity of their disease and their disease and their total dependence upon a machine and the health professionals who are responsible for treatment by these machines; their very existence constantly reminds them of the delicate balance between life and death that is supported by this life –sustaining technology. [20]

Hemodialysis nursing is a specialized area of nursing practice focusing on needs of patients with renal failure and their families across the lifespan. This specialized care requires the nurse to promote competent, safe, ethical care, and demonstrate current specialty knowledge and practice. [21]

Patient education is a fundamental and essential component of nursing practice that improves the health of individuals and provides necessary knowledge and skills for managing chronic illness such as kidney disease. The ultimate goal of patient education is to achieve long-lasting changes in behavior by providing knowledge, skills, and abilities that allow patients to make autonomous decisions and take ownership of their care to improve their own outcomes. [22]

Guidelines play role to help practical decision-making with the aim of improving care. Although, if rigorously developed guidelines can do precisely that, developed guidelines must have supporting of development and criticized resulting for being logic, avoid unnecessary effort. [23]

Nurses working in hemodialysis units are expected to demonstrate competency and understanding of the technical processes involved in supporting patients undergoing hemodialysis treatment. [24]

Nurses experiences of using clinical competencies a qualitative study. All standards of practice provide a guide to knowledge, skills, judgment and attitude that are needed to practice safely. The nursing standards are important because they outline what the profession expects of its member, promote, guide and direct professional nursing practice. The standards aid in developing better understanding and response for various and complementary roles that nurses have. [25]

The aim of initiatives worldwide of measuring and evaluating the type and quality of renal care is to identify practice patterns, meet and support health provider in improving the quality of their domestic care delivery system or to gives policy-makers transparency and the public. [26]

1. 3Objective:

1.3.1 General objective:

- To evaluate the effectiveness of nursing guidelines on hemodialysis on nurses knowledge and practice at River Nile state hemodialysis centers

1.4.2 Specific objective:

1. To assess basic knowledge regarding hemodialysis pre, during and post hemodialysis management.
2. To assess nurses performance regarding management of hemodialysis machine**.**
3. To design hemodialysis nursing guidelines.
4. To implement the program for hemodialysis nurses.
5. To identify health teaching that provided to the patient on dialysis.
6. To identify nurse's knowledge regarding complications, occur during hemodialysis.

1.4 Research hypothesis:

- Nurses have good knowledge regarding hemodialysis management
- Nurses have satisfactory practice regarding hemodialysis procedure
- Application of hemodialysis nursing guidelines is effective in increasing knowledge and improving practice of hemodialysis nurses.

2. Literature review:

2.1 Kidney disease:

Kidney disease is the partial or complete reduction of the normal kidney function described above. This is characterized by the inability to remove excess water and metabolic wastes from the body. This subsequently has hemodynamic effects on other systems including blood pressure, blood volume and the blood content. Renal failure is classed in two different forms depending on the rate of onset and the cause. The first is Acute Kidney Injury (AKI), the second is Chronic Kidney Disease (CKD). [28, 29, 30]

2.1.1 Acute Kidney injury:

Up to 2004, the rapid cessation of renal excretory function within a time frame of hours or days, accompanied by a rise in serum urea and creatinine, and accumulation of nitrogenous waste products in a patient whose renal function was previously normal was defined as acute renal failure (ARF). AKI is a common complication of critical illness and the predominant reason why patients require continuous renal replacement therapy in the intensive care units. [31]

2.1.2 Chronic kidney disease (CKD):

Chronic kidney disease is a long standing progressive deterioration of renal function in which the body will lose its ability to maintain electrolyte and metabolic balance leading to enormous increasing the nitrogenous substances in blood. It may result from any cause of renal dysfunction of sufficient magnitude. The most common causes are nephropathy followed by hypertensive nephroangio sclerosis and various primary and secondary glomerulonephropathies. [32]

2.2 Renal replacement therapy (RRT):

When end-stage renal disease (ESRD) occurs, renal replacement therapy (RRT) - dialysis, transplantation - is required. There are two types of dialysis treatment:

extracorporeal blood purification (mainly hemodialysis) and intracorporeal blood purification (peritoneal dialysis). All patients with ESRD should be considered for kidney transplantation. Patients without absolute contraindications should be placed on the transplant waiting list, and receive a kidney, if possible. Patients should be educated about each procedure of RRT. [33]

2.3 Dialysis:

In medicine, **dialysis** (from Greek "dialusis", meaning dissolution, dia, meaning through, and lysis, meaning loosening or splitting) is a process for removing waste and excess water from the blood and is used primarily as an artificial replacement for lost kidney function in people with kidney failure. [34] Dialysis may be used for those with an acute disturbance in kidney function (acute kidney injury, previously acute renal failure) or progressive but chronically worsening kidney function—a state known as chronic kidney disease stage 5 (previously chronic kidney failure or end-stage renal disease). [35]

The latter form may develop over months or years, but in contrast to acute kidney injury is not usually reversible and dialysis is regarded as a "holding measure" until a kidney transplant can be performed or sometimes as the only supportive measure in those for whom a transplant would be inappropriate. [35]

2.3.1 Types of dialysis:

There are two types of dialysis, hemodialysis and peritoneal dialysis. [36]

2.4 Hemodialysis:

This is the classical form of dialysis where the blood is carried via a tube into a dialysis machine which contains a semi permeable membrane. Inside the machine, blood is filtered through the membrane to remove excess water, waste products and toxins before being passed back into the body. Each session of dialysis may last for around four hours and needs to be performed three times a week. [36]

There are four main methods of performing dialysis: In-center intermittent hemodialysis (IHD), home hemodialysis (HHD), peritoneal Dialysis (PD), continuous renal replacement therapy (CRRT)

2.4.1 Advantages and Disadvantages of Hemodialysis Treatment:

Advantages of hemodialysis treatment include full medical care during in center HD sessions, high effectiveness in waste and fluid removal, high possibility of individualization of HD schedule, easy administration of intravenous drugs (erythropoietin stimulating agents, iron), quick help in sudden situations (pulmonary edema), no anticoagulation for dialysis purposes, most similar to original kidneys, and self-control over schedule. Disadvantages of hemodialysis are infections with blood borne viruses (HBV, HCV), muscle cramps, hypotension episodes, dialysis-related amyloidosis, repeated anticoagulation, vascular access problems, and under nutrition. [37, 38]

2.4.2 Purpose of Dialysis:

Dialysis is used to remove fluid and uremic waste products from the body when the kidneys cannot do so, it may also be used to treat patients with edema that does not respond to treatment, hepatic coma, hyperkalemia, hypercalcemia, hypertension, and uremia.[38, 39, 40]

2.4.2.1 Acute or sudden illness:

Acute conditions where dialysis may be used include metabolic acidosis or a change of the blood pH to acidic. Usually, this condition can be treated by neutralizing the acidic blood with sodium bicarbonate. However, dialysis may be needed in cases where this is impractical or if there is a risk of fluid overload, electrolyte imbalance such as severe hyperkalemia where the blood level of potassium is raised, overload of fluid in the body that diuretics cannot relieve, acute poisoning where the harmful substance can be removed by dialysis. Lithium, a drug used to treat mood disorders

and the pain reliever aspirin are two examples of drugs that can be removed using dialysis, and uremia - Certain complications of the condition uremia where urea and other waste material builds up in the blood. Such complications include pericarditis (inflammation of the pericardium in the heart), encephalopathy or a disease affecting brain function and gastrointestinal tract bleeding. [40]

2.4.2.2 Chronic or long-term illness:

Chronic or long-term illness include renal failure where symptoms are manifesting, in the case of a lowered glomerular filtration rate (GFR) that has dropped to less than 10-15 mls/min/1.73m2, although in diabetics dialysis is started before this stage is reached, and in cases of low GFR where medication is unable to control fluid overload and rising levels of serum potassium or phosphorus.[40]

2.4.3 Duration of dialysis:

In the case of chronic renal failure, the kidneys do not improve and people need dialysis for the rest of their lives, unless they are a suitable candidate for kidney transplant. Some cases of acute kidney disease, however, can be treated and dialysis may only be required in the short term. Usually, each hemodialysis treatment lasts about four hours and is done three times per week. A type of hemodialysis called high-flux dialysis may take less time. You can speak to your doctor to see if this is an appropriate treatment for you. [41]

2.4.4 Principles of Hemodialysis:

Diffusion: The toxins and wastes in the blood are removed by diffusion that is, they move from an area of higher concentration in the blood to an area of lower concentration in the dial sate. Osmosis: Excess water is removed from the blood by osmosis, in which water moves from an area of higher solute concentration (the blood) to an area of lower solute concentration (the dial sate bath). Ultra filtration is defined as water moving under high pressure to an area of lower pressure. [42]

2.4.5 Standard hemodialysis session:

Standard HD consists of three sessions a week with duration of about four hours per session. A person is usually connected to the dialysis machine for 3-4 hours each day or every other day. Sometimes, dialysis must be done more slowly. Different medical centers offer longer and occasionally continuous dialysis. Patients needing long term treatment can undergo dialysis in a dialysis center, but some hospitals provide dialysis in the patient's own room. Blood tests tell the team how well dialysis is working and how often it is needed. [33, 44]

2.4.6 Contraindications of hemodialysis:

2.4.6.1 Relative contraindications of Hemodialysis:

Renal failure or uremia patients may need to depend on hemodialysis to improve their life quality, although there's no absolute contraindication for hemodialysis, but in order to guarantee the safety of patients in the process, there some relative contraindications include serious bleeding or anemia, severe hypotension or shock, serious heart or brain complications, i.e. obvious cardiomegaly with insufficiency of heart function, serious arrhythmia, severe hypertension or brain blood vessel disease, end-stage uremia with serious irreversible complications, uncontrolled diabetes, serious infection, have malignant disease such as cancer at the same time, still within the 3 days after a big operation, and old high-risk patients, non cooperative mental disorder patients, infant and children. [45]

2.4.6. 2 Absolute contraindications of Hemodialysis:

Include hemodynamic instability, inability to anticoagulant, and lack of access to circulation.[46]

2.5 Hemodialysis apparatus:

The apparatus used to conduct hemodialysis consists of dialyzer, dialysis solution (dialysate), and tubing for transport of blood and dialysis solution. [47]

Dialysate fluid helps remove wastes from the patient's blood. It can also replace needed substances, such as bicarbonate, to maintain the patient's acid-base balance. Since only a semipermeable membrane keeps the patient's blood apart from the dialysate, the exact make-up of the dialysate is key to your patient's well-being. (48)

The extracorporeal circuit includes the dialyzer, bloodlines, monitoring lines, heparin line, and transducer protectors. An aseptic technique should be used when you taking any cap off of a bloodline, so bloodlines do not contaminated and infection do not occur. (49)

Hemodialysis machines deliver a patient's dialysis prescription by controlling blood and dialysate flows through the dialyzer. In addition, they incorporate monitoring and alarm systems that protect the patient against adverse events that may arise from equipment malfunction during the dialysis treatment. This chapter will focus on essential principles of hemodialysis, the major components of HD machines and their respective monitoring devices. (50)

2.6 Hemodialysis system:

The operational system of the HD machine represents a complex array of detectors, controllers, monitors, and safety devices to ensure a safe operation. The system is a totally self-contained machine that provides the necessary control functions for hemodialysis therapy. Basic functions of the unit are: Automatically primes extracorporeal circuit; Prepares Dialysate; monitors dialysate and blood; pumps blood and anticoagulant at predetermined rates; controls fluid removal; automatically cleans, disinfects, and rinses dialysate flow path. Single-patient hemodialysis systems can be divided into three major components: the extracorporeal blood-delivery circuit, the dialysate delivery system, and the dialyzer. Blood is taken via the extracorporeal circuit, passed through a dialyzer for solute and fluid removal, and returned to the patient. Each system has its own monitoring and control circuits. (50)

2.7 Dialysate:

2.7.1 Dialysate Delivery Circuit:

Dialysate can replace needed substances, such as calcium and bicarbonate, which helps keep the body's pH balance. During a treatment, the patient's blood is on one side of the membrane, in the blood compartment. The dialysate is on the other side, in the dialysate compartment. Dialysate and blood never mix, unless the membrane breaks. Dialysis patients' blood has high concentrations of waste products and excess water. Dialysate is prescribed to have desired levels of solutes the patient needs and none of the ones that must be re-moved completely. [50]

2.7.2 Types of Dialysate:

Dialysis solutions are usually prepared from concentrates and contain either acetate or bicarbonate as a buffer. [50]

2.7.2.1 Acetate Dialysate:

In the early 1960s acetate became the standard dialysate buffer for correcting uremic acidosis and offsetting the diffusive losses of bicarbonate during hemodialysis. Acetate is physiologically compatible with blood and metabolized to bicarbonate in the liver. It is mixed with water in proportioning system, usually 1 part concentrate and 34 parts of water, to form the dialysate. [50]

2.7.2.2 Bicarbonate Dialysate:

Calcium and magnesium will not remain in solution with bicarbonate because of low hydrogen ion content (high pH). To solve this problem, two separate concentrate are used. The proportioning (delivery) system mix and monitor three liquids instead of two, the "A" concentrate, the "B" concentrates or powder, and purified water [50]

2.7.3 Composition of Dialysate [50]

Solute	Dialysate (mmol/L)
Sodium	135 – 145
Potassium	0 – 4
Chloride	98–124
Calcium	1.25 – 1.75
Magnesium	0.5 – 0.75
Acetate /Citrate	2 – 4
Bicarbonate	30 – 40
Dextrose	11
Glucose (g/L)	0 – 2
CO_2 P (mmHg)	40-110
PH 7	7.1–7.3

2.8 Infection control policies:

The general guide to infection control include use disposable gloves when dealing with patients, remove gloves and wash hands between patients, items used on a treatment station should be either disposable or for single use, and reserved for a single patient, clean areas should be designated and used for the preparation and handling of medications and should be separated from contaminated areas, multidose medication vials should be prepared for use away from the patient, use new external venous and arterial pressure transducer filters for each patient's treatment, to prevent blood contamination of the dialysis machine pressure monitor, clean and disinfect dialysis stations between patients (including chair, table, bed, machine), and especially the dialysis machine control panel, and discard fluids carefully and clean/disinfect all containers. [51, 52]

2.9 Predialysis Treatment Procedures

Several tasks must be done before a patient's treatment can start. Preparing the dialysis equipment, and predialysis patient assessment. [53]

2.9.1 Treatment plan

Dialysis is done according to a doctor's prescription. Each patient has a specific treatment plan. It is vital to know where to find these plans and how to carry them out as ordered. While dialysis treatments for all patients are similar, the nephrologist tailors each patient's treatment plan to meet the patient's needs. One patient may have a longer treatment time, while a second patient may use a different dialyzer. The physician continually evaluates each patient and varies the treatment plan, when needed, by writing new orders. [53]

2.9.2 Priming and recirculation:

Bloodlines and dialyzer should be prepared for the treatment by priming (rinsing and filling the extracorporeal circuit with saline) them with normal saline.

Then to attached the venous and arterial bloodlines together to form a loop, and re circulate the prime (send it around the loop). Priming removes air and germicide from the bloodlines and dialyzer; recirculation keeps the process going. During recirculation, UF and diffusion help "dialyze off" any germicide that is left. The germicide moves from the blood side of the dialyzer to the dialysate side, then down the drain. Priming also warms the saline so the patient does not get too cool when the treatment begins. [53]

2.9.3 Predialysis safety check::

Completing this check is vital for patient safety. If an alarm is not working correctly and the treatment is started, the patient could be harmed. All alarm checks must be

successfully completed before the machine is used for a treatment. If any of the alarm checks fail, remove the machine from the patient area for inspection. [53]

2.9.4 Predialysis patient evaluation:

Patient's health should be evaluated before a treatment, and to compare this information with data from last treatment. Abnormal findings should be reported to the nurse. This is an important task since, in rare cases, the nurse may then decide that the patient's health is not stable and that treatment in an outpatient setting may not be safe. Components of the predialysis patient evaluation include weight, edema (swelling), pulse, blood pressure, respiration, temperature, general physical and emotional state, problems since the last treatment, and access status. [54]

2.9.4.1 Weight:

The patient's pretreatment weight is used to decide, how much fluid weight the patient gained since the last treatment, and how much fluid weight to take off at this treatment. The dry weight or estimated dry weight is what the patient's weight would be with no extra fluid and with a normal blood pressure. [54]

The doctor prescribes a "dry weight" for each patient. This number is then used to decide how much fluid weight is to be removed during the treatment. In an ideal case, by the end of a treatment the patient will be at or near dry weight. Not all weight gain is fluid—many factors can affect a patient's actual dry weight like a hospital stay or illness with loss of appetite, diarrhea, or vomiting can cause the dry weight to drop, the holidays often cause increases in dry weight because patients eat more than usual, patients may lift weights to build muscle, and may gain real weight, and wearing different clothes or shoes to dialysis can raise or lower a patient's weight on the scale. [54]

2.9.4.2 Edema:

Edema occurs when extra fluid builds up in the patient's tissues. Due to gravity, it is often seen in the feet or ankles. Edema may also be seen in the hands, face, abdomen, or back. [54]

2.9.4.3 Pulse:

The rhythm of the pulse can also be recorded. A normal pulse for an adult is between 60 and 100 beats per minute with a regular rhythm. [54]

2.9.4.4 Blood Pressure:

In patients with kidney failure, changes in fluid status are the key reason that BP readings rise or fall. As fluid weight increases, the BP also increases (extra fluid in the blood raises pressure inside the blood vessels). As fluid weight is removed, the BP goes down (total blood volume drops). [54]

2.9.4.5 Respiration:

With each breath, oxygen from the air enters the lungs and carbon dioxide leaves the lungs. This exchange of gases affects the health of every cell in the body. An adult's respirations are normally regular at a rate of about 12–16 per minute.

In dialysis patients, fluid weight gains may cause fluid to enter the lungs. This leads to shortness of breath or labored, difficult breathing. [54]

2.9.4.6 Temperature:

Hemodialysis patients also tend to have low baseline (predialysis) temperatures, for unknown reasons. A high temperature before a treatment could be due to a cold or flu, or an infection. [54]

2.9.4.7 Vascular Access::

The patient's vascular access is his or her lifeline. Before each treatment starts, check the access to be sure it is working. [54]

2.9.4.8 General and Emotional Health:

Talking with patients, asking them questions, and listening to their answers is another way to gather predialysis information. Patients know themselves best. By talking to and watching them, you can find clues to their general health and emotional well-being. (54)

2.9.5 Investigations recommended for patients on maintenance hemodialysis:

Blood urea should examined monthly, Serum creatinine should examined monthly, Serum sodium should examined monthly, Serum potassium, Kt/V (a number used to quantify hemodialysis and peritoneal dialysis treatment adequacy. K – Dialyzer clearance of urea. t – Dialysis time. V – volume of distribution of urea, approximately equal to patient's total body water), Platelet count, Total leucocytes count, ESR, Serum calcium, Serum phosphorus, PTH, Serum uric acid, SGPT, SGOT, ALP, and Iron studies.(55)

2.10 Initiation of Dialysis::

Once the predialysis tasks are done, the treatment can begin. A number of steps are needed to start the treatment: calculating how much fluid to remove, venipuncture (putting the needles into the patient’s access), blood testing, and starting the machine. (56)

2.10.1 Removing fluid:

Removing excess fluid from the blood is a main dialysis task. This process of fluid removal is called ultra filtration (UF). Fluid moves out of the blood and across the dialyzer membrane due to a pressure difference between the blood and the dialysate (pressure is always higher on the blood side). How fast (and how much) fluid is removed (the UF rate) can be changed by increasing or decreasing the degree of pressure difference. (56)

2.10.2 Replacing Fluid:

Rarely, you may need to give patients normal saline during the treatment to help them reach their goal weight. For example, a patient may come in for a treatment below the prescribed dry weight due to vomiting or diarrhea. Follow your center's policies and procedures to decide if saline is needed during a treatment and, if so, to figure out how much is needed. [56]

2.10.3 Venipuncture:

To do hemodialysis, an access is needed so blood can be pumped into the dialyzer and then back to the patient.

With either a fistula or a graft, needles must be placed into the access. Skilled and gentle needle placement prolongs the life of the access. Good blood flow through the needles helps ensure that the patient will receive an adequate treatment, with proper clearances of waste and fluid from the blood. [56]

2.10.4 Measuring dialysis adequacy:

There are two main lab tests that estimate the "adequacy" of dialysis given to a patient during a treatment: urea reduction ratio (URR) and urea kinetic modeling (UKM). [56]

2.11 Factors affecting dialysis treatment:

2.11.1 Clearance factors::

Dialyzers vary in size, porosity, and surface area, all of which affect how much dialysis a patient receives during a treatment. Other treatment factors can also reduce clearance (K) and the treatment's effectiveness. These include: Poor blood flow from the patient's access, poor dialyzer function due to insufficient heparin/anticoagulation, clotting of the dialyzer's fibers, wrong estimates of dialyzer performance, wrong blood flow rate settings, blood pump calibration

errors, reduced blood pump speed, such as when the patient has hypotension or muscle cramps, wrong dialysate flow rate settings that do not match the physician's orders, and access recirculation (mixing dialyzed venous blood with undialyzed arterial blood in the patient's access during a treatment). [57]

2.11.2 Time Factors:

Factors that affect the patient's time per treatment will also affect adequacy. These may include: Stopping a treatment early, frequent alarms that stop the blood pump (extracorporeal arterial or venous pressure), frequent alarms that divert dialysate to the drain (alarms that put the machine into "bypass"). [57]

2.12 Patient Well-being:

Dialysis should control or reduce the complications of chronic kidney disease. Patient well-being is a way to tell if dialysis is adequate—but it is only a late measure. A patient who receives poor dialysis may have few symptoms in the short-term, but may run into severe problems in the long-term and is likely to die sooner. [58]

2.13 Starting the dialysis treatment:

The treatment can start after match the dialyzer and dialysate concentrate to the patient, prime the dialyzer and tubing with normal saline, check all tubing connections, test and arm all alarms, take the patient's vital signs and complete predialysis assessments, insert the dialysis needles and tape them in place, or be sure that the catheter is properly flushed and prepared, and make sure all monitors are set and are within limits (e.g., arterial and venous pressures, blood leak detector, UF, conductivity, temperature, dialysate flow, blood pump speed, and sodium variation). [59]

2.14 Monitoring During Dialysis:

During the treatment, monitor the patient and the machine. Patient monitoring includes taking vital signs and assessing the patient's general condition. Machine monitoring includes doing equipment safety checks, monitoring the bloodlines and the machine readings, and checking the alarms when they occur. (60)

2.14.1 Patient monitoring::

2.14.1.1 Vital Signs:

Check the patient's vital signs during dialysis to ensure a safe and effective treatment. Check the patient's vital signs every half an hour, or more often if the patient is having symptoms or is unstable. Report any unusual findings to the nurse. (60)

2.14.1.2 General Patient Condition:

Patients are tolerating the treatment should be evaluated by watching and listening to them. Watch the patient's behavior, appearance, response, and symptoms. (60)

2.14.2 Technical monitoring:

If an alarm sounds or the equipment malfunctions during the treatment, you must act quickly to find the problem. It will be your job to monitor the extracorporeal circuit, dialysate circuit, and equipment for problems during each treatment. These checks help ensure patient safety. Check all systems every half hour to hour, per your center's policy. (60)

2.14.2.1 Anticoagulation:

During a treatment, the patient's blood comes in contact with the artificial (man-made) dialyzer and lines. This contact can cause blood clots, which could clog the dialyzer and make dialysis difficult or even impossible. Anticoagulants (blood

thinners) help prevent clots and keep the patient's blood flowing freely. Anticoagulants used in dialysis include heparin, saline, or citrate. [60]

2.14.2.1.1 Heparin:

The anticoagulant of choice in hemodialysis is heparin. Heparin is easy to give, works fast, breaks down quickly in the body, and is removed quickly. The patient's doctor prescribes the dose of heparin used in a treatment. There are three ways to give heparin before a treatment. Which technique is used will depend on the patient's needs and your center's procedure. [60]

2.15 Post dialysis Procedures

At the end of a treatment, you will have another set of steps to do. These include discontinuing the dialysis treatment, taking the patient's vital signs and weight, documenting the treatment, and cleaning up the equipment. [61]

2.16 Discontinuing dialysis:

At the end of the treatment, the blood pressure and pulse are taken. This will help you to determine the amount of saline you will need to use to return the patient's blood. Draw any post dialysis blood samples that have been ordered by the physician. To end a treatment, you will reduce the blood flow rate and UFR. You will check the patient's vital signs again. Usually, when the fluid in the venous bloodline is pink, you will stop the saline. Check blood pressure and pulse rate again before the dialysis needles are removed. You will look at the dialyzer after the blood is returned to see how much blood was left clotted in the dialyzer after Rinse back. Learn and follow your center's policy on discontinuing dialysis. [61]

2.17 Post Dialysis Nursing Care:

It include assess and document vital signs, weight, and vascular access site condition, monitor BUN, serum creatinine, serum electrolyte, and hematocrit levels between dialysis treatments, assess for dialysis disequilibrium

syndrome, with headache, nausea and vomiting, altered level of consciousness' and hypertension, assess for other adverse responses to dialysis, such as dehydration, nausea and vomiting, muscle cramps, or seizure activity,assess for bleeding at the acc ess site or elsewhere, blood transfusion is given during dialysis, monitor for possible transfusion reaction, provide psychologic support and listen actively. Address concerns and accept responses such as anger, depression, and noncompliance. Reinforce client and family strengths in coping with renal failure and hemodialysis, and refer to social services and counseling as indicated. Clients with renal failure may need additional support services to help them adapt to and live with their disease. (62)

2.18 Patient education:

2.18.1 Vascular access for hemodialysis: the patient's lifeline:

Three types of access to circulation can provide adequate blood flow for a thorough dialysis.

Two types of internal accesses require cannulation with two large bore fistula needles for every dialysis session. One needle will pull the blood into the tubing and dialyzer, while the other is used to return the blood. The needles are removed after the treatment is completed. (63)

2.18.1.2 Arteriovenous Fistula

An arteriovenous fistula created by surgically connecting an artery to a vein, it is the standard preferred access, should not be used until it is determined to be ready for use, usually 6 to 12 weeks after its creation, and it has lowest risk for infection. (63)

2.18.1.2 Arteriovenous Graft:

An arteriovenous graft is created by attaching special synthetic tubing to an artery at one end and a vein at the other, it is ready for use in 2 to 3 weeks (after surgical site healed and swelling has gone down).[63]

2.18.1.3 Central Vein Catheter:

Is an external access and may be used for hemodialysis immediately, is placed in a large vein through the neck or upper chest, the ports to access the catheter remain outside the body, does not require canulation, and connects directly to the blood tubing of the dialysis machine.[63]

2.18.2 Typical medications:

Multivitamins without minerals or vitamin D to replace excess loss during hemodialysis (folic acid 1 mg/day), phosphate binders to limit GI absorption of phosphorous and prevent renal bone disease or hyperparathyroidism (e.g. Phoslo, Renvela, Fosrenal), erythropoietin for anemia (Aranesp, Epogen, Procrit), iron for anemia management (oral or IV – e.g. Ferrlecit, iron dextran, Venofer or Ferraheme), vitamin D (1,25 vitamin D3) to prevent/treat renal bone disease (Hectorol, Rocaltrol Zemplar), and antihypertensives for blood pressure management (ACE inhibitors, angiotensin receptor blockers, beta blockers, calcium channel blockers, central alpha-2 agonist, alpha-1 blockers, vasodialators, and especially for CKD, diuretics). [63]

2.18.3 Arteriovenous fistula or graft care:

Clean the skin over the fistula or graft each day with soap and water, remove the bandage over fistula or graft 4 to 6 hours after dialysis, check fistula or graft each day for good blood flow by touching it with your fingertips. The buzzing sensation means that it is working, check for bleeding, pain, redness, or swelling. These may be signs of infection or a clogged fistula or graft, prevent damage to the fistula or graft. Do not

let anyone take your blood pressure or draw blood from the arm that has the fistula or graft, do not sleep on that arm, and do not wear tight clothes or jewelry. [64]

2.18.4 Activity and limitations:

Exercise benefits for dialysis patients include increased strength and energy, improved muscle strength and stronger bones, better BP control, better sleep, better control of body weight, and lowered level of blood fats (cholesterol & triglycerides). [64] Advice patients to check with their health care professional, follow the treatment plan, take any appropriate medications, and follow their diets. Emphasize that individual health, fitness level, interest, and available time will vary. [64]

Recommend continuous exercises that will move large muscle groups, such as walking, swimming, bicycling, skiing, and aerobic dancing, and recommend low level strength exercises, such as low weights and high repetitions. Emphasize that there is to be no heavy lifting, and that a slow, relaxed pace of exercise can still yield positive benefits. [64]

Recommend a minimum of 3 days per week of exercise, and advise patients to work toward exercising 30 minutes/session. Emphasize that a patient's endurance will be better on non dialysis days. [64]

Patient should contact nephrologist if he or she have a fever, do not feel a buzzing sensation in fistula or graft, have chills, cough, or feel weak and achy, skin itches or skin rash, cannot make it to follow-up or dialysis visit, or have questions or concerns about condition or care.[64]

Return to the emergency department If blood soaks through the bandage, the skin around fistula or graft is painful, hot, red, or swollen, patient urinate or not at all, patient cannot eat or drink because he is vomiting, your fingers are blue or pale, or he feel cool to the touch, you are breathing fast or have a fast heartbeat, patient feel

confused, dizzy, or lightheaded, or patient have sudden chest pain or trouble breathing. [64]

2.18.5 Nutritional management: typical recommendations:

Protein 1.0-1.2 g/kg/day 50% high biologic value protein, potassium 40-70 mEq (1,500-2,500 mg)/day (avoid high potassium foods and salt substitute that is potassium chloride), sodium 750-1,000 mg/day (avoid high sodium foods and do not use added salt), phosphorus 600-1,200 mg/day (limit dairy products), calories >35 kcal/kg/day, less for obese patients (25-30 kcal/kg), and more with stress or malnutrition (40-45 kcal/day), fluids limited to 1-1.5 liters plus urine output per day, and diabetes Mellitus: Same meal plan but limit concentrated sweets. [65]

2.18.6 Partnering with the health care team:

Patients can be confident that health care professionals will listen, offer education, continuity of care, and encouragement, as well as information on support groups and rehabilitation, patients who are active participants in their care may have a greater sense of control of their disease, health care professionals (doctors, nurses, social workers, dieticians, and case managers) are invaluable resources to patients, worldwide web is also available and offers numerous informative sites sponsored by nationally recognized kidney organizations, but beware of misinformation, and patients can be confident that support is available for lifestyle changes. Hemodialysis can be offered as a home therapy when appropriate and if desired by the patient. [66]

2.18.7 Dialysis diet:

Nephrologist will tell patient what changes he needs to make to the foods he eats. A dietitian can help him plan meals, limit potassium, phosphorus, sodium (salt), and liquid. The patient will need more protein than he did before he started dialysis. Ask which liquids to drink, and how much to have, write down how much liquid to drink

each day. Remember to count ice cubes and ice chips. Also count foods that contain liquid. This includes soup, gravy, gelatin, ice cream, and popsicles. Try to drink only when you are thirsty. Limit the amount of caffeine you drink, and suck on hard candy or chew gum to help keep your mouth moist without having to drink liquids. Lemon wedges may also help keep your mouth moist. [67]

2.19 Equipment clean-up:

A dialyzer that is to be reused should be refrigerated or reprocessed within 10–15 minutes after a treatment to reduce the loss of volume. If your center does not reuse the dialyzer, discard it. Remove and disinfect clamps and other non disposable items, per center policy, before using them for other patients. To kill any bacteria, you must disinfect equipment that will be used for another patient. Otherwise, the bacteria could transfer to the next patient who uses it. Clean the outside of the machine with a disinfectant after each treatment. Pay special attention to control knobs and other surfaces that may have been touched and contaminated during the treatment. You must disinfect the dialysate delivery system regularly with heat or chemicals: n Heat disinfection is a 3-cycle process built in to some central dialysate systems and some individual patient machines. During a“warm-up”cycle, water is heated to 85°C–95°C. Depending on the system, hot water passes through the hydraulic circuit for 20–60 minutes in a “recirculation”cycle. This disinfects the machine. At the end of the cycle, the hot water is drained and replaced with cool water. The temperature- regulating mechanism resumes normal operation in the “normalization”cycle. Chemical disinfection is a 3-cycle (water fill, circulation, rinse) process. The machine runs with disinfectant instead of dialysate. The chemical disinfectant mixes with treated water and follows the dialysate path. The rinse cycle washes out the disinfectant. Before you start the next treatment, the rinse water must be tested for residual disinfectant. [68]

2.20 Hemodialysis Complications:

Hemodialysis technology has improved, but there is always a risk of complications during a treatment. Complications can be either clinical (related to patient care) or technical (related to equipment). Hypotension is the most common complication in hemodialysis, it is defined as low blood pressure Decreased systolic blood pressure by >20-30 mmHg from predialysis pressure .Systolic blood pressure <100 mmHg, muscle cramps occur in up to 90% of dialysis treatments, mainly towards the end of dialysis, nausea and vomiting, headache, chest pain, itching, chills and fever, phylogenic reaction: Fever reaction due to presence of dead bacteria endotoxins, hypertension is a common complication of CKD and persists among most patients (80–90%) with ESRD on maintenance HD. It is also a major risk factor for cardiovascular morbidity. [69, 70, 71] Disequilibrium Syndrome is defined as a set of systemic and neurologic symptoms, air embolism is an introduction of enough air into extra corpeal system to stop circulation, and clotting [72, 73, 74, 75, 76, 77, 78]

3. Methodology

3.1Study design:

This study was quasi experimental study, carried out to evaluate the effect of nursing guidelines on nurses' knowledge and practice at hemodialysis centers at River Nile State Hemodialysis Centers in period extent from August to December 2018.

3.2 Study area:

River Nile State is one of the 18 states of Sudan, is located between Latitudes 16-22North, and Longitudes 32-35South, It has an area of 122,123 km² (47,152 mi²) and an estimated population of 1,027,534 (2006). From the North, it's bordered by the Arab Republic of Egypt from the East Kassala and Red Sea States and on the South Khartoum State and from West the Northern State. Population live in rural areas and in urban area, most of them are farmers and most of them afroarab .The River Nile traverse the lands of the State on its way Northwards towards its Mouth, where it is joined by Atbara River. Localities: Ad-Damir (Capital), Atbara, Shendi, Berber, Abu Hamed, Al Matamah, and Al Buhaira localilty.

3.3 Setting:

This study was carried at River Nile State hemodialysis centers, Shendi center, which established since 2005. Atbara hemodialysis center established since 1998 as peritoneal dialysis center, and then started hemodialysis since 2002. Berber hemodialysis center established since2016. Ad- Damir hemodialysis center was established since 2004.

3.4 Study population:

All registered nurses that work at River Nile State hemodialysis centers, during study period (August – December 2018).

3.4.1 Inclusion criteria:

- Nurses who agreed to participate.

3.4.2Exclusion criteria:

- Nurse, who could not agree to participate, Trainee nurses, nurses on holidays, and technician nurses.

3.5 Sampling:

3.5.1 Sampling techniques:

All nurse in hemodialysis centers, who met the inclusion criteria.

3.5.2 Sample size:

(50) Nurse agreed to participate. The total number of nurses was 69 nurses.

3.6 Variable:

3.6.1 Dependent variable:

Knowledge and practice of hemodialysis nurses.

3.6.2 Independent variables:

Demographic characteristics which include age, sex, years of experience, and qualifications.

3.7.1 Data collection tools :

Data was collected within a period of (5) months. Two tools were used for collecting data, namely a self administered questionnaire and an observation checklist.

3.7.1.1 Tool I: A self administered questionnaire:

The questionnaire was constructed by the researcher based on research objectives and review of literature. It consisted of six parts concerned to knowledge about hemodialysis management.

3.7.1.2 Tool II: Observation checklist.

An observational check list was used to assess practice of nurses during hemodialysis management, (initiation of dialysis, nursing intervention with common

problems during hemodialysis session and at termination of dialysis). It consisted of 11 sections of (86) items.

3.7.6 Operational Design:

Operational design includes pilot study and data collection technique.

3.7.7 Validity and reliability:

Structured data collection instrument was examined by view of two assistant professor working at Shendi University; discussion was held together with the researcher to look into issues of clarity, specificity of variables to be measured and relevance of the contents of the questionnaire. Nurses practice check list constructed according to literature review.

3.7.8 Pilot Study:

The structured data collection instrument was pilot tested using (10) nurses at Shendi, by the researcher to find out unclear or ambiguous questions, Ambiguous questions were reworked or removed, the pilot testing of the structured data collection instrument helped to estimate the time that could be taken to respond to the questionnaire which was an average of 20 minute, and to determine whether or not the items were understood by the nurse , nurses involved in pilot were not included in the main study.

- Cronbach's alpha =0.76 - Degree of confidence= $\sqrt{0.76}$=0.87
- Nurse understand the method used to fulfill each tool, some items needed to be modified; rephrasing, omission, whether these items stay as they were or by adding some words.
- Based on pilot results the modification was done and further the researcher refined tool, finally making assurance that tool as a whole achieved the aim of the study.

3.7.2 Data collection technique:

Data collected in two phases, before application of nurses guidelines (**phase I**), in which the questionnaire was distributed for nurses and each nurses was allowed sufficient time to fill it in (August and September 2018) , after collection of pretest data (**phase I**) nurses were received the training program, the training was continued, questionnaire was filled after explanation verbally the purpose of the study ,verbal consent was taken, then nurses filled the questionnaire, after that the researcher and trainees implement the program in the centers, three months later for the identified group the same tools used in pretest was used to collect post test (**phase II**) in November ,and December 2018).

Nurse considered eligible for participation was approached by the researcher, a (book) is initially given together with verbal information describing the study , in details, the nurse was given sample time to read the information, The researcher returned within 2–3 week (next appointment) or at a planned time to answer any questions nurse might have (learning session).

3.7.3 Data management:

The following statistical measures were used

Descriptive Statistics was used, frequency and percentage distributions then crosstab analysis using chi-square and Pearson correlation. Paired sample T-test was done between time period of the program (p1, p2), and data was recorded.

3.7.4 Data entry and analysis:

Data was entered into the computer using SPSS software program, Data was cleaned before being subjected to analysis, Data analysis was performed using SPSS(version 22) software program, Information was summarized using frequency tables, The chi-square test was used to compare proportions, correlation (Pearson

correlation) analysis was done, P-value of equal or less than 0.05 was considered a statistically significant .

3.7.5 Scoring system:

The items observed to be done correctly were scored (1), the items done incorrectly were scored (1/2), and the items not done and not applicable were scored (0). For each area, the scores of the items were summed up and the total divided by the number of the items, giving a mean score for the part. These scores were converted into a percent score. The practice was considered satisfactory if the percent score was 60% or more and unsatisfactory if less than 60%.

3.7.9 Program:

During the activity of this doctoral study the researcher designed a book about guidelines for nurses in hemodialysis centers, and done educational program about Hemodialysis management, many modules were used including different media showing.

3.7.9.1 Content of the program:

Functions of the kidney & principles of hemodialysis, doing observations, preparing dialysis machine, preparing pack, programming dialysis machine, preparing fistula/graft for dialysis, preparing tunnelled line for dialysis, commencing dialysis, discontinuing dialysis with fistula/graft, discontinuing dialysis with tunnelled line, post dialysis

3.7.9.2 Duration of the program:

The program was done in period of five month (August – December 2018).

3.7.9.3 Steps of conducting the program:

(a) Pretest:

This include structured data collection instrument which was developed by the researcher, to evaluate nurse knowledge and practice about hemodialysis management.

(b) Information (Educational Program):

This section includes pictures of the slides, talking points, videos.

The intervention was implemented to small groups (2-5), the program were implemented in two (August and September 2018), each session took about one hour and at the end of each session each nurse understood the instructions.

Anatomy of the kidney & normal, kidney function, renal failure, principles of hemodialysis, fluid removal & effect of fluid on the heart

(c) Training program:

Training program includes:

Doing observations, preparing dialysis machine, preparing pack, programming dialysis machine, preparing fistula/graft for dialysis, preparing tunnelled line for dialysis, commencing dialysis, discontinuing dialysis with fistula/graft, discontinuing dialysis with tunnelled line, and after dialysis

3.8 Inspiration Guide for Nurse Researcher Consultation:

The nurse can consult the nurse researcher in person or by phone, the educational program intervention was performed by the researcher in groups by researcher using media (videos, lectures).

3.10 Ethical consideration:

Ethical clearance was sought and granted from the Research and Publication Ethical Committee of Shendi University the permission to conduct the study was obtained from Shendi, Atbara, and Berber centers , confidentiality was guaranteed by storing data and only the researcher was having the data, Participation in this study was voluntary and details about the aim and objectives of the study was explained to the participants, verbal consent was obtained, the participants were free to withdraw at any stage without incurring any consequences.

Result summary:

Table (1) demographic characteristics of study group:

The table showed that (80.0%) were female, (52.0%) aged between 20-30 year, (84.0%) had bachelor degree.

Table (2) knowledge of study group about hemodialysis:

The table showed that (38.0%) of nurses had good knowledge about definition of hemodialysis in **phase I** upgraded to (60.0%) in **phase II**, with significant results, (P value = .024),(48.0%) had good knowledge about Indications for acute dialysis (emergency) in **phase I** upgraded to (70.0%) in **phase II**, with highly significant results (P value = .002). (32.0%) had good knowledge about Indication of chronic dialysis in **phase I** upgraded to (62.0%) in **phase II**, with highly significant results (P value = .001).

Also (8.0%) had good knowledge about Absolute contraindications of hemodialysis in **phase I** improved to (34.0%) in **phase II**, with highly significant results (P value = .000). (22.0%) had good knowledge about Relative contraindications of hemodialysis in **phase I** upgraded to (38.0%) in **phase II**, with highly significant results (P value .005). (18.0%) had good knowledge about Optimum sessions for hemodialysis in **phase I** upgraded to (32.0%) in **phase II**, with significant results (P value = .010).

While (66.0%) had good knowledge about Process of hemodialysis in **phase I** improved to (74.0%) in **phase II**, with insignificant results (P value = .391). (74.0%) had good knowledge about Equipment for hemodialysis in **phase I** upgraded to (84.0%) in **phase II**, with significant results (P value = .044). (58.0%) had good knowledge about Dialysate in **phase I** same to **phase II**, with insignificant results (P value = .896). (78.0%) had good knowledge about Components of dialysate in **phase I** upgraded to (84.0%) in **phase II**, with insignificant results (P value =.382). (74.0%) had good knowledge about

Components of extracorporeal circuit in **phase I** upgraded to (78.0%) in **phase II**, with insignificant results (P value = .489). (58.0%) had good knowledge about Principles of Hemodialysis in **phase I** upgraded to (74.0%) in **phase II**, with highly significant results (P value = .001). (58.0%) had good knowledge about Infection control policies in **phase I** upgraded to (74.0%) in **phase II**, with significant results (P value = .012).

Figure (1): Years of experience in hospital

Figure (2): Years of experience in hemodialysis centers

Figure (3): Participation in training sessions concerned to hemodialysis

Table (3) knowledge of study group about vascular access of hemodialysis:

The table showed that (48.0%) of nurses had good knowledge about vascular access for hemodialysis in **phase I** upgraded to (62.0%) in **phase II**, with significant results, (P value = .062). (58.0%) had good knowledge about Types of vascular access in **phase I** upgraded to (62.0%) in **phase II**, with significant results (P value = .202). (52.0%) had good knowledge about an arteriovenous fistula in **phase I** upgraded to (70.0%) in **phase II**, with highly significant results (P value = .021). (52.0%) had good knowledge about Characters of an Arteriovenous fistula in **phase I** upgraded to (70.0%) in **phase II**, with highly significant results (P value = .034). (54.0%) had good knowledge about Characters of an arteriovenous graft in **phase I** upgraded to (74.0%) in **phase II**, with significant results (P value = .063). (70.0%) had good knowledge about A venous catheter in **phase I** same to (74.0%) in **phase II**, with insignificant results (P value =.755). (50.0%) had good knowledge about Initiation of a new fistula in **phase I** same to (62.0%) in **phase II**, with highly significant results (P value = .017).

Figure (4): knowledge about Pre dialysis nursing care

Figure (5): knowledge about during dialysis nursing care

Figure (6): knowledge about Post dialysis nursing care

Table (4) knowledge of study group about patient teaching:

The table showed that (68.0%) of nurses had good knowledge about Arteriovenous fistula or graft care in **phase I** improved to (82.0%) in **phase II**, with insignificant results, (P value =. 147). (56.0%) of nurses had good knowledge about Nutritional management in **phase I** upgraded to (76.0%) in **phase II**, with highly significant results, (P value =. 001). (72.0%) of nurses had good knowledge about Typical medications in **phase I** upgraded to (82.0%) in **phase II**, with highly significant results, (P value = . 055). (74.0%) of nurses had good knowledge about Medications and hemodialysis in **phase I** upgraded to (84.0%) in **phase II**, with highly significant results, (P value = .026). (56.0%) of nurses had good knowledge about Regular Blood Tests for Hemodialysis Patients in **phase I** upgraded to (72.0%) in **phase II**, with highly significant results, (P value = .015). (46.0%) of nurses had good knowledge about Guidelines for exercise in **phase I** upgraded to (64.0%) in **phase II**, with low significant results, (P value = .119). (26.0%) of nurses had good knowledge about Types of exercise in **phase I** upgraded to (48.0%) in **phase II**, with insignificant results, (P value = .147). (32.0%) of nurses had good knowledge about Time to exercise in **phase I** improved to (64.0%) in **phase II**, with highly significant results, (P value =. 000).

Table (5) knowledge of study group about Complications of Hemodialysis:

The table showed that (48.0%) of nurses had good knowledge about during dialysis complications in **phase I** upgraded to (64.0%) in **phase II**, with highly significant results, (P value = .017). (62.0%) of nurses had good knowledge about between treatment complications in **phase I** upgraded to (70.0%) in **phase II**, with insignificant results, (P value = .151). (72.0%) of nurses had good knowledge about

Long term complications in **phase I** upgraded to (84.0%) in **phase II**, with highly significant results, (P value = .029). (48.0%) of nurses had good knowledge about Nursing management of Hypotension in **phase I** upgraded to (82.0%) in **phase II**, with highly significant results, (P value = .044). (44.0%) of nurses had good knowledge about Nursing management of Muscle Cramps in **phase I** upgraded to (66.0%) in **phase II**, with highly significant results, (P value = .003). (52.0%) of nurses had good knowledge about Nursing management of Chest pain in **phase I** upgraded to (68.0%) in **phase II**, with highly significant results, (P value = .003). (64.0%) of nurses had good knowledge about Nursing management of Itching in **phase I** upgraded to (74.0%) in **phase II**, with highly significant results, (P value = .031). (70.0%) of nurses had good knowledge about Nursing management of Chills and Fever in **phase I** upgraded to (76.0%) in **phase II**, with highly significant results, (P value = .202). (54.0%) of nurses had good knowledge about Nursing management of Pyrogenic Reaction in **phase I** upgraded to (74.0%) in **phase II**, with highly significant results,(P value=.005).(78.0%)of nurses had good knowledge about Nursing management of Hypertension in **phase I** upgraded to (82.0%) in **phase II**, with insignificant results, (P value = .162). (64.0%) of nurses had good knowledge about Nursing management of Disequilibrium Syndrome in **phase I** upgraded to (72.0%) in **phase II**, with significant results, (P value = .110). (72.0%) of nurses had good knowledge about Nursing management of air embolism in **phase I** upgraded to (76.0%) in **phase II**, with significant results, (P value = .371). (78.0%) of nurses had good knowledge about Nursing management of clotting in **phase I** same to (78.0%) in **phase II**, with significant results, (P value = .077).

Table (6) Cross tabulation of years of experience in hemodialysis centers and training sessions concerned to hemodialysis and nurses knowledge about indications, process and principles of hemodialysis:

Table (7): Nursing performance regarding hemodialysis management in hemodialysis centers:

The table clarified that nurses performance regarding pre dialysis surgical a tire, (32.4%) of nurse had good performance in **phase I**, upgraded to (44.0%) in **phase II**, with highly significant result, (P value =0.000). Regarding Pre dialysis observation (40%) of nurses had good performance in **phase I** improved to (42.4%) in **phase II**, with highly significant result, (P value =0.000). About preparation of dialysis machine, (100.0%) of nurse had good performance in **phase I**, same to **phase II**, with highly significant result, (P value =0.000). Preparation of hemodialysis pack "Kit", (88.0%) of nurse had good performance in **phase I**, retrograded to (70.4%) in **phase II**, with highly significant result, (P value =0.000). Programming dialysis machine, (100.0%) of nurse had good performance in **phase I**, same to **phase II**, with highly significant result, (P value =0.001). Preparing fistula/graft for dialysis, (60.0%) of nurse had good performance in **phase I**, upgraded to (69.0%) in **phase II**, with highly significant result, (P value =0.000). Nurse's performance regarding Preparing tunneled line for dialysis, (100%) of nurse had good performance in **phase I**, same to **phase II**, with highly significant result, (P value =0.003). Commencing dialysis, (100%) of nurse had good performance in **phase I**, same to **phase II**, with highly significant result, (P value =0.000). Nurse's performance regarding Discontinuing dialysis with fistula, (67.8%) of nurse had good performance in **phase I**, upgraded to (73.0) in **phase II**, highly significant result, (P value =0.005). Discontinuing dialysis with tunneled, (80.0%) of nurse had good performance in **phase I**, same to **phase II**, with significant result, with highly significant result, (P value =0.000). And Post Dialysis Care, (36.0%) of nurse had good performance in **phase I**, upgraded to (67.8%) in **phase II**, with highly significant result, (P value =0.000).

PART ONE

Table (1) demographic characteristics of study group (N=50):

Item	Frequency	Percent
Sex		
Female	40	80.0%
Male	10	20.0%
Age		
20-30 years	26	52.0%
31-40 years	18	36.0%
41-50 years	4	8.0%
>50 years	2	4.0%
Nurse qualification		
Diploma	3	6.0%
Bachelor	42	84.0%
post graduate	5	10.0%

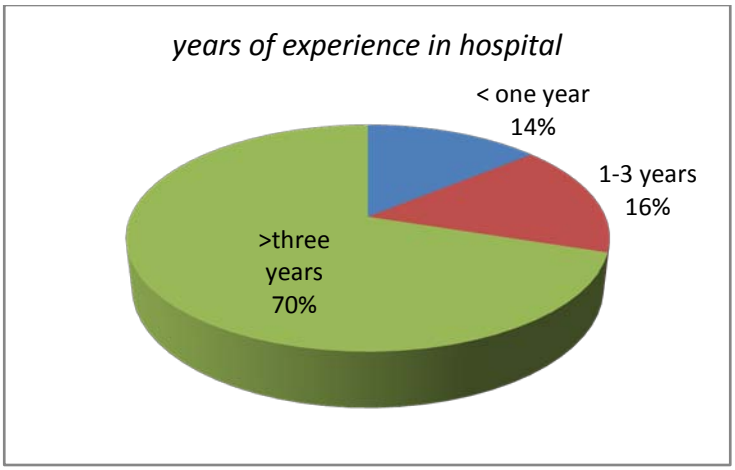

Figure (1): Years of experience in hospital

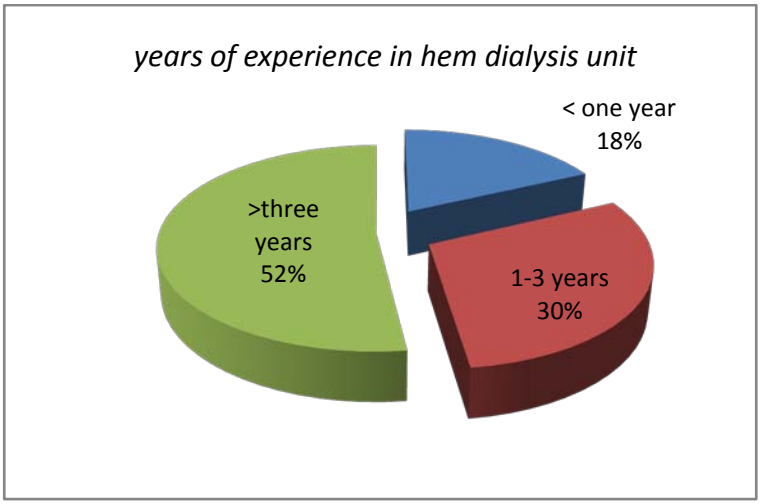

Figure (2): Years of experience in hemodialysis centers

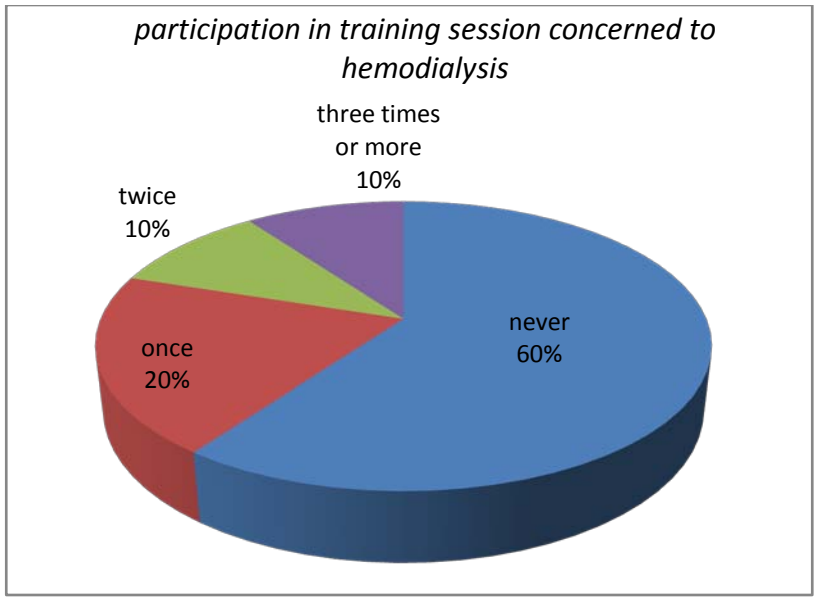

Figure (3): Participation in training sessions concerned to hemodialysis

PART TOW

Table (2) knowledge of study group about hemodialysis (N=50):

Item	Pre test						Post test						P value
	Good		Satisfy		Poor		Good		Satisfy		Poor		
	N	P	N	P	N	P	N	P	N	P	N	P	
Definition of dialysis	19	38.0%	11	22.0%	20	40.0%	30	60.0%	9	18.0%	11	22.0%	.024
Indications for acute dialysis(emergency)	24	48.0%	10	20.0%	16	32.0%	35	70.0%	12	24.0%	3	6.0%	.002
Indications of chronic dialysis	16	32.0%	9	18.0%	25	50.0%	31	62.0%	9	18.0%	10	20.0%	.001
Absolute contraindications of hemodialysis	4	8.0%	9	18.0%	37	74.0%	17	34.0%	17	34.0%	16	32.0%	.000
Relative contraindications of hemodialysis	11	22.0%	7	14.0%	32	64.0%	19	38.0%	14	28.0%	17	34.0%	.005
Optimum sessions for hemodialysis	9	18.0%	9	18.0%	32	64.0%	16	32.0%	16	32.0%	18	36.0%	.010
Process of hemodialysis	33	66.0%	6	12.0%	11	22.0%	37	74.0%	6	12.0%	7	14.0%	.391
Equipment for hemodialysis	37	74.0%	3	6.0%	10	20.0%	42	84.0%	5	10.0%	3	6.0%	.044
Principles of Hemodialysis	29	58.0%	5	10.0%	16	32.0%	37	74.0%	10	20.0%	3	6.0%	.001
Dialysate	29	58.0%	10	20.0%	11	22.0%	29	58.0%	11	22.0%	10	20.0%	.896
Components of dialysate	39	78.0%	5	10.0%	6	12.0%	42	84.0%	5	10.0%	3	6.0%	.0382
Components of extracorporeal circuit	37	74.0%	5	10.0%	8	16.0%	39	78.0%	6	12.0%	5	10.0%	.489
Infection control policies	29	58.0%	8	16.0%	13	26.0%	37	74.0%	10	20.0%	3	6.0%	.012

PART THREE

Table (3) knowledge of study group about vascular access of hemodialysis (N=50):

Item	Pre test						Post test						P value
	Good		Satisfy		Poor		Good		Satisfy		Poor		
	N	P	N	P	N	P	N	P	N	P	N	P	
Vascular access for hemodialysis	24	48.0%	10	20.0%	16	32.0%	31	62.0%	12	24.0%	7	14.0%	.062
Types of vascular access	29	58.0%	11	22.0%	10	20.0%	31	62.0%	16	32.0%	3	6.0%	.202
An Arteriovenous fistula	26	52.0%	11	22.0%	13	26.0%	35	70.0%	12	24.0%	3	6.0%	.021
Characters of an Arteriovenous fistula	39	78.0%	7	14.0%	10	20.0%	33	66.0%	10	20.0%	1	2.0%	.034
An Arteriovenous graft	27	54.0%	18	36.0%	5	10.0%	37	74.0%	11	22.0%	2	4.0%	.063
Venous catheter	35	70.0%	10	20.0%	5	10.0%	35	70.0%	12	24.0%	3	6.0%	.755
Initiation of a new fistula	25	50.0%	8	16.0%	17	34.0%	31	62.0%	14	28.0%	5	10.0%	.017

PART Four

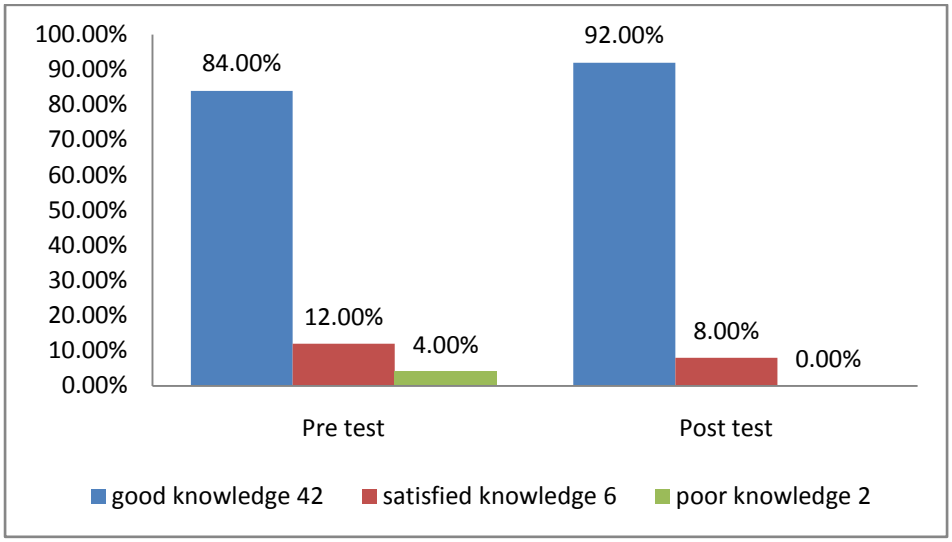

Figure (4): knowledge about Pre dialysis nursing care

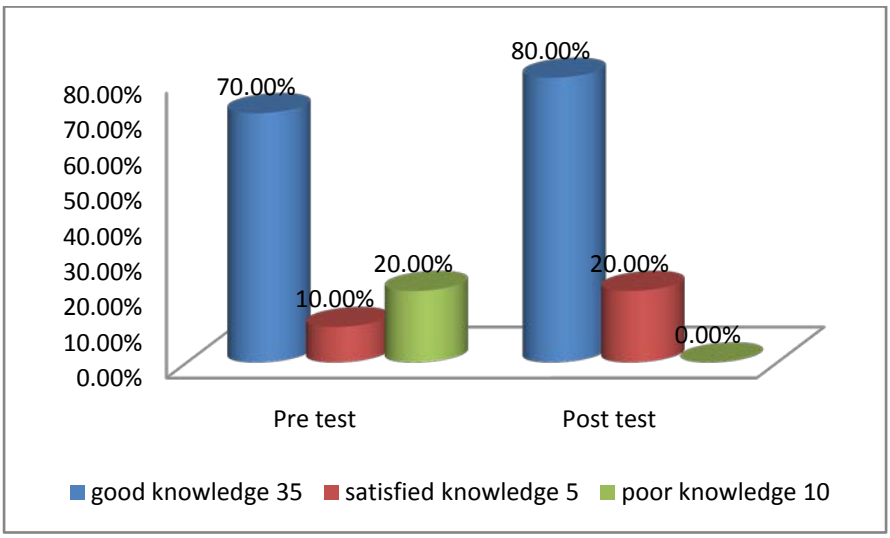

Figure (5): knowledge about during dialysis nursing care

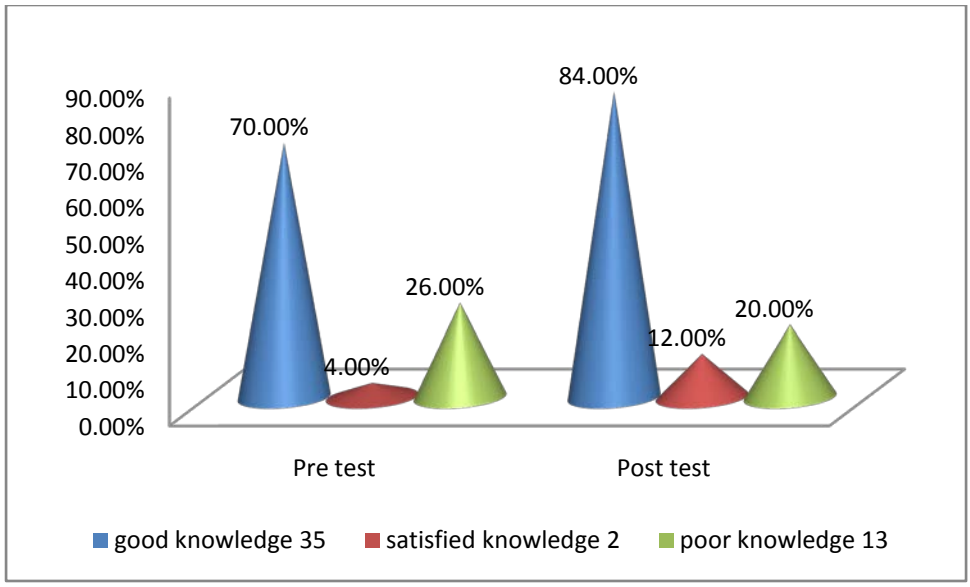

Figure (6): knowledge about Post dialysis nursing care

PART FIVE

Table (4) knowledge of study group about patient teaching (N=50):

Item	Pre test						Post test						P value
	Good		Satisfy		Poor		Good		Satisfy		Poor		
	N	P	N	P	N	P	N	P	N	P	N	P	
Arteriovenous fistula or graft care	34	68.0%	6	12.0%	10	20.0%	41	82.0%	3	6.0%	6	12.0%	.147
Nutritional management	28	56.0%	10	20.0%	12	24.0%	38	76.0%	12	24.0%	0	00.0%	.001
Typical medications	36	72.0%	8	16.0%	6	12.0%	41	82.0%	9	18.0%	0	00.0%	.055
Medications and hemodialysis	37	74.0%	4	8.0%	9	18.0%	42	84.0%	7	14.0%	1	2.0%	.026
Regular Blood Tests for Hemodialysis Patients	28	56.0%	12	24.0%	10	20.0%	36	72.0%	14	28.0%	0	00.0%	.015
Guidelines for exercise	23	46.0%	13	26.0%	11	22.0%	32	64.0%	8	16.0%	10	20.0%	.119
Types of exercise	13	26.0%	14	28.0%	23	46.0%	24	48.0%	17	34.0%	9	18.0%	.147
Time for exercise	16	32.0%	14	28.0%	20	40.0%	32	64.0%	7	14.0%	11	22.0%	. 000

PART SIX

Table (5) knowledge of study group about Complications of Hemodialysis (N=50):

Item	Pre test						Post test						P value
	Good		Satisfy		Poor		Good		Satisfy		Poor		
	N	P	N	P	N	P	N	P	N	P	N	P	
During dialysis complications	24	48.0%	14	28.0%	12	24.0%	32	64.0%	16	32.0%	2	4.0%	.017
Between treatment complications	31	62.0%	11	22.0%	8	16.0%	35	70.0%	13	26.0%	2	4.0%	.151
Long term complications	36	72.0%	6	12.0%	8	16.0%	42	84.0%	8	16.0%	0	00.0%	.029
Nursing management of Hypotension	24	48.0%	16	32.0%	10	20.0%	32	64.0%	18	36.0%	0	00.0%	.044
Nursing management of Muscle Cramps	22	44.0%	9	18.0%	19	38.0%	33	66.0%	11	22.0%	6	12.0%	.003
Nursing management of Chest pain	26	52.0%	9	18.0%	15	30.0%	34	68.0%	14	28.0%	2	4.0%	.003
Nursing management of Itching	32	64.0%	8	16.0%	10	20.0%	37	74.0%	11	22.0%	2	4.0%	031.
Nursing management of Chills and Fever	35	70.0%	6	12.0%	9	18.0%	38	76.0%	9	18.0%	3	6.0%	.202
Nursing management of air embolism	36	72.0%	8	16.0%	6	12.0%	38	76.0%	10	20.0%	2	4.0%	.371
Nursing management of Pyrogenic	27	54.0%	9	18.0%	14	28.0%	37	74.0%	11	22.0%	2	41.0%	.005

Reaction													
Nursing management of Hypertension	39	78.0%	3	6.0%	8	16.0%	41	82.0%	8	16.0%	1	2.0%	.162
Nursing management of Disequilibri Syndrome	32	64.0%	8	16.0%	10	20.0%	36	72.0%	12	24.0%	2	4.0%	.110
Nursing management of clotting	39	78.0%	6	12.0%	5	10.0%	44	88.0%	6	12.0%	0	00.0%	.077

Table (6) Cross tabulation of years of experience in hemodialysis centers and training sessions concerned to hemodialysis and nurses knowledge about indications, process and principles of hemodialysis:

Nurses knowledge / Nurses Data	Indications of acute dialysis		indications of chronic dialysis		Process of hemodialysis		Principles of hemodialysis	
	Pre test	Post test	Pre test	Post test	Pre test	Post test	Pre test	Post test
Years of experience in hemodialysis	.038	.572	.756	.740	.849	.257	.438	.709
Participation in training session concerned to hemodialysis	.741	.087	.389	.102	.844	.338	.144	.002

- P.V Significant < 0. 5
- P.V Highly Significant < 0.0 5

Table (7): Nursing performance regarding hemodialysis management in hemodialysis centers:

Procedure	Pre						Post						P. value
	Done correctly		Done incorrectly		Not done		Done correctly		Done incorrectly		Not done		
	N	%	N	%	N	%	N	%	N	%	N	%	
Pre dialysis	16	32.4	0	0.0	34	67.6	28	44.0	0	0	22	44.0	0.000
Pre dialysis observation:	20	40.0	8	16.0	32	44.0	21	42.4	12	24	17	34	0.000
Preparation of dialysis machine	50	100.0	0	0.0	0	0.0	50	100.0	0	0.0	0	0.0	0.000
Preparation of hem dialysis pack “Kit”:	44	88.0	6	12.0	0	0.0	35	70.4	13	25.6	2	4.0	0.000
Programming dialysis machine	50	100.0	0	0.0	0	0.0	50	100.0	0	0.0	0	0.0	0.001
Preparing fistula/graft for dialysis	30	60.0	14	28	6	12.0	35	69.0	9	19.0	7	13.0	0.000

Preparing tunneled line for dialysi	50	100	0	0.0	0	0.0	42	85.7	0	0.0	8	14.3	0.003
During Dialysis(Commencing dialysis)	50	100	0	0.0	0	0.0	50	100	0	0.0	0	0.0	0.000
Discontinuing dialysis with fistula	34	67.75	4	7.25	12	25	37	73.0	1	2.0	13	25.0	0.005
Discontinuing dialysis with tunne	40	80.0	0	0.0	10	20.0	40	80.0	0	0.0	10	20.0	0.000
Post After Dialysis	18	36.0	12	24.0	20	40.0	34	67.75	4	8.25	12	24.0	0.000

- P.V Significant < 0.5
- P.V Highly Significant < 0.05

5.1 Discussion:

This study was conducted to evaluate the effect of hemodialysis nursing guidelines on nurses knowledge and practice at River Nile State hemodialysis centers in period from August to December 2018, (50) nurses who work in river Nile state Hemodialysis centers were participate in the study.

Throughout the course of this study, concerning years of experience in hemodialysis; more than half (52.0%) of study group had more than three years of experience in hemodialysis centers, these results agree with study of **Uğur, et al** [(74)] which stated that ((68,9 %) had 0-5 years of experience in hemodialysis unit). As for the results of training sessions, two third (60.0%) of nurses never participate in training session concerned to hemodialysis, and this indicated lack of training in hemodialysis centers.

The study represented that study group knowledge about definition of hemodialysis, had been improved in **phase II**, with insignificant results (P value .024). Study group knowledge about Indications for acute dialysis, Indication of chronic dialysis had been improved in **phase II**, with significant results, (P value = .002, .001) respectively.

The study illustrated that study group knowledge about absolute contraindications of hemodialysis, relative contraindications of hemodialysis, and optimum sessions for hemodialysis had been improved in **phase II**, with highly significant results (P value = .000, .005, .010), these finding can justify that the study group had background knowledge about hemodialysis in **phase I**, these finding has been changed in **phase II** and there was increased in knowledge and that improvement of the study group was affected by application of guidelines.

As regard to the study group knowledge about Process of hemodialysis was improved with insignificant results (P value =.391), in **phase II**. Study group knowledge about equipment for hemodialysis had been improved in **phase II**, with significant results (P value = .044). Also study group had good knowledge about dialysate in **phase I** same to **phase II**, with insignificant results (P value = .896). Study group knowledge about dialysate, components of extracorporeal circuit in had been improved in **phase II**, with insignificant results (P value = .382, .489) respectively. Study group had good knowledge about principles of hemodialysis in **phase I** upgraded in **phase II**, with highly significant results (P value = .001). Study group had good knowledge about Infection control policies in **phase I** upgraded in **phase II**, with significant results (P value = .012), these results come in agreement with study of **Prathibha Jackline** [(78)], who stated that health care workers in dialysis environment is very much susceptible for contracting infections hence they should possess good knowledge, this indicated the importance of continuous learning and training to maintain optimum level of safety. Health care workers had good knowledge of infection control measures in dialysis units. The Health and Safety of Nephrology Nurses and the Environments in Which They Work: Important for Nurses, Patients, and Organizations.

The study showed that study group had good knowledge about vascular access for hemodialysis in **phase I** upgraded in **phase II**, with significant results, (P value = .062). Also their knowledge about types of vascular access was improved in **phase II**, with insignificant results (P value = .202). Study group had good knowledge about an arteriovenous fistula in **phase I** upgraded in **phase II**, with highly significant results (P value = .021). Nurses had good knowledge about characters of an arteriovenous fistula in **phase I** upgraded in **phase II**, with highly significant results (P

value =.034). Study group knowledge about Characters of an arteriovenous graft in **phase I** and in **phase II**, with insignificant results (P value = .063). Study group had good knowledge about A venous catheter in **phase I** same to in **phase II**, with insignificant results (P value =.755). Study group had good knowledge about Initiation of a new fistula in **phase I** same to in **phase II**, with highly significant results (P value = .017). These results agreed with study of **Yousif , et al** [79] which stated that, structured educational program based on the K/DOQI clinical practice guidelines for HD vascular access care had a significant impact on the dialysis nurses' knowledge, and this enhances the effect of educational program on nurses knowledge.

Moreover the study showed that regarding pre dialysis care study group knowledge about pre dialysis care had been improved in **phase II**, with insignificant results, (P value = .135). Study group had good knowledge about during dialysis care in **phase I** upgraded in **phase II**, with significant results, (P value = .027). Study group had good knowledge about post dialysis care in **phase II**, with highly significant results, (P value = .019). and this indicate that some of study group were respond, this goes with Study done by **Lydia Antony, et al** [80] in Narayana Medical College Hospital, Nellore, which found that nurses having adequate level of knowledge regarding care of patients undergoing hemodialysis.

As regard to knowledge of study group about patient's teaching, The study represented that the study group knowledge about an arteriovenous fistula or graft care upgraded in **phase II**, with insignificant results, (P value =. 147), study group knowledge about nutritional management in **phase I** upgraded in **phase II**, with highly significant results, (P value =. 001), this consistent with **Adamasco Cupisti, et al**.[81], who stated that comparing the level of knowledge between staff nurses and nursing students, staff

nurses having adequate level of knowledge than nursing students regarding care of patients undergoing hemodialysis.

The study illustrated that study group had good knowledge about typical medications in **phase I** upgraded in **phase II**, with highly significant results, (P value =. 055). Majority of (74.0%) of study group had good knowledge about medications and hemodialysis in **phase I** upgraded in **phase II**, with significant results, (P value = .026), also study group had good knowledge about regular blood Tests for hemodialysis Patients in **phase I** upgraded in **phase II**, with highly significant results, (P value = .015). study group had good knowledge about guidelines for exercise in **phase II** , insignificant results, (P value = .119). study group had good knowledge about Types of exercise in **phase II**, with insignificant results, (P value = .147). study group had good knowledge about time to exercise in **phase I** upgraded to (64.0%) in **phase II**, with highly significant results, (P value = . 000).

The study reflected that regarding hemodialysis complication study group had good knowledge about during dialysis complications in **phase I** upgraded in **phase II**, with highly significant results, (P value = .017). Study group had good knowledge about between treatment complications in **phase II**, with insignificant results, (P value = .151). Study group had good knowledge about long term complications in **phase I** upgraded in **phase II**, with highly significant results, (P value = .029). Study group had good knowledge about nursing management of hypotension, muscle cramps, chest pain in **phase I** upgraded in **phase II**, with highly significant results, . Study group had good knowledge about nursing management of muscle cramps in **phase I** upgraded in **phase II**, with highly significant results, (P value =.044) .003.003) respectively. Study group had good knowledge about nursing management of itching in **phase I** upgraded in **phase II**, with highly significant results, (P

value = .031). Study group had good knowledge about nursing management of chills and fever in **phase II**, with highly insignificant results, (P value = .202). Study group had good knowledge about nursing management of pyrogenic reaction in **phase I** upgraded in **phase II**, with highly significant results, (P value = .005). Study group had good knowledge about nursing management of hypertension in **phase I** upgraded to (82.0%) in **phase II**, with insignificant results, (P value = .162). Study group had good knowledge about nursing management of disequilibrium syndrome in **phase I** upgraded in **phase II**, with insignificant results, (P value =.110). Study group had good knowledge about nursing management of air embolism in **phase I** upgraded in **phase II**, with insignificant results, (P value =.371). Study group had good knowledge about nursing management of clotting in **phase I** same to (78.0%) in **phase II**, with significant results, (P value = .077). This indicated the importance of applications of programmed nursing care and this finding goes with goes with a semi –experimental study were performed in Tehran concluded that nurses decrease hemodialysis complications in patients by performing programmed nursing care, **Mottahedian, et al**. [82]

The study illustrated that **there** was highly statistical significant (p value = .038) in **phase I** between study group years of experience and their knowledge about Indications of acute dialysis, put it clarified that there was no statistical significant in **Phase II**, no statistical significant (p value = .756, . 740) in pre test and **Phase II** between years of experience in hemodialysis centers and their knowledge about indications of chronic dialysis, also there was no statistical significant (p value = .849, . 257) in **phase I** and **Phase II** between years of experience in hemodialysis centers and their knowledge about process of hemodialysis, and also there was no statistical significant (p value =

.438, . 709) in **phase I** and **phase II** between years of experience in hemodialysis centers and their knowledge about principles of hemodialysis. The study reflected that there was no statistical significant (p value = .741, .087) in **phase I** and **phase II** between participation in training session concerned to hemodialysis and their knowledge about indications of acute dialysis, no statistical significant (p value = .389, .102) in **phase I** and **phase II** between participation in training session concerned to hemodialysis and their knowledge about indications of chronic dialysis, no statistical significant (p value = .844, .338) in **phase I** and **phase II** between participation in training session concerned to hemodialysis and their knowledge about process of hemodialysis, also there was no statistical significant (p value = .144) in **phase I** between participation in training session concerned to hemodialysis and their knowledge about principles of hemodialysis, put there was highly statistical significant (p value = .002) in **phase I** between participation in training session concerned to hemodialysis and their knowledge about principles of hemodialysis.

As regarded performance of pre dialysis surgical attire the study reflected that third (32.4%) of study group had good performance in **phase I**, upgraded to (44.0%) in **phase II**, with highly significant result, (P value =0.000), which represented high quality level of nursing services regarding pre dialysis attire practice guideline, data analysis of the present study had revealed that the implementation of the nursing practice guideline had a positive effect on the hemodialysis nurses' quality care this goes with **Donaldson** [(83)], who stated that high quality level of nursing services regarding of pre dialysis attire practice guideline and this considered as important to nurses' performance improvement aspect of hemodialysis centers and enhancing factor toward patients' outcomes. It helps to improve hemodialysis patients’ morbidity and mortality rate so it acts to minimize the cost on the heath institutions. Also, it

will provide continuous cycle to save the patients and care givers. And this study finding incompatible with **Sarra, et al** . [84], who stated that there are serious gaps in HD staff knowledge and adherence to infection control recommendations. And this indicated that a structured training program for HD staff members is urgently required.

Nurses practice pre-hemodialysis phase, showed that study group practice was accepted before beginning of nurses' guidelines and improvement was clearly observed through **phase II** and that improvement of was affected by application of nurses' guidelines.

All items of preparation of equipment was accepted in **phase I** and **phase II** except hand washing, the researcher reported that because nurses had morning and afternoon dialysis work time and there was no enough and accessible sinks in hemodialysis units, so they pay best practice to gain time and may be as a result of routine and daily recurrent practice.

Related to pre dialysis observation the result showed that less than half (40%) of study group had good performance in **phase I** upgraded to (42.4%) in **phase II**, with highly significant result, (P value =0.000).

About performance of "machine preparation" the result reflected that all nurses (100.0%) had good performance in **phase I**, same to **phase II**, with highly significant result, (P value =0.000). So most items are accepted in pre-implementation of nursing guideline, while the improvement in nursing practice was clearly observed in **phase II** and this will improvement related to nurses guideline which has several advantages such as , improve patient safety decreased urgent hemodialysis, decrease mortality rate, and increase treatment quality and this goes with study of **Page**. [85] , who stated that hemodialysis is complicated life keep procedure which can cause of some risks for patients. Probably more than 2 to 4% of end stage renal failure

patient who treated by hemodialysis died related to hemodialysis complications. Additionally, nurses at hemodialysis units who have a lack with standardized hemodialysis policies compliance their procedures featured with rush and unplanned skills toward patients in hemodialysis treatment that caused threat of patient safety and treatment quality.

Also in pre dialysis preparation the study reflected that study group performance regarding preparation of hemodialysis pack “Kit”, majority (88.0%) of study group had good performance in **phase I**, retardeded to (70.4%) in **phase II**, with highly significant result, (P value =0.000), this may be related to lack of facilities due to financial limits. nurse’s performance regarding programming of dialysis machine, (100.0%) of study group had good performance in **phase I**, same to **phase II**, with highly significant result, (P value =0.001). Study group performance regarding preparing fistula/graft for dialysis, two third (60.0%) of study group had good performance in **phase I**, upgraded to (69.0%) in **phase II**, with highly significant result, (P value =0.000). Study group performance regarding preparing tunneled line for dialysis, (100%) of study group had good performance in **phase I**, same to **phase II**, with highly significant result, (P value =0.003).

Regarding intra-hemodialysis phase the study reflected study group performance regarding commencing dialysis, (100%) of study group had good performance in **phase I**, same to **phase II**, with highly significant result, (P value =0.000).so the study group practice was accepted before implementation of nursing practice guideline in most items and the effectiveness of implementation of guideline was clearly observed in post test.

Concerning of prepare to disconnection" end hemodialysis study group performance regarding discontinuing dialysis with fistula, (67.8%) of study

group had good performance in **phase I**, upgraded to (73.0) in **phase II**, highly significant result, (P value =0.005).,clarified nurse's performance regarding discontinuing dialysis with tunneled, (80.0%) of study group had good performance in **phase I**, same to **phase II**, with significant result, with highly significant result, (P value =0.000).And this showed study group practice was accepted in all items before implementation the guideline and become accepted after implementation of guideline and this improvement clearly observed in post test .

The study showed study group performance regarding post dialysis Care, (36.0%) of study group had good performance in **phase I**, upgraded to (67.8%) in **phase II**, with highly significant result, (P value =0.000).and this goes with study of **Al-Aama** [(86)], who indicated that nursing care guidelines may make nurses have the ability to recognized patients' quality of care and safety measurements and lead to improvement it. Such as prevent measures of hemodialysis lines clots, avoid hemodialysis equipment and facilitation fall, prevent medications errors, avoid needle dislocation, and patient fall prevention. It also improves the nurse infection control measures adherence such as hand hygiene, safety of vascular access, safety of water management, immunizations for hemodialysis nurses and patients, environmental and equipment cleaning-disinfection, and follow policies and standardized procedures that applied in hemodialysis unit, in relation to applying health patients' ambulation during entering or going out the unit, and isolation The findings indicated that there was significant association between nurse's practice and their knowledge in all items specialized with hemodialysis treatment.

5.2 Conclusion:

- The study group knowledge about hemodialysis improved in the phases of the program.
- The study group had acceptance level of practice upgraded in post test phase.
- The current study indicated that Nurses guidelines were effective in increasing knowledge and improving practice of hemodialysis nurses.

5.3 Recommendation:

1. The developed guidelines for nurses regarding hemodialysis management should be available in Arabic and English language in all hemodialysis centers and should be revised and updated annually.
2. Nurses need training, support and information in order to be able to understand the importance of improving their performance.
3. Regular conferences between nurse's staff with other hemodialysis centers in Sudan to exchange knowledge, and find ways to improve performance services provided to their patient.
4. It is essential to apply this program in River Nile state and to be generalized in Sudan.

Further studies and researches should be conducted to improve nurses knowledge and practice in hemodialysis centers.

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جامعة شندى

كلية الدراسات العليا

Research educational Program

Educational hand book Summary

The handbook has been developed as a guideline for hemodialysis nurses to learn how to take part in hemodialysis care, and to become guidance for nurses to improve their knowledge and practice in hemodialysis center.

The handbook is designed to help nurses to practice hemodialysis procedures safely and to protect patient from hemodialysis complications.

The handbook will become a guidance of nurse's progress, and insure that a level of safe practice has been achieved according to the definitions given.

The hand book presents a description about control of a hemodialysis (HD) machine. It provides an overview of the requirements and the design of an HD machine, HD machine's functionality, related safety conditions, and a top-level system architectural description.

Content of the program

1. Functions of the kidney & principles of hemodialysis
2. Doing observations
3. Preparing dialysis machine
4. Preparing pack
5. Programming dialysis machine
6. Preparing fistula/graft for dialysis
7. Preparing tunnelled line for dialysis
8. Commencing dialysis
9. Discontinuing dialysis with fistula/graft
10. Discontinuing dialysis with tunnelled line
11. After dialysis

1. Functions of the kidney & principles of hemodialysis:

TOPIC	Duration of session	
	Day (1)	Day(2)
Anatomy of the kidney & normal	1 hour	1 hour
kidney function	1 hour	1 hour
Renal failure	1 hour	1 hour
Principles of hemodialysis	1 hour	1 hour
fluid removal & effect of fluid on the heart	1 hour	1 hour

Time table for training of nurses about hemodialysis procedure:

Procedure	Duration	Content	Day(1)	Day(2)
1. Predialysis surgical attire	2 hours	Performing hand washing Wearing cap Wearing masks Wearing gown Wearing sterile gloves	1 hour	1 hour
2. Pre dialysis observation:	2 hours	General assessment of patient condition Weight Pulse Blood pressure Temperature	1 hour	1 hour
3. Preparation of dialysis machine:	2 hours	Hand Hygiene Collect equipment Connect acid concentrate Connect bicarb cartridge Attach dialyzer Attach arterial and venous blood lines Attach heparin syringe (if applicable) Prime blood circuit Re-circulate	1 hour	1 hour 1 hour
4. Preparation of hemodialysis pack "Kit":		Hand Hygiene Surface hygiene Collect equipment Prepare "putting on" pack using aseptic technique Safely handle and dispose of sharps.	1 hour	
5. Programming dialysis machine:	2 hours	Dialysis time Fluid loss / ultrafiltration volume Sodium and bicarb levels Dialysate fluid flow Heparin dose & stop time or Anticoagulant regime Automated Blood Pressure monitor on hemodialysis machine (if applicable)		

6. Preparing fistula/graft for dialysis	2 hours	Prepare 'putting on' pack Prime needles (if required) Check fistula/graft Assess needle sites Clean needle sites Remove scabs if buttonholing & clean site Insert needles using agreed technique Tape needles securely	1 hour	1 hour
7. Preparing tunnelled line for dialysis:	2 hours	Hand hygiene Collect & prepare 'putting on' pack Assess exit site Remove old dressing & redress exit site if required Clean luer-lock connections Remove luer-lock caps & aspirate locking solution Assess patency of tunnelled line	1 hour	1 hour
8. During Dialysis				
1. Commencing dialysis	2 hours	Stop re-circulation Clamp off sodium chloride (saline) Attach arterial line to take-out needle/ port & prime blood out Attach venous line to put-back needle/port Start blood pump at baseline pump speed Check arterial & venous pressures Give anticoagulant Record all pressures at baseline pump speed Increase blood pump to required speed Put machine into 'dialyse' mode Re check prescription		

A. Discontinuing dialysis with fistula/graft	2 hours	Aware of completion of dialysis Hand hygiene Connect sodium chloride (saline) to arterial line 'wash back' Disconnect blood lines from fistula needles Remove & dispose of fistula needles, apply pressure, apply dressings Hand hygiene	1 hour	1 hour
B. Discontinuing dialysis with tunnelled line	2 hours	Aware of completion of dialysis Hand hygiene Collect & prepare 'taking off ' pack Clean luer-lock connections Connect sodium chloride (saline) to arterial line 'wash back' Disconnect blood lines from tunnelled line Flush & lock tunnelled line Attach luer-lock caps Hand hygiene	1 hour	1 hour
C. Post After Dialysis:	2 hours	Reassure the patient Record the following: Weight Blood Pressure Pulse Temperature Any unusual condition if occur Strip machine and dispose of all equipment Setup machine for Rinsing and disinfection Clean machine externally	1 hour	1 hour

جامعة شندى

كلية الدراسات العليا والبحث العلمى

A thesis submitted in requirement for doctoral degree in medical surgical nursing

Questionnaire to evaluate the effect of application of hemodialysis nursing guidelines on Nurses Knowledge and Practice at River Nile State hemodialysis centers:

Part one:

Demographic data:

1. **Gender**: ☐ Female b. Male ☐
2. **Age(years)**
   a. 20___ 30years ☐
   b. 31___40 years ☐
   c.41____50 years ☐
   d. More than 50 years ☐
3. **Qualification:**
   a. Diploma ☐
   b. Bachelor ☐
   c. Post graduate ☐
4. **years of experience in hospital:**
   a. Less than 1 year. ☐
   b. 1 to 3 years. ☐
   c. More than 3 years ☐
5. **years of experience in hemodialysis units:**
   a. Less than 1 year ☐
   b. 1 to 3 years. ☐
   c. More than 3 years ☐
6. **participation in training sessions concerned to hemodialysis:**
   a. Never ☐
   b. Once ☐
   c. Twice ☐
   d. Three times or more ☐

Part two:

General knowledge about hemodialysis:

7. Definition of dialysis:

a. It is a process for removing waste product and excess water from the blood. ☐
b. Hemodialysis is the most common therapy for patients with CKD. ☐
c. It is used as an artificial replacement for lost kidney function in people with kidney failure. ☐
d. Dialysis is an effective means of correcting metabolic toxicities at any age. ☐

8. Indications for acute dialysis(emergency):

a. Electrolyte imbalance such as severe hyperkalemia ☐
b. Fluid overload or impending pulmonary edema. ☐
c. Metabolic acidosis or a change of the blood pH to acidic. ☐
d. Acute poisoning. ☐
e. Uremia ☐

9. Indications of chronic dialysis:

a. Renal failure where symptoms are manifesting ☐
b. Lowered glomerular filtration rate (GFR), less than 10-15 mls/min/1.73m2 ☐
c. Uremia affecting all body systems. ☐
d. Low GFR with fluid overload and rising levels of serum potassium or phosphorus. ☐

10. Absolute contraindications of hemodialysis:

a. Hemodynamic instability. ☐
b. Inability to anticoagulant. ☐
c. Lack of access to circulation. ☐

11. Relative contraindications of hemodialysis:

a. Serious bleeding or anemia. ☐
b. Severe hypotension or shock. ☐
c. Serious heart or brain complications ☐
d. End-stage uremia with serious irreversible complications. ☐
e. Uncontrolled diabetes. ☐
f. Serious infection. ☐
g. Have malignant disease such as cancer at the same time. ☐
h. Still within the 3 days after a big operation. ☐
i. Old high-risk patients, non cooperative mental disorder patients, infant and children. ☐

12. Optimum sessions for hemodialysis:

a. Treatments usually occur three times a week for at least 3 to 4 hours per t[illegible]nent.

b. A type of hemodialysis called high-flux dialysis may take less time[illegible]

c. Some patients undergo short-daily hemodialysis[illegible]

13. Process of hemodialysis:

a. Removes wastes and water by circulating blood outside the body[illegible]

b. The anticoagulant heparin is administered to keep blood from clotting in the dialys[illegible]rcuit

c. The cleansed blood is then returned via the circuit back to the body[illegible]

d. Waste products have been removed, the electrolyte balance has been restored to normal, and the buffer system has been replenished.[illegible]

14. Equipment for hemodialysis:

a. Dialyzers or an artificial kidney.[illegible]

b. Dialysate[illegible]

c. Tubing for transport of blood and dialysis solution.[illegible]

15. Dialysate:

a. a solution with minerals, flows in the opposite direction with the blood circu[illegible]g

b. Dialysate fluid helps remove wastes from the patient's blood.[illegible]

c. It can also replace needed substances, such as bicarbonate, to maintain the patient's acid-[illegible] balance.

16. Components of dialysate:

a. Sodium chloride[illegible]

b. Sodium bicarbonate or sodium acetate[illegible]

c. Calcium chloride[illegible]

d. Potassium chloride[illegible]

e. Magnesium chloride.[illegible]

f. Other compounds such as glucose.[illegible]

17. Components of extracorporeal circuit:

a. Dialyzer[illegible]

b. Bloodlines[illegible]

c. Monitoring lines[illegible]

d. Heparin line[illegible]

e. Transducer protectors[illegible]

18. Principles of Hemodialysis:

a. Diffusion – movement from higher concentration (blood) to lower concentrat dialysate).
b. Osmosis - Excess water is removed from the blood by osmosis.
c. Ultrafiltration - water moving under high pressure to an area of lower pressure

19. Infection control policies:

a. Use disposable gloves when dealing with patients.
b. Remove gloves and wash hands between patients.
c. Items used on a treatment station should be either disposable or for single use, and reserved for a single p t.
d. Clean areas should be designated and used for the preparation and handling of medications and should be separated from contaminat areas.
e. Multidose medication vials should be prepared for use away from the patie
f. Use new external venous and arterial pressure transducer filters for each patient's treatment, to prevent blood contamination of the dialysis machine pr e monitor.
g. Clean and disinfect dialysis stations between patients (chair, table, bed, machine), and especially the dialysis machine control p
h. Discard fluids carefully and clean/disinfect all containers.
i. All HD patients should be screened for HBV and HCV infection on admission, and routin
j. Patients with risk factors should be tested for HIV

Part three:

Knowledge about vascular access of hemodialysis:

20. A vascular access for hemodialysis:

a. A vascular access is a hemodialysis patient's lifeline
b. It is an access to the patient's vascular system
c. The access is a surgically created vein used to remove and return blood during hemodi s
d. Must be established to allow blood to be removed, cleansed, and returned to the patient's vascular system at rates between 200 and 800 mL/minute.

21. Types of vascular access:

a. Subclavian, internal, jugular, and femoral catheters, (for long-term use).
b. Fistula, (for long-term use).
c. An arteriovenous graft, (for long-term use).

22. An arteriovenous fistula:

a. Is a connection, of an artery to a vein, in the forearm or upper arm. ☐
b. It causes extra pressure and extra blood to flow into the vein, making it grow l☐and strong.
c. The arterial segment is used for arterial flow and the venous segment for reinfusion of the di☐d blood.
d. Simple exercises help an AV fistula grow larger after the procedure ☐
e. It requires 2 to 3 months for maturation, before using for hemodialysis ☐
f. It takes 4 to 6 weeks to mature before it is ready for use. ☐

23. An arteriovenous fistula is preferable, for this characters:

a. provides good blood flow for dialysis ☐
b. lasts longer than other types of access ☐
c. Is less likely to get infected or cause blood clots than other types of access ☐

24. An arteriovenous graft:

a. An AV graft is a looped, plastic tube that connects an artery to a vein ☐
b. A patient can usually use an AV graft 2 to 3 weeks after the surgery ☐
c. It is more likely to have problems with infection and clotting. ☐
d. A well-cared-for graft can last several years. ☐
e. Risks include infection and thrombosis. ☐

25. A venous catheter:

a. It is a tube inserted into subclavian, internal, jugular, or femoral vein. ☐
b. Immediate access to the patient's circulation for acute hemodialysis. ☐
c. Clamps must be closed on each line when connecting and disconnecting the cathe☐om the tubes
d. When it is needed for more than 3 weeks, A tunneled catheter is used. ☐
e. Risks include hematoma, pneumothorax, infection, thrombosis, and inadequate blood flow. ☐

26. Initiation of a new fistula:

a. Fistula assessment after 4 weeks post surgery ☐
b. Before each dialysis session: Look, Listen and feel. ☐
c. Secure an order ☐
d. Adjust heparin dose ☐
e. Always use tourniquet. ☐

f. Use 17 gauge needles initially. ☐

g. Use one lumen of the catheter venous and one needle fistula (art☐).

h. Always cannulate the needles in opposite directions. ☐

i. After 3-6 treatments with 17 gauge you can advance to ☐ 16gauge.

j. Upon removal: use two fingers compression for continuous 10 minutes. Never use clam☐

Part four:

Knowledge about hemodialysis nursing care:

27. Pre dialysis care includes:

a. Doing hand washing between patient and other. ☐
b. Wearing gloves before dealing with the pt. ☐
c. Using sterile technique during insertion of the catheter. ☐
d. Checking of vascular access site for signs of infection. ☐
e. Checking vascular access site for functioning. ☐
f. Catheter insertion accurately (placement). ☐
g. Assessing and documenting vital signs. ☐
h. Measuring the patient weight. ☐

28. During dialysis care includes:

a. Assessing and documenting vital signs ☐
b. Assessing the patient's general condition. ☐
c. Monitoring machine by doing equipment safety checks. ☐
d. Monitoring the bloodlines. ☐
e. Monitoring machine readings. ☐
f. Monitoring alarms when they occur. ☐

29. Post dialysis care includes:

a. Assessing and documenting vital signs ☐
b. Measuring the patient weight ☐
c. Assessing vascular access site condition for bleeding ☐
d. Assessing client general condition ☐
e. providing psychological support ☐

Part five:

Knowledge about patient's teaching:

30. Arteriovenous fistula or graft care:

a. Clean the skin over the fistula or graft each day with soap and water.
b. Remove the bandage over fistula or graft 4 to 6 hours after dialysis.
c. Check fistula or graft each day for thrill by touching it with your fingertips.
d. Check for signs of infection or a clogged fistula or graft.
e. Do not take blood pressure or draw blood from the fistula or graft site.
f. Do not sleep on that arm.
g. Do not wear tight clothes or jewelry.

31. Nutritional management:

a. Protein 1.0-1.2 g/kg/day 50% high biologic value prote
b. Potassium 40-70 mEq (1,500-2,500 mg)/day (avoid high potassium foods and salt substitute that is potassium chloride)
c. Sodium 750-1,000 mg/day (avoid high sodium foods and do not added salt)
d. Phosphorus 600-1,200 mg/day (limit dairy produ
e. Calories >35 kcal/kg/day, less for obese patients (25-30 kcal/kg), and more with stress or malnutrition (40-45 kcal/day)
f. Fluids limited to 1-1.5 liters plus urine output per d
g. Diabetes Mellitus, same meal plan but limit concentrated sweets

32. Typical medications:

a. Multivitamins without minerals or vitamin D to replace excess loss during hemodialysis
b. Phosphate binders to limit GI absorption of phosphorous and prevent renal bone disease or hyperparathyroidism
c. Erythropoietin for anemi
d. Iron for anemia managemen
e. Vitamin D to prevent/treat renal bone disease
f. Antihypertensive for blood pressure management

33. Medications and hemodialysis:

a. Many medications are removed from the blood during hemodialysis

b. Metabolites of drugs bounded to protein are not removed during dialysis ☐

c. Cardiac glycosides, antibiotic agents, antiarrhythmic medications, antihypertensive agents are monitored to maintain levels without toxic accumulation. ☐

d. All medications and their dosages must be carefully evaluated. ☐

e. If an antihypertensive agent is taken on a dialysis day, a hypotensive effect may occur during dialysis. ☐

f. Many medications that are taken once daily can be held until after the dialysis treatment. ☐

34. Regular Blood Tests for Hemodialysis Patients:

a. Blood tests should be monitored monthlyor more often if needed ☐

b. Blood Urea Nitrogen (BUN), Creatinine (CR) ☐

c. Phosphorous (P) , Calcium (Ca), Potassium (K) ☐

d. Parathyroid Hormon ☐

e. Bicarbonate ☐

35. Guidelines for exercise :

a. check with their health care professional ☐

b. Follow the management plan ☐

c. Take any appropriate medications ☐

d. Follow their diet. ☐

e. Emphasize that individual health, fitness level, interest, and available time will vary. ☐

36. Types of exercise:

a. Continuous exercises, such as walking, swimming. ☐

b. Low level strength exercises, such as low weights and high repetitions. ☐

c. Avoid heavy lifting, and that a slow, relaxed pace of exercise ☐

37. Time to exercise:

a. A minimum of 3 days per week of exercise. ☐

b. Advise patients to exercise 30 minutes/session. ☐

c. A patient's endurance will be better on non dialysis days. ☐

Part six:

Knowledge about Complications of Hemodialysis:

38. During dialysis complications:

a. Hypotension ☐
b. Arrhythmias ☐
c. Exsanguinations ☐
d. Seizures ☐
e. fever ☐

39. Between treatment complications:

a. Hypertension ☐
b. Hypotension ☐
c. Edema ☐
d. Pulmonary edema ☐
e. Hyperkalemia ☐
f. Bleeding ☐
g. Clotting of access ☐

40. Long term complications:

a. Hyperparathyroidism ☐
b. CHF ☐
c. AV access failure ☐
d. pulmonary edema ☐
e. neuropathy ☐
f.anemia ☐
g. GI bleeding. ☐

41. Nursing management of Hypotension:

a. Stop or reduce Ultrafiltration. ☐
b. Place patient in Trendelenburg position. ☐
c. Administration of saline and hypertonic agents. ☐
d. Continuous infusions of presser agents are very rarely needed. ☐

42. Nursing management of Muscle Cramps:

a. Minimize interdialytic weight gain and need for excessive UF. ☐
b. Prevent dialysis hypotension, higher sodium dialysate, or sodium profiling. ☐
c. Administer intravenous saline (normal or hypertonic) and intravenous 50% dextrose a ☐ery effective
d. Local massage offers some relief. ☐
e. Administer Carnitine supplementation and quinine sulphate ☐

43. Nursing management of Chest pain:

a. Management of hypotension. ☐
b. Angina pain with Nitroglycerin. ☐
c. MI pain requires pain killer. ☐

44. Nursing management of Itching:

a. Adequate dialysis to regulate electrolyte levels.☐

b. Lotions or medications for dry skin/allergies. ☐

45. Nursing management of Chills and Fever:

a. Obtain blood cultures. ☐

b. Begin broad spectrum antibiotics immediately. ☐

46. Nursing management of Pyrogenic Reaction:

a. Remove from dialysis immediately ☐

b. Gather samples of dialysate ☐

47. Nursing management of Hypertension:

a. Review of Bp medications.☐

b. Assessment of target weight and fluid removal goal. ☐

48. Nursing management of Disequilibrium Syndrome:

a. Monitor new patients carefully for hypertension.☐

b. Decrease blood flow rate BFR ☐

c. Treat nausea, vomiting and headache per protocol. ☐

d. Be alert for restlessness, speech/mental changes.☐

49. Nursing management of air embolism :

a. Clamp blood lines and stop blood pump.☐

b. Place patient in trendelenburg position turning them on left side.☐

c. Treat symptoms ☐

d. Oxygen for shortness of breath and chest pain.☐

e. Normal saline to support blood pressure.☐

50. Nursing management of clotting:

a. Anticoagulation. ☐

b. Vascular access care. ☐

جامعة شندى

كلية الدراسات العليا

Checklist to evaluate nursing performance regarding hemodialysis management in hemodialysis centers:

Procedure	Done correctly	Done incorrectly	Not done
1. **Predialysis surgical attire**			
a. Performing hand washing			
b. Wearing cap			
c. Wearing masks			
d. Wearing gown			
e. Wearing sterile gloves			
2. **Pre dialysis observation:**			
General assessment of patient condition			
Weight			
Pulse			
Blood pressure			
Temperature			
3. **Preparation of dialysis machine:**			
Check machine for readiness			
Start priming by:			
Hand Hygiene			
Collect equipment			
Connect acid concentrate			
Connect bicarb cartridge			
Attach dialyzer			

Attach arterial and venous blood lines			
Attach heparin syringe (if applicable)			
Prime blood circuit			
Re-circulate			
Attach dialysate lines to dialyzer			
4. **Preparation of hemodialysis pack "Kit":**			
Hand Hygiene			
Surface hygiene			
Collect equipment			
Prepare "putting on" pack using aseptic technique			
Safely handle and dispose of sharps.			
5. **Programming dialysis machine:**			
Dialysis time			
Fluid loss / ultrafiltration volume			
Sodium and bicarb levels			
Dialysate fluid flow			
Heparin dose & stop time or Anticoagulant regime			
Automated Blood Pressure monitor on hemodialysis machine (if applicable)			
6. **Preparing fistula/graft for dialysis**			
Hand & arm hygiene			
Prepare 'putting on' pack			
Prime needles (if required)			
Check fistula/graft			
Assess needle sites			
Clean needle sites			
Remove scabs if buttonholing & clean site			
Insert needles using agreed technique			
Tape needles securely			

7. **Preparing tunnelled line for dialysis:**			
Hand hygiene			
Collect & prepare 'putting on' pack			
Assess exit site			
Remove old dressing & redress exit site if required			
Clean luer-lock connections			
Remove luer-lock caps & aspirate locking solution			
Assess patency of tunnelled line			
During Dialysis			
1. Commencing dialysis			
Stop re-circulation			
Clamp off sodium chloride (saline)			
Attach arterial line to take-out needle/ port & prime blood out			
Attach venous line to put-back needle/port			
Start blood pump at baseline pump speed			
Check arterial & venous pressures			
Give anticoagulant			
Record all pressures at baseline pump speed			
Increase blood pump to required speed			
Put machine into 'dialyse' mode			
Re check prescription			
2. Discontinuing dialysis with fistula/graft			
Aware of completion of dialysis			
Hand hygiene			
Connect sodium chloride (saline) to arterial line			
'wash back'			
Disconnect blood lines from fistula needles			
Remove & dispose of fistula needles,			

apply pressure, apply dressings			
Hand hygiene			
3. Discontinuing dialysis with tunnelled line			
Aware of completion of dialysis			
Hand hygiene			
Collect & prepare 'taking off ' pack			
Clean luer-lock connections			
Connect sodium chloride (saline) to arterial line			
'wash back'			
Disconnect blood lines from tunnelled line			
Flush & lock tunnelled line			
Attach luer-lock caps			
Hand hygiene			
4. Post After Dialysis:			
Reassure the patient			
Record the following:			
Weight			
Blood Pressure			
Pulse			
Temperature			
Any unusual condition if occur			
Strip machine and dispose of all equipment			
Setup machine for Rinsing and disinfection			
Clean machine externally			

Work shop: Hemodialysis Nurses Leading Quality Care

Date: 15th of August 2018

Venue: Shendi hemodialysis center, Sudan

Educational program

Topics	Lecturer	Time
Registration		**8:00-8:30 AM**
Opening ceremony		**8:30-9:00 AM**
Dean Faculty of Nursing Sience	**Prof:Higazi Mohamm**	
Quality Manager University	**Dr: Haj Hamed**	
Hospital Quality manager	**Sis:Hana Ali Mubara**	
Matron	**Shaima Alata**	
Hemodialysis management	**Ust:Tomadir Algadi**	**9:00- 10:00A**
Break		
Infection control policies in hemodialysis centers	**Dr:sondos Abd Elmel**	**11:00-11:30A**
Hemodialysis procedure	**Ust:Tomadir Algadi**	**11:30- 12:00M**
Hemodialysis patient education	**Dr:sondos Abd Elmel**	**12:00_12:30P**
Certificates of attending		**12:30-1:00PM**

Work shop: Hemodialysis Nurses Leading Quality Care

Date: 14th of September 2018

Venue: Atbara hemodialysis center , Sudan

Educational program

Topics	Lecturer	Time
Registration		**8:00-8:30 AM**
Opening ceremony		**8:30-9:00 AM**
Dean Faculty of Nursing Sience	**Prof:Higazi Mohamm**	
Quality Manager University	**Dr: Haj Hamed**	
Hospital Quality manager	**Sis:Hana Ali Mubara**	
Matron	**Shaima Alata**	
Hemodialysis management	**Ust:Tomadir Algadi**	**9:00- 10:00A**
Break		
Infection control policies in hemodialysis centers	**Dr:sondos Abd Elmel**	**11:00-11:30A**
Hemodialysis procedure	**Ust:Tomadir Algadi**	**11:30- 12:00M**
Hemodialysis patient education	**Dr:sondos Abd Elmel**	**12:00_12:30P**
Certificates of attending		**12:30-1:00PM**

Work shop: Hemodialysis Nurses Leading Quality Care

Date: 15th of September 2018

Venue: Berber hemodialysis center , Sudan

Educational program

Topics	Lecturer	Time
Registration		**8:00-8:30 AM**
Opening ceremony		**8:30-9:00 AM**
Dean Faculty of Nursing Sience	**Prof:Higazi Mohamm**	
Quality Manager University	**Dr: Haj Hamed**	
Hospital Quality manager	**Sis:Hana Ali Mubara**	
Matron	**Shaima Alata**	
Hemodialysis management	**Ust:Tomadir Algadi**	**9:00- 10:00A**
Break		
Infection control policies in hemodialysis centers	**Dr:sondos Abd Elmel**	**11:00-11:30A**
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