Effect of Nursing Intervention on Prevention of Vascular access Complications for Patients undergoing Regular Hemodialysis

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Abstract: **Hemodialysis patients are more prone to develop complications related to their VA such as infection, clotting, rupture, aneurysm formation and stenosis lead to morbidity, hospitalization. Therefore, patient undergoing hemodialysis procedure requires special nursing care with high skilled personnel trained in the art of hemodialysis procedure to decrease those kinds of complications. Aim of the study: to evaluate the effect of nursing intervention on prevention of vascular access complications for patients undergoing regular hemodialysis. Study Design: Quasi-experimental research design was conducted in this study. Subject of the present study comprised from patients and nurses. 120 adult patients were selected from hemodialysis unit - Mansoura University Main Hospital & 30 nurses enrolled in the studies who are working in previously mentioned setting and directly contact, caring with those dialysis patients. Tools: Three tools were used for data collection, Structure Interview Patients Questionnaires Sheet, Structure Interview Nurses Questionnaires Sheet and Patient's Outcome Assessment Sheet. Results: Knowledge and practice of the nurses improved significantly after nursing intervention implementation, where $P \leq 0.005$, Vascular access complications greatly increased in the 1st & 2ed month for control group than study group with significant statistically difference, where $P \leq 0.005$. Conclusions: There was significant improvement in nurse's knowledge and practices leading to improvement function of vascular access, decrease complications and result in better outcomes for patient. Recommendation: Training and continuing education of the clinical practice guidelines for staff nurses are important to improve care provided in the hemodialysis units and maintenance their vascular access.**

Keywords: **Cannulation, Hemodialysis, Knowledge, Nursing intervention, practice, vascular access.**

I. INTRODUCTION

End stage kidney disease (ESKD) imposes significant social and economic burdens on the national health care system. Worldwide more than two million patients with end-stage kidney disease (ESKD) have renal replacement therapy (RRT) by either renal transplantation, peritoneal dialysis (PD), or intermittent hemodialysis (HD). Hemodialysis is a life-sustaining treatment for 1.5 million end-stage renal disease patients across the world [1].

Hemodialysis (HD) has become part of routine medical service and well tolerated therapy for patients with end-stage kidney disease (ESKD).This process, involves pumping a patient's blood via an external dialysis machine to filter and clean the blood before returning it to the body. Dialysis requires a well-functioning vascular access to be placed in the patient to allow the blood to flow from the patient to the dialysis machine and back again. There are three forms of

vascular access depend in part on how quickly the patient needs to begin hemodialysis, including central venous catheters (CVCs) and surgically created arteriovenous access types, i.e. native arteriovenous fistulas (AVFs) and synthetic arteriovenous grafts (AVGs) each of these forms of hemodialysis vascular access has its own specific problems [2].

Vascular access (VA) is a major cause of morbidity and mortality in patients on maintenance hemodialysis. More than 30 % of the hospitalizations of long-term hemodialysis patients in the United States are related to VA and approximately $1 billion is spent annually to manage VA complications [3].

Dysfunctional dialysis access disrupts scheduled dialysis treatment and associates with higher mortality rates. Thus, preservation of patent dialysis access is essential to the care of hemodialysis patients. So it's important to take care of the vascular access to prevent complications. Moreover, nephrology nurse holds key responsibility for cannulation and infection prevention and management, as well as maintenance of the access sites, and can take the lead in optimization of vascular access use and care. Consequently, the nephrology nurse has a profound effect upon access outcomes, which has been confirmed by Dialysis Outcomes and Practice Patterns Study (DOPPS) data. One of the best ways to preserve the access is to try to make every cannulation trouble-free by decreasing cannulation attempts and needle manipulation. This will lessen the chance of infiltration and damage to the intimal lining of the vessel wall of the vascular access [4].

The nephrology nurse has important role in maintaining VA function. In view of a long-term lifespan for a good VA, a few rules for its correct use have to be followed by nurses. The main precautions include the disinfection of puncture sites, the use of adequate needles, correct cannulation of the arterialized vein, and, finally, general care of the A VF by the patient. Disinfection of puncture sites at the beginning of each hemodialysis, the forearm must be washed with soap and disinfected with products adequate to prevent infections. At the end of hemodialysis, the vein puncture sites must be covered with a sterile medication. The use of a bandage surrounding the forearm should be avoided, since compression of the vein may cause thrombosis. Uses of adequate needles today high-quality needles are available for hemodialysis. In adult patients, 15-gauge needles are usually recommended. Smaller needles (e.g., 16 gauge needles) may be used when the vein is small or at the beginning of cannulations [5].

To improving the quality of care for hemodialysis patients, clinical practice guidelines (CPGs) should be available. CPGs provide nurses with the necessary information needed in making diagnosis and treatment decisions. In additional implement the national guidelines for hemodialysis nurses in Egypt and the Canadian Association of Nephrology Nurses and Technologists (CANNT) standards of care for a hospital-based hemodialysis unit in Egypt [6].

Aim of the study

The aim of conducting this study is to evaluate the effect of nursing intervention on prevention of vascular access complications for patients undergoing regular hemodialysis

Research hypothesis

I. The hemodialysis department nurses will have higher knowledge and performance score of nursing intervention related to prevention of vascular access complication

II. Patients undergoing regular hemodialysis who received nursing intervention will maintain their function of vascular access and have a positive effect on prevention of vascular access complications post implementation.

II. SUBJECT AND METHOD

Research design

A Quasi experimental research design was utilized in this study

The setting of study:

The current study was conducted at hemodialysis unit at Mansoura University Main Hospital, Mansoura University, Egypt.

Sampling:

Sample of the present study comprised from patients and nurses

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Purposive sample was composed of 120 adult patients divided into two equal groups, n = (60 control and 60 study) with vascular access which selected with various sexes, ages, different level of education who undergoing regular hemodialysis, was accept to participate voluntary in the study, patients who are psychiatric and have VA complications are excluded from the current study & all available nurses (36), 3 nurses included in pilot study, 3 refused the study and 30 nurses enrolled in the study who are working in previously mentioned setting and directly contact, caring with those dialysis patients and accepted to participate in the study with different age, years of experience, and level education were included in the study.

Research Instruments

Data were collected using the following three tools.

Tool I: Structure Interviewing Patients Questionnaires Sheet:

This tool was developed by the researcher, aimed to identify patient demographic data and assess patient's characteristic at the time of hemodialysis, used only one time (pre-intervention) for both group. It comprised of two main parts and consists of 14 questions.

Tool II: Structure Interview Nurses Questionnaires Sheet:

This tool was developed by the researcher, used to identify nurse's demographic data and assess nurse's knowledge and practice pre and post intervention. It comprised of three main parts.

Part (1): Demographic data sheet for nurse:

Part (2): Hemodialysis nurse's knowledge assessment sheet:

 Scoring system: Total knowledge scores level was categorized into three levels: (Low level < 50% of total, Moderate level = 50 to 75% of total scores & High level >75% to 100% of total scores.

Part (3): Nurse's observational checklist: It was developed by the researcher based on reviewing literatures and scientific references as a monitoring and an evaluative tool for nurse's performance related to nursing practice pre and post intervention, a likert scale is used, It holds (41) items and each items in the checklist has four options: scored from (0) for not done, (1) for need improvement, (2) for completely performed and (3) for proficient to be checked by the researcher

Tool III: Patient's Outcome Assessment Sheet:

This tool used to evaluate the effect of nursing intervention on prevention of VA complication. It was filled by the researcher, used post intervention, it include two main parts as following:

Part (1) Vascular Access Tracking Tool:

This tool used to detecting vascular access dysfunction. Adaptive from AV Fistula First Breakthrough Initiative Coalition, sponsored by the Centers for Medicare and Medicaid Services (CMS), (Sidawy et al., 2008) It include tracking of VA at the start of hemodialysis session such as (observe signs of infection, steal syndrome & at the end of dialysis session as blood flow rate different than the prescribed blood flow rate throughout treatment, Patient have bleeding time > 15 minutes, cannulation difficult, absent thrill or bruit)

Part (2) Needle cannulation chart: This tool adaptive from (Brouwer, .2011), used to track AVF & AVG for difficulty or easy cannulations which indicated to function or dysfunction of VA, a likert scale is used include six options: scored as (0) for cannulation with ease no difficulty, (1) for poor flash back or no flash back, (2) for flash back, but un able to advance needle, (3) for poor blood flow, (4) for Clotted needle and (5) for infiltration , to be checked by the researcher.

Validity and reliability of the instruments:

The content validity was done for developed study tools (I & II) to determine whether the tools covered the aim of the current study and to determine that the standardized tools (III) were appropriately transported. They were revised by a panel of 5 experts in the field of study from two experts of Medical- Surgical Nursing, one specialist professors of medical from Faculty of Medicine- Mansoura University, one specialist professors of vascular surgery from Faculty of

Medicine- Mansoura University and one specialist in biostatistics from Faculty of Medicine- Mansoura University, as a jury to test the study tools for content validity, completeness, feasibility, clarity, relevance, understanding and applicability for implementation. Also, the nursing intervention booklet was reviewed by the same jury. All comments and suggestions were considered and rewording, and revising of the tools was carried out and necessary modifications were done accordingly. Reliability was measured to evaluate whether all items on the study tools measure the same variable, and how well the used items fit together conceptually. The reliability of the study tools was tested by Cranach's Coefficient Alpha to measure the internal consistency of tool I (r = 0.972), tool II (r = 0.903).

Pilot study: The pilot study was conducted on 10 % (3nurse) of total number of sample (30 nurses) and (12 patients) from patient's sample (120 patients) in previously mentioned sitting, they selected randomly from the hemodialysis unit of Mansoura University Hospital. Those nurses and patients were excluded from the actual study. The pilot study was done to ascertain the relevance, clarity, objectivity, relevance & applicability of the developed tools and to estimate the time needed to fill the questionnaire sheet with each subject. Based on the findings of the pilot study, modifications were made such as omission, addition, and rewording in order to make the tools more applicable to patients and nurses. The final form of the tools was formulated and the time needed for completing them was also determined.

Ethical consideration

An official permission was issued from the faculty of nursing, Mansoura University to carry out the study and interview the patients and nurses in the selected hospital. An official letter was issued with approval from the hospital manger after explanation of the study purpose and schedule of data collection. Verbal explanation of the nature and aim of the study will be performed to nursing staff and patients.

A written approval was obtained from the ethics and research committee of the Faculty of Nursing. At the time of data collection a verbal agreement was taken from every participant in the study after clear and proper explanation of the study purpose and its importance for them. All relevant ethical aspects were considered for ensuring patient's and nurses privacy and confidentiality of the collected data during the study. The aim of the study was clarified to each nurse and patient, and then an oral agreement for participation in the study was obtained from each one of them. Voluntary participation and right to refuse to participate in the study and withdrawn at any time was emphasized to nurses and patients.

Theoretical framework for the study:

Sampling phase:-Once the necessary approvals granted to proceed with the proposed study, subject who met sampling criteria & agreed to participate in the study, interviewed and observed by the researcher to collect the necessary data and implement nursing intervention after explanation of the purpose of the study

Data collection phase: The study was conduct from the beginning of June 2018 to the end of November 2018.The study was implemented through the following four phases: Assessment phase, Planning phase, Implementation phase, Evaluation phase.

I. Assessment Phase:

Nurses assessment: The researcher started by introducing herself, Nurses were interviewed according to their work schedule by the researcher individually in the hemodialysis unit to accomplish demographic data for nurse's and knowledge questionnaire by using tool II part 1&2. Nurse's performance was observed indirectly during morning, afternoon and evening shifts through tool II part 3.

Patient's assessment: Patients who met inclusion criteria were individually interviewed. The researcher managed to interview from 5 to 10 patients per day where patients were asked about demographic data and complete patient's characteristic at the time of hemodialysis from patient's medical record using tool I.

II. Planning Phase: Based on the data achieved from first assessment, in addition to literature, the researcher planned the nursing intervention under the guidance of the supervisors. A simple colored booklet was developed for nurses in simple, clear and obvious Arabic language that supported with figures for more clarification. The content of the nursing intervention included theoretical part & practical part.

III. Implementation Phase: The nursing interventions apply for nurses after finishing the control group and evaluate the effect of routine hospital care on the appearance of vascular access complication. Nurses were divided into small groups each group consist of 3-5 nurses, each session lasted for 15 to 20 minutes, the nursing intervention program was conducted through 3 session; (1 theoretical & 2practical session). At the beginning of the session, an orientation to the aim of the study and the goals of the nursing intervention took place. Also, nurses were oriented about the phases of the study and the nursing intervention sessions (time, duration, place, and contents). Direct reinforcement in the form of a copy of the booklet was given as a reward for each nurse to use it as a future reference. At the end of each session, a brief summary was given by the researcher.

IV. Evaluation Phase: This phase focused on appraising effect of nursing intervention on nurses and patients as the following:

Nurse's evaluation: Nurse's knowledge was evaluated by using tool II part 2 according to their working schedule. Nurse's performance was observed indirectly during morning and afternoon shifts through tool II part 3.The researcher evaluate nurse's knowledge and nurse's performance and then compare the result before and after apply nursing intervention.

Patient's evaluation: The researcher used tool III after one month & after two month to evaluate vascular access complication and compare the result of study and control group.

Statistical design:

After data were collected it was revised, coded and fed to statistical software IBM SPSS version 20.The given diagrams were constructed through Microsoft excel software .All statistical analysis was done by two tailed tests and alpha error of 0.05. P value less than or equal to 0.05 was considered to be statistically significant. Regarding scoring system, the items discrete scores for each scale (knowledge or practice) were summed together then the sum of scores for each dimension and total score was calculated by summing the scores given for its responses. All scores were transformed into categories.

III. RESULTS

Table (1) Demographic characteristic of nurses (N = 30)

Nurses Demographic		Nurses (N= 30)	
		No	%
Sex	Female	21	70%
	Male	9	30%
Age	20 : <30	24	80.0%
	30 : <40	3	10.0%
	40 : <50	2	6.7%
	50 : ≤ 60	1	3.3%
Level of education	Secondary school	4	13.3%
	Technical institute	17	56.7%
	Bachelor degree	9	30.0%
Chance of training	No	23	76.7%
	Yes	7	23.3%
Number of training	None	23	76.7%
	One program	3	10.0%
	Two program	3	10.0%
	Three or more	1	3.3%

Data are expressed as frequency (Percentage).

Table 1shows that, more than two third of nurses (70%) were female. Regarding to age, there were the mostly of the nurses (80.0%) ranged between 18 to less than 30 years. Concerning the level of nurse's education, it was found more than half of nurses (56.7%) were inceptor from technical institute of nursing and about one third (30.0%) graduate from faculty of nursing. In addition, more than three quarter (76.7%) had no chance of training.

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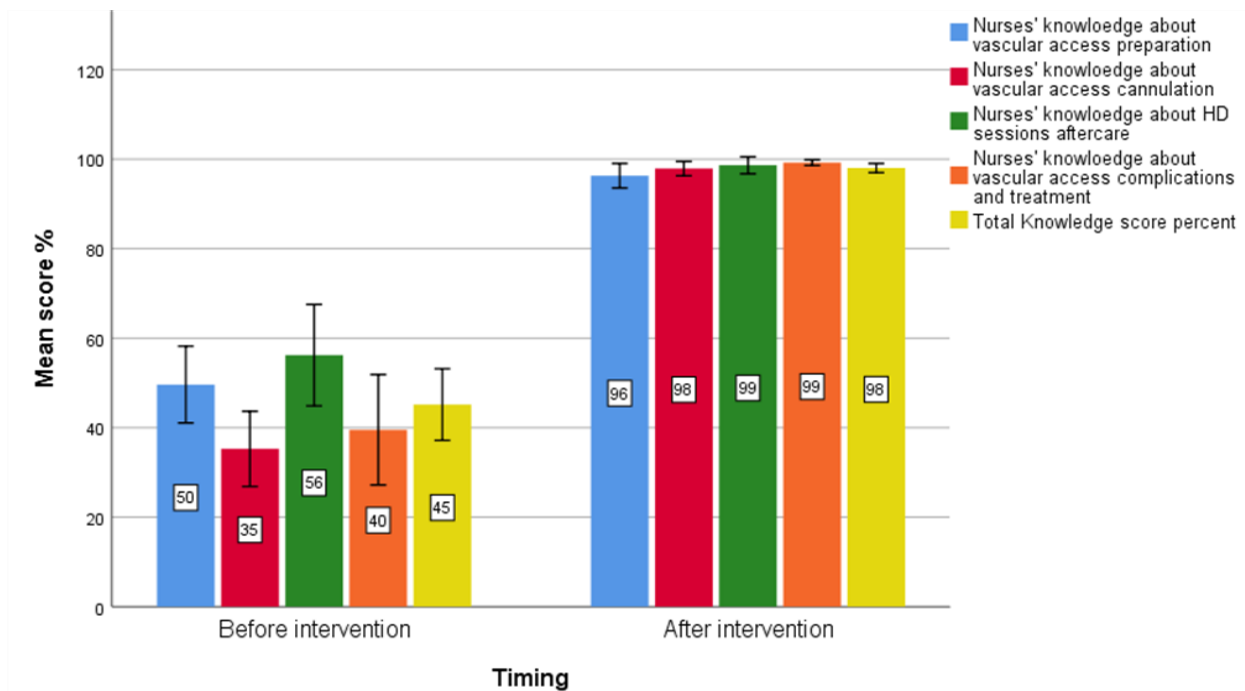
Mean of nurse's knowledge score pre and post nursing intervention

Figure (1): Comparison between nurses according to their mean score of total knowledge pre and post nursing intervention (N= 30). As revealed in this figure, the mean score of the nurses knowledge improved significantly after nursing intervention implementation, where $P \leq 0.005$.

Table (2) Comparison between nurses practice about VA preparations pre and post nursing intervention (N=30)

Nurses practice AVF& AVG preparation		Timing															
		Pre (N = 30)								Post (N = 30)							P value
		Not done		Need improve		Completely performed		proficient		Not done		Need improve		Completely performed		proficient	
		No	%	No	%	No	%	No	%	No	%	No	%	No	%	No	%	
1- fistula assessment	Look fistula (redness, swelling)	4	13.3%	15	50.0%	11	36.7%	0	0%	0	0%	2	6.7%	9	30%	19	63.3%	<0.0005
	Look puncture site	4	13.3%	14	46.7%	12	40%	0	0%	0	0%	1	3.3%	7	23.3%	22	73.3%	
	Feel (thrill)&listen bruit	10	33.3%	16	53.3%	4	13.3%	0	0%	0	0%	0	0%	7	23.3%	23	76.7%	
2- before sticking fistula	Wash hands &arms with antibacterial soap	18	60.0%	7	23.3%	3	10.3%	2	6.7%	0	0%	0	0%	8	26.8%	22	73.3%	
	Select site(straight, smooth vein)	3	10.3%	20	66.7%	6	20%	1	3.3%	0	0%	2	6.7%	5	16.7%	23	76.7%	
	Gather all supplies	0	0%	23	76.7%	7	23.3%	0	0%	0	0%	4	13.3%	10	33.3%	16	53.3%	<0.0005
	Disinfect fistula with Betadine or 2% chlorhexidine	1	3.3%	22	73.3%	7	23.3%	0	0%	0	0%	2	6.7%	6	20%	22	73.3%	
	Put on tourniquet	28	93.3	2	6.7%	0	0%	0	0%	1	3.3%	3	10.3%	7	23.3%	19	63.3%	

For every item, p value was <0.0005, P value by Wilcoxon's test.

Table 2 clarifies that, more than half of the nurse's (53.3%) were need improvement in the practice related to fistula assessment in the pretest compared by more than three quarter of nurses (76.7%) were proficient in the post test following nursing intervention, in reference to nurses practice before sticking the fistula there were more three quarter of the nurses (76.7% &73.3%) were need improvement when gather all supplies and disinfect fistula with betadine or chlorhexidine respectively. Meanwhile more than half of nurses and less than three quarter (53.3% & 73.3%) respectively were done proficient .This table also shows that, the nurses practice about VA preparations improved significantly after nursing intervention implementation, where $P \leq 0.005$.

Table (3) Comparison between nurses practice about (AVF & AVG) cannulation pre and post nursing intervention (N=30)

Nurses practice AVF& AVG Cannulation		Timing															P value
		Pre (N = 30)								Post (N = 30)							
		Not done		Need improve		Completely performed		proficient		Not done		Need improve		Completely performed		proficient	
		No	%	No	%	No	%	No	%	No	%	No	%	No	%	No	%
Fistula cannulation	Open the needles.	1	3.3%	18	60.0%	11	36.7%	0	0.0%	0	0.0%	0	0.0%	5	16.7%	25	83.3%
	Remove protective cover (keep needles clean).	9	30%	18	60.0%	3	10.3%	0	0.0%	0	0.0%	0	0.0%	3	10.3%	27	90.0%
	Determine your angle (20-35 for AVF& 40-45for AVG)	13	43.3%	16	53.3%	1	3.3%	0	0.0%	1	3.3%	1	3.3%	6	20%	22	73.3%
	Hold needle by wings	3	10.3%	20	66.7%	7	23.3%	0	0.0%	0	0.0%	2	6.7%	2	6.7%	26	86.7%
	Look for blood movement in tubing.	0	0.0%	17	56.7%	13	43.3%	0	0.0%	0	0.0%	1	3.3%	3	10.3%	26	86.7%
	Tape with chevron to secure needle.	1	3.3%	22	73.3%	7	23.3%	0	0.0%	0	0.0%	2	6.7%	1	3.3%	27	90.0%
	Release tourniquet.	25	83.3%	5	16.7%	0	0.0%	0	0.0%	1	3.3%	2	6.7%	8	26.8%	19	63.3%
	Rotate the puncture sites every session	7	23.3%	22	73.3%	1	3.3%	0	0.0%	0	0%	2	6.7%	5	16.7%	23	76.7%

P value column: <0.0005 (spanning the table)

For every item, p value was <0.0005, P value by Wilcoxon's test.

Table 3 display that, about two third (60%, 66.7%) and less than three quarter (73.3%) were need improvement in the practice related to fistula cannulation in the pretest. On contrast in the post test following nursing intervention, the majority of the nurse's (90%) and mostly of nurses (83.3% & 86.7%) were done proficient. This table also shows that, the nurses practice related to fistula cannulation improved significantly after nursing intervention implementation, where $P \leq 0.005$.

Table (4) Comparison between nurses practice related to needles removal pre and post nursing intervention (N=30).

Nurses practice Continue (needle removal)		Timing															P
		Pre (N= 30)								Post (N = 30)							
		Not done		Need improve		Completely performed		proficient		Not done		Need improve		Completely performed		proficient	
		No	%	No	%	No	%	No	%	No	%	No	%	No	%	No	%
Needle removal	Apply gauze dressing without pressure	19	63.3%	10	33.3%	1	3.3%	0	0.0%	0	0.0%	2	6.7%	3	10.3%	25	83.3%
	Remove needle at insertion angle	15	50.0%	14	46.7%	1	3.3%	0	0.0%	1	3.3%	3	10.3%	3	10.3%	23	76.7%
	Never flip needle	20	66.7%	8	26.8%	2	6.7%	0	0.0%	0	0.0%	2	6.7%	5	16.7%	23	76.7%
	Leveling out of needle followed by advanced	4	13.3%	22	73.3%	3	10.3%	1	3.3%	0	0.0%	0	0.0%	5	16.7%	25	83.3%
	Apply brief pressure with two fingers	17	56.7%	11	36.7%	2	6.7%	0	0.0%	0	0.0%	2	6.7%	3	10.3%	25	83.3%
	Don't apply excessive pressure	15	50.0%	14	46.7%	1	3.3%	0	0.0%	0	0.0%	2	6.7%	2	6.7%	26	86.7%
	Hold for 10-12	5	16.7%	22	73.3%	3	10.3%	0	0.0%	0	0.0%	1	3.3%	4	13.3%	25	83.3%
	Apply adhesive bandage	2	6.7%	14	46.7%	14		0	0.0%	0	0.0%	1	3.3%	3	10.3%	26	86.7%
	Dispose off needles in a sharps bin	1	3.3%	16	53.3%	13	43.3%	0	0.0%	0	0.0%	0	0.0%	3	10.3%	27	90.0%

P column: <0.0005 (spanning the table)

For every item, p value was <0.0005, P value by Wilcoxon's test

Table 4 shows that, more than half (53.3%) and less than three quarter (73.3%) of nurses were need improvement in the practice related to needle removal in the pretest. Meanwhile, mostly of nurses (83.3%& 86.7%) and majority (90%) were done proficient in the post test. This table also clarifies that, the nurses practice related to needle removal improved significantly after nursing intervention implementation, where $P \leq 0.005$.

Table (5) Statistical Correlations between nurses total knowledge score levels and their demographic data related to VA Pre & post nursing intervention.

Nurses demographic	Timing			
	Total nurses knowledge (pre N= 30)		Total nurses knowledge (post N=30)	
	coefficient	P	coefficient	P
1- sex	0.135	0.476	0.000	0.998
2- age	-0.331	0.074	0.130	0.492
3- level of educations	0.324	0.081	0.176	0.351
4-Years of experience	-0.255	0.174	0.090	0.635
5- Number of training	0.386	0.035	0.156	0.411

P value by Point bi-serial correlation for sex and by Spearman's correlation for others.

In reference to table 5, there were no statistical correlation between nurses demographic data and their total knowledge score levels where *P >0.05*.

Table (6) Demographic characteristic of the studied patients (N = 120)

Demographic data		Group						P value
		Control (N = 60)		Study(N = 60)		Total (N=120)		
		No	%	No	%	No	%	
Gender	Male	41	68.3%	31	51.7%	72	60%	
	Female	19	31.7%	29	48.3%	48	40%	0.062
Age	20- <30	9	15.0%	10	16.7%	19	15.9%	0.325
	30- <40	9	15.0%	7	11.7%	16	13.4%	
	40 - <50	15	25.0%	8	13.3%	23	19.1%	
	50 - ≤60	27	45.0%	35	58.3%	62	51.6%	
Residence	Rural	35	58.3%	34	56.7%	69	57.5%	0.853
	Urban	25	41.7%	26	43.3%	51	42.5%	
Education	Illiterate	18	30%	25	41.7%	43	35.9%	0.569
	Read & Write	6	10.0%	5	8.3%	11	9.1%	
	Pre- University	19	31.7%	14	23.3%	33	27.5%	
	University	17	28.3%	16	26.7%	33	27.5%	
Job	Working	9	15%	6	10%	15	12.5%	0.408
	Not working	51	85%	54	90%	105	87.5%	
Work nature	Arm used	4	6.7%	2	3.3%	6	5.0%	0.402
	Arm not used	56	93.3%	58	96.7%	114	95%	

Data are expressed as frequency (Percentage). P value by Chi-Square test. * P < 0.05 (significant)

Table 6 shows that, about two third of the studied group (60%) were male and more than half (51.6 %) ranged between 50 to less than 60 years. This table also illustrate that no statistically significant difference between the two groups as regards all items of demographic characteristic Where P >0.05.

Table (7) comparison between two groups according to their complications (AVF&AVG) in the 2nd month (N=103).

AVF& AVG		Group				χ^2	P value
		Control (N = 52)		Study(N = 51)			
Assess 2nd month		No	%	No	%		
At the beginning of HD session	Signs of infection	14	26.9%	0	0%	15.891	<0.0005
	Signs of steal syndrome	21	40.4%	6	11.8%	10.904	.001
	Access blood flow decrease >25% from previous baseline	13	25.0%	0	0.0%	14.592	<0.0005
	Venous pressure >120 mmHg when measured at the start of treatment with BFR of 200 ml/min	17	32.7%	2	3.9%	14.167	<0.0005
	New aneurysms	25	48.1%	3	5.9%	23.158	<0.0005
	Temperature of hands and arms difference	15	28.8%	1	2.0%	27.358	<0.0005
At the end of HD session	Blood flow rate different from the prescribed BFR throughout	13	25.0%	1	2.0%	11.637	.001
	Patient has bleeding time >15 minute	13	25.0%	0	0.0%	14.592	<0.0005
	Difficult cannulation	27	51.9%	2	3.9%	29.329	<0.0005
	Unstable intra-access flow pressure	12	23.1%	1	2.0%	10.410	.001
	Absent thrill / bruit	7	13.5%	0	0%	7.366	.013
(Doppler US)	Occurrence of stenosis	17	32.7%	1	2.0%	16.861	<0.0005
	Occurrence of thrombosis	19	36.5%	1	2.0%	19.674	<0.0005

P value by Chi-Square Test. * P < 0.05 (significant)

*AVF: arteriovenous fistula *AVG: arteriovenous graft

Table 7 illustrates that, majority of study group having no symptoms of AVF & AVG complications following the nursing intervention at the beginning & end of hemodialysis session in the 2^{ed} month. Only about 11.8% of them had signs steal syndrome in the post test. This table also clarifies that these complains greatly decreased in the 2^{ed} month and the difference observed was statistically significant, where $P \leq 0.005$.

On contrast, the most of the control group having symptoms of AVF & AVG complications in the 2^{ed} month at the beginning of HD session include more than quarter 26.9% of them had signs of infection and more than one third (40.4%) of them had signs of steal syndrome, about quarter 25.0 % had access blood flow decrease >25% from previous baseline, less than half (48.1 %) had new aneurysm. Regarding to complications occur at the end of HD session include equal percent 25.0% had blood flow rate different from the prescribed BFR and bleeding time >15 minute, more than half (51.9%) had difficulty cannulations, 13.5% had access failure represent in absent thrill and bruit and about one third (32.7% & 36.5) had stenosis and thrombosis respectively. This table also shows that these complications greatly increased in the 2^{ed} month for control group with significant statistically difference, where $P \leq 0.005$.

Table (8) Comparison between two groups according to their complications (CVC) in the 1st month & 2nd month (Control N=8 & Study N=9).

CVC dysfunction Assess	1st month Control (N = 8)		Study(N= 9)		χ^2	P value	2nd month Control (N = 8)		Study(N= 9)		χ^2	P value
	No	%	No	%			No	%	No	%		
BFR < 300 ml/min	5	62.5%	1	11.1%	4.898	0.50	5	62.5%	1	11.1%	4.898	.050
Venous pressure > 250 mmHg	2	25.0%	0	0.0%	2.550	.206	4	50.0%	1	11.1%	3.085	.131
URR <65% or Kt/v <1.2	2	25.0%	1	11.1%	.562	.576	2	25.0%	0	0.0%	2.550	.206
Unable to aspirate blood freely	4	50.0%	1	11.1%	3.085	.131	4	50.0%	0	0.0%	5.885	.029
Frequent pressure alarms	4	50.0%	0	0.0%	3.885	.029	4	50.0%	0	0.0%	5.885	.029

P value by Fisher's exact Test. * P < 0.05 (significant)

Table 8 shows that, nearly all study group had signs and symptoms of healthy CVC following the nursing intervention in the 1st & 2nd month. On the other hand, control group had signs and symptoms of CVC dysfunctions posttest in the 1st & 2nd month include about two third 62.5% had BFR < 300ml/min, about quarter 25.0% had URR < 65% or Kt/v < 1.2 and about quarter had venous pressure > 250 mmHg in the first month compared by equal percent 50.0% had venous pressure > 250 mmHg & unable to aspirate blood freely and frequent pressure alarms in the 2nd month. These complication slightly increased in the control group than study group but the difference observed wasn't statistically significant, where (P value > 0.05).

IV. DISCUSSION

Vascular access complications account for approximately 20% to 30% of hospital admissions for patients on HD and incur substantial health care costs, so it's important to take care of the vascular access to prevent those complications. Moreover, the nephrology nurses have the primary responsibility to assure the highest quality cannulation to preserve vascular access integrity and prevent access complications [7].

Regarding demographic characteristics of nurse's, the findings represented that, females constituted more than two third of studied nurses, this agree with the study of [8]. who stated that more than two third of nurses are females, the majority of nurses were females can be attributed to that females in eastern community prefer to work in nursing proficiency as it is suitable for their nature, while males in theses community don't prefer working as nurses. Concerning to the age, the majority of the nurses ranged between 20 to < 30 years, young age of nurses in the studied sample may be explained as they provide direct nursing care to the hemodialysis patients whereas the elderly nurses are occupied with administrative task. These agree with the study of [9] who stated that three quarter of nurses are females and average age was 33.7 years old. While all nurses in study of [10] were females, and about two third were > 30 years old.

Concerning the level of nurse's education, it was found more than half of nurses had degree of technical institute of nursing and one third had bachelor degree, because academic study in technical institute is only 2 years while faculty of nursing takes 4 academic years and in the light of the economic conditions in the area of the study, family prefer technical institute as it requires shorter duration and less expenditures. Results obtained agreed with the study presented by [11] revealed that about half of hemodialysis nurses were nursing institute graduate and one quarter graduated from nursing college. In contrast [12] who observed that more than half of nurses in hemodialysis unit had bachelor degree, such differences between the current study and other studies on the impact of variables such as education this is might be due to learning cultural or social differences between the Egyptian community and other advanced communities.

Nurses are knowledge dependent workers and knowledge plays important role in the quality of health care today as they should be able to create a match between each patient and the dialysis machine, the results of the current study showed that, mean score level improved significantly after nursing intervention implementation. Which agree with the study of

[12] who reported that less than half of the nurses had satisfactory knowledge as regards vascular access in the pre intervention phase, the minority of them had satisfactory knowledge about site of insertion and evidence-based guidelines of VA maintenance care. However, the vast majority of them had improvement in their knowledge mean score immediately and 6 months after guideline implementation with highly statistically significant difference. In additional [13] supported that significant improvement in nurses' knowledge after attending a program emphasized that improve the quality of care provided to patients and described the importance of reference books as an effective way to support staff development.

Practice and knowledge is essential for hemodialysis nurses to improving care provided in the hemodialysis units and maintenance their vascular access, as well as improving nurses practice result in nurse's high self-efficacy when providing VA maintenance care, the results of the presented study clarifies highly significant improving of nurses' practice regarding VA preparation post interventions implementation. This result supported by [14] who found that there was statistical significant improvement in the assessment of nurses' practice pre and post educational intervention in variables related to vascular access preparation, AVF cannulation techniques and identifying AVF complications. In the same respect, [15] reflected that the importance of receiving accurate and timely information by skilled lead to increases nurses' performance. Conversely, [16] stated that performance improvements are restricted and determined by the presence of some changes in the unit structure for patients such as the availability of resource. So that he stated that lack of human resources, guidelines, and regulations in certain hospitals often obscure nurse staff working in hemodialysis unit. The Egyptian Ministry of Health and Population (2016) emphasized that personal protective equipment should be available to dialysis personnel family, and visitors in the suitable sizes and should be monitored and enforced.

Result obtained by [17] who revealed that cannulation is learned skill that generally improves with practice and years of experience this is accepted with our results which explained that nurse's practice about VA cannulation improved significantly after nursing interventions implementation. The results come in the same result of [18] who used four intervention programs for teaching nurses Arteriovenous fistulas (AVFs) cannulation, they found represented improvement in successful fistula cannulation and practice changes based on these results may improve cannulation, decrease complications and result in better outcomes for patients. On contrast results obtained by [19] indicated that while nurses are well trained on cannulation techniques; there were barriers to perform successful cannulation because of the pressure of time imposed by HD schedules**.**

Nurse's practice related to needle removal improved significantly after nursing interventions implementation. This may be attributed to many of nurses in dialysis units under study had not long experience work in dialysis units, so they need intervention and educational programs to improve their practices towards patients .This findings supported by study of [20] who compare the effect of intervention method to the traditional method of cannulation on time to hemostasis, needle stick pain, and aneurysm size. On the other hand the study of [21] found gaps in practice were identified regarding needles handling among Nurses in Renal Dialysis Units in Abha City – Saudi Arabia

Regarding the correlation between nurses demographic data and total knowledge score levels related to VA Pre & post nursing interventions, shows that, there were no statistical significant differences between nurses demographic data and their total knowledge score levels, this results came similar to [12] who found no significant difference between nurse's knowledge in terms of their demographic characteristics and no significant difference in nurses knowledge along the study.The study concluded that the nurses who received evidence-based guidelines educational program as regards vascular access maintenance and care showed high score level in nurses' knowledge and practice after implementation of the program than that before recommendation. But opposite to [21] who found the Saudi nurses had better knowledge than non-Saudi

Regarding gender of patients**,** two third of patients were males, which came in agreement with study of [22] found that majority of HD patients were males. The higher rates of males may be due to their more exposure to environmental factors, for example, physical (harmful rays), chemical (heavy metals, dyes, and hydrocarbons), and biological (viral infection). In contrast to our findings [23] reported that the incidence of ESKD among females was higher than males.

In relation to age of the patients, more than half of HD patients were ranged between 50 to less than 60 years. The study results came in the same line of [24] who concluded that the most common age groups of patients complaining from ESKD and undergoing HD were ranging from 50 - 60 years old, that may be due to age related changes , such as the

increasing prevalence of obesity, diabetes and hypertension. The current result is supported by [9] who reported that the patients between 50 and 60 years were frequently affected by ESRD more than other age groups.

Risk of vascular access complication could be reduced with appropriate training of nurses, physicians and patients. This could potentially prolong the life of vascular access [2] Which came agree with our result indicated that complications greatly increased in 2nd month among patients of control group while there were minors in patients in study group and the difference observed was statistically significant, which indicated the effectiveness of this nursing intervention to decrease these kinds of complications. Those complications represent in several forms as the present study show more than half of the control group was difficult cannulation, this come in the same line of results obtained by [25] who reported that more complications for cannulation performed by un experienced nurses. So the nephrology nurse responsible for maintaining functioning vascular access.

Results showed that most of the study group had signs and symptoms of healthy CVC following the nursing intervention in the 1st & 2nd month. On contrast, the majorities of the control group had signs and symptoms of CVC dysfunctions posttest in the 1st & 2nd month, these results came similar to [26] who found that the use CVC educational program can reduce the risk of infections, result in significant cost savings and should be considered for implementation by all nephrology training programs.

In summary the study results suggest that hemodialysis nurse's must be has ability to multi-task, organize, and effectively communicate with all members of the VA team. Hemodialysis or Vascular access nurses must be highly trained individuals who were central to the dialysis programs. Which agree with the study of [27] who reviews the basic skills needed by all dialysis staff to correctly cannulate an AV fistula or graft, found that nursing research is needed to better evaluate all cannulation procedures, aimed to safely cannulate any access without causing unnecessary damage to the patient's lifeline.

V. CONCLUSION

Based on the findings of the present study the following can be concluded:

- There was significant improvement in nurse's knowledge and practices leading to improvement function of vascular access, decrease complications and result in better outcomes for patient.

VI. RECOMMENDATION

The current study recommended the following:

1- Training and continuing education of the clinical practice guidelines for staff nurses are important to improve care provided in the hemodialysis units.

2- All patients scheduled for HD procedure and their families need adequate knowledge and skills to help them to adapt with their vascular access.

3- Distributing the designed nursing intervention booklet to all nurses working in HD units.

4- Replication of the current study on larger probability sample and various setting in Egypt to examine the effectiveness nursing intervention on prevention of vascular access complications.

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