Nurses' Knowledge and Practices Regarding Permanent Vascular Access Care among Patients on Hemodialysis

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Abstract

Background: Maintenance hemodialysis is considered the main form of treatment in patients with end-stage renal disease. So, vascular access is the major determinant for successful hemodialysis. Permanent vascular access nursing care is vital to maintain easy cannulation and sufficient blood flow which is considered as Achilles heel for hemodialysis patients. **Aim of the study**: To assess the nurses' knowledge and practices regarding permanent vascular access care among patients on hemodialysis. **Research design**: A descriptive cross-sectional research design was used. **Setting**: Hemodialysis unit in Itay-Elbaroud General Hospital affiliated to El-Beheira Health Directorate, Ministry of Health and Population, Egypt. **Subjects**: Included all nurses (N=67) who were involved in providing direct care for patients with permanent vascular access. **Tools of data collection**: Two tools were used: **Tool (I):** Assessment of Nurses' Knowledge Related to Permanent Vascular Access Questionnaire, **Tool (II):** Nurses' Practices Regarding Permanent Vascular Access Care Observational Checklist. **Results**: The study showed that (61.7%) of nurses had poor overall nurses' knowledge, and (76.7%) of them had incompetent nurses' practices regarding permanent vascular access care. In addition, a highly statistically significant weak positive correlation was found between nurses' practices and their knowledge levels; where (p<0.001) and (r=0.476). **Conclusion**: Nurses had poor knowledge and incompetent practices regarding permanent vascular access care. **Recommendations**: Implementing updated pre-service and periodic in-service programs to the hemodialysis nurses to improve their knowledge and practices regarding permanent vascular access care throughout hemodialysis session, and its related complications. Besides, including nursing care of permanent vascular access throughout hemodialysis session in nursing curricula.

Keywords: Hemodialysis, Nurses' Knowledge, Nurses' Practices and Permanent Vascular Access.

Introduction

The International Society of Nephrology **(ISN., 2023)** , has stated that End Stage Renal Disease (ESRD) affects more than 850 million people; and those who rely on Maintenance Hemodialysis (MHD) to maintain their lives are 323 per million people worldwide. In Egypt, the estimated annual incidence of ESRD is 74 per million, and around 98% of them are on Hemodialysis (HD) **(Ahmed et al., 2020).**

Hemodialysis is a life-saving option for patients with ESRD when their kidney's function decreases permanently with glomerular filtration rate is lower than <15ml/min/1.73m2, to replace kidney function, particularly excretory function **(Malekshahi et al., 2024).** Patients on HD must have a well-functioning permanent Vascular Access (VA) to remove, and return blood into

the patient's vascular system. Permanent VA is considered a critical and crucial part of HD. So, the maintenance of patent and well-functioning VA is a prerequisite for preserving successful HD as the quality of VA directly affects the HD outcomes **(Kim et al., 2023).**

The three available types of permanent VA are Arterio-Venous Fistula (AVF) which can be used between 6–12 weeks after creation, Arterio-Venous Graft (AVG) which can be used 2–3 weeks after placement and Tunneled Central Venous Catheter (t CVC) which can be used directly after insertion **(Roetker et al., 2023).** The choice of VA depends on the vascular status, clinical condition of the patient, and the time available before initiation of HD **(Lok et al., 2020).** To prolong VA durability and enhance patient care, nursing staff must have the knowledge and clinical skills to improve the patients' monitoring, and provide specialized care. The duties of hemodialysis nurses include assessment, establishment, maintenance, monitoring of VA, and patient education **(Meng et al., 2023).**

Nurses' assessment of the VA is the essential element to determine the feasibility of cannulation with a minimal risk for complications; this assessment includes inspection, palpation and auscultation to evaluate the inflow and outflow tract **(Correia et al., 2021).** In addition, cannulation and decannulation of the permanent VA requires significant nursing skills to avoid negative consequences for patients. As reported in recent studies, nurses' malpractice enforces trauma to VA, and increases the incidence of complications among HD patients such as weakness of vascular wall, infection, aneurysm, bleeding, steal syndrome, ischemic neuropathy and thrombosis **(Torreggiani et al., 2021-**

Pinto et al., 2022). Cannulation methods that can be used are: rope ladder, buttonhole technique and area cannulation technique **(Staaf et al., 2021).**

Significance of the study:

Vascular access is the lifeline for HD patients; it has a significant role in improving the quality of HD. **(Torreggiani et al., 2021-Chen et al., 2022)**. Proper care of VA is essential for ensuring its longevity and minimizing complications **(Ibrahim et al., 2022 - Meng et al., 2023)**. Therefore, the current study will provide valuable insights into potential defects in nurses' knowledge and practices which in turn will help in the development of more effective VA care training programs for nurses caring for patients on MHD. Accordingly, this will contribute to the enhancement of VA nursing care, as well as, improvement in patients' outcomes .

Aim Of The Study

This study aimed to assess the nurses' knowledge and practices regarding permanent vascular access care among patients on hemodialysis.

Research questions:

- What is the level of nurses' knowledge regarding permanent vascular access care among patients on hemodialysis?

- What is the level of nurses' practices regarding permanent vascular access care among patients on hemodialysis?

Operational definitions:

- **Permanent vascular access**: in this study refers to arterio-venous fistula and arterio-venous graft in patients on maintenance hemodialysis.

- **Nursing care practice**: in this study, refers to permanent vascular access care done by nursing staff before, during and immediately after the dialysis session for patients on maintenance hemodialysis.

Subjects And Methods

Study design:

A descriptive cross-sectional research design was used to conduct this study.

Study Setting:

The study was conducted at Hemodialysis Unit in Itay-Elbaroud General Hospital, affiliated to El-Beheira Health Directorate, Ministry of Health and Population, Egypt.

Subjects

The subjects included all nurses (N=67) who were involved in providing direct care at the hemodialysis unit for patients on maintenance hemodialysis, and having permanent vascular access.

Tools of data collection

Two tools were used for data collection:

Tool (I): "Assessment of Nurses' Knowledge Related to Permanent Vascular Access Questionnaire"

This tool was developed by the researchers after reviewing the recent related literature **(Hanafy et al., 2022; Ibrahim et al., 2022; Moursy& Sharaf., 2017).** It is a self-administering questionnaire, in Arabic language, to collect data about nurses' demographic characteristics, and knowledge regarding permanent VA. It included two parts:

Part 1: Nurses' demographic data sheet: It included seven items; nurse's age, gender, qualification, years of experience in the current unit, previous training on nursing care for permanent VA, previous experiences in other specialties, and cannulation techniques training.

Part 2: Nurses' knowledge related to permanent vascular access assessment: This part aimed to assess the nurses' knowledge about permanent VA for HD patients; it included twenty-six questions and it was divided into three sections as follows:

Section (1): Nurses' knowledge regarding general information about permanent VA including eight questions; seven open-ended questions regarding definition of VA, types of permanent VA, indications, contraindications, advantages, disadvantages and duration of maturation phase for each type and one multiple choice question regarding factors that promote the functionality of the permanent VA.

Section (2): Nurses' knowledge regarding phases of permanent VA care including nine questions; eight multiple choice questions regarding VA assessment before HD session and caring of the access before, during and immediately after dialysis session and one open-ended question regarding different types of cannulation techniques.

Section (3): Nurses' knowledge regarding permanent VA complications including nine questions; six multiple choice questions regarding signs and symptoms of VA complications namely early failure, infection, stenosis, steal syndrome, aneurysm, thrombosis, in addition to three open-ended questions regarding VA complications that occur during cannulation, nursing measures in case of VA bleeding and the preventive nursing measures of these complications.

Scoring system:

Each question answer was scored as follows: (2) for correct complete answer, (1) for correct incomplete answer and (0) for incorrect answer or don't know. The total score of part 2 in tool I ranged from 0 – 52 scores. The total score was summed up and transformed into percentage and was categorized as follows:

- ≥ 80 % of the total score which ranged from (42-52 scores) was considered as good knowledge
- 60 - <80% of the total score which ranged from (32-41scores) was considered as fair knowledge
- 60% of the total score which ranged from (0-31 scores) was considered as poor knowledge

Tool II: "Nurses' Practices Regarding Permanent Vascular Access Care Observational Checklist".

This tool was developed by the researchers after reviewing the recent relevant literature **(Aitken et al., 2018; Bayoumi& Khonji., 2020; Lok et al., 2020).** This tool was used to assess the nurses' practices regarding permanent VA throughout HD session; it included sixty-six sub-steps that the HD nurse should do under the following headings:

Part 1: **Nurses' practices in pre-cannulation phase immediately before starting the dialysis session.** It included twenty steps and sub-steps for weighing the patient, measuring the patient blood pressure, infection control measures, physical examination of VA site, and disinfection technique of VA site.

Part 2: Nurses' practices in cannulation technique at the starting of the dialysis session. It included twenty-two steps and sub-steps for the needle size and type selection, use of tourniquet, needle site selection, selection of insertion areas, patient's

positioning during cannulation, cannulation technique, required precautions after cannulation, taping needles and catheters after cannulation, dialysis machine calibration, and ensuring intra-dialytic flow needed.

Part 3: **Nurses' practices during dialysis session.** It included eleven steps and sub-steps for blood pressure measurement, dialysis machine setup, heparin administration, continuous monitoring of VA during session and checking the alarms of the machine.

Part 4: **Nurses' practices in VA decannulaion immediately after finishing dialysis session.** It included thirteen steps and sub-steps for infection control measures before disconnecting the patient, disconnecting the needles and catheters, removing the needles and taping needle sites, patient's teaching, and patient's complaints, and infection control measures after finishing dialysis session.

Scoring system:

Each step and sub-step of the observed nurses' practices in the tool II was scored as follows: (1) if done, and (0) if not done. The total score ranged from 0 – 66 scores of every nurse's practices and categorized into the following:

- ≥80 % of the total score which ranged from (53-66 scores) was considered competent practices.
- <80 % of the total score which ranged from (0-52 scores) was considered incompetent practices.

Methods:

The study was accomplished according to the following steps:

Approval

• An official permission letter was obtained from the Dean of Faculty of Nursing –Damanhour University and directed to the administrative authorities

to have their permission to collect the data after an explanation of the aim of the study.

Tools of the study:

Tools of the study were developed by the researchers after reviewing the recent related literature **(Aitken et al., 2018; Bayoumi& Khonji., 2020; Hanafy et al., 2022; Ibrahim et al., 2022; Lok et al., 2020; Moursy& Sharaf., 2017).**

1. Content validity

The tools were tested for content validity, completeness and clarity of items by panel of five experts in Medical Surgical Nursing-Faculty of Nursing, Damanhour University. Accordingly, some modifications were done.

2. Pilot study

A pilot study was carried out on (10%) of total sample size (n= 7 nurses), they were not included in the study sample, in order to ensure the feasibility, clarity of the tools, and to identify obstacles that might be encountered during data collection, after pilot study conduction, no modifications were done.

3. The tools reliability

The two tools of the study were tested for its reliability, using **Cronbach's Alpha test**; where it was (0.889) for tool I part 2; and (0.805) for tool II; which indicated good reliability.

Data collection:

- Data collection took two months from the mid of September 2023 to the mid of November 2023.
- Data collection started with observing the HD nurses practices using tool II, then interviewing them to assess their knowledge using tool I.

1. Observation of nurses' practices regarding vascular access care.

Concealed observation was conducted through three observations for three different nurses per shift throughout the (morning, afternoon and evening shifts) according to nurses' working schedule. The aim that was told to the nurses for the researcher's presence in the unit was to observe the patient's response during the HD session. The researcher observed each nurse's practices twice in two different times. For close observation, the researcher stood as close as possible to the nurse while observing her practices throughout the dialysis session. Each HD nurse was observed at a time while connecting, caring and decannulating the patient. The second observation for the same nurse was conducted by the researcher after at least two days according to the nurse's working schedule.

2. Assessment of nurse's knowledge regarding VA.

The researcher interviewed each nurse individually to collect data about nurses' knowledge regarding permanent VA once, the aim of the study was explained, and the instructions for questionnaire filling were given before the distribution of the questionnaire during their break time in the nursing office, filling in the questionnaire took from 20 to 30 minutes.

Ethical Consideration

The research approval was obtained from the ethical committee of the Faculty of Nursing – Damanhour University, prior to the start of the study (**Approval No. 74-C) on 16/3/2023**. An official letter of approval from Scientific Research Ethics Committee of MOHP was obtained after sending permission from the general director of Itay El-Baroud General Hospital and Directorate of Health

Affairs in El-Beheira Governorate, Egypt (**Approval No. 15-2023/7) on 13/9/2023.** The researcher met the head nurse individually in her working office to explain the aim of the study and to obtain witness informed verbal consent for concealed observation. Informed consent was obtained from all the studied nurses after explanation of the study aim before using tool I. Privacy of the studied nurses was respected and assured throughout the study. Anonymity was maintained by using nurses' code number instead of the studied nurses' names. Data confidentiality was assured during implementation of the study. All the studied nurses were assured that they have the right to withdraw from the study at any time.

 Statistical Analysis

The collected data were organized, tabulated and statistically analyzed using the Statistical Package for Social Studies (SPSS) Version 23.0. Qualitative data were described using number and percent. Quantitative data were described by mean ± standard deviation. The mean of the two observations (tool II) was calculated and obtained. Finally analysis and interpretation of data were conducted.

The used tests were:
- Chi-square test (Monte Carlo) test was used to explore relationship between demographic data and knowledge, practices of studied nurses.
- Pearson coefficient was used to correlate between knowledge and practices of studied nurses.
- P-values of 0.05 or less were considered statistically significant.

Results

Table (1) shows the percent distribution of the studied nurses according to their demographic and academic characteristics. Regarding nurses' age, more than half of studied nurses (55%) were within age group from 30 < 40 years old. Concerning gender, qualification and cannulation technique training, it was found that all the studied nurses were females, had bachelor degree of nursing and they learnt CT in the current dialysis unit. In relation to years of experience in the current HD unit, it was noticed that the highest percent of the studied nurses (71.7%) had from 1 < 5 years of experience. As regards previous training courses on nursing care for permanent VA, the majority of the studied nurses (88.3%) didn't attend any training courses.

Table (2) and Figure (1) shows the percent distribution of the studied nurses according to their knowledge levels regarding permanent VA, it was noticed that the highest percent of the studied nurses (61.7%) had poor overall knowledge regarding permanent VA care with a minimum score of 16 and maximum of 51, also the mean and standard deviation was (31.12±8.70).

Table (3) and Figure (2) shows the percent distribution of the studied nurses according to their levels of practices regarding permanent VA care, it can be noticed that more than three-quarters of the studied nurses (76.7%) had incompetent practices with a minimum score of 40 and maximum of 63, and the mean and standard deviation was (47.82±5.52).

Table (4) illustrates the relationship between nurses' demographic, academic characteristics and their knowledge levels. It was clear that the highest percentages of the studied nurses who had good knowledge were in the age group from 20<30 years old, had from 1<5 years of experience in the current

unit, didn't attend any previous training courses, and worked previously in intensive care unit with percentages of (71.4%, 57.1%, 85.7%,42.6%) respectively. From this table, it can be noticed that there was no statistical significant relationship between the studied nurses' demographic, academic characteristics and their knowledge levels.

Table (5) reveals the relationship between nurses' demographic, academic characteristics and their practices levels. It was noticed that the highest percentages of the studied nurses with competent practices had from 1<5 years of experience in the current unit, didn't attend any training courses, and worked previously at intensive care units with percentages of (78.6%, 85.7%, 42.9%) respectively. Also, it can be seen that there was no statistical significant relationship between the studied nurses' demographic, academic characteristics and their practices' levels.

Table (6) depicts the correlation between the studied nurses' knowledge and their practices regarding permanent VA care, as noticed there was a highly statistically significant correlation (p <0.001 the) between overall nurses' knowledge and their practices in pre-cannulation phase, it was positive and moderate; where (r=0.546). Also, there was weak positive statistically significant correlation between the overall nurses' knowledge and their practices during the dialysis session, and after finishing the dialysis session; where (p= 0,028, r= 0.283) and (p= 0.008, r= 0.340) respectively. But there was no statistically significant correlation between the overall nurses' knowledge and their practices in CT at the starting of dialysis session (p= 0.554, r=0.078). Concerning the correlation between the overall nurses' knowledge

and their overall practices regarding permanent VA care, there was a highly significant positive weak correlation where (p<0.001, r=0.476), as the nurses who had poor knowledge, had incompetent practices, in parallel.

Table (1): Percent distribution of the studied nurses according to their demographic and academic characteristics.

Nurses' demographic and academic characteristics	No.	%
	n=60	
- Age		
• 20 < 30	27	45.0
• 30 < 40	33	55.0
-Gender		
• Female	60	100.0
-Qualification		
• Bachelor of nursing	60	100.0
-Years of experience in the current HD unit		
• 1 < 5 years	43	71.7
• 5 < 10 years	17	28.3
- Previous training courses on nursing care for permanent VA		
• No	53	88.3
• Hemodialysis training	7	11.7
-Previous experiences in other specialties	15	25.0
	n=45	
• No previous experience		
• Yes	21	46.7
▪ Intensive care unit	24	53.3
▪ Neonatal intensive care unit		
-Cannulation techniques training		
• In the current unit	60	100.0

Table (2): Percent distribution of the studied nurses according to their knowledge levels regarding permanent vascular access.

| Nurses' knowledge related permanent VA	Nurses' knowledge levels n=60					
	Poor		Fair		Good	
	No.	%	No.	%	No.	%
-General information about permanent vascular access	27	45.0	25	41.7	8	13.3
Min. – Max. 0.0-14.0 **Mean ± SD** 9.27±3.35						
-Phases of permanent vascular access care	41	68.3	9	15.0	10	16.7
Min. – Max. 6.0-20.0 **Mean ± SD** 12.08±3.87						
-Permanent vascular access complications	37	61.7	14	23.3	9	15.0
Min. – Max. 4.0-15.0 **Mean ± SD** 9.77±3.04						
Overall nurses' knowledge related permanent vascular access	37	61.7	16	26.6	7	11.7
Min. – Max. 16.0-51.0 **Mean ± SD** 31.12±8.70						
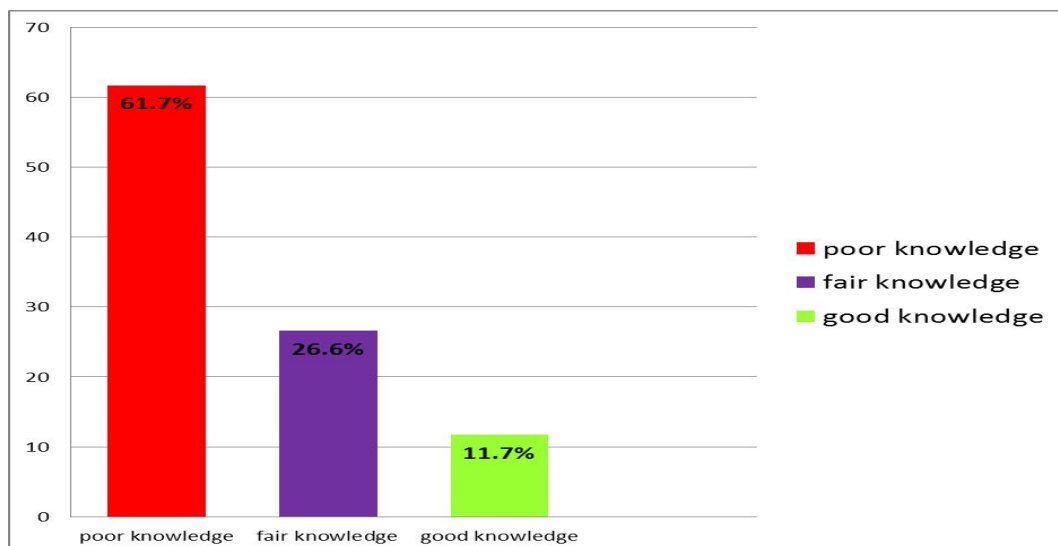
Figure (1): Percent distribution of the studied nurses according to their overall knowledge levels regarding permanent vascular access.

Table (3): Percent distribution of the studied nurses according to their levels of practices regarding permanent vascular access care.

Practices regarding permanent vascular access care	Nurses' practices levels n=60			
	Average observation			
	Incompetent		**Competent**	
	No.	**%**	**No.**	**%**
-Nurses' practices in pre-cannulation phase (immediately before starting dialysis session)	54	90.0	6	10.0
Min. – Max. 7.0-20. **Mean ± SD** 10.07±3.26				
-Nurses' practices in cannulation technique (at the starting of dialysis session)	8	13.3	52	86.7
Min. – Max. 14.0 – 21.0 **Mean ± SD** 18.35±1.41				
-Nurses' practices (during dialysis session)	34	56.7	26	43.3
Min. – Max. 7.0-11.0 **Mean ± SD** 8.55±1.10				
-Nurses' practices in vascular access decannulaion (immediately after finishing dialysis session)	30	50.0	30	50.0
Min. – Max. 8.0-13.0 **Mean ± SD** 10.82±1.10				
Overall nurses' practices related permanent VA	46	76.7	14	23.3
Min. – Max. 40.0-63.0 **Mean ± SD** 47.82±5.52				

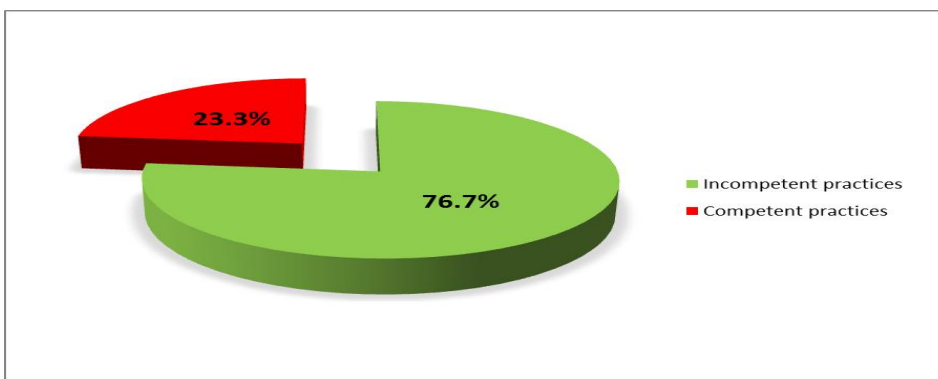**Figure (2): Percent distribution of the studied nurses according to their overall levels of practices regarding permanent vascular access care.**

Table (4): Relationship between nurses' demographic, academic characteristics and their knowledge levels.

Nurses' demographic and academic characteristics	Nurses' knowledge levels						χ^2	^{MC}p
	Poor (n =37)		Fair (n =16)		Good (n =7)			
	No.	%	No.	%	No.	%		
-Age								
• 20 < 30	14	37.8	8	50.0	5	71.4	5.621	0.222
• 30 <40	23	62.2	8	50.0	2	28.6		
-Years of experience in the current dialysis unit								
• 1 < 5 years	28	75.7	11	68.8	4	57.1	4.152	0.464
• 5 <10 years	9	24.3	5	31.3	3	42.9		
- Previous training courses on nursing care for permanent vascular access								
• No	33	89.2	14	87.5	6	85.7	0.515	1.000
• Hemodialysis procedure training	4	10.8	2	12.5	1	14.3		
-Previous experiences in a specialty other than dialysis								
• No	8	21.6	5	31.3	2	28.6		
▪ Intensive care unit	11	29.7	7	43.8	2	42.6	3.298	0.519
▪ Neonatal intensive care unit	18	48.6	4	25.0	2	28.6		

χ^2: Chi square test   MC: Monte Carlo

Table (5): Relationship between nurses' demographic, academic characteristics and their practices levels.

Nurses' demographic and academic characteristics	Nurses' practices levels				χ^2	^{MC}p
	Incompetent (n =46)		Competent (n =14)			
	No.	%	No.	%		
-Age						
• 20 < 30	20	43.5	7	50.0	0.746	0.817
• 30 <40	26	56.5	7	50.0		
-Years of experience in the current dialysis unit:						
• 1 < 5 years	32	69.6	11	78.6	0.694	0.799
• 5 < 10 years	14	30.5	3	21.4		
-Previous training courses on nursing care for permanent vascular access						
• No	41	89.1	12	85.7	0.122	0.660
• Hemodialysis procedure training	5	10.9	2	14.3		
-Previous experiences in a specialty other than dialysis						
• No	12	26.1	3	21.4		
▪ Intensive care unit	15	32.6	6	42.9	0.540	0.799
▪ Neonatal intensive care unit	19	41.3	5	35.7		

χ^2: Chi square test   MC: Monte Carlo

Table (6): The correlation between the studied nurses' practices and their knowledge regarding permanent vascular access care.

Nurses' Practices Regarding VA	Nurses' Knowledge related VA							
	General information about permanent Vascular Access (VA).		Phases of permanent VA care		Permanent VA complications		Overall Nurses' Knowledge	
	r	p	r	p	r	p	r	p
-Nurses' practices in pre-cannulation phase immediately before starting dialysis session	0.440**	<0.001	0.443**	<0.00	0.364*	0.004	0.546**	<0.001
- Nurses' practices in cannulation technique at the starting of dialysis session.	0.077	0.561	0.060	0.650	0.113	0.391	0.078	0.554
- Nurses' practices during dialysis session	0.227	0.081	0.221	0.090	0.243	0.061	0.283*	0.028
- Nurses' practices in VA decannulaion immediately after finishing dialysis session	0.281*	0.030	0.211	0.105	0.247	0.057	0.340*	0.008
Overall Nurses' Practices	0.388*	0.002	0.371*	0.004	0.349*	0.006	0.476**	<0.001

r: Pearson coefficient
*: Statistically significant at p ≤ 0.05

Discussion

Permanent VA is the mainstay to HD patients. The maintenance of VA is a prerequisite for preserving HD, quality of VA that directly affects the dialysis outcomes, and the quality of life of HD patients. However, the life of VA can be affected by a variety of factors, including nurses' knowledge and practices regarding permanent VA **(Arhuidese et al., 2019).** Such practices as unsuccessful CT might impose trauma, and increase the incidence of VA complications among HD patients. So, the nursing staff should have the appropriate knowledge and efficient skills concerning permanent VA care and early detection of its potential complications and initiating preventive measures for possible consequences **(Aljuaid et al., 2020).** Therefore, the current study was conducted to assess nurses' knowledge and practices regarding permanent VA care among patients on HD.

The findings of the present study revealed that more than half of the studied nurses had poor knowledge regarding permanent VA and more than three-quarters of studied nurses had incompetent practices regarding permanent VA care. These findings might be interpreted in light of the following :

As regards nurses' demographic and academic characteristics: the current study reported that more than half of the studied nurses were within the age group from thirty to less than forty years old. This result might be interpreted in light of the fact that the recruitment of HD nurses in the dialysis unit is based on their seniority in other units. This result is consistent with the study conducted by **Alsolami and Alobaidi., (2024)**. In contrast, this finding diagrees with a study done by **Ali et al., (2018)** as the higher percent of their subjects were within the age group from eighteen to less than twenty-eight years old, as the majority of their subjects had technical nursing education.

Concerning nurses' gender, it was noted that all the studied nurses were females which may be interpreted by that the study of nursing in Egyptian universities and schools were exclusively for females for many years. This result is in harmony with studies conducted by **Alsolami and Alobaidi., (2024)** and **Nasarullah et al., (2021)**. However, this study isn't in line with a study conducted by **Bakey., (2014)** as more than half of the study participants were males, this discrepancy may be due to the type of setting as he conducted the study in teaching hospitals in Baghdad; the capital of Iraq and that the subjects included both genders.

As regards nurses' qualifications in the present study, all the studied nurses had bachelor's degree in nursing; it could be justified that HD unit needs highly qualified nurses to deal with sensitive machines and to care for such patients with fluid and electrolyte imbalance. This result is consistent with a study conducted by **Thomas et al., (2016)**. In relation to years of experience in the current HD unit, nearly three-quarters of the studied nurses had less than five years of experience, although the major age was from thirty to forty years old. This was attributed to the recruitment of other units' seniors in the dialysis unit. This is similar to that of **Mohamed et al., (2023)**. Conversely, the current finding is in contradiction with **Abdel-Latif et al., (2019)** as most of their participants had from five to less than ten years of experience.

As regards the previous training courses on nursing care for the permanent VA, the present study

illustrated that the majority of the studied nurses did not attend any training courses; this finding may be attributed to a lack of in-service training programs, shortage of nurses and the nature of work in the current unit that require the presence of nurse throughout the shift as close as possible to their patients. This result is similar to that of **Morkes et al., (2018)**. On the other hand, this finding is contradicted with **Chen et al., (2022)** in that the majority of the nurses had received training on VA, as their study was conducted in public and private hospitals in China.

Regarding nurses' knowledge of general information about permanent vascular access, the current study reported that, more than two-fifths of the studied nurses had poor knowledge, which might be interpreted by that: the majority of the studied nurses didn't attend any training courses about VA, and the nurses are overwhelmed with many personal duties. This finding is in agreement with a study conducted by **Chen et al., (2022)** in that the knowledge of VA among their HD nurses was unsatisfactory, especially in VA assessment and AVF puncture techniques. On the other hand, the study of **Sagiron and Jarelnape., (2022)** is contradicting this finding in that, the studied nurses had sufficient knowledge regarding HD procedure which might be interpreted by conduction of continuous educational and training programs in their HD unit.

Regarding phases of permanent vascular access care, more than two-thirds of the studied nurses had poor knowledge, this finding may be due to nurses' years of experience as the majority of the studied nurses had one to less than five years of experience in the current unit which may be insufficient

time for nurses to be knowledgeable about dialysis and VA care. This finding is in line with **Ibrahim et al., (2022)** in that the highest percent of their subjects had poor knowledge regarding AVF care. Contrarily, this finding contradicts with **Hanafy et al., (2022)** as the majority of their studied nurses had satisfactory knowledge about the care of AVF, as the majority of their subjects attended training courses about VA care.

In relation to permanent VA complications, more than two-thirds of the studied nurses had poor knowledge, this finding might be interpreted by that; the highest percent of the studied nurses had less than five years of experience; more than half of them had their previous experience in the neonatal intensive care unit. This result is in harmony with those of **Mahmood & Mohamed., (2016), Abdel-Latif et al., (2019)** and **Hanafy et al., (2022)** as the majority of their nurses had poor knowledge of complications of AVF and AVG devices for HD patients.

Concerning the overall nurses' knowledge regarding permanent vascular access care, the present study revealed that more than half of the studied nurses had poor knowledge, in spite of that all the studied nurses had a bachelor degree of nursing, this result may interpreted by that almost all of the studied nurses didn't attend any education courses about permanent VA. This finding corresponds with a study conducted by **Yousif et al., (2017)**. In contrast, this finding isn't in parallel with those of **Huang and Liu., (2024), Meng et al., (2023)**, **Meng et al., (2024)** and **Hanafy et al., (2022)** in that most of their participants had satisfactory knowledge level regarding VA care.

In relation to nurses' practices regarding permanent vascular access care, nurses' practices in the pre-cannulation

phase immediately before starting dialysis session, were incompetent. This may be interpreted by the lack of time and the shortage in the number of nurses responsible for patient care (as every nurse was assigned for three patients per shift), as well as the lack of supervision by senior staff. This result is consistent with a study conducted by **Gomaa et al., (2024)** and **Moursy and Sharaf., (2017)** as they indicated that most of HD nurses had poor practices regarding preparation for themselves and preparation for HD patients. In contrast, **Ali et al., (2018)** reported that the HD preparation phase in their study had sufficient practices in all items.

Regarding nurses' practices in cannulation technique at starting of dialysis session, the majority of the studied nurses had competent practices, in spite of having poor knowledge about cannulation techniques but they gained the skill through their daily practice in cannulation by imitating each other. This result is similar to that of **Hanafy et al., (2022)**. Conversely, the results of **Gomaa et al., (2024)** and **Parisotto et al., (2017)** contradict with this finding, as they found that most of the HD nurses had incompetent practices concerning cannulation practices; they interpreted that by inadequate supervision, and lacking in knowledge, skills, and lack of training courses for their subjects.

In relation to nurses' practices during the dialysis session, the present study revealed that more than half of the studied nurses had incompetent practices. This finding may be due to inadequate nurse-to-patient ratio and increased workload. This finding is in parallel with studies conducted by **Gomaa et al., (2024)**, and **Alramadhan et al., (2019)** in that the majority of HD nurses had

poor level of practices in monitoring patient condition during HD procedure.

Regarding nurses' practices in VA decannulation immediately after finishing the dialysis session, it was noticed that half of the studied nurses had incompetent practices. This finding may be attributed to shortage of supplies and nurses desire to finish their shift and delegate the responsibility to the next shift. This is in accordance with the results of **Gomaa et al., (2024),** and **Mohammed and Baeez., (2023)** who reported that most of their HD nurses performed all items of nurses' practices for post-HD nursing management incompletely.

As for, overall nurses' levels of practices regarding permanent vascular access care; the present study revealed that more than three-quarters of the studied nurses had incompetent practices. This finding may be interpreted by that the highest percent of the studied nurses had less than five years of experience in the current unit, all nurses were females and more occupied with their personal responsibilities, lack of training courses or guidelines posters in hospital, lack of supervision inside unit from head nurse, which was noticed by the researcher during data collection. Also, it was noticed that nurses depend only on imitating each other to master practices.

This result is in line with the studies conducted in Egypt by **Ibrahim et al., (2022), Abdel-Latif et al., (2019), Hanafy et al., (2022) and Tahoun et al., (2022),** as they reported that almost all of the studied nurses had unsatisfactory level of total practices about VA care. However, this study is in contrast with a study conducted in Singapore by **Meng et al., (2024)** in that the majority of the studied nurses had a satisfactory level of

total practices of VA care, this may be due to the large sample as five hundred sixteen dialysis nurses participated the survey from different settings.

For a better understanding of the results, it was essential to explore the relationship between the studied nurses' knowledge, practices levels, and their demographic, and academic characteristics. Regarding this, the current study revealed that there was no significant relationship between the studied nurses' knowledge, practices levels and their demographic, academic characteristics; this result may be due to the majority of the studied nurses from the same age, gender, level of education, years of experience and not attending a training course. This result is congruent with that of **Bakey., (2014)**. Conversely, this result contradicts with **Mahmood & Mohamed., (2016)** as they stated that there was a significant relationship between the studied nurses' age, level of education, years of experience in HD units, attendance training sessions, and nurses' knowledge, practices toward vascular access devices .

As for the correlation between the studied nurses' overall knowledge and their overall practices regarding permanent VA care, the study revealed that there was a highly significant positive weak correlation which may be interpreted by the influence of knowledge in practice as the nurses who had poor knowledge, sequentially had incompetent practice. To the best of our knowledge VA related care throughout HD session is not included as a part of theory or clinical teaching in educational nursing curricula, so nurses depend on imitating their seniors to develop their practices in HD unit. This finding is in line with studies conducted in Egypt by **Mohammed et al., (2017)**, and **Ibrahim**

et al., (2022). Moreover, this finding is consistent with the study of **Mahmood & Mohamed., (2016)** in Baghdad. In contrast, this result is contradicted with the findings of **Tahoun et al., (2022)** as they reported no statistical significant correlation between overall knowledge and overall practice where all their subjects had good knowledge and unsatisfactory level of practice, as they studied only tCVC.

Based on the current results, it can be inferred that nurses are lacking knowledge and practices concerning the care of permanent VA among HD patients. Hence, it is essential for regular assessment of nurses' knowledge and practices of this aspect. Besides, further improvement and training of permanent VA care is continuously needed to implement necessary changes for enhancing the quality of nursing care.

Limitations of the study:

- The sample was not representative; as subjects in the present study were all females and they had bachelor degree which might not be accepted to generalize the results.

Conclusion

In light of the current study, it can be concluded that the highest percent of the studied nurses had poor overall knowledge and incompetent practices regarding permanent VA care.

Recommendations
Based on the findings of the current study the following recommendations can be suggested:
Recommendation for nurses:
- Implementing updated pre-service and periodic in-service programs to the HD nurses to improve their

knowledge and practices regarding permanent vascular access care throughout HD session and the VA related complications.

Recommendation for head nurses and administration:

- An update manual procedures, posters and comprehensive booklet that include permanent VA care guidelines should be available in each HD unit.
- Newly employed nurses in HD unit are required to successfully complete a test of basic knowledge and skills before assuming independent responsibility for dealing with VA and connecting patient to machine.
- Availability of competent and qualified team to be responsible for training the junior nurses about VA care in HD unit.
- Adequate facilities and supplies should be available in HD unit.

Recommendations for education:

- Include nursing care of VA throughout HD session in nursing baccalaureate programs.

Recommendations for further studies:

- Replication of this study on both genders, different nursing qualifications, using a large study sample of HD nurses, from different geographical area for generalization.
- Study the effect of implementing education program on nurses' knowledge and practices regarding permanent VA among patients on HD.
- Explore the relationship between nursing care of permanent VA and occurrence of VA complications among patients on HD.

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