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Original Article

The Effect of an Educational Program for Vascular Access Care on Nurses' Knowledge at Dialysis Centers in Khartoum State, Sudan

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ABSTRACT. End-stage renal disease is a worldwide problem that requires highly skilled nursing care. Hemodialysis (HD) is a corner-stone procedure in the management of most patients who require renal replacement therapy. Adequate vascular access is essential for the successful use of HD. Appropriate knowledge in taking care of vascular access is essential for minimizing complications and accurately recognizing vascular access-related problems. This study was to evaluate the effect of an educational program for vascular access care on nurses' knowledge at nine dialysis centers in Khartoum State. This was a Quasi experimental study (pre- and post-test for the same group). Sixty-one nurses working in these HD centers were chosen by simple random sampling method. A structured face-to-face interview questionnaire based on the Kidney Dialysis Outcome Quality Initiative (K/DOQI) clinical practice guidelines for vascular access care was used. Instrument validity was determined through content validity by a panel of experts. Reliability of the instrument was tested by a pilot study to test the knowledge scores for 15 nurses. The Pearson correlation coefficient obtained was (r = 0.82). Data collection was taken before and after the educational intervention. A follow-up test was performed three month later, using the same data collection tools. Twenty-two individual variables assessing the knowledge levels in aspects related to the six K/DOQI guidelines showed improvement in all scores of the nurses' knowledge after the educational intervention; and the differences from the preeducational scores were statistically significant (P < 0.001). The study showed that a structured educational program based on the K/DOQI clinical practice guidelines had a significant impact on the dialysis nurses knowledge in caring for vascular access in HD patients. The knowledge level attained was maintained for at least three months after the educational intervention.

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Introduction

The integrity of vascular access for hemodialysis (HD) is closely associated with the outcome of dialysis.[1] Central venous catheters (CVCs) are less favorable because of

the high rate of infections associated with their use for HD.[2,3] However, a large number of dialysis patients use CVC as access for HD, especially in the early phases of dialysis therapy.[4] In the 2009, US renal data system reported that 82% of 101,688 patients who began HD in 2007 did so using CVC.[4] Initiation of HD with CVC was associated with a two to three-fold increase in the risk of death compared with those using arteriovenous fistula (AVF) and arteriovenous graft (AVG).[3]

The American National Kidney Foundation published Kidney Dialysis Outcome Quality Initiative (K/DOQI) which have provided a list of techniques that could be applied for monitoring and surveillance of vascular accesses.[5]

HD patients with poor personal hygiene habits should be taught by nurses how to improve and maintain their personal hygiene.[6] In addition, there is a higher rate of complications in HD vascular access when new or inexperienced dialysis staff manipulates the vascular access.[7] The nephrology nursing staff has a great role in tracking the occurrence of complications such as catheter exit site infection, thrombosis, and bleeding, as they can help identify the source and allow corrective action to be taken.[8-12]

Internationally, hospitals and medical facilities usually keep track of nurses' skills, abilities and education both for regulatory compliance and to ensure the delivery of the best possible care to patients.[9]

In Sudan, a study was conducted in 2009 as a national survey for chronic kidney disease patients maintained on renal replacement therapy.[13] At that time, there were 41 active HD centers in the country serving a total of 2858 patients. In that study, patients were reported as being dialyzed through CVC and AVF though no percentages were given for the respective use of the vascular access type. Current data from the Sudan National Kidney Center reported the total number of patients being dialyzed in Khartoum State as being 3008 patients (personal communication).

The aim of this study is to evaluate the effect of an educational program using the protocols and recommendations of the K/DOQI guidelines for vascular access care on dialysis nurses' knowledge at nine dialysis centers in Khartoum State, Sudan.

Materials and Methods

This was a Quasi experimental study with pre- and post-test one-group design, conducted for nurses working in nine dialysis centers at Khartoum state in the period from January 2013 to July 2013. There were 17 HD centers serving 3000 patients in Khartoum State at the time of the study. Of these, nine governmental centers were randomly selected for performing the study. The total number of dialysis nurses working in these nine centers was 167 nurses, and they were all willing to participate in the study. The sample size (n=61) required for the study was calculated using the following mathematical equation:[14]

$$N = \frac{(z_{1-\alpha} + z_{1-\beta})^2}{\Delta^2} + \frac{z_{1-\alpha}^2}{2}$$

These were randomly selected out of the total nurses working in the nine dialysis centers.

Inclusion and exclusion criteria

Nurses with Bachelor degree in Nursing and those holding Master of Science in Nursing working in the nine appointed dialysis centers, and willing to participate in the study were enrolled for the study. Their working experience in HD was required to be at least one year. Nurses who had formal training of K/DOQI guidelines and those who participated in the pilot study were excluded from the study.

Data collection tools

A structured, face-to-face interview questionnaire was constructed by the researcher (KIY) and accepted for content validity by a panel of expert nephrologists. The questionnaire consisted of 28 multiple-choice questions based on of K/DOQI guidelines. Reliability of the instrument was determined by a pilot test for the assessment of 15 nurses' knowledge taken before the intervention. Pearson correlation coefficient for reliability was (r = 0.82). Twenty-

two paired variables were tested before and after the educational intervention. These covered the knowledge of aspects related to measures necessary for infection control, steps needed for correct handling the AVF, ability to diagnose and assess vascular access complications, the correct steps needed for dialysis catheter hub and cap cleaning, and the ability to correctly assess and manage catheter dysfunction. These aspects were based on six guidelines from K/DOQI.[5] These were: Guideline 3 (for AVF fistula needle cannulation); Guideline 5 (for vascular access physical examination); Guideline 7 (for identification and management of catheter dysfunction); Guideline 13 (for infection control measures in the dialysis settings); Guideline 14 (for AVF fistula care); and Guidelines 15 (for HD catheter care). Data collection was taken before and after the educational intervention. This was followed up by a repeat test three months later, using the same data collection tools. Statistical tests used were the paired *t*-test, 95% confidence interval (C.I.). Pearson correlation coefficient was used to summarize the magnitude and to determine the relationship between the variables.

Ethical considerations

The research protocol was examined and approved by the Research Committee on Human Subjects (Medical) of the University of Khartoum postgraduates studies.

Ethical approval for this study was also obtained from each of the hospitals in which the dialysis centers were based.

No financial incentives were provided and the participants were not under pressure to take part in the study. Respondents had the right to withdraw any time if they so wished.

Results

Demographic data

The calculated and recruited sample size was 61 nurses. Four participants dropped out of the study before completion for personal and family reasons. Fifty-seven nurses (94%) completed the study. Mean age of the study sample was 34.31 years (range 25–50, standard deviation ± 6.59). The majority of the nurses (72%) were younger than 36 years of age (Figure 1). There were 47 female nurses (82.5%) involved in this study. Seventy-five percent of the nurses were university graduates, and 25% of the participants had Master degrees in nursing. Most of the nurses (89.5%) had experience in HD between 1 and 10 years.

The state of nurses' knowledge

The majority of the nurses (89.5%) attained a score of knowledge less than "good" before the educational intervention. Their knowledge score improved dramatically after the intervention so

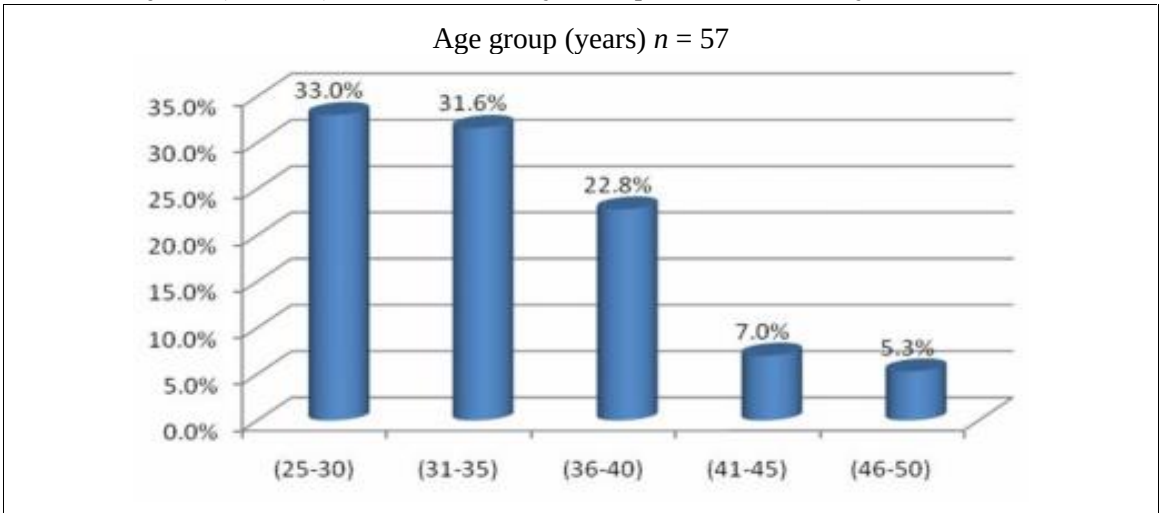

Figure 1. The age distribution of the study sample. Age group (years) *n* = 57.

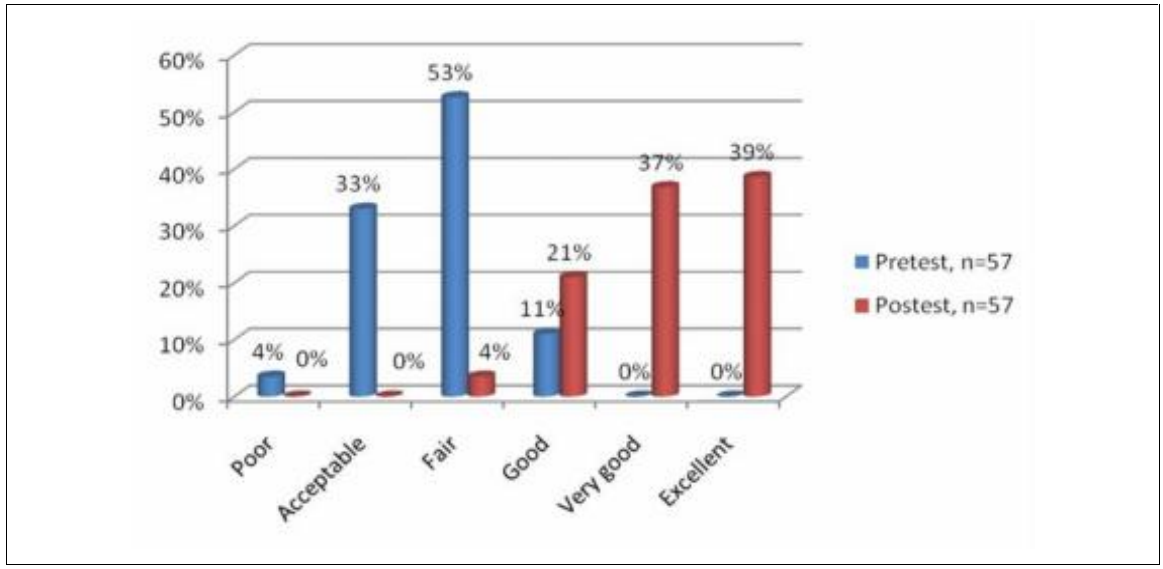

Figure 2. Comparison between the levels of knowledge among nurses participating in the study before and after the educational intervention.

that 75% of them scored levels of "very good" to "Excellent" (Figure 2).

Table 1 shows the difference between the scores in the two stages of the nurses' knowledge. The statistical difference between the level of knowledge attained before and after the educational intervention was highly significant (P <0.001; 95% C.I.s - 26.35–−22.91).

Table 2 shows details of the knowledge variables related to infection control tested before and after the educational intervention. There was a statistically significant difference in the improvement of the scores attained after the educational intervention (P <0.001).

Similar results were obtained in variables related AVF care (Table 3). Almost identical results were obtained in the assessment of nurses' knowledge before and after educational intervention in variables related to CVC care, heparinization procedures, AVF cannulation techniques and identifying AVF complications.

Table 1. Overall score of nurses' knowledge before and after the educational intervention.

Variable	Maximum score	Pretest		Posttest		95% C.I.		*t*	df	*P*
		Mean	SD	Mean	SD	Lower	Upper			
Knowledge total scores	100	61.3	7.2	85.9	8	-26.4	-22.9	-29	56	<0.001

SD: Standard deviation, C.I.: Confidence interval.

Table 2. Assessment of nurses' knowledge in infection control precautions before and after the educational intervention (n = 57, df = 56).

Variable*	Pretest		Posttest		95% C.I.		*t*	*P*
	Mean	SD	Mean	SE	Lower	Upper		
Infection control precautions	4.51	0.658	4.89	0.105	−0.6	−0.175	−3.659	<0.001
Assess catheter care	3.58	0.731	4.47	0.124	−1.14	−0.646	−7.195	<0.001
Fistula assessment	3.19	0.953	4.63	0.132	−1.7	−1.173	−10.86	<0.001
Fistula stenosis	1.91	1.138	3.35	0.192	−1.82	−1.053	−7.481	<0.001
Cannulation off dialysis	2.32	0.848	4.65	0.126	−2.59	−2.081	−18.52	<0.001

*Each of the above variables has a maximum score of 5.

Table 3. Effect of the educational program on nurses handling the AVF (n = 57; df = 56).

Variable*	Pretest		Posttest		95% C.I.		t	P
	Mean	SD	Mean	SE	Lower	Upper		
AVF infection assessment	3.19	0.953	4.63	0.132	-1.7	-1.173	-10.858	<0.001
Diagnosis of AVF stenosis	1.91	1.138	3.35	0.192	-1.82	-1.053	-7.481	<0.001
Cannulation of new AVF	2.32	0.848	4.65	0.126	-2.59	-2.081	-18.52	<0.001

*Each of the above variables has a maximum score of 5. AVF: Arterio-venous fistula

Follow-up evaluation of state of knowledge

To test the degree of maintenance of knowledge gained from our educational intervention, a follow-up evaluation of knowledge was performed three months after the study was over. There was a slight deterioration in the immediate postknowledge test compared to the follow-up test performed three months later, but the difference did not attain statistical significance.

Correlation between the level of nurses' education and knowledge scores

There was a positive Pearson correlation between the nurses' knowledge scores and level of qualification. Nurses who had postgraduate qualifications in nursing attained significantly higher scores in knowledge compared to nurses who had Bachelor degrees (correlation at P = 0.01 level).

Discussion

Fifty-seven dialysis nurses were randomly selected from nine different HD centers in Khartoum State to participate in this study. The majority of the nurses (82.5%) were females. This reflects the general nursing situation in Sudan, where most of the nursing is carried out by females.[15] The mean age of the study sample was 34.31 years, and the majority of the nurses (72%) were younger than 36 years of age. This is consistent with the findings of Serwan Jafar[16] who showed, in a study conducted at Baghdad teaching hospitals, that the majority of HD nurses were 30 years of age or younger. Similar findings were reported by Uğur[17] who stated that (73.9%) of nurses in HD units in Ankara were under 30 years of age. This, perhaps, reflects the demanding nature of dialysis service so that older nurses may find it difficult to cope with the load of work required. Almost 90% of the nurses had experience in HD practice ranging from one to 10 years, and 47% of them had experience of more than five years in HD.

In our study there was a positive correlation between the degree of education and scores attained in knowledge level, with nurses who had obtained Master degrees in nursing did better than with nurses with only Bachelor degrees. In this study, the participating nurses were subjected to a unified test before the educational intervention based on the K/DOQI clinical practice guidelines for vascular access care[18] using an interview questionnaire. When the same questionnaire was repeated after the educational intervention, there was a significant improvement in the level of knowledge. These findings are in agreement with a study from Nepal which showed that the overall knowledge level of the participants improved from 50% to 75% after applying an educational program in vascular access care (P = 0.001).[19]

There are several publications that show the importance of proper assessment of HD vascular access complications with aim of reduction of morbidity and vascular access loss.[20,21] In this study, the educational interventions resulted in significant improvement in the nurses' knowledge in all these aspects. The nurses enrolled in our study showed significant improvement in their understanding of infection control measures. Hemodialysis access dysfunction has been shown to increase the morbidity and mortality. Moreover, it adds to higher health care costs.[22,23]

In our study there was a highly significant difference in our nurses' knowledge between the paired examinations in all aspects related to these assessments.

Conclusion

The study showed that a 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. The knowledge level attained was maintained for at least three months after the educational intervention.

Acknowledgment

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The authors declare no financial or other conflict of interests in relationship with a company/organization or commercial identities.

Conflict of interest: None declared.

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