

Effect of Nursing Intervention on Controlling Interdialytic Weight and Vascular Access Complications among Patients Undergoing Hemodialysis

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Abstract: Background: Chronic kidney disease has become a major chronic health problem worldwide and the need for development of educational interventions which help patients to better manage their conditions is evident internationally. It has been recognized that poor adherence can be a serious risk to the health and wellbeing of patients. Adherence to fluid restrictions, dietary and medication guidelines as well as attendance at prescribed hemodialysis sessions are essential for adequate management of chronic kidney disease. Purpose to examine the effect of nursing intervention on controlling interdialytic weight and vascular access complications among patients undergoing hemodialysis. **Setting:** Hemodialysis unit in Menoufia University and Shebin El-Kom Teaching Hospitals. **Sampling:** A consecutive sample of 100 adult patients on hemodialysis were selected and divided alternatively into two equal groups: 50 patients for each group (study - control). **Instruments:** two instruments were used for data collection: Structured interview questionnaire, and biophysiological measurement instrument. **Results:** There was significant improvement among study group than control group one month and three months post intervention regarding total knowledge score, interdialytic weight and vascular access complications. **Conclusions:** Nursing intervention is proven to be effective in controlling interdialytic weight and vascular access complications. **Recommendations:** Supervised nursing intervention should be carried out for all hemodialysis patients and colored booklet should be available and distributed for all patients.

Key words: Hemodialysis, Interdialytic weight, Nursing, Vascular access complications

Introduction

Chronic kidney disease (CKD) is an irreversible progressive condition with high morbidity and mortality by means of an increase in incidence and prevalence, poor outcomes along with high cost. Lifelong treatment and lifestyle modifications are difficult to adapt, which significantly impairs treatment adherence and quality of life (James et al., 2021).

The worldwide prevalence of kidney disease exceeds 850 million with 843.6 million accounted for by chronic kidney disease (Jager et al., 2019). The prevalence of end stage renal disease in Egypt raised to 483 patients per million according to 9th Annual Report of The Egyptian Renal Registry provided by Egyptian Society of Nephrology and Transplantation (El-Ballat et al., 2019).

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Hemodialysis is a major healthcare intervention for patients with renal failure and end-stage renal disease. An efficient hemodialysis treatment requires at least three sessions per week, with each session running for three to four hours and effective adherence to the diet, fluid, and following medical instructions. Adherence to the treatment regimen has proven to be difficult in patients undergoing Hemodialysis worldwide (Macdougall et al., 2019).

Compliance to the therapeutic regimen is important for achieving optimal, effective, and successful hemodialysis outcomes. compliance is a crucial factor that helps patients achieve good therapeutic results (Naalweh et al., 2017). However, failure to adhere to the hemodialysis regimen can lead to serious and occasionally fatal conditions, such as hypertension, muscle cramps, arteriovenous fistula (AVF) blockage, dyspnea associated with pulmonary edema, or heart attack due to hyperkalemia, and can lead to poor quality of life, decreased life expectancy, increased morbidity, mortality, and a higher cost and burden on the health care system (Suganthi et al., 2019).

The process of adherence to treatment in hemodialysis method includes diet, fluid intake, drug management, participation in dialysis sessions and completion of sessions (Ok & Kutlu, 2019).

Excessive fluid intake leads to shortness of breath, headache, abdominal distension, edema, hypertension and heart failure (Wong et al., 2017). It also causes disorders in cognitive functions, an increase in hospitalization and mortality (Naalweh et al., 2017).

Non adherence to each dietary component causes different problems in patients. The lack of compliance

with sodium intake causes excessive fluid intake and associated increase in total body fluid and interdialytic weight; incompatibility in phosphorus intake causes disorders in mineral metabolism and cardiovascular diseases; incompatibility in potassium intake causes arrhythmias and increase in mortality; and incompatibility in protein intake causes complications and increase in mortality due to increase in urea (Ko et al., 2017).

Medication and dietary non-adherence in hemodialysis patients could lead to serious negative consequences including poor health outcomes and increased morbidity and mortality (Milazi et al., 2017). Nursing intervention is beneficial for raising dialysis compliance, providing evidence to strengthen nursing care for end stage renal disease patients administered with dialysis in daily clinical practice (Wang et al., 2018). Nursing intervention includes application of behavioral, educational, cognitive and dietary techniques that has proven to have positive effects on the emotional and physical health of patients with end stage renal disease (Wang et al., 2017).

Purpose:

The purpose of the current study was to determine the effect of nursing intervention on controlling interdialytic weight and vascular access complications among patients undergoing hemodialysis.

Research Hypotheses

The following research hypotheses were formulated to achieve the purpose of the study: -

- Patients in the study group who follow the nursing intervention are expected to exhibit more control of the interdialytic weight than patients who don't (control group).

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- Patients in the study group who follow the nursing intervention are expected to have fewer vascular access complications than patients who don't (control group).

Method

Research design:

A quasi-experimental research design was utilized to achieve the purpose of this study.

Setting:

The study was conducted at the hemodialysis unit in Menoufia University and Shebin El-Kom Teaching Hospitals.

Sampling:

A consecutive sample of 100 hemodialysis patients were assigned randomly and alternatively into two equal groups, 50 patients for each group:

- Study group (I): Exposed to the nursing intervention along with routine hospital care.
- Control group (II): Exposed only to routine hospital care.

Inclusion criteria:

The study subjects were selected according to the following criteria:

- Adult patients (18 - 65 years old).
- Chronic cases undergoing hemodialysis for at least 2 months for 3times / week regularly.
- Have not received any educational intervention regarding his/ her illness and its care.

Exclusion criteria:

- Patients who are critically ill and unable to communicate

Sampling technique:

- The participants of the study were chosen from hemodialysis unit in Menoufia University and Shebin El-Kom teaching hospitals. The sample size was determined based on the

following equation: $n = (z^2 \times p \times q) / D^2$.

- Z= the value from the standard normal distribution reflecting the confidence level that will be used 1.96 for confidence 95%.
- P = proportion.
q = 1- proportion.
D2 = margin of error.

Instruments of the study:

Based on the review of relevant literature (Wang et al., 2018), two instruments were used by the researcher for data collection, these instruments were:

Instrument I: Patients knowledge structured interview questionnaire:

It was developed by the researcher to assess social, and patient's knowledge regarding hemodialysis and therapeutic regimen. It contained three parts:

1. **Part one: Patient's Social characteristics:** It contained nine questions related to patient's age, gender, education, occupation, marital status, monthly income, family member's number, and residence.
2. **Part two: Medical data:** It contained seven questions about intake of stimulant drinks, smoking, duration of dialysis treatment, duration of dialysis sessions, complain during hemodialysis sessions, complain of other diseases, and family history of chronic renal failure.
3. **Part three: Patient's knowledge:** It included 22 questions divided into three sections as follows:
 - **Section one:** Patient's knowledge about renal failure:
It was contained 4 questions related to patient's knowledge about definition, causes, clinical manifestations, methods of treatment of renal failure.

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- **Section two:** Patient's knowledge about hemodialysis:

It included 5 questions related to patient's knowledge about definition, indications, and contraindications, complications of hemodialysis and care of hemodialysis vascular access.

- **Section three:** Patient's knowledge about hemodialysis therapeutic regimen:

It involved 13 questions related to patient's knowledge about medications for hemodialysis, medications at the end of hemodialysis sessions, diet for hemodialysis, diet rich in protein, potassium and sodium, allowed amount of fluid, forbidden drinks for hemodialysis, complications of drinking a lot of fluid, periodic investigations for hemodialysis, definition of compliance to therapeutic regimen, and complications of non-compliance to therapeutic regimen.

Scoring system:

Each question was given two marks if the subject reported completely correct answer, one mark if he /she reported incompletely correct answer and zero if the answer was incorrect or I don't know. All questions were summed to give a score ranged from zero to forty-four. The greater the score the better the knowledge.

Instrument II: Biophysiological measurement tool:

It was constructed by the researcher to assess patient's interdialytic weight gain and vascular access complications. It comprised of two parts as the following:

- Part one: Estimation of interdialytic weight gain: It comprised of assessment of pre-dialysis weight, post dialysis weight and interdialytic weight gain.
- Part two: vascular access complications assessment: It was comprised of

assessment of complications such as bleeding, edema, inflammation, failure, and blood clotting.

Reliability:

The study instruments were tested using a test- retest method to ascertain consistency. The period between both tests was two weeks. The results were 0.97 for first instrument and 0.91 for the second one.

Pilot study:

A pilot study was conducted prior to data collection on 10% of the study sample (ten patients) to test the feasibility, clarity and applicability of the instruments then necessary modifications were done. These patients were excluded from the study sample.

Ethical Considerations:

An agreement from the Faculty of Nursing Ethical ethical commitment was obtained from ethical and research committee of the Faculty of Nursing, Menoufia University. A verbal and written agreement to participate in this study was obtained from subjects who met the inclusion criteria after explanation of the purpose of study. Each participant was reassured that any obtained information would be confidential and would only be used for the study purpose. The researcher emphasized that participation in the study was entirely voluntary and anonymity of the patients were assured through coding data. Participants were also informed that they can withdraw from the study at any time without penalty and refusal to participate wouldn't affect their care. Moreover, they were assured that the nature of the questionnaire didn't cause any physical or emotional harm to them.

Procedure:

An official letter was submitted from the Dean of the Faculty of Nursing to the directors of Menoufia University

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hospital and Shebin El Kom Teaching hospital explaining the purpose of the study and methods of data collection. Then, a written approval to conduct the study was obtained.

Data collection extended over a period of 8 months from November 2020 to June 2021. Patients who agreed to participate in the study and fulfilled the inclusion criteria were assigned randomly into two equal groups (study group (I) and control group (II)).

Each patient was individually assessed for social characteristics, medical data and knowledge about renal failure, hemodialysis, and therapeutic regimen, pre-dialysis weight, post dialysis weight (using instrument one). Interdialytic weight gain using part one of the second instrument and complications of hemodialysis vascular access. The researcher started to assess the control group at first. The assessment phase lasted between 20-30 minutes

Accordingly, a colored booklet supported with illustrative pictures was prepared. It included information about renal failure (Definition, types, causes, clinical manifestations, and treatment), hemodialysis (definition, indications and complications), vascular access (definition, types, and care of vascular access), therapeutic regimen (dietary restrictions, fluid restriction, medication adherence, importance of adherence to therapeutic regimen, and complication of non-adherence).

In the study group, patients received health education as well as routine hospital care. The researcher distributed the prepared booklet between each patient in group 1 (study group) before starting session I. In each session lectures and discussions were used. Each teaching session was started by a brief summary about information provided at prior sessions. . At the end of each teaching session a

follow-up session was conducted to emphasize on the received information through asking questions and answering any question.

First session included information about renal failure definition, types, causes, clinical manifestations, stages and treatment were illustrated. At the end of this session the researcher allowed patients to ask questions and provided them with the answers. During the second session, the researcher provided education about hemodialysis definition, indications, contraindications and complications. Also, patients received information regarding periodical investigations for hemodialysis patients

In the third session, the researcher provided education about vascular access (definition, types, complications, and care of hemodialysis vascular access and medications commonly prescribed for hemodialysis patients. The fourth session included dietary restriction of sodium, potassium, phosphorus and fat and allowed amount of fluids per day importance of adherence to therapeutic regimen and complications of non-adherence).

Posttest was carried out 1 month after the last teaching session. and 3 months after intervention in order to determine the effectiveness of nursing intervention using instrument I part three and instrument II.

Statistical analysis

The collected data were organized, tabulated and statistically analyzed using SPSS software (Statistical Package for the Social Sciences, version 28, SPSS Inc. Chicago, IL, USA). For quantitative data, the range, mean and standard deviation were calculated. For qualitative data, frequency and percentage were used Chi-square test (χ^2) was used for comparison between groups. T test was

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used for comparison between means Z value of Mann-Whitney test and Kruskal-Wallis (χ^2). Correlation between variables was evaluated using Pearson's correlation coefficient (r).

Results:

Table 1 shows Distribution of both study and control groups according to their social characteristics. This table shows that there were no statistical significant differences between both groups regarding all social characteristics.

Table 2 shows distribution of patients in the study and control groups according to their medical data. This table reveals that there were no statistically significant differences between both study and control groups regarding almost all medical data.

Table 3 displays distribution of patients in the study and control groups according to their level of knowledge on pre and post intervention. It is evident that about two thirds of both groups (66.0%) had poor total knowledge score pre intervention that was decreased to 2.0 % three months post intervention among study group compared to 62.0% among control group. Therefore, there were very highly statistical significant difference between patients in the study group

than control group one month and three months post intervention (P=0.000*).

Table 4 illustrates mean and standard deviation of pre-dialysis weight, post dialysis weight and interdialytic weight gain among study and control groups pre and post intervention. This table shows that patients in the study group had more weight control than patients in the control group. Therefore, there were very highly statistical significant differences in controlling of weights of patients in the study and control groups on pre-dialysis, one month post intervention and three months post intervention.

Table 5 clarifies the distribution of patients in the study and control groups according to the presence of vascular access complications pre intervention, 1 month post intervention and 3 months post intervention. This table shows that after three months. of intervention, vascular access complications had been reduced among study group to 0%, 0%, 4%, 0%, and 0% respectively compared to 2%, 48%, 100%, 30%, and 8% respectively in the control group. There was a statistical significant reduction of vascular access complications among patients in the study group compared to control group.

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Table (1): Distribution of both study and control groups according to their social characteristics

Social characteristics	Studied patients (n= 100)				X2	P-value
	Study group (n=50)		Control group (n=50)			
	No	%	No	%		
• Age						
20 <30	4	8.0	1	2.0	9.195	.056
30 < 40	8	16.0	3	6.0		
40 <50	5	10.0	13	26.0		
50 <60	16	32.0	11	22.0		
60+	17	34.0	22	44.0		
Min –Max Mean ±SD	23-75 52.32±10.92		23-62 52.64±9.25			
• Gender					.160	.689
Male	25	50.0	27	54.0		
Female	25	50.0	23	46.0		
• Level of education					2.821	.420
Illiterate	26	52.0	32	64.0		
basic	2	4.0	3	6.0		
secondary	21	42.0	15	30.0		
high or post graduate	1	2.0	0	0.0%		
• Occupation					.208	.901
Worker	10	20.0	10	20.0		
house wife	25	50.0	23	46.0		
don't work or retired	15	30.0	17	34.0		
• Marital status					1.011	.603
Single	3	6.0	3	6.0		
Married	46	92.0	47	94.0		
Widow	1	2.0	0	0.0%		
• Income					.706	.401
Sufficient	9	18.0	6	12.0		
Insufficient	41	82.0	44	88.0		
• Residence					.543	.461
Rural	47	94.0	45	90.0		
Urban	3	6.0	5	10.0		
• Family members number					1.001	0.606
less than 3 members	5	10.0	4	8.0		
from 3 to 5 members	22	44.0	18	36.0		
five members or more	23	46.0	28	56.0		

****more than one answer selected**

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Table (2): Distribution of patients in the study and control groups according to their medical data

Medical data	Studied patients(n=100)				X2	p-value
	Study group (n=50)		Control group(n=50)			
	No	%	No	%		
Stimulant intake (coffee or tea)						
Yes	42	84.0	47	94.0	2.554	.110
No	8	16.0	3	6.0		
Number of stimulant intake	N=42		N=47			
one time	5	11.9	2	4.3	7.10	0.029*
two times	17	40.5	32	68.1		
three times or more	20	47.6	13	27.7		
Smoking						
Yes	2	4.0	5	10.0	1.382	.240
No	48	96.0	45	90.0		
Number of cigarettes	N=2		N=5			
less than one packet	2	100.0	5	100.0	7.00	0.008*
Starting of dialysis						
from 6 months to 1 year	1	2.0	1	2.0	4.075	.254
from 1 to 2 years	4	8.0	1	2.0		
from 2 to 5 years	2	4.0	0	0.0		
from 3 years or more	43	86.0	48	96.0		
Complaint during dialysis session						
Yes	37	74.0	40	80.0	0.508	0.476
No	13	26.0	10	20.0		
**Type of complaint during dialysis session	N=37		N=40			
Headache	0	0.0	1	2.5	40.18	.000
nausea or vomiting	5	13.5	0	0.0		
Hypotension	21	56.8	4	10.0		
muscle cramps	20	54.1	12	30.0		
muscle cramps and hypotension	5	13.5	33	82.5		
Complaint of other diseases						
Yes	36	72.0	43	86.0	2.954	.086
No	14	28.0	7	14.0		
**Type of disease	N=36		N=43			
Hypertension	28	77.8	28	65.1	8.455	.076
Diabetes	12	33.3	13	30.2		
heart disease	2	5.6	2	4.7		
hypertension and diabetes	3	8.3	16	37.2		
hypertension and heart disease	1	2.8	0	0.0		
Family history						
Yes	5	10.0	3	6.0	.543	.461
No	45	90.0	47	94.0		
Relative relation	N=5		N=3			
first degree	5	100.0	3	100.0		

*Statistically significant (P<0.05)

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Table (3): Distribution of patients in the study and control groups according to their level of knowledge on pre and post intervention

Level of total knowledge		Pre intervention		1 month post intervention		3 months post intervention		X ² / p-value Preintervention	X ² / p-value 1 month post intervention	X ² / p-value 3 months post intervention
		No	%	No	%	No	%			
Study group (n=50)	Good	2	4.0	22	44.0	37	74.0	0.366/ 0.833	42.14/ 0.000*	63.43/ 0.000*
	Average	15	30.0	24	48.0	12	24.0			
	Poor	33	66.0	4	8.0	1	2.0			
Control group (n=50)	Good	1	2.0	1	2.0	1	2.0			
	Average	16	32.0	17	34.0	18	36.0			
	Poor	33	66.0	32	64.0	31	62.0			

*Statistically significant (P<0.05)

Table (4): Mean and standard deviation of pre-dialysis weight, post dialysis weight and interdialytic weight gain among study and control groups pre and post intervention

weight	Studied hemodialysis patients (n=100)	Pre intervention			1 month post intervention			3 months post intervention		
		Mean	±SD	T p-value	Mean	±SD	T p-value	Mean	±SD	T p-value
Pre-dialysis weight	Study group	75.07	16.74	.091	71.35	16.66	3.362	71.31	16.50	3.812
	Control group	74.75	18.23	.927	74.87	18.15	.001*	75.13	18.17	.001*
Post dialysis weight	Study group	71.46	16.68	.052	69.95	16.54	3.092	69.91	16.53	3.119
	Control group	71.28	18.03	.959	71.27	18.05	.002*	71.32	17.95	.001*
Interdialytic weight gain	Study group	4.23	.809	.340	2.42	.477	11.093	1.44	.585	21.854
	Control group	4.17	.950	.735	3.77	.715	.000**	4.05	.608	.000**

Independent t test was used * Statistically significance p<0.05 ** highly statistically significance p<0.001

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Table (5): Distribution of patients in the study and control group according to the presence of vascular access complications pre intervention, 1 month post intervention and 3 months post intervention

Vascular access complications	Studied hemodialysis patients (n=100)	Pre intervention			1 month post intervention			3 months post intervention		
		No	%	X2 p-value	No	%	X2 p-value	No	%	X2 p-value
Bleeding	Study group	3	6.0	0.211	0	0.0	2.041	0	0.0	1.010
	Control group	2	4.0	0.646	2	4.0	0.153	1	2.0	0.315
Edema	Study group	29	58.0	2.154	0	0.0	36.98	0	0.0	31.579
	Control group	36	72.0	0.142	27	54.0	0.000**	24	48.0	0.000**
Inflammation	Study group	47	94.0	3.097	17	34.0	49.25	2	4.0	92.308
	Control group	50	100.0	0.079	50	100.0	0.000**	50	100.0	0.000**
Failure	Study group	14	28.0	0.190	0	0.0	17.647	0	0.0	17.647
	Control group	16	32.0	0.663	15	30.0	0.000**	15	30.0	0.000**
Blood clots	Study group	6	12.0	0.102	0	0.0	5.263	0	0.0	4.167
	Control group	5	10.0	0.749	4	8.0	0.022*	4	8.0	0.041*

**more than answer selected.

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Discussion:

Hemodialysis is a major healthcare intervention for patients with renal failure and end-stage renal disease. An efficient hemodialysis treatment requires at least three sessions per week, with each session running for three to four hours and effective adherence to the diet, fluid, and following medical instructions. Non-adherence to dialysis could be concerning because it can result in life threatening consequences. Failure of adherence in hemodialysis patients can increase morbidity, mortality, cost, and burden on the healthcare system (Alhawery et al., 2019). Educational and self-management interventions are frequently used to improve adherence to fluid intake, diet, and drug management in hemodialysis patients (Tao et al., 2020).

The current study showed that patients in the study group had a higher level of knowledge than patients in the control group one month and three months post intervention. These results are in line with Mohammed et al., (2017). Besides, it was similar to Abdel-Gawad et al., (2020) who mentioned that the mean total knowledge score is highly improved in study group on the 3rd and the last week post intervention than in control group. Also, it was in the same line with Vulpio et al., (2021) who revealed that patients' nutritional knowledge significantly improved one year after they received collective teaching and individual counseling.

Moreover, patients in the study group had higher level of knowledge on pre intervention than one and three months after intervention. These results were consistent with Alikari et al., (2018) who studied "the impact of education on knowledge, adherence and quality of life among patients on hemodialysis" and stated that prior to the intervention, both groups had

similar levels of knowledge. After the intervention, the increase in the knowledge of patients in the intervention group was significantly higher than patients in the control group. Besides, El Kareem & Fadlalmola (2020) reported that there was improvement in patient's knowledge from the pre to posttest after the implementation of the educational program about hemodialysis.

From the researcher's point of view, the low knowledge score before any intervention demonstrates that patients were in need for education while increased knowledge level after education demonstrates the effect of developed intervention.

Hypothesis I: Patients of study group who apply the nursing intervention exhibit control of the interdialytic weight than patients who don't (control group).

The present study revealed that there was significant improvement of interdialytic weight gain between patients in the study group than patients in the control group one month and three months post intervention. These results were in congruence with Matetiu et al., (2017) reported that the mean IDWG in the hemodialysis patients was significantly reduced at different time points from baseline to the 4th week, 10th week and 16th week after the patient education.

In the sameline, Shaker et al., (2018) who studied effect of hemodialysis patients' knowledge related to types of food rich fluid on interdialytic weight gain among hemodialysis patients concluded that improving knowledge of patients undergoing hemodialysis about types of food rich in fluids increases adherence to fluid intake which has a direct effect on decreasing interdialytic weight gain. From the

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researcher's point of view decreased interdialytic weight gain post intervention may be related to increased compliance to fluid restriction.

Hypothesis II: Patients of study group who apply the nursing intervention exhibit control of vascular access complications than patients who don't (control group).

The present study showed that there was a statistical significant reduction in vascular access complications among patients in the study group compared to patients in the control group as regards to edema, inflammation, failure, and blood clots after one month and three months post intervention. These results were in congruence with Sobh et al., (2019) who studied effect of nursing intervention on prevention of vascular access complications for patients undergoing regular hemodialysis and stated that complications were greatly increased in the 2nd month among patients in the control group as compared with patients in the study group and the difference was statistically significant could indicate the effectiveness of this nursing intervention to decrease these complications.

Also, Yang et al., (2019) stated that improving the level of arteriovenous fistula (AVF) self-care behavior by people receiving hemodialysis is an effective way to reduce the occurrence of complications and mortality in a research study entitled "Self-care behavior of hemodialysis patients with arteriovenous fistula in China: A multicenter, cross-sectional study".

In the same line, Zha et al., (2021) concluded that the implementation of multidisciplinary collaborative nursing intervention procedure can significantly promote maturation of arteriovenous fistula, effectively increase blood flow of arteriovenous

fistula, promote the growth of vessel diameter and reduce the occurrence of complications in dialysis patients.

From the researcher's point of view decreased incidence of vascular access complications post intervention may be related to increased compliance to care of vascular access.

I- Conclusions:

Patients in the study group who followed the nursing intervention exhibited more control of the interdialytic weight than patients who don't (control group). Patients in the study group who followed the nursing intervention had fewer vascular access complications than patients who didn't (control group).

II- Recommendations:

Based on the findings of the present study, the following recommendations are derived and suggested:

- Supervised health teaching regarding treatment regimen should be given for hemodialysis patients to improve their compliance behavior.
- A colored illustrative booklet should be available and distributed to all hemodialysis patients. It should include knowledge about disease, hemodialysis, therapeutic regimen (diet, medication, attendance to hemodialysis sessions and care of vascular access), importance of compliance to therapeutic regimen and consequences of non-compliance.

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