ORIGINAL RESEARCH

The Effectiveness of Preventive Nursing Interventions in Patients on Hemodialysis with Arteriovenous Fistulas and Their Value in Preventing Complications

Liang Yu, BSc; Xinghong Xu, BSc

ABSTRACT

Objective • To analyze the effectiveness of preventive nursing interventions in patients on hemodialysis with arteriovenous fistulas (AVF) and the value in preventing complications of the AVF.

Method • It was a randomized controlled trial that enrolled 60 patients on hemodialysis treated in our hospital from April 2019 to May 2021. All enrollments were divided into control group (n = 30) and study group (n = 30) by random table methods. The control group received conventional nursing methods, while the study group received preventive nursing methods. The incidence of AVF complications, blood flow in the AVF, levels of anxiety and depression, quality of life and nursing satisfaction were assessed and compared.

Results • The incidence of AVF complications in the study group after intervention was significantly lower than that in the control group. Blood flow in the AVF was much higher in the study group than in the control group. The anxiety and depression levels of patients in the study group after intervention were both lower than those of patients in the control group. Patients in the study group had a much better quality of life after intervention than those in the control group. The nursing satisfaction of patients in the study group after intervention was also higher than that of patients in the control group. In other words, patients in the study group were more satisfied with the way they had been cared for compared to those in the control group.

Conclusion • Preventive nursing interventions are effective in patients on hemodialysis. Not only do they reduce the incidence of AVF complications, they also improve blood flow in the AVF. In addition, they reduce such negative emotions as anxiety and depression, improves the patient's quality of life, as well as his or her satisfaction with care provision. (*Altern Ther Health Med.* [E-pub ahead of print.])

Liang Yu, BSc, Department of Nephrology; **Xinghong Xu, BSc,** Department of Hemodialysis; Anhui Wannan rehabilitation hospital The fifth people's hospital of Wuhu, Wuhu, China.

Corresponding author: Xinghong Xu, BSc
E-mail: xingfu76573047@163.com

INTRODUCTION

Patients in the nephrology department can experience abnormal developments in their renal organ functions, with common conditions including nephritis, nephrotic syndrome, renal dysfunction, and renal failure. Among these, renal failure is a severe kidney condition that can result from the progression of various renal diseases. Patients may exhibit symptoms such as fatigue, vomiting, and pruritus of the skin. In advanced stages, severely affected patients can experience altered consciousness or even coma, necessitating life-sustaining hemodialysis for their survival.[1] The hemodialysis machine performs most functions that should otherwise be performed by the kidneys, such as fluid, electrolyte and acid/base balance. Hemodialysis involves gaining access to the circulation, either through a central venous catheter or an arteriovenous fistula or graft. The patient's blood is pumped through a hemodialysis machine, which allows bidirectional diffusion of solutes between blood and the dialysate across a semipermeable membrane down a concentration gradient. The composition of the dialysate can be varied to achieve the desired gradient, and fluid can be removed by applying negative pressure to the dialysate side.

In patients with ESRD, vascular access for hemodialysis is gained by formation of an AVF, usually in the forearm. An AVF is a connection between an artery and a vein. It causes extra pressure and blood to flow into the vein, leading to distension and thickening of the venous wall (arterialization). The large vein provides easy and reliable access to the circulation. Without this kind of access, regular hemodialysis sessions would not be possible. The scholar Li Si[2] and other related studies have shown that the formation of an AVF is an

important way to gain vascular access for hemodialysis in patients with kidney failure, and forms the lifeline of treatment in these patients. AVFs have a high safety profile and can be used for a long time. However, it is prone to various complications caused by factors that are either intrinsic or extrinsic to the AVF, affecting not only the service life, but also the physical and mental health of patients, all of which may reduce the efficiency of hemodialysis.[4]

Corresponding and effective nursing intervention measures in patients on hemodialysis can reduce the incidence of AVF complications. Appropriate care is important to reduce complications. External application of TCM, Chinese herb, moxibustion, and massage have achieved good results in the prevention of AVF complications. External application of TCM such as safflower alcohol, golden ointment, and aloe vera is also effective in relieving hematoma. However, traditional nursing methods tend to prioritize only the essential care needs, often falling short of achieving more satisfactory treatment outcomes. In contrast, preventive nursing methods emphasize proactive interventions and individualized care, with a particular focus on early control of potential adverse events or complications to reduce the risks of such complications. It can help to maintain ease of access to the patient's circulation and enhances treatment effectiveness, ultimately contributing to higher treatment satisfaction among patients. This study selected 60 patients on hemodialysis treated in our hospital from April 2019 to May 2021 as the study subjects. The aim of the study was to determine the effectiveness of preventive nursing interventions in patients on hemodialysis, as well its value in preventing complications, with a view to providing corresponding reference for clinical application.

MATERIALS AND METHODS

General data

It was a randomized controlled trial that enrolled 60 patients on hemodialysis treated in our hospital from April 2019 to May 2021. All enrollments were divided into control group (n = 30) and study group (n = 30) by random table methods. The protocol of this study was approved by the Ethics Committee of the fifth people's hospital of Wuhu (No. 2019-25/854). All patients obtained informed consent and signed informed consent before enrollment.

Inclusion and exclusion criteria

Inclusion criteria: (1) Patients that were diagnosed with renal failure by relevant clinical tests. (2) Patients that required hemodialysis. (3) Patients who have undergone autogenous arteriovenous fistula (AVF) surgery for vascular access. (4) good treatment compliance.

Exclusion criteria: (1) Patients with mental illnesses. (2) Patients with abnormal coagulation or liver function. (3) Patients with severe heart or lung disease. (4) who rescinded their consent.

Method

Surgical methods. Patients in both groups underwent surgery to create an autologous AVF in the forearm. The methods that were used are radial artery-cephalic vein end to side anastomosis, ulnar artery-basilic vein end to side anastomosis and radial artery-cephalic vein end to end anastomosis. After the operation, all patients were given an injection of low-molecular weight heparin (LMWH, manufactured by Qilu Pharmaceutical Co. Ltd. H20000095) at a dose of 100 IU/kg for anticoagulation.

Control group. Conventional nursing methods were used for interventions in the control group. This included routine usage of the AVF, close observation of changes in the patient's signs and timely symptomatic treatment in the event of an emergency. It also included helping the patient maintain dryness of the wound. Patients were instructed to cooperate with treatment and take their medicine on time.

Study group. Preventive nursing methods were used for interventions in the study group. Firstly, factors that can result in complications of the AVF should be identified, then a specific plan aimed at preventing the occurrence of such complications should be devised. Lastly, targeted preventive nursing intervention measures should be put into effect, according to the plan that has been devised. The specific measures are as follows:

(1) Psychological care: Patients should be informed of the necessity, advantages and relevant precautions of using an AVF. In addition, nurses should care for, encourage and comfort patients in a timely manner to help them get rid of such negative emotions as anxiety and depression[6].

(2) Care of the AVF: Nursing staff should regularly use a stethoscope to check for vascular murmurs, as well as use their fingers to check for tremors in the anterior segment of the stoma. They should also observe whether there is any blood oozing from the stoma. If any abnormality is found, then the doctor should immediately be informed. If there is swelling in the arm, nursing staff should instruct the patient to elevate the arm, as this improves blood circulation, which in turn reduces swelling [7].

(3) Optimal usage of the AVF: Nursing staff should disinfect the hemodialysis hall before and after every treatment session. The surroundings should be kept neat and tidy. The entire treatment session should be carried out under septic conditions. Before inserting the needle, the side limbs of the AVF should be cleansed with warm water. It is crucial to perform a comprehensive and accurate evaluation of the patient's vascular access before cannulation, ensuring the selection of an appropriate puncture site and planned vessel utilization. The needle must be inserted with an appropriate force in the correct direction. After the needle has been successfully inserted, an elastic sterile Band-Aid should be used to cover the entry point. For poorly compliant patients, nursing staff can use restraining belts with the permission of the patient and their family members. Nursing staff should accurately adjust the patient's blood flow, increase the frequency of inspections, and closely observe the patient's vital signs. Patients should be told to be careful not to fold or twist the extracorporeal circulation channels when turning over or pulling the quilt. The needle insertion site should be

checked to see if there is any blood oozing out, and appropriate pressure should be applied to the site after the treatment session is complete. Later, a tourniquet must be applied. If the patient's coagulation function is poor, the application time can be appropriately extended.[8]

(4) Dietary guidance: Nursing staff should assess the patient's condition and kidney function in a timely manner, and formulate a personalized daily dietary plan that is in line with the patient's eating habits. The diet should have enough calories, be rich in vitamins, high in calcium, low in phosphorus, etc. Nursing staff should also help patients to properly supplement foods such as fresh milk, beef and other foods that are rich in proteins.[9]

(5) Skin care: Nursing staff should clean the patient's skin on time. The patient should be informed that its normal for the skin to itch, and that they must refrain from directly scratching the skin. Ice or warm wet compresses can be used to relieve symptoms of itching. Emulsifying oils or oral histamines should also be used, and the patient's nails must be trimmed.

(6) Exercise guidance: Nursing staff should instruct patients on how to properly perform aerobic exercise such as Taiji boxing and everyday walking, as these can enhance the patient's physical condition.[10]

(7) Continuous Monitoring: Throughout the treatment process, the nursing team conducts regular follow-ups and monitoring to ensure that patients adhere to the planned preventive care measures. This includes examining and documenting the status of the arteriovenous fistula, soliciting feedback from patients, and addressing any potential issues that may arise.

Observation indicators

AVF complications and blood flow in the AVF. AVF complications included thrombosis, infection, hemorrhage, hemangioma, etc. Blood flow in the AVF was recorded by relevant medical staff in our hospital.

Anxiety and depression. The Self-Rating Anxiety Scale (SAS) was used to evaluate the degree of anxiety in patients. The scale has a range of 0-100 points, and a cut-off value of 50. A score of 50-59 was considered as mild anxiety, that of 60-69 was considered as moderate anxiety, and a score of 69 or greater was considered as severe anxiety. The Self-Rating Depression Scale (SDS) was used to evaluate the degree of depression in patients. The scale has a range of 0-100 points, and a cut-off value of 53. A score of 53-62 was considered as mild depression, that of 63-72 was considered as moderate depression, and a score of 73 or greater was considered as severe depression. The SAS and SDS scales were concurrently administered in the study to assess anxiety and depression levels in both groups at identical time points.

Quality of life. The post-intervention quality of life was assessed using the SF-36 scale, which encompasses eight domains: physical function, role-physical, bodily pain, general health, vitality, social functioning, role-emotional, and mental health.

Nursing satisfaction. The "Nursing Satisfaction Questionnaire" developed by our hospital was used to find out satisfied the patients were with the way they had been cared for. The questionnaire has 20 questions, and patients are scored according to how satisfied they are with various aspects of care provision. A total score of 90 or greater means the patient is very satisfied, that of 70 to 89 means that the patient is satisfied, and that of less than 70 means that the patient is dissatisfied.

Statistical analysis

The data was analyzed using SPSS20.0. The measurement data was expressed as (±s), and the independent sample *t* test was used. The count data was expressed as the number of cases (rate), and the χ^2 test was used. Statistical significance was assumed at $P < .05$. GraphPad Prism 8 was utilized for the creation of graphical representations, allowing for a more comprehensive visualization of the data and results.

RESULTS

Comparison of general data

The difference in the general data of patients from the two groups was not statistically significant ($P > .05$). See Table 1 for details. It shows that the basic data of the two groups of patients are comparable and have little impact on the intervention results.

Comparison of AVF complications

The incidence of AVF complications in the study group after intervention was significantly lower than that in the control group ($P < .05$). See Table 2 for details. The results indicate that predictive nursing, by proactively addressing various factors contributing to AVF complications, significantly reduces the incidence of such complications. This approach can lead to improved clinical outcomes and enhanced safety for patients with renal conditions.

Comparison of blood flow in the AVF

Blood flow in the AVF was significantly higher in the study group than in the control group ($P < .05$). See Figure 1 for details. It shows that predictive nursing can improve blood flow and has better effectiveness.

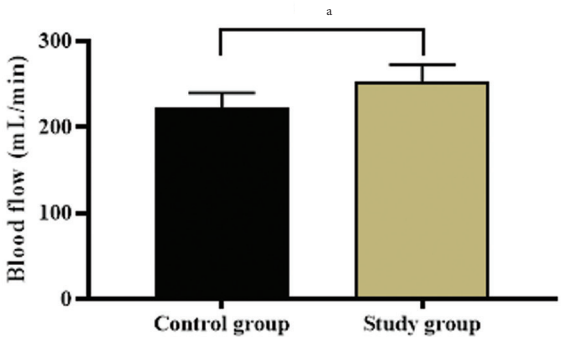
Table 1. Comparison of General data

	Control group	Study group	t/χ^2	*P* value
n	30	30		
Sex (M/F)	17/13	16/14	0.067	.795
Age (years)	56.84±8.77	56.89±8.85	0.022	.983
Disease duration (years)	4.12±0.56	4.21±0.54	0.634	.529
Primary disease			0.951	.813
Diabetic nephropathy	8	11		
Hypertension	7	6		
Glomerular nephritis	9	9		
Others	6	4		

Table 2. Comparison of AVF complications

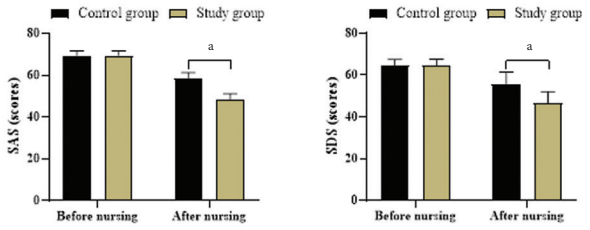
Group	n	Thrombosis	Infection	Hemorrhage	Hemangioma	Total incidence
Control group	30	2	3	2	2	9 (30.00%)
Study group	30	0	1	1	0	2 (6.67.00%)
χ^2						17.543
P value						<.001

Figure 1. Comparison of blood flow in the AVF



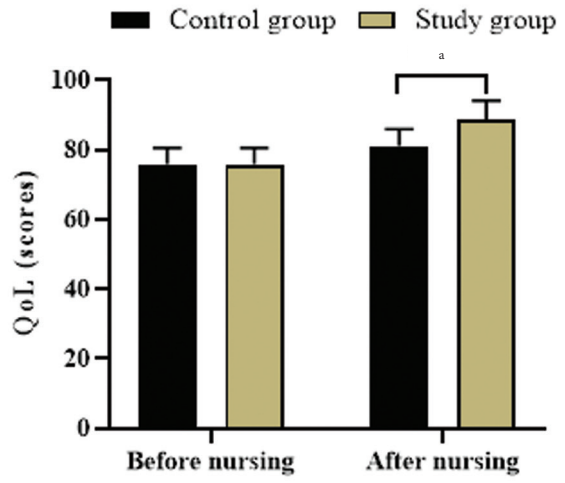
[a]indicated $P < .001$

Figure 2. Comparison of SAS and SDS scores



[a]indicated $P < .001$

Figure 3. Comparison of SF-36 scores



[a]indicated $P < .001$

Table 3. Comparison of nursing satisfaction

Group	n	Dissatisfied	Satisfied	Very satisfied	Total satisfaction rate
Control group	30	10	12	8	20 (67.00%)
Study group	30	2	13	15	28 (93.00%)
χ^2		-	-	-	21.125
P value		-	-	-	<.001

Comparison of SAS and SDS scores

Patients in the study group had significantly lower SAS and SDS scores after intervention than those in the control group ($P < .05$). See Figure 2 for details. It shows that predictive nursing pays attention to the psychological status of patients and can significantly improve anxiety and depression.

Comparison of SF-36 scores

The SF-36 score of patients in the study group after intervention was much higher than that of their counterparts in the control group ($P < .05$). See Figure 3 for details. It shows that predictive care improves quality of life.

Comparison of nursing satisfaction

Patients in the study group were much more satisfied with the care that they received compared to those in the control group ($P < .05$). See Table 3 for details. It shows that predictive nursing focuses on humanistic care, closes the doctor-patient relationship, and improves nursing satisfaction.

DISCUSSION

In recent years, changes in people's daily lives and diet have led to an increase in the number of patients with ESRD in China. Hemodialysis is the main form of treatment for patients with ESRD. Without it, most patients with ESRD experience a steady and sharp decline in their quality of life. An AVF is a common way to gain vascular access for hemodialysis. Some of its advantages include, but are not limited to, carrying a low risk of infection, being a long-term solution for dialysis, and having little impact on the patient's life. It plays a vital role in the maintenance of hemodialysis treatment. However, some clinical studies have pointed out that some patients on hemodialysis are affected by factors such as the time required dialysis, puncture techniques and AVF complications, all of which reduce the efficiency of treatment.[13] The scholar Ma Boyu[14] has shown that active and effective nursing interventions for patients on hemodialysis may have a positive impact on preventing the occurrence of AVF complications. In the past, conventional nursing methods were often used in the management of patients on hemodialysis. However, scholars such as Zhang Siqi[15] have pointed out that conventional nursing methods have many limitations, and that they are neither scientific, perfect nor systematic.

In this study, preventive nursing interventions were used for patients in the study group. Such nursing interventions actively and effectively target possible complications in patients on hemodialysis. They make patients aware of complications that may arise during treatment, and measures that can be taken to avoid or treat such complications. This helps in reducing the incidence of said complications. Our study found that the incidence of AVF complications in the study group after nursing interventions was significantly lower than that in the control group. This suggests that preventive nursing interventions can effectively reduce the incidence of AVF complications in patients on hemodialysis.[16] The reason for this finding may be that preventive nursing interventions devise a targeted nursing plan based on the patient's physical condition. This improves the quality of care that a patient receives, thus reducing the incidence of AVF complications.

Insufficient blood flow in the AVF seriously affects the efficiency of hemodialysis. The scholar Wang Qi[18] and other studies have found that complications such as AVF stenosis,

thrombosis and anastomotic hematoma can all reduce blood flow in AVF. The results of this study showed that blood flow in the AVF in the study group was significantly higher than that in the control group. This could perhaps be explained by the fact that preventive nursing interventions reduce the incidence of AVF complications (and, as has just been mentioned, AVF complications themselves reduce blood flow in the AVF), as a result, the reduced incidence of AVF complications preserves the stability of blood flow in the AVF conduit, ensuring the patency of the AVF access and, consequently, an adequate blood flow level for these patients [19]. Knowing that they have to be on hemodialysis for the rest of their lives and must undergo surgery to create an AVF, some patients develop anxiety and other negative emotions. This may make treatment very difficult. Also, their already poor physical condition may make it difficult for them to lead a normal life, greatly affecting their quality of life.

The results of this study showed that the SAS and SDS scores of patients in the study group after nursing interventions were significantly lower than those of patients in the control group. At the same time, patients in the study group had higher SF-36 scores than those in the control group. This shows that preventive nursing interventions can reduce patients' anxiety and depression, as well as improve their quality of life. This may be attributed to the fact that nursing and healthcare professionals foster an environment where patients are encouraged to articulate their emotions and concerns, while meticulously attending to their needs. This process of emotional expression and attentive listening assists patients in effectively unburdening their inner negative emotions, thus aiding them in managing sentiments of anxiety and depression. Consequently, it contributes to the enhancement of patients' treatment confidence, leading to improved treatment adherence. The improvement in the quality of life can be attributed to the fact that preventive nursing interventions provide tailored dietary and exercise guidance to patients, which may have a ripple effect on their health. This can help patients enhance their post-treatment recovery and speed. Moreover, with the reduction in complications and symptoms, patients are more likely to engage in social and recreational activities, thereby fostering a sense of normalcy and overall well-being. These factors collectively contribute to an enhanced quality of life.[20] Lastly, the results showed that patients in the study group were more satisfied with the way they had been cared for compared to those in the control group, further demonstrating that preventive nursing interventions are effective in patients on hemodialysis.[21]

This study possesses several noteworthy limitations. Primarily, its single-center design may restrict the generalizability of the findings to a broader patient population and different healthcare settings. The study's small sample size might limit the statistical power and the ability to detect less common outcomes. Additionally, the relatively short follow-up duration might not capture long-term effects and sustainability of the preventive nursing interventions. Furthermore, this study did not account for the potential influence of patients' and their families' educational backgrounds on their acceptance of nursing interventions. This oversight might introduce confounding variables that could impact the observed outcomes, potentially resulting in a disparity between the actual and anticipated intervention effects. It is crucial for future research to address these limitations and consider larger, multi-center studies with longer follow-up periods to provide a more comprehensive understanding of the effectiveness and broader applicability of these nursing interventions.

CONCLUSION

The application of preventive nursing interventions in hemodialysis patients with arteriovenous fistulas (AVFs) in the nephrology department demonstrates significant potential. These nursing interventions have not only effectively reduced the incidence of AVF complications but have also demonstrated remarkable improvements in patients' vascular access blood flow, reductions in negative emotional states such as anxiety and depression, and enhancements in overall quality of life and clinical satisfaction. For a broader patient population, especially those requiring long-term hemodialysis treatment, the prevention of complications and the maintenance of optimal vascular access are of paramount importance. Therefore, preventive nursing interventions hold significant reference value. In other healthcare institutions, the adoption of similar preventive nursing interventions may yield similar advantages for hemodialysis patients with arteriovenous fistulas (AVFs) in the nephrology department. These institutions can consider implementing this type of nursing approach in their clinical practices to ensure that AVF patients receive the best possible treatment outcomes. Preventive nursing interventions reinforce the concept that nursing care should not be passive but proactive. This study encourages healthcare professionals and institutions to prioritize preventive nursing interventions as a core component of their standard care protocols.

DATA AVAILABILITY STATEMENT

No data was used in this study.

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