Research on the Preventive Effect of Targeted Nursing Interventions on Deep Vein Thrombosis in Patients with Hemodialysis Catheter Indwelling

Ling Ding

Yancheng No.1 People's Hospital, Yancheng 224000, Jiangsu, China

Abstract: *Objective*: To investigate the preventive effect of targeted nursing interventions on deep vein thrombosis in patients with hemodialysis catheter indwelling. *Methods*: A prospective study was conducted involving patients who underwent hemodialysis catheter indwelling and were admitted between August 2023 and August 2025, totaling 108 cases. These patients were randomly divided into two groups using a random number table method, with 54 cases in each group. The control group received routine nursing interventions, while the observation group received targeted nursing interventions. The incidence of deep vein thrombosis and hemodynamic indicators were compared between the two groups. *Results*: The incidence of deep vein thrombosis in the observation group was lower than that in the control group ($p < 0.05$). After two weeks of nursing, the hemodynamic indicators in the observation group were higher than those in the control group ($p < 0.05$). *Conclusion*: Targeted nursing interventions can effectively prevent deep vein thrombosis and improve hemodynamics in patients with hemodialysis catheter indwelling, making them worthy of clinical promotion.

Keywords: Hemodialysis; Catheter indwelling; Routine nursing intervention; Targeted nursing intervention

1. Introduction

Hemodialysis is a common treatment for end-stage renal disease (ESRD), with approximately 90% of ESRD patients receiving this therapy [1]. Among them, most patients undergoing maintenance hemodialysis have temporary indwelling femoral vein central catheters, which are convenient for puncture, suitable for bedridden patients, and do not affect upper limb movement [2]. However, the indwelling of hemodialysis catheters is an invasive procedure that can cause stress reactions and has a certain potential to induce deep vein thrombosis (DVT) [3]. ESRD is often accompanied by hypercoagulability and platelet activation, making thrombosis relatively easy to occur. Once DVT develops, if effective intervention is not implemented as early as possible,

50–60% of cases will progress to pulmonary embolism, ultimately leading to death [4]. Therefore, it is essential to provide good nursing care during the indwelling period of hemodialysis catheters, shifting from a passive to an active approach, actively preventing complications such as DVT, and enhancing the safety of hemodialysis. Conventional nursing care places more emphasis on hemodialysis treatment and lacks awareness of proactive prevention of complications, thus having limitations. Targeted nursing care requires the development of individualized nursing plans based on patients' clinical characteristics, understanding their physical and psychological needs, meeting their various reasonable needs, and helping patients adapt to hemodialysis and catheter indwelling. This study investigated 108 patients with indwelling hemodialysis catheters to explore the value of targeted nursing interventions.

2. Materials and methods

2.1. General information

This study is a prospective study aimed at analyzing the impact of different nursing interventions on patients with indwelling hemodialysis catheters. The study involved 108 subjects who were admitted to the hospital between August 2023 and August 2025. The sample size calculation method utilized an expected effect size of 0.63 for efficacy, a test level of 0.05, and a power of 0.90. Sample size estimation was performed using G*Power 3.1 software, with initial estimates indicating a minimum sample size of 40 cases per group. However, due to issues such as case exclusion and loss to follow-up during the study period, the sample size was increased to 54 cases per group, resulting in a total sample size of 108 cases.

2.1.1. Control group

32 males and 22 females, aged 35–76 years (55.89 ± 5.46 years), with a disease duration of 1–7 years (4.37 ± 1.21 years).

2.1.2. Observation group

30 males and 24 females, aged 36–74 years (55.37 ± 5.31 years), with a disease duration of 1–8 years (4.69 ± 1.35 years). There were no significant differences in basic demographic data between the two groups ($p > 0.05$).

2.1.3. Inclusion criteria

(1) Patients meeting the diagnostic criteria for end-stage renal disease as outlined in the "Clinical Management Guidelines for Slowing the Progression of Chronic Kidney Disease (2025 Edition)" [5];
(2) Patients with indications for indwelling hemodialysis catheters;
(3) Patients who are mentally alert and conscious;
(4) Patients who provide informed consent to participate in the study.

2.1.4. Exclusion criteria

(1) Patients with concurrent major diseases, including malignant tumors, organ dysfunction, heart disease, etc.;
(2) Patients who underwent kidney transplantation within 6 months prior to the study or during the study period;

(3) Patients with coagulation disorders or hematopoietic abnormalities;

(4) Patients with mental disorders, unconsciousness, cognitive impairment, or lack of autonomy.

2.2. Methods

In the control group, routine nursing interventions were carried out in the hospital. After the placement of a hemodialysis catheter, patients were verbally informed about the reasons for catheter placement and precautions. They were instructed to maintain the correct body position, avoid compression, twisting, or displacement of the catheter, wear loose clothing, avoid compressing the limb with the catheter during sleep, protect the catheter during activities, and ensure that the catheter remained unobstructed at all times. Patients were encouraged to engage in appropriate physical activity, avoid prolonged bed rest or immobilization, promote blood circulation, and reduce blood stasis. During hospitalization, efforts were made to actively control underlying conditions such as blood glucose, blood lipids, and blood pressure to improve the overall health status of patients and reduce hypercoagulability. Patients were also provided with dietary guidance, emphasizing the necessity of regular meals, controlled fluid intake, and reduced sodium consumption.

In the observation group, targeted nursing interventions were implemented in the hospital:

(1) Thrombosis prevention

Patients were educated about the causes, symptoms, hazards, and prevention and treatment strategies for deep vein thrombosis, and encouraged to actively participate in prevention efforts. Elastic stockings were provided, and patients were instructed to wear them upon waking and remove them before going to bed, continuing this for a minimum of 8 weeks. If necessary, an intermittent pneumatic compression pump was used, with one to two sessions per day, each lasting 15–20 minutes. The patients' physical function was assessed, and their activity preferences were understood to jointly develop a targeted exercise plan with the patients, including aerobic exercises such as walking and brisk walking. If patients were severely ill and required prolonged bed rest, family members were involved to help the patients turn over regularly and move their limbs, with each exercise session lasting 20–30 minutes and conducted one to two times per day.

(2) Disease condition nursing

Closely monitor the patient's laboratory test results, particularly fibrinogen and fibrin degradation products, as well as coagulation function indicators. Promptly communicate with the doctor upon detecting any abnormalities and, if necessary, increase anticoagulant medication. Closely monitor the patient's symptoms, actively inquire about issues such as pain and abnormal leg circumference, and promptly conduct color Doppler ultrasound examinations. Upon detecting deep vein thrombosis, immediately implement effective interventions.

(3) Health education

Evaluate the patient's understanding of hemodialysis and catheter placement, taking into account their educational level. In addition to routinely distributing knowledge pamphlets and playing popular science videos, communicate with the patient one-on-one using simple and understandable language to gently and patiently explain the reasons, purposes, expected outcomes, common complications, prevention and treatment plans, and critical management methods by medical staff for hemodialysis catheter placement. After completing theoretical education, teach patients self-prevention and treatment skills for complications using models, and encourage patients to actively participate in nursing care.

(4) Psychological support

Pay attention to the patient's psychological state during hospitalization, identify negative emotions such as anxiety and depression, analyze the triggering causes, and actively communicate with the patient to answer every question. Patiently soothe the patient's fears and unease caused by the illness and hospitalization, and stabilize their psychological state. On the premise of not affecting the patient's emotions and treatment, encourage patients to engage in recreational activities that do not interfere with hemodialysis, including reading novels and watching TV. For patients with obvious negative emotions, patiently understand the reasons, carefully alleviate negative emotions, meet reasonable requests of patients to the best of their ability, and collaborate with family members to provide emotional support. Cite cases where hemodialysis has achieved ideal results without complications, use them as role models, and guide patients to learn from these examples and cooperate with treatment and nursing.

(5) Nutritional support

Analyze the patient's nutritional status using nutritional assessment tools to ensure fluid balance during hospitalization. If the patient has a fever, for every 1 °C increase in body temperature, the calorie intake needs to be increased by 10%. If the patient can eat orally, convert the required calorie intake into various foods, providing nutritious, light, and easily digestible foods that align with the patient's preferences, and encourage the patient to eat small, frequent meals. If oral intake is not possible, provide enteral or parenteral nutritional support by preparing nutritional solutions on-site based on calorie requirements.

(6) Regular monitoring and assessment

Conduct regular vascular ultrasounds, echocardiograms, and other examinations to promptly identify issues such as catheter-related thrombosis, fibrous sheaths, or vascular stenosis for early intervention. When the patient returns to the hemodialysis room, actively inquire about the catheter function during hemodialysis, such as dialysis blood flow, aspiration, and blood return conditions, and promptly address any abnormalities.

Both groups received nursing care for two weeks.

2.3. Observation indicators

2.3.1. Incidence of deep vein thrombosis

Record the number of cases with and without occurrence, and calculate the percentage.

2.3.2. Hemodynamic indicators

Perform color Doppler ultrasound examinations and record peak blood flow velocity and average blood flow velocity.

2.4. Statistical methods

Data analysis was performed using SPSS 27.0. After confirming normal distribution through the Shapiro-Wilk test, measurement data were expressed as ($\overline{x} \pm s$) and analyzed using t-tests. Count data were expressed as frequencies (percentages) and analyzed using χ^2 tests. A p-value < 0.05 was considered statistically significant.

3. Results

3.1. Comparison of the incidence of deep vein thrombosis between the two groups

As shown in **Table 1**, the incidence of deep vein thrombosis in the observation group was lower than that in the control group ($p < 0.05$).

Table 1. Incidence of deep vein thrombosis in both groups (n/%)

Group	Number of cases (n)	Incidence rate	Non-incidence rate
Observation group	54	1 (1.85%)	53 (98.15%)
Control group	54	7 (12.96%)	47 (87.04%)
χ^2-value	-		4.860
p-value	-		0.027

3.2. Comparison of hemodynamic indicators between the two groups

As shown in **Table 2**, after two weeks of nursing care, the hemodynamic indicators in the observation group were higher than those in the control group ($p < 0.05$).

Table 2. Hemodynamic indicators in both groups ($\overline{x} \pm$ s, cm/s)

Group	Number of cases (n)	Peak blood flow velocity (cm/s)		Mean blood flow velocity (cm/s)	
		Pre-care	2 weeks post-care	Pre-care	2 weeks post-care
Observation group	54	25.12 ± 4.67	52.18 ± 5.86^a	15.45 ± 3.11	31.65 ± 4.76^a
Control group	54	25.98 ± 4.92	45.02 ± 5.46^a	15.76 ± 3.26	25.49 ± 4.61^a
t-value	-	0.932	6.569	0.506	6.831
p-value	-	0.354	< 0.001	0.614	< 0.001

Note: Compared with the same group before nursing, $^a p < 0.05$.

4. Discussion

Currently, maintenance hemodialysis is commonly used in clinical settings to treat end-stage renal disease. Through regular, timed, and effective hemodialysis, renal function can be maintained and survival time prolonged [6]. To preserve vascular access resources for long-term dialysis and reduce the adverse effects of long-term dialysis on blood vessels, clinical practice advocates for the placement of hemodialysis catheters. Due to the greater blood flow in the femoral vein compared to other vessels, lower puncture difficulty, and minimal impact on limb movement, temporary catheters are often placed in the femoral vein [7]. However, catheter placement also carries certain risks, with a certain probability of complications such as deep vein thrombosis and catheter-related infections.

In this study, the incidence of deep vein thrombosis was lower in the observation group compared to the control group. The reason for this is that deep vein thrombosis is a common complication of hemodialysis, characterized by abnormal blood coagulation in the deep veins. This pathological change can obstruct the venous lumen, severely impede venous blood flow, and, if the condition worsens, can progress to pulmonary embolism, threatening the patient's life safety [8]. Patients with hemodialysis catheter placement often develop thrombosis due to damage to the blood vessel wall caused by catheter insertion [9]. Conventional nursing places

greater emphasis on hemodialysis treatment than on the prevention and treatment of complications such as deep vein thrombosis, with limited nursing measures and scope, resulting in nursing outcomes that are unsatisfactory to both patients and clinicians. Targeted nursing differs from conventional nursing by shifting from a passive to an active approach. It requires healthcare professionals to proactively understand the causes of deep vein thrombosis (DVT) in patients with hemodialysis catheter placement and develop tailored nursing plans based on these causes. By focusing on health education, nutritional support, thrombosis prevention, and disease management, targeted nursing aims to improve the prevention and treatment outcomes of DVT, reduce its incidence, and enhance the physical and mental comfort of patients.

In this study, the observation group demonstrated higher levels of various hemodynamic indicators compared to the control group. The reason for this is that peak blood flow velocity and mean blood flow velocity can accurately reflect the hemodynamic stability of patients, aid in the clinical identification of abnormalities, and guide early and effective clinical interventions [10]. However, conventional nursing does not effectively address these relevant indicators, making it difficult to prevent thrombosis and resulting in only modest improvements in hemodynamics. Targeted nursing interventions can compensate for the shortcomings of conventional nursing by emphasizing health education to enhance patients' understanding of maintenance hemodialysis treatment, the reasons for catheter placement, and precautions. By changing patients' perceptions, their behaviors can be transformed, leading to improved compliance with catheter placement, local dressing changes, and aseptic techniques, thereby effectively preventing related complications. Psychological support can regulate patients' mental states, correct negative coping styles and emotions, and encourage active participation in hemodialysis treatment. Through health education and thrombosis prevention measures, patients' attention to DVT prevention can be further heightened, and a series of clinically validated effective nursing methods can be employed to reduce thrombosis formation, regulate hemodynamics, and accelerate peak and mean blood flow velocities. During the nursing process, effective communication between nurses and patients enables a thorough understanding of patients' nursing needs. After meeting patients' reasonable demands, the nurse-patient relationship can be improved, further enhancing nursing compliance and outcomes.

5. Conclusion

In summary, targeted nursing interventions can assist patients with indwelling hemodialysis catheters in preventing deep vein thrombosis, and accelerate the peak blood flow velocity and the average blood flow velocity. However, this study has certain limitations. It only recorded the incidence of deep vein thrombosis as a complication and did not document the occurrence of other complications such as catheter-related infections, making it impossible to comprehensively evaluate the preventive effect of targeted nursing on complications. Additionally, it only measured hemodynamic indicators without considering hemorheological indicators or quality of life, preventing verification of the positive impact of targeted nursing on other aspects of patients and hindering its clinical promotion. Therefore, clinical research should increase the number of case studies, extend observation periods, and enrich various indicators to comprehensively analyze the application value of targeted nursing.

Disclosure statement

The author declares no conflict of interest.

References

[1]   Wang K, Hu M, Jiang X, 2024, The Impact of Neuman Nursing Based on the Concept of Structured Health Education on Self-Care Ability, Mindfulness, and Water-Sodium Control Compliance in Maintenance Hemodialysis Patients. Journal of North Sichuan Medical College, 39(08): 1138–1142.

[2]   Li X, Ma Q, Kang H, et al., 2025, Application of Follow-Up Management Based on the Integrated Theory of Health Behavior Change in Outpatient Hemodialysis Patients. Chinese Nursing Research, 39(16): 2777–2785.

[3]   Yang Y, Li X, Ye C, et al., 2024, The Impact of Whole-Life Cycle Nursing Intervention Based on the Integrated Theory of Health Behavior Change on Frailty and Quality of Life in Maintenance Hemodialysis Patients. China Medical Herald, 21(13): 138–141.

[4]   Shi X, Zhou H, He L, et al., 2023, The Application Effect of Predictive Nursing in Catheter Care for Chronic Renal Failure Patients Undergoing Maintenance Hemodialysis. International Journal of Nursing, 42(17): 3196–3200.

[5]   Expert Group of the Clinical Management Guidelines for Slowing the Progression of Chronic Kidney Disease, 2025, Clinical Management Guidelines for Slowing the Progression of Chronic Kidney Disease (2025 Edition). Chinese Journal of Nephrology, 41(06): 455–488.

[6]   Sun N, Zhang C, Hu G, et al., 2025, The Impact of Cognitive-Behavioral Nursing Intervention on Work Resumption Adaptability, Hope Level, and Self-Management Behaviors in Young and Middle-Aged Patients Undergoing Maintenance Hemodialysis. International Journal of Nursing Sciences, 44(05): 788–793.

[7]   Zhang H, Ji S, Cui L, et al., 2024, Application of Continuity of Care Based on the Timing Theory in Patients with Chronic Renal Failure Undergoing Hemodialysis Treatment. International Journal of Nursing Sciences, 43(03): 556–561.

[8]   Zhang C, Wu L, Sun N, 2025, The Impact of Family-Participatory Nursing Based on the Theory of Reasoned Action/ Planned Behavior on Self-Management Behaviors and Self-Perceived Burden in Patients Undergoing Maintenance Hemodialysis. International Journal of Nursing Sciences, 44(04): 602–607.

[9]   Lin P, Wu X, Chen S, 2024, Observation on the Effect of Micro-Videos Combined with Educational and Thematic Workshops on Internal Fistula Care in Patients Undergoing Maintenance Hemodialysis. Chinese Journal of Practical Nursing, 40(08): 612–618.

[10] Sun L, Xu H, Wang Z, 2024, The Application Effect of High-Quality Targeted Nursing Mode in Patients with Hypertensive Nephropathy Undergoing Hemodialysis. International Journal of Nursing Sciences, 43(10): 1784–1787.