

Article

Predictive nursing to reduce PICC-related thrombosis and psychological distress in cancer patients

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Abstract: This study investigated the risk factors for venous thrombosis following peripherally inserted central venous catheter (PICC) placement in cancer patients and evaluated the impact of predictive nursing on clinical and psychological outcomes. From August 2021 to July 2023, 136 cancer patients who developed PICC-related venous thrombosis were included as the observation group, and 136 patients without thrombosis served as controls. Clinical data were retrospectively analyzed, and univariate and multivariate logistic regression were performed to identify independent risk factors. The observation group further received predictive nursing, while the control group received routine nursing. Knowledge of catheter care, hemodynamic parameters, inflammatory and nutritional indicators, emotional status, complications, and nursing satisfaction were compared between groups. Univariate analysis showed significant differences in age, diabetes, catheterization duration, puncture site, platelet-promoting drug use, and prophylactic anticoagulation ($P < 0.05$). Logistic regression identified age ≥ 60 years (OR = 4.065), diabetes (OR = 5.185), catheterization ≥ 14 days (OR = 5.652), cephalic vein puncture (OR = 6.165), platelet-stimulating drugs (OR = 5.859), and absence of prophylactic anticoagulation (OR = 11.025) as independent risk factors ($P < 0.01$). Compared with routine nursing, predictive nursing resulted in higher satisfaction, improved beliefs, knowledge, and behaviors, better hemodynamic stability, lower TNF- α and IL-1 β levels, enhanced nutritional indicators, reduced anxiety and depression, and fewer complications ($P < 0.05$). Conclusion: Advanced age, diabetes, extended catheterization, cephalic vein puncture, platelet-stimulating drugs, and lack of prophylactic anticoagulation increase thrombosis risk. Predictive nursing effectively improves emotional state, hemodynamics, nutritional status, and safety in cancer patients undergoing PICC-based chemotherapy.

Keywords: PICC tube placement; venous thrombosis; risk factors; predictive nursing

1. Introduction

Recently, with the continuous improvement of intravenous infusion technology, peripherally inserted central venous catheter (PICC) has also been widely used in cancer chemotherapy patients [1]. PICC technology can effectively prevent phlebitis, local tissue necrosis, swelling, and other vein-related injuries caused by the exudation of chemotherapy stimulant drugs and has the advantages of simple operation and safe infusion, significantly improving patients' tolerance to chemotherapy drugs [2]. Although PICC has many advantages, it still has the risk of complications such as catheter blockage, venous thrombosis, and infection. Venous thrombosis is the most

common complication in patients with long-term PICC catheterization of tumors, with an incidence of about 1%–4% [3], which not only increases the medical burden and psychological pressure of patients but also increases the cost of treatment, increases the readmission rate, and decreases the quality of life [4–6]. Beyond the physiological burden, PICC related venous thrombosis can also trigger significant psychological and emotional distress among cancer patients. The sudden onset of pain, swelling, restricted limb movement, and fear of treatment interruption often increases anxiety, reduces self confidence, and weakens the patient's sense of safety during chemotherapy [7,8]. Research in psycho oncology shows that complications involving vascular access raise emotional vulnerability, intensify depressive symptoms, and negatively influence adherence to treatment. Because many patients view thrombosis as a sign of disease progression or failure of therapy, the event can further reduce trust in the course of treatment. For these reasons, the inclusion of psychological and emotional considerations in PICC care, especially through proactive and supportive nursing, is essential to maintain stability and overall well being during cancer treatment. The possible causes of venous thrombosis in patients with long-term PICC catheterization of tumors include vascular endothelial injury, hemodynamic changes, catheter-related factors (material and model of catheter, catheter indwelling time, and improper catheter maintenance), hypercoagulable state caused by disease factors, drugs' impacts and individual differences, and patient's own factors (age, gender, activity limitation, and previous history of thrombosis) [9,10]. Therefore, it is important to analyze the risk factors of venous thrombosis after long-term PICC catheterization in cancer patients.

The prevention of venous thrombosis can reduce the incidence of complications, improve the quality of life, and optimize the utilization of patients with long-term PICC catheterization of tumors [11]. For tumor patients, PICC catheterization is an unfamiliar nursing operation. Patients are bound to cause PICC catheter-related complications due to various bad living habits. Therefore, corresponding nursing countermeasures must be given to patients. Predictive nursing is a nursing model based on risk assessment and active intervention, which can reduce the incidence of complications by identifying high-risk factors in advance and taking targeted measures [12]. The core of predictive nursing lies in active prevention rather than passive response, which requires nurses to have solid professional knowledge and keen observation and needs the active cooperation of patients and their families [13]. Predictive nursing includes risk assessment and hierarchical management, dynamic monitoring and early identification, and the implementation of individualized nursing programs [14]. As reported previously, predictive nursing intervention is beneficial to improve the effects of thrombolytic therapy in patients with ischemic stroke, which improves the neurological, cognitive, and motor functions of patients and reduces the occurrence of complications, suggesting an important clinical application value [15]. However, the application effects of predictive nursing on the emotional and nutritional status of patients with venous thrombosis caused by long-term PICC chemotherapy are not clear.

Therefore, this study retrospectively analyzed the clinical data of 136 patients with venous thrombosis caused by long-term PICC chemotherapy in our hospital. The influencing factors of venous thrombosis in patients were analyzed to provide a basis

for clinical prevention and nursing intervention. Besides, this study explored the effects of predictive nursing strategies on the emotional and nutritional status of patients with venous thrombosis caused by long-term PICC chemotherapy, aiming to provide effective clinical reference for nursing such patients.

2. Material and methods

2.1. General data

A total of 136 patients with venous thrombosis caused by long-term PICC chemotherapy in our hospital from August 2021 to July 2023 were selected as the group A. Data of 136 patients without venous thrombosis who received long-term PICC chemotherapy in our hospital during the same period and met the inclusion criteria were selected as group B. The above two groups of data were retrospectively analyzed. There were 70 males and 66 females in group A, aged from 46 to 78 years old, with a mean age of 57.6 ± 4.8 years old. Among them, there were 41 cases of malignant tumors of the digestive system, 39 cases of malignant tumors of the respiratory system, and 56 malignant tumors of the blood system. In group B, there were 72 males and 64 females, aged 45–78 years old, with a mean age of 57.4 ± 4.5 years old. Among them, there were 42 cases of malignant tumors of the digestive system, 39 cases of malignant tumors of the respiratory system, and 55 cases of malignant tumors of the blood system. There were no significant differences in gender, age, and disease type between the 2 groups ($P > 0.05$). Inclusion criteria: (1) Met the criteria of the World Health Organization (WHO) in the Guidelines for the Early Diagnosis of Cancer (2019), and malignant tumor was confirmed by pathological examination. (2) Venous thrombosis in group A was diagnosed by color Doppler ultrasound, and the diagnostic criteria were 1) the venous cavity compression could not be closed; 2) the blood signal in the venous lumen disappeared or decreased; 3) constant phase change of blood flow spectrum; 4) poor sound transmission or solid echo in the lumen, mural thrombosis; 5) the enhancement of blood flow in the distal limb of compression was weakened or disappeared; and 6) the anaphylactic reaction was weakened or disappeared. (3) Tumor patients treated with chemotherapy and met the conditions of PICC catheterization. (4) Patients voluntarily participated in the study and signed informed consent. (5) Complete clinical data. (6) Patients with the same tumor type in the two groups received the same chemotherapy agents. Exclusion criteria: (1) Venous thrombosis, phlebitis, obstruction of lymphatic return, and catheter-related infection existed before PICC catheterization. (2) Anticoagulant drugs were used within 3 months before PICC catheterization. (3) Abnormal liver and kidney function. (4) A history of cognitive impairment or mental illness. (5) Lactating and pregnant women. This study was approved by the hospital Ethics Committee. In addition, patients in group A were randomly divided into a control group (CG) and observation group (OG), with 68 cases in each group. An independent researcher performed this assignment using a random number generator from the random.org website. The ultrasound technicians reading thrombosis scans were blinded to the nursing group. There were 34 males and 32 females in the CG, aged from 46 to 78 years old, with a mean age of 57.7 ± 5.1 years old. Among them, there were 21 cases of malignant tumors of the digestive system, 20 cases of malignant tumors of the

respiratory system, and 30 malignant tumors of the blood system. There were 23 cases of diabetes, 14 cases of hyperlipemia, and 28 cases of hypertension. There were 36 males and 34 females in the OG, aged from 46 to 78 years old, with a mean age of 57.4 ± 4.6 years old. Among them, there were 20 cases of malignant tumors of the digestive system, 19 cases of malignant tumors of the respiratory system, and 26 malignant tumors of the blood system. There were 24 cases of diabetes, 15 cases of hyperlipemia, and 32 cases of hypertension. There were no significant differences in gender, age, tumor type, and underlying diseases between the CG and the OG ($P > 0.05$).

2.2. Sample size

Sample size was calculated using the correlation power and sample size calculation in G*Power. The desired power of our study was set at 80% with a significance level of 0.05 in a two-sided test. Our study recruited 136 patients with venous thrombosis caused by long-term PICC chemotherapy as group A and recruited 136 patients without venous thrombosis who received long-term PICC chemotherapy as group B, which satisfied the sample size requirement. In addition, 136 patients with venous thrombosis caused by long-term PICC chemotherapy were selected for assessing the application effect of predictive nursing, which also satisfied the sample size requirement.

2.3. Methods

2.3.1. Data collection

Clinical data of the two groups were gathered, which contained gender (male, female), age (≥ 60 years old, < 60 years old), body mass index (≥ 21 kg/m², < 21 kg/m²), underlying disease (diabetes, hyperlipidemia, hypertension), tumor type (digestive system malignancy, respiratory system malignancy, hematological system malignancy), duration of catheterization (≥ 14 days, < 14 days), catheterization of limbs (left and right sides), puncture of blood vessels (noble vein, median cubocephalic vein), use of hemostatic drugs (yes, no), use of platelet-promoting drugs (yes, no), use of preventive anticoagulant drugs (yes, no), and surgical history (yes, no).

2.3.2. Nursing methods

The CG was treated with routine nursing methods after PICC catheterization as follows: The nurses changed the dressing every 7 days to keep it clean. If the dressing became loose daily, the nurse could change it again according to the situation. Nurses replaced the heparin cap or positive-pressure connector every 7 days. During treatment, nurses flushed the catheter, usually every 7 days, to maintain patency.

Both groups received nursing intervention for 1 week. The OG was treated with predictive nursing after PICC catheterization, including:

1. Nurses closely observed the limb condition of patients after PICC catheterization. Prophylactic use of anticoagulants (Enoxaparin sodium injection, 4000 Axa IU, produced by Hangzhou Jiuyuan Gene Engineering Co., Ltd.) was implemented. The nurse thoroughly evaluated the patient's systemic condition and vascular

condition, and the first choice was to place an intravenous tube. Nurses actively controlled patients' underlying diseases. Nurses instructed patients to strengthen the tube limb's warmth. Nurses chose a light and digestible diet for patients. Nurses strengthened the PICC catheterization education for patients and their families, provided PICC catheterization consultation services, established a PICC maintenance journal, and did a good job in recording and tracking the entire process of cases.

2. A risk factor assessment tool for upper extremity deep vein thrombosis in patients with PICC catheterization designed by Seeley et al. [16]. was used to evaluate the risk of venous thrombosis, mainly including deep vein local tenderness (0~13 points), anticoagulation during hospitalization or at home (0~9 points), long-term bed rest (0~14 points), smoking (0~10 points), and osteomyelitis catheterization (0~20 points). The total score was 0~66 points, and 20 points were used to evaluate the limit. A score <20 indicated no risk, and a score ≥ 20 indicated the possibility or occurrence of risk, and the score was positively correlated with the risk. Cronbach's α was 0.852~0.921.
3. Non-risk patients could be treated with routine cognitive, functional activities, and maintenance care interventions. For patients with risk, nurses clarified and highlighted the "leader" of the patient in nursing management and informed patients of the importance of PICC in risk prevention and control and nursing management when explaining PICC knowledge to patients. After the puncture, the nurse applied an elastic bandage to the puncture site for pressure dressing and gave hemostatic drugs to patients according to the doctor's advice. Nurses kept the area around the puncture site dry and pollution-free and carried out aseptic cleaning operations on the heparin cap and positive pressure junction to ensure that the catheter was always in a sterile state. If an adverse infection occurred, the catheter was removed in time to prevent the continuous expansion and spread of infection. After catheter indwelling, the nurse applied a hot wet compress with a sterile towel soaked in water at 40~45 °C, 2~3 cm above the puncture point, for 8~10 min and then took it off, replaced it with a new hot towel, and continued to apply a hot wet compress for 8~10 min, once a day in the morning, in the afternoon, and in the evening. Nurses paid close attention to the skin alterations around the patient's puncture and cleaned or applied drugs to treat it in time.

2.3.3. Observation indicators

- (1) The clinical data of 2 groups were compared, and the risk factors of long-term venous thrombosis after PICC catheterization were analyzed.
- (2) Logistic regression was adopted to analyze the independent risk factors of long-term post-PICC venous thrombosis in tumor patients.
- (3) The cognitive level of catheter maintenance included three dimensions: belief, knowledge, and behavior. The cognitive level before and after intervention was compared between 2 groups.
- (4) Comparison of patient satisfaction between the two groups. The self-made satisfaction questionnaire was used to investigate the two groups of patients, and the satisfaction of the questionnaire was very satisfied, basically satisfied, and

dissatisfied. The formula for calculating satisfaction is $\text{Satisfaction} = (\text{very satisfied} + \text{basically satisfied}) / \text{total number of people} \times 100\%$.

- (5) Hemodynamic indicators. Hemodynamic parameters such as mean arterial pressure (MAP), heart rate (HR), and cardiac index (CI) were compared between 2 groups.
- (6) Emotional changes in the two groups. Evaluated using the self-rating anxiety scale (SAS) and the self-rating depression scale (SDS), with scores directly proportional to the patient's level of anxiety and depression.
- (7) The occurrence of complications in 2 groups was analyzed and compared.

2.3.4. Detection methods

Five mL fasting peripheral venous blood samples were gathered before nursing and after nursing. The blood was subjected to centrifugation at 3000 rpm for 10 min. Tumor necrosis factor- α (TNF- α) and interleukin-1 β (IL-1 β) levels were tested through enzyme-linked immunosorbent assay (ELISA). Albumin content was tested through the bromocresol green method. Transferrin content was tested through immunoturbidimetry. All kits were purchased by Nanjing Jiancheng Bioengineering Institute.

2.3.5. Statistical analysis

SPSS 23.0 software was adopted for data processing and analysis. The statistical data were expressed as (n , %), and the χ^2 test was adopted for comparison; measurement data were expressed as ($x \pm s$), and the t test was adopted for comparison. Unconditioned univariate and multivariate Logistic regression were used to analyze the risk factors of venous thrombosis after long-term PICC catheterization in tumor patients, and the test level was $\alpha = 0.05$.

3. Results

3.1. Univariate analysis of risk factors for venous thrombosis after long-term PICC catheterization in cancer patients

Univariate analysis manifested that there were statistically significant differences in age, diabetes, continuous catheterization time, use of blood vessel puncture, platelet-promoting drugs, and preventive anticoagulant drugs between the two groups of patients with long-term PICC catheters ($P < 0.05$, **Table 1**).

3.2. Multivariate logistic regression analysis of venous thrombosis after long-term PICC catheterization in tumor patients

Multivariate Logistic regression analysis manifested that age ≥ 60 years old, diabetes mellitus, continuous catheterization time ≥ 14 days, cephalic vein puncture, use of platelet-stimulating drugs, and non-prophylactic use of anticoagulant drugs were independent risk factors for venous thrombosis after long-term PICC catheterization in tumor patients ($P < 0.01$, **Table 2**).

Table 1. Univariate analysis of risk factors for venous thrombosis after long-term PICC catheterization in cancer patients.

Factors		Group A (n = 136)	Group B (n = 136)	χ^2	P
Gender	Male	70 (51.47)	71 (52.21)	0.007	0.935
	Female	66 (48.53)	65 (47.79)		
Age	≥60 years	117 (86.03)	79 (58.09)	7.94	0.005
	<60 years	19 (13.97)	57 (41.91)		
Body mass index	≥21 kg/m ²	74 (54.41)	75 (55.15)	0.008	0.928
	<21 kg/m ²	62 (45.59)	61 (44.85)		
Underlying diseases	Diabetes	47 (34.56)	21 (15.44)	8.631	0.001
	Hyperlipemia	29 (21.32)	40 (29.41)	1.003	0.531
	Hypertension	60 (44.12)	75 (55.14)	2.823	0.130
Tumor type	Digestive system malignancy	58 (42.65)	55 (40.44)	0.096	0.953
	Malignant tumor of respiratory system	47 (34.56)	46 (33.82)		
	Hematological malignant tumor	31 (22.79)	35 (25.34)		
Continuous tube placement time	≥14 d	85 (62.50)	30 (22.06)	16.2880.	0.00
	<14 d	51 (37.50)	106 (77.94)		
Position of the limb with catheterization	Left side	82 (60.29)	85 (62.50)	0.070	0.791
	Right side	54 (39.71)	51 (37.50)		
Puncture vessel location	Vena basilica	97 (71.32)	126 (92.65)	10.01	60.007
	Median cubital vein	4 (2.94)	4 (2.94)		
	Vena capitis	35 (25.74)	6 (4.51)		
Use of hemostatic drugs	Yes	39 (28.68)	43 (31.62)	0.084	0.773
	No	97 (71.32)	93 (68.38)		
Thrombocytotropic drugs	Yes	78 (57.35)	40 (29.42)	7.184	0.007
	No	58 (42.65)	96 (70.58)		
Use of prophylactic anticoagulants	Yes	46 (33.83)	91 (66.91)	6.019	0.014
	No	90 (66.17)	45 (33.09)		
Operation history	Yes	89 (65.44)	85 (62.50)	0.091	0.763
	No	47 (34.56)	51 (37.50)		

Table 2. Multivariate Logistic regression analysis of venous thrombosis after long-term PICC catheterization in tumor patients.

Variate	Regression coefficient	Wald value	OR value	P value	95% CI
Age ≥60 years old	0.350	1.204	4.065	0.005	1.168–9.198
Had diabetes	0.656	1.645	5.185	0.003	2.025–11.052
Continuous tube placement time ≥14 days	0.652	1.625	5.652	0.002	2.526–22.052
The puncture vessel was the cephalic vein	0.352	2.452	6.165	0.000	1.640–16.523
Use of platelet promoting drugs	0.452	1.826	5.859	0.001	1.526–15.052
Non-prophylactic use of anticoagulants	0.226	9.412	11.052	0.000	1.952–21.065

Note: A more than fourfold increase was seen in age ≥60 years old; a more than fivefold increase in risk was seen in diabetes mellitus, continuous tube placement time ≥14 days, cephalic vein puncture, use of platelet-stimulating drugs, and non-prophylactic use of anticoagulant drugs.

3.3. Satisfaction analysis of two groups after nursing

The nursing satisfaction score was 95.35% in the OG, higher than 76.74% in the CG ($P < 0.05$), as shown in **Figure 1**.

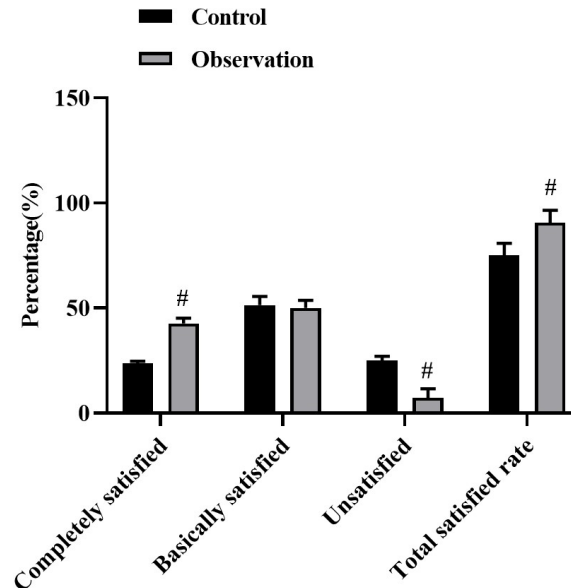


Figure 1. Satisfaction analysis of two groups after nursing. Compared with the control group, # was $P < 0.05$.

3.4. SAS scores and SDS scores of patients with different nursing methods

After nursing, the SAS score in the OG was (37.74 ± 3.32) points, presented lower than that of (45.55 ± 3.36) points in the CG ($P < 0.05$). The SDS score in the OG was (34.52 ± 3.21) points, lower than that of (39.37 ± 3.32) points in the CG ($P < 0.05$, **Figure 2**).

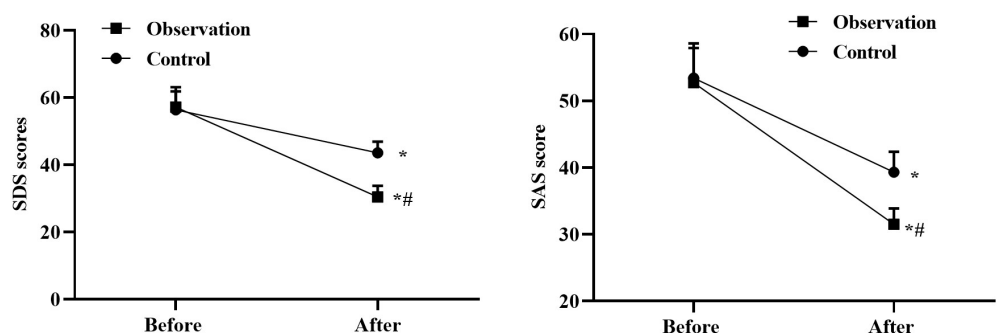


Figure 2. SAS scores and SDS scores of patients with different nursing methods. Compared with before nursing, * was $P < 0.05$; compared with the control group, # was $P < 0.05$.

3.5. Cognitive level of catheter maintenance between the two groups before and after intervention

Before nursing, there were no significant differences in the dimensions of belief, knowledge level, and behavior between the 2 groups ($P > 0.05$). After nursing, the scores of patients in the OG in the dimension of belief, knowledge level, and behavior were significantly higher than those in the CG ($P < 0.05$, **Figure 3**).

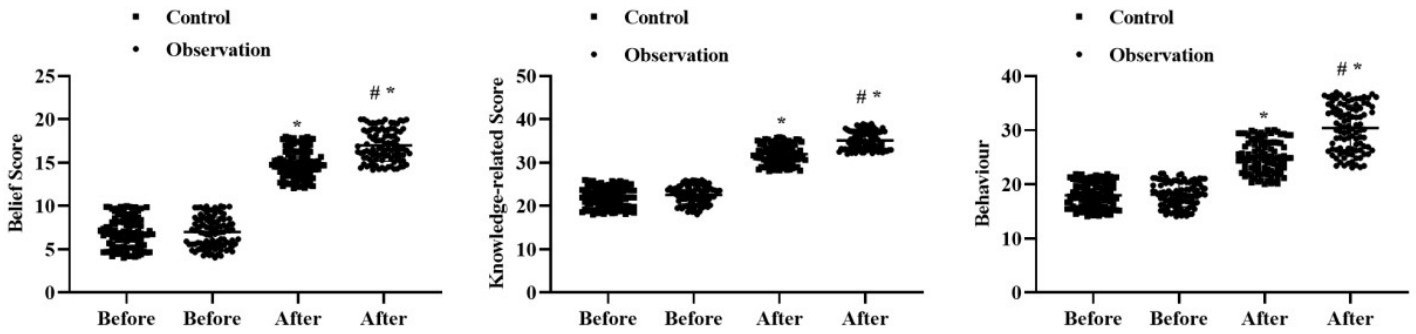


Figure 3. Cognitive level of catheter maintenance between 2 groups.

Compared with before nursing, * was $P < 0.05$; compared with the control group, # was $P < 0.05$.

3.6. Hemodynamic indexes between 2 groups

Prior to nursing, there were no significant differences in MAP and HR along with CI between the 2 groups ($P > 0.05$). After nursing, MAP, HR, and CI of patients in both groups were significantly improved, and patients in the OG were better than those in the CG ($P < 0.05$), as shown in **Figure 4**.

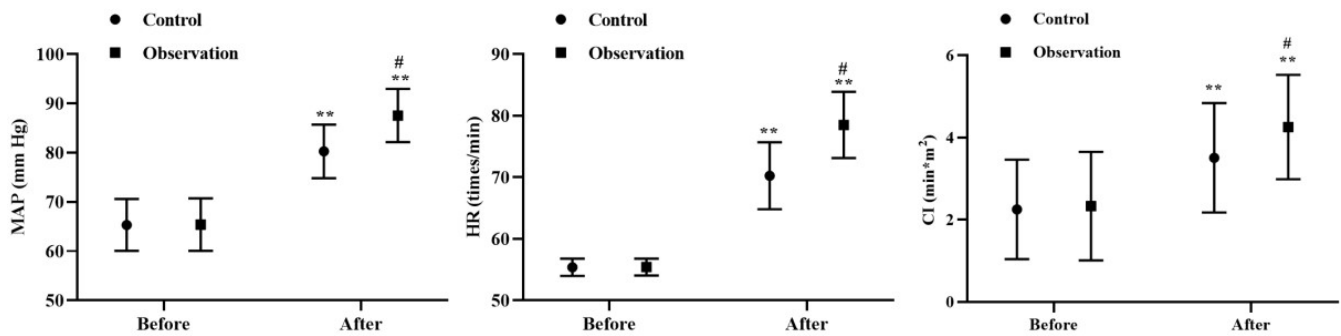


Figure 4. Hemodynamic indexes between 2 groups.

Compared with before nursing, ** was $P < 0.01$; compared with the control group, # was $P < 0.05$.

3.7. Inflammatory factors between 2 groups

Before nursing, there were no significant differences in the levels of inflammatory factors TNF- α and IL-1 β between 2 groups ($P > 0.05$). After nursing, TNF- α and IL-1 β levels of patients in the OG were significantly lower than those in the CG ($P < 0.05$, **Figure 5**).

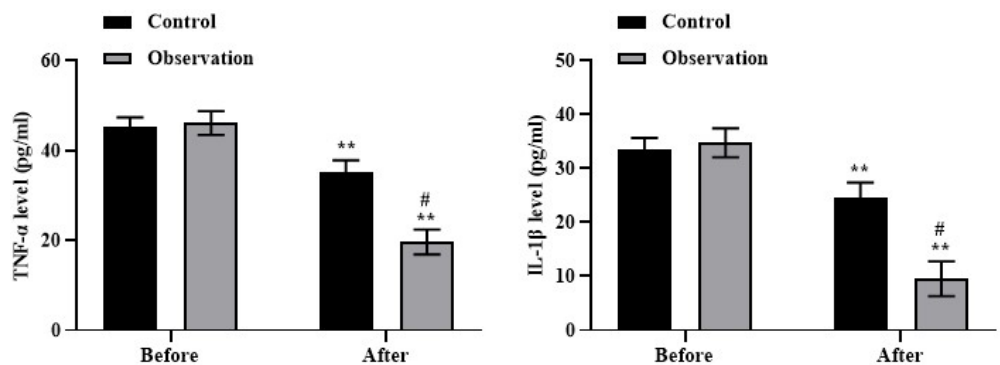


Figure 5. Inflammatory factors between 2 groups.

Compared with before nursing, ** was $P < 0.01$; compared with the control group, # was $P < 0.05$.

3.8. Nutritional status between 2 groups

Before nursing, there were no significant differences in the contents of nutritional indicators, including albumin and transferrin, between the 2 groups ($P > 0.05$). After nursing, albumin and transferrin contents in the OG were significantly higher than those in the CG ($P < 0.05$, **Figure 6**).

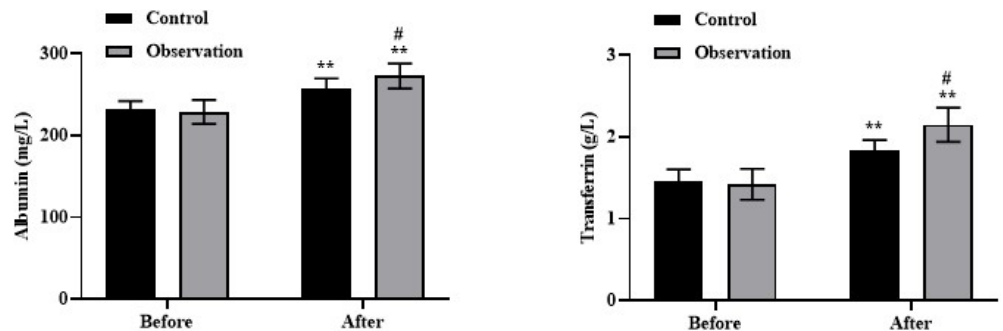


Figure 6. Nutritional status between 2 groups.

Compared with before nursing, ** was $P < 0.01$; compared with the control group, # was $P < 0.05$.

3.9. Occurrence of complications in 2 groups

In the CG, there were 2 cases of errhysis, 3 cases of puncture site infection, 4 cases of skin allergy, and 2 cases of phlebitis. The total incidence rate was 16.17% (11/68). In the OG, there was 1 case of errhysis and 1 case of skin allergy. The total incidence rate was 2.94% (2/68). In comparison with the CG, the incidence of complications in the OG was significantly lower ($P < 0.01$, **Table 3**).

Table 3. Occurrence of complications in 2 groups.

Groups	Errhysis		Puncture site infection		Skin allergy		Phlebitis		Total incidence rate (%)
	Cases	%	Cases	%	Cases	%	Cases	%	
Observation group ($n = 68$)	1	1.47	0	0.00	1	1.47	0	0.00	2.94
Control group ($n = 68$)	2	2.94	3	4.41	4	5.88	2	2.94	16.17
									6.88
									<0.01

4. Discussion

Malignant tumors are a serious disease threatening people's life safety, and they are mainly treated by operation, chemotherapy, and radiotherapy. Among them, chemotherapy is one of the effective means to treat tumors, which achieves the purpose of treatment by killing cancer cells with chemotherapy drugs [17]. However, the toxic effect of chemotherapy drugs is relatively large, and it is easy to cause local tissue damage and even necrosis if it oozes out of blood vessels. With the development of intravenous infusion technology, PICC has also been widely used in patients with malignant tumor chemotherapy. Compared with traditional peripheral venipuncture technology, PICC can further prolong the catheterization time, which is not only conducive to the maintenance and operation of nursing staff but also avoids the huge physical and mental pain caused by repeated venipuncture to patients [18]. However, PICC catheterization is an invasive operation, and the retention time is relatively long,

and related complications are unavoidable [19]. Venous thrombosis belongs to one of the common complications in patients with PICC catheterization, which can not only lead to upper limb pain, swelling, and other problems, but also cause pulmonary embolism, cerebral infarction, and other serious consequences, increasing the risk of death of patients [20]. In view of this, this research analyzed the risk factors of venous thrombosis after long-term PICC catheterization in cancer patients and proposed predictive nursing countermeasures in order to provide reliable reference for PICC catheterization in cancer chemotherapy patients.

Some literature studies have shown that there are many factors affecting the formation of venous thrombosis after long-term PICC catheterization in tumor patients, including age, puncture method, and puncture site [21]. Through univariate and multi-factor Logistic regression analysis, this study found that age ≥ 60 years old (OR = 4.065), diabetes mellitus (OR = 5.185), continuous catheterization time ≥ 14 days (OR = 5.652), cephalic vein puncture (OR = 6.165), use of platelet-stimulating drugs (OR = 5.859), and non-prophylactic use of anticoagulant drugs (OR = 11.025) were the risk factors for venous thrombosis after long-term PICC catheterization in tumor patients. Elderly patients aged ≥ 60 years old have a declining vasodilation function, which obstructs blood circulation, so it is easy to form thrombosis. At present, advanced age has been included as a risk factor for tumor-related venous thrombosis in the expert consensus of the Chinese Society of Clinical Oncology [22]. At the same time, with the extension of PICC catheterization time, the risk of injury to the indwelling vein also increases, which increases the probability of venous thrombosis. One study pointed out that the risk of post-diabetic venous thrombosis in patients with PICC catheterization for tumor chemotherapy was 2.021 times higher than that of patients without diabetes [23]. High blood glucose can improve the adhesion of endothelial cells, enhance the blood viscosity, slow the blood flow in the blood vessels, and provide favorable conditions for the formation of venous thrombosis. Some scholars have found that PICC catheters in cephalic veins [24]. The results of this study were similar to these results. The cephalic vein is a shallow vein on the palmar and dorsal side of the radial forearm, with a relatively thin diameter and close to the limb [25]. Venous valves are usually visible at the place where it merges into the axillary vein, thus interfering with the direction of blood and increasing the risk of thrombosis [26]. Repeated and multiple chemotherapy can increase the risk of leukopenia and suppression of bone marrow hematopoietic function in patients, so it is necessary to combine it with platelet-stimulating drugs, which can induce increased platelet reactivity in tumor patients and promote the formation of venous thrombosis [27]. In addition, the preventive use of anticoagulant drugs can improve the hypercoagulable state of the patient's blood, avoid the imbalance between the fibrinolytic system and the coagulation system, and then reduce the probability of thrombosis [28].

Relevant studies have shown that in patients with PICC-associated venous thrombosis in malignant tumors, the risk of accidents can be lessened through better nursing methods [29]. By comparing the two methods of routine nursing and intervention nursing, the author found that the satisfaction of intervention nursing was higher than that of routine nursing. Therefore, the author believes that in the nursing of patients with venous thrombosis in malignant tumors, it is necessary to carry out

comprehensive intervention nursing and targeted nursing measures, which can improve the prognosis of nursing and reduce the generation of related risk factors. The results of this study showed that the score of nursing satisfaction was 95.35 in the OG, higher than 76.74 in the CG. After nursing, the SAS score in the OG was (37.74 ± 3.32) points, lower than that of (45.55 ± 3.36) points in the CG. The SDS score in the OG was (34.52 ± 3.21) points, lower than that of (39.37 ± 3.32) points in the CG. This study found that after intervention, the scores of the belief dimension, knowledge level dimension, behavior dimension, and total score of the OG were higher than those of the CG. Thus, nurses can summarize and analyze the risk factors existing in clinical patients during treatment and recovery with the help of the relevant thrombosis risk assessment scale, divide patients into different risk levels based on their own conditions, and carry out targeted and precise nursing intervention countermeasures [30]. Nurses optimized and improved knowledge education modes such as oral education and infusion explanation in conventional nursing, placed patients in the main position of nursing intervention, improved patients' sense of "ownership" of self-care management, enhanced their sense of responsibility and belief in the development and completion of nursing management, stimulated their subjectivity and thirst for knowledge learning and mastery, and strengthened their knowledge of PICC-related expertise.

This study found that after intervention, MAP, HR, and CI indexes of the OG were better than those of the CG. The reasons are as follows: Under the supervision of the self-care leader, the patients completed the limb functional activity training formulated by the nurses actively and regularly, which promoted the gradual smooth circulation of peripheral blood, reduced the blood viscosity, increased the amount of blood perfusion back to the heart, and helped maintain the mean pulse pressure, heart rate, and other hemodynamic indicators at a stable and normal level.

This study found that after intervention, inflammatory factors in the OG were lower than those of the CG. TNF- α and IL-1 β are classical inflammatory factors, which can result in the expansion of inflammatory response [31]. Good nutritional status is an important prerequisite for promoting patient recovery. Albumin and transferrin are commonly used clinical nutritional indicators [32]. This study found that, after intervention, the contents of nutritional indicators albumin and transferrin of the OG were better than those of the CG. These results indicated that predictive nursing could alleviate the inflammatory response and improve the nutritional status of patients, which is an important mechanism for promoting patient recovery. This study found that the complication rate of the OG was lower than that of the CG. It could be seen that through prospective analysis and evaluation of possible risks and problems of patients, nurses promoted the development of clinical nursing work and the formulation of intervention measures to be more targeted and preventive, which well ensured the safety of patients during the catheterization, while timely replacement of the application and strict compliance with aseptic operation could effectively reduce the occurrence of complications and improve the comfort of patients.

Beyond the physiological findings, the results of this study also carry important psychological implications for cancer patients receiving PICC-based chemotherapy. Recent evidence in psycho-oncology indicates that treatment-related complications, disruptions in vascular access, and uncertainty about future therapy can significantly

heighten anxiety, depressive symptoms, and overall emotional burden in oncology populations [33]. Emotional distress in turn has been linked with poorer self-management, decreased adherence to medical recommendations, and lower confidence in treatment safety [34]. The reductions in anxiety and depression observed in the predictive nursing group suggest that structured education, anticipatory guidance, and continuous emotional support may help buffer these psychological reactions and maintain a greater sense of control during therapy. This is consistent with systematic evidence showing that nurse-led educational interventions significantly reduce anxiety and moderately reduce depression among cancer patients [35]. Moreover, research specific to PICC-managed cancer patients demonstrates that home-care-based education significantly improves psychological well-being, self-management behaviors, compliance, and overall treatment satisfaction [34]. This may partially explain why predictive nursing improved satisfaction, cognitive engagement, and treatment outcomes in this study.

This study has some limitations. First, whether family history and lifestyle factors influencing the risk of venous thrombosis were not assessed between the two groups. Second, this was a retrospective design and was prone to bias and unmeasured confounders (e.g., patient mobility, off-protocol nutritional support). In addition, this was a single-center study that may not be representative of the broader oncology environment.

5. Conclusion

Age ≥ 60 years, diabetes mellitus, prolonged catheterization time, cephalic vein puncture, use of platelet-stimulating medications, and the absence of prophylactic anticoagulation were confirmed as independent risk factors for PICC-related venous thrombosis in cancer patients. Beyond these clinical factors, the study demonstrates that predictive nursing not only improves physiological stability but also provides meaningful psychological benefits. By reducing anxiety and depression, enhancing patients' confidence in treatment safety, and improving cognitive engagement with catheter-care behaviors, predictive nursing contributes to better emotional adjustment during chemotherapy. These findings highlight the importance of integrating proactive, supportive, and psychosocially informed nursing practices into PICC care to safeguard both physical safety and psychological well-being in oncology patients.

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Informed consent statement: Informed consent was obtained from all subjects involved in the study.

Availability of data and materials: The data that support the findings of this study are available from the Corresponding Author [Shao Y], upon reasonable request.

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