

Original Article

Effects of high-quality nursing on complications of peripherally inserted central catheter placement in patients with leukemia

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Abstract: Objective: To determine the effects of high-quality nursing on negative emotions, treatment compliance, and complications of peripherally inserted central catheter (PICC) placement in patients with leukemia. Methods: A total of 87 patients with leukemia treated in our hospital from May 2018 to May 2020 were retrospectively enrolled and their clinical data were analyzed. The patients were assigned to a routine group (n=40) and a high-quality group (n=47) based on different nursing schemes. The self-rating depression scale (SDS) and self-rating anxiety scale (SAS) were used to compare the negative emotional changes in patients of the two groups, and the visual analogue scale (VAS) was used to analyze the degree of pain. The two groups were compared in treatment compliance, quality of life, incidence of complications of PICC placement, and nursing satisfaction. Results: After intervention, the high-quality group got significantly lower SDS and SAS scores than the routine group (both $P < 0.05$). Compared with the routine group, the high-quality group showed higher treatment compliance and nursing satisfaction, experienced higher quality of life (all $P < 0.05$), with also a lower total incidence of complications of PICC placement ($P < 0.01$). Conclusion: For patients with leukemia, high-quality nursing can substantially improve their psychological state, treatment compliance and nursing satisfaction, and reduce the incidence of complications of PICC placement.

Keywords: High-quality nursing, leukemia, complications of PICC placement, negative emotions

Introduction

Leukemia is a common disease of blood system, posing a threat to global cancer control, with the number of patients increased by 19% from 2007 to 2017 [1]. It is mainly manifested by anemia, infection, bone pain and bleeding [2, 3], and its occurrence is significantly associated with genetic factors, viruses, chemical factors and radiation factors [4]. At the current stage, chemotherapy is a common treatment for leukemia [5], but long-term chemotherapy is likely to damage patients' blood vessels, and drug extravasation will severely damage patients' health [6]. Peripherally inserted central catheter (PICC) placement is easy to operate because it requires no repeated puncture of blood vessels, which substantially reduces the stimulation of chemotherapy drugs to patients' peripheral blood vessels [7]. However, patients with leukemia generally have poor immunity, and most of patients' blood is in a

hypercoagulable state, so PICC is prone to various complications after placement, which worsens the disease [8]. Therefore, it is of great significance to apply high-quality nursing to patients who have received PICC placement to prevent complications.

As a novel nursing mode, high-quality nursing is getting more common. Different from the conventional mode, high-quality nursing is a people-centered mode that provides patients with scientific and efficient nursing. Such nursing will clarify nursing philosophy and responsibilities and use professional knowledge, operation and attitude to help them recover [9, 10]. Currently, high-quality nursing has been applied to the care of various diseases. According to previous research, under high-quality nursing, elderly patients with rheumatoid arthritis show better compliance with medication [11]. Samus et al. [12] have pointed out that compared with routine nursing, high-quality nursing can

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improve the independent living ability of patients with dementia and promote their quality of life. Improving the nursing quality in terms of blood flow rate can forestall and detect early deep venous thrombosis (DVT) [13].

Currently, the research on the application of high-quality nursing in leukemia patients is limited. This study implemented high-quality nursing intervention for leukemia patients to understand the clinical value of high-quality nursing in such patients.

Materials and methods

Clinical data collection

A total of 87 patients, including 66 patients with acute lymphoblastic leukemia and 21 patients with acute myeloid leukemia, treated in our hospital who required PICC placement from May 2018 to May 2020 were retrospectively enrolled and their clinical data were analyzed. The patients were assigned to a routine group (n=40) and a high-quality group (n=47) based on different nursing schemes. The routine group received routine nursing, while the high-quality group received high-quality nursing intervention. This study was conducted with approval of the Ethics Committee of our hospital, with ethical approval number of 2018 (LL) review 018A.

Inclusion and exclusion criteria

The inclusion criteria: Patients with acute leukemia diagnosed according to the European Society for Medical Oncology (ESMO)-related guidelines [14, 15], patients with detailed clinical data, patients meeting indications for PICC placement, patients who voluntarily participated in this study, and patients who and whose families agreed and signed the informed consent form.

The exclusion criteria: Patients younger than 18 years old, pregnant patients, lactating women, and patients with mental disease, cognitive impairment, severe heart, lung or brain failure or severe complications.

Nursing methods

Patients in the routine group were given routine nursing intervention, covering routine health education, daily life guidance, psychological

care, and prevention of complications. Patients were given routine PICC-related operation and nursing care, and related diagnosis and treatment were performed according to the doctor's advice. Patients and their families were told in detail about catheter-related nursing precautions and told to pay attention to local skin dryness and cleanliness, and seek medical treatment in time when redness, swelling and hot pain occurred.

Patients in the high-quality group were given high-quality nursing as follows.

Health education: The relevant knowledge of leukemia, chemotherapy and PICC placement were explained to patients and their families, with an emphasis on the importance of following doctors' guidance, to help patients understand the high overall puncture and placement rate of PICC, risk factors of bleeding at PICC puncture site and common complications of PICC, so that they can be psychologically prepared.

Psychological nursing: The nursing staff was arranged to provide psychological guidance service in the whole process and pay attention to the emotional changes of patients. The staff was required to communicate with and guide patients with negative emotions in time by appropriate psychological intervene methods and ask family members to accompany patients more.

Quality control: Operators of PICC had all been registered for more than 3 years, and they placed it under the supervision and guidance of nurse in charge during catheter placement to ensure the high success rate of puncture and placement.

Nursing during placement: The tube placement was carried out in strict accordance with the principle of aseptic operation, with appropriate catheter length and gentle puncture, under the guidance of ultrasound. An appropriate amount of sterile auxiliary materials was covered on the puncture site while the puncture catheter was well fixed, and the dressing was replaced regularly.

Post-puncture nursing: The puncture site was bandaged. The staff was arranged to regularly observe whether the puncture site of the patient was red and swollen, and tell the patient

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to move the catheter site properly while protecting the limb on the catheter side, but do not exercise violently or frequently to prevent mechanical injury. The patient was urged to not press the catheterization vessels during sleep, and pulse or positive pressure should be selected to flush and seal the tubes. The dressing change operation was standardized. The tube was flushed with normal saline before infusion every day, and urokinase solution was adopted for thrombolysis if the catheter was blocked. The staff was required to actively ask patients about their pain after infusion, measure the changes of their body temperature, reasonably adjust the infusion speed, and regularly inspect the puncture site for bleeding, pay close attention to complications after placement, and address them in time. In addition, the staff instructed the patient to clench and loosen their fists once every morning and evening, 20 min each time.

Diet intervention: The patients were required to take a scientific, balanced and nutritious diet, mainly including a light and digestible diet under the condition of satisfying energy demand.

Outcome measures

Primary outcome measures: The Self-rating anxiety scale (SAS) [16] and self-rating depression scale (SDS) [17] were adopted to evaluate the negative emotions of patients in the two groups, and a higher SAS/SDS score indicates more severe anxiety/depression. The treatment compliance of the two groups was evaluated. The total treatment compliance = (patients with complete compliance + patients with partial compliance)/the total number of patients $\times 100\%$. The incidence of complications of PICC placement in the two groups was recorded.

Secondary outcome measures: The visual analog scale (VAS) [18] was adopted to evaluate patients' pain degree after 7 days of placement. With a total score of 0-10 points, the VAS indicates no pain with 0 points, mild pain with 1-3 points, moderate pain with 4-6 points, and severe pain with 7-10 points. The MOS 36-Item Short-Form Health Survey (SF-36) [19] was adopted for evaluation of quality of life of patients. The Newcastle Nursing Satisfaction Scale (NSNS) [20] was used to evaluate pa-

tients' nursing satisfaction. The self-made treatment compliance scale was used to evaluate patient compliance. Complete compliance: Patients fully accepted the treatment plan and received the whole treatment; good compliance: patients cooperated with various nursing measures; partial compliance: patients did not understand the adverse reactions and did not cooperate with various medical and nursing work; non-compliance: patients just followed the doctor's advice, or just cooperated with nursing. The compliance rate = (complete compliance + partial compliance) cases/total cases $\times 100\%$.

Statistical analyses

In this study, SPSS20.0 (Chicago SPSS Company, United States) was adopted to statistically analyze the collected data, and GraphPad Prism 7 (San Diego Graphpad Software Co., Ltd., United States) was used to visualize the data into required figures. The enumeration data (%) was analyzed using the chi-square test and presented by χ^2 . Measurement data (Mean \pm SD) were all in normal distribution. Inter-group comparisons were performed by the independent-samples T test, and presented by t. $P < 0.05$ implied a significant difference.

Results

Comparison of baseline data

Comparison of baseline data between the two groups revealed no significant difference between them in gender, age, body mass index (BMI), course of disease, educational level, dietary favor, place of residence, smoking history, drinking history and disease composition (all $P > 0.05$, **Table 1**).

Changes of SAS and SDS scores

The SAS and SDS were adopted for evaluation of patients' anxiety and depression before and after intervention, respectively. According to the results, before intervention, the two groups were similar in SAS and SDS scores (both $P > 0.05$), while after intervention, SAS and SDS scores of both groups decreased significantly (both $P < 0.001$), with lower SAS and SDS scores in the high-quality group than those in the routine group (both $P < 0.001$) (**Figure 1**).

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Table 1. Comparison of baseline data between the two groups

Group	Routine group (n=40)	High-quality group (n=47)	χ^2/t	P-value
Gender				
Male	26 (65.00)	25 (53.19)	1.242	0.265
Female	14 (35.00)	22 (46.81)		
Age (Y)	44.6±7.6	46.2±8.1	0.945	0.348
BMI (kg/m ²)	21.54±2.14	22.10±2.07	1.238	0.219
Course of disease (Y)	2.6±0.5	2.8±0.7	1.508	0.135
Education level			1.554	0.213
<senior high school	24 (60.00)	22 (46.81)	1.509	0.219
≥ senior high school	16 (40.00)	25 (53.19)		
Dietary favor				
Light	18 (45.00)	17 (36.17)	0.701	0.403
Heavy	22 (55.00)	30 (63.83)		
Place of residence				
Urban area	23 (57.50)	22 (46.81)	0.989	0.320
Rural area	17 (42.50)	25 (53.19)		
Smoking history				
Yes	21 (52.50)	28 (59.57)	0.440	0.507
No	19 (47.50)	19 (40.43)		
Drinking history				
Yes	26 (65.00)	35 (74.47)	0.925	0.336
No	14 (35.00)	12 (25.53)		
Disease type				
Acute lymphoblastic leukemia	29 (72.50)	37 (78.82)	0.457	0.499
Acute myeloid leukemia	11 (27.50)	10 (21.28)		

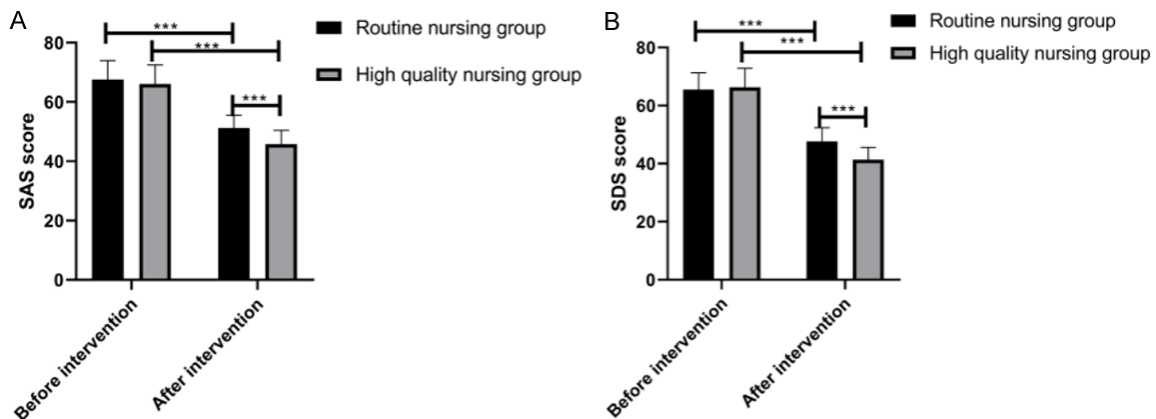


Figure 1. Changes in SAS and SDS scores of the two groups before and after nursing. A, B. Before intervention, the two groups were similar in SAS/SDS scores, while after intervention, SAS/SDS scores of both groups decreased significantly, with lower SAS/SDS scores in the high-quality group than those in the routine group. ***indicates P<0.001.

Comparison of VAS score

The VAS was adopted for evaluation of patients' pain after 7 days of PICC placement,

and the results revealed a significantly lower VAS score in the high-quality group than that in the routine group (P<0.001, **Figure 2**).

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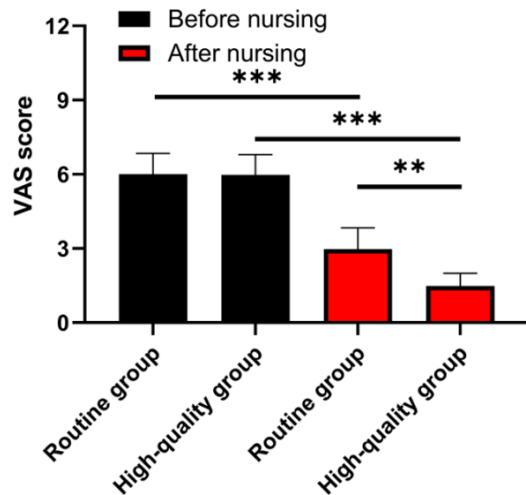


Figure 2. Comparison of VAS score between the two groups before and at 7 days after PICC placement. The VAS score of the high-quality group was significantly lower than that of the routine group. **means $P < 0.01$, ***means $P < 0.001$.

Comparison of treatment compliance

Comparison of the two groups in treatment compliance revealed significantly higher treatment compliance in the high-quality group than that in the routine group (Table 2).

Comparison of the incidence of complications

Comparison of the two groups in the incidence of complications of PICC placement revealed a significantly lower incidence of complications in the high-quality group than that in the routine group ($P < 0.005$, Table 3).

Comparison of quality of life

The SF-36 was adopted for evaluation of patients' quality of life after nursing. According to the results, the quality of life scores of the high-quality group were all higher than those of the routine group in 8 dimensions (all $P < 0.001$, Table 4).

Comparison of nursing satisfaction

The self-made *Nursing Satisfaction Questionnaire* of our hospital was used to evaluate nursing satisfaction of the two groups. As a result, the high-quality group expressed higher nursing satisfaction than the routine group ($P < 0.05$, Table 5).

Discussion

The pathogenesis of leukemia is complex [21]. Its treatment is still unsatisfactory and developing novel drugs and reasonable combined chemotherapy regimen is the focus [22]. Currently, chemotherapy is the primary means to treat leukemia. In order to avoid the damage triggered by chemotherapy drugs, PICC placement is required, which is a common clinical means of long-term intravenous nutrition support and administration for critically ill patients and chemotherapy patients [23]. However, PICC placement may bring some complications, especially catheter-related deep vein thrombosis of upper extremity (UEDVT) and infection, which will compromise the normal progress of chemotherapy and even threaten the life of patients [24]. Accordingly, it is of great importance to carry out high-quality nursing for the treatment and rehabilitation of leukemia patients with PICC placement.

This study implemented high-quality nursing intervention for leukemia patients to evaluate the clinical value of high-quality nursing in such patients. Patients with leukemia suffer great psychological pressure, especially those with severe clinical symptoms who suffer more severe anxiety and depression [25]. In our study, the SAS and SDS were adopted for evaluation of patients' anxiety and depression before and after intervention, respectively. According to the results, after intervention, SAS and SDS scores of both groups decreased significantly, with lower SAS and SDS scores in the high-quality group than those in the routine group. The results indicate stronger effect of high-quality nursing in alleviating negative emotions of patients than routine nursing. Psychological intervention could help to alleviate the negative emotions and improve the quality of life of patients [26]. Our study intervened patients with leukemia by high-quality nursing. Firstly, health knowledge associated with leukemia was disseminated to the patients so that they could have a certain understanding of the disease, and psychological intervention was taken for them to solve their confusion and alleviate their negative emotions. Then, the pain of patients after 7 days of PICC placement was evaluated, and the pain of the high-quality group was significantly milder than that of the routine group. In our study, as for PICC place-

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Table 2. Comparison of treatment compliance between two groups

Group	Complete compliance	Partial compliance	Non-compliance	Total compliance rate
The routine group (n=40)	23 (57.50)	11 (27.50)	6 (15.00)	34 (85.00)
The high-quality group (n=47)	34 (72.34)	12 (25.53)	1 (2.13)	9 (97.87)
χ^2				4.840
P-value				0.028

Table 3. Comparison of the incidence of complications

Group	Skin allergy	Infection	Catheter loss/blocking	Phlebitis	Total
The routine group (n=40)	2 (5.00)	3 (7.50)	4 (10.00)	2 (5.00)	11 (27.50)
The high-quality group (n=47)	0 (0.00)	1 (2.13)	2 (4.26)	0 (0.00)	3 (6.38)
χ^2 value	-	-	-	-	7.137
P-value	-	-	-	-	0.008

Table 4. Comparison of quality of life

	The routine group (n=40)	The high-quality group (n=47)	t-value	P-value
Body function	63.37±7.93	75.46±6.25	7.949	<0.001
Role-physical	51.76±6.64	62.37±7.15	14.14	<0.001
Bodily pain	65.84±8.54	75.64±8.65	5.297	<0.001
Health status	58.40±9.28	65.33±8.21	3.695	<0.001
Energy	60.74±6.87	66.38±7.24	3.707	<0.001
Social function	52.77±7.05	59.46±8.12	4.066	<0.001
Role emotional	64.35±8.83	71.45±8.76	3.754	<0.001
Mental health	55.94±7.49	64.17±7.28	5.186	<0.001

Table 5. Comparison of nursing satisfaction between the two groups

Group	Satisfaction	Moderate satisfaction	Dissatisfaction	Overall satisfaction
The routine group (n=40)	21 (52.50)	12 (30.00)	7 (17.50)	33 (82.5)
The high-quality group (n=47)	28 (59.57)	17 (36.17)	2 (4.26)	45 (95.74)
χ^2 -value	-	-	-	4.087
P-value	-	-	-	0.043

ment, all operators had registered for more than three years, and nurses are highly professional, so the success rate of catheterization was relatively high. In addition, the placement was carried out in strict accordance with the principle of aseptic operation, and comprehensive nursing was applied after catheterization, which took a crucial part in relieving patients' pain. Currently, the compliance of leukemia patients with PICC placement in China is hindered by many factors, and poor compliance increases the treatment burden of patients [27]. In our study, comparison of the two groups in treatment compliance revealed significantly higher treatment compliance in the high-quality group than that in the routine group.

Similar to our results, Zhu et al. [28] found that for patients who underwent cancer chemotherapy and PICC placement, high-quality nursing intervention could improve their self-management ability, prolong PICC placement time, reduce the incidence of complications, and thus improve their treatment compliance and nursing satisfaction. Compared with their research, we not only analyzed the impact on PICC patients' post nursing compliance, but also compared the anxiety and depression of patients before and after nursing. Some patients are more prone to negative emotions, psychological stress, fear of treatment failure and other adverse consequences, and thus have poor compliance and quality of life [29],

which also delays their treatment process. Therefore, in our study, the nursing staff were arranged to fully communicate with the patients and their families and publicize successful treatment cases to them, so as to dispel their psychological worries, enlighten the patients together with their families and take daily care of them. In addition, the staff were also arranged to remind and supervise the treatment process of the patients to a certain extent to improve their compliance and quality of life.

PICC placement has many advantages, such as safety, unobstructed pipeline, no blood return, convenient operation and little pain, but it also has some disadvantages that should not be ignored, especially for leukemia patients who are likely to suffer catheter-related blood flow infection, phlebitis and other complications after placement due to thick blood and low immunity [30]. In our study, the incidence of complications in the two groups was analyzed, and the high-quality group showed a significantly lower incidence of complications than the routine group. Chou et al. [31] also pointed out the risk factors and etiological distribution of catheter-related infection (CRI) and appropriate nursing measures that can reduce the incidence of CRI in leukemia patients. Then the SF-36 was adopted for evaluation of patients' quality of life after nursing. According to the results, the quality of life scores of the high-quality group were all higher than those of the routine group in 8 dimensions, indicating that compared with routine nursing, high-quality nursing was more advantageous in improving the quality of life of leukemia patients undergoing PICC placement. Sun et al. [32] have indicated that high-quality nursing could alleviate the negative emotions of patients with leukemia and improve their quality of life and nursing satisfaction. At the end of the study, the nursing satisfaction of the two groups was evaluated, and the high-quality group expressed higher nursing satisfaction than the routine group. The result indicates that the high-quality nursing model in this study has been recognized by most leukemia patients with PICC placement.

There are still some limitations in this study. First of all, this study is a retrospective study, and we cannot follow up the patients for a long time, so we are unable to understand whether the survival of the patients after nursing was

influenced. Secondly, the sample size of this study is small, which may lead to bias of the results. Therefore, we hope to carry out a randomized controlled study in the future to further improve our conclusions.

Disclosure of conflict of interest

None.

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