Preventative Value of Predictive Health Interventions on PICC-Related Thrombosis in Patients with Severe Burns

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Background Burn mainly refers to the damage caused by high temperature to the skin and mucous membrane tissue. Seriously, it causes damage to the subcutaneous tissue or subcutaneous mucous membrane, which is easy to induce infection and poses a threat to the life safety of patients.For patients with deep burns, surgical removal of damaged skin and mucosal tissue, Postoperative,immediate coverage of surgical wounds,avoid infection due to body fluid and energy loss with related tissue necrosis.The clinical treatment period for critical burn patients is longer and high incidence of postoperative complications.The corresponding nursing intervention while undergoing treatment can help to eliminate the impact of the bad psychological state on the patients, improve the treatment compliance, and reduce the occurrence of complications.

Objective Evaluation of the value of predictive health intervention in preventing thrombosis associated with Peripherally Inserted Central Catheter (PICC) via peripheral vein in critically ill burn patients

Methods Select 90 patients with severe burn treated by PICC infusion from January 2019~ February 2021, Group by reference to intervention methods, with 45 using conventional health intervention (control group) and another 45 using predictive health interventions (observation group). The incidence of pulmonary and wound infection, the incidence of adverse events associated with PICC catheterization and wound healing time were recorded in the two groups. The degree of pain was evaluated by visual simulation (VAS) score, and the differences of platelet, D- dimer (D-D) and hemodynamics were detected in the two groups

Results The incidence of pulmonary infection, PICC associated thrombus and total adverse events in the observation group was lower, and higher rate of functional recovery,but less wound healing time with control group,which had statistical significance（P<0.05）.Incidence of wound infection, incidence of catheter blockage, incidence of unplanned extubation,the difference was not statistically significant（P>0.05）.Comparison before intervention,The pain score decreased at 7 d、14d、21d (P<0.05), and the observation group was lower than the control group（P<0.05）.Intervention of the 7d、14d two sets all platelet elevation（P<0.05）,but D-D concentration decreases（P<0.05）.Intervention of the 7d、14d two sets was increased of the intrathoracic blood volume index (ITBVI)（P<0.05）, but extravascular lung water index（EVLWI）and mean arterial pressure（MAP）the difference was not statistically significant（P>0.05）.

Conclusions Predictive health intervention can reduce the pain degree of critically burned patients, reduce the incidence of adverse events such as infection and PICC-related thrombosis, and promote wound recovery.

Central venous catheter (Peripherlly Inserted CentralCatheter,PICC) via peripheral vein is often used in patients with severe burns，the successful rate is high, which can reduce the stimulation of operation and damage to peripheral venous intima[1,2].But its catheter time

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is longer, PICC related infection, thrombosis and other complications are higher, affecting the prognosis of patients.Old age state , slow blood flow in upper limbs and lower vascular diameter are the causes of venous thrombosis[3].There may be many unpredictable changes in the treatment and care of severely burned patients,Therefore, to formulate effective measures to eliminate adverse factors to the maximum extent and reduce the occurrence of adverse events, so as to ensure that the treatment and recovery of patients have positive clinical and practical significance[4].Nursing process，Solid basic nursing skills and extensive nursing experience are very important.The ability of predictive intervention helps to predict the unsafe factors in nursing process in advance,and then formulate corresponding emergency prevention plans and measures[5,6].Application of routine nursing mode and predictive health intervention in nursing safety management of critically ill burn patients to prevent PICC associated thrombosis in critically ill burn patients.

INFORMATION AND METHODOLOGY
General Information
Selection criteria for cases

Inclusion criteria：（1）Consistent with Surgery (8th Edition)[7]Moderate and Severe Burn （General area30%～49%，Area III10%～19%，General area ＜ 30% ， But the whole body condition is heavy or already shock, compound injury, moderate and severe inhalation injury）和 Severe burn（General area3≥50%，Area III≥20%）；（2） Older than eighteen and younger than seventy-five；（3）Bur burns to hospital admission less than 48 hours； （4） No infection of burn wounds； （5） No surgical treatment outside hospital； （6） Complete clinical data.

Exclusion criteria：（1）Upper limb on side of tube take thrombus and history of phlebitis or other diseases affecting venous return； （2） Chemical burn 、electric burn and radiation burn； （3） History of mental illness； （4） Severe dysfunction combined with other organs； （5） Previous history of infectious diseases； （6） Diabetes or abnormal blood sugar。

Case information

Select 90 patients with severe burn treated by PICC infusion from January 2019~ February 2021, Group by reference to intervention methods, with 45 using conventional health intervention (control group) and another 45 using predictive health interventions (observationgroup). Comparison of baseline data between two groups ， which had statistical significance（P<0.05） . Table 1

Method
Control group:

①health education： After Admission ， Nursing staff explain burn related knowledge and nursing precautions to patients and their families。②Mental nursing ： Analysis of patient psychological changes through conversations with patients and their families，give patient answers to patient questions， to meet patient needs 。③Anti-scar treatment and nursing：After wound healing, anti-scratch drugs were given as soon as possible，Nursing staff can use elastic bandages and elastic covers to give anti - scar care to patients.④rehabilitation training ：Postoperative，Development of rehabilitation training courses based on patient acceptance ， progressive procession。⑤Discharge Guidance：To instruct the patients and their families to pay attention to the nursing of wound after discharge，Diet and medication guidance，Inform the importance of functional exercise.

Observation group:

①Targeted learning and training：Regular lectures on knowledge related to predictive intervention for nursing staff.For nursing staff with low seniority and inexperience，explain the importance and necessity of predictive thinking，In order to enhance the nursing staff to actively develop the ability of predictive thinking awareness and initiative.

② Scientific and objective assessment of risks: Guide and train healthcare staff to scientifically and objectively predict and evaluate various possible risk factors.To evaluate the actual burn condition, possible changes, adverse events, complications and so on by using the rigorous predictive nursing method.

③Develop targeted measures ： Special attention to the observation of patients with lower limb edema, skin color change, superficial vein anger, gastrocnemius tenderness, etc.Imaging examinations such as Doppler

ultrasonography of lower extremity veins if necessary to identify and take targeted treatment. It is particularly important of postural care，Regular replacement of proper position，using gravity to promote venous return，A slight flexion of the hip and knee，but avoid trying to excessive joint flexion to compress the veins，promote venous reflux.The limbs keep warm，avoidvaso spasm from cold stimulation，reduction of thrombosis。According to the burn wound characteristics，selection of venipuncture sites。Because of the less chance of venous embolism in the upper limb, we should choose the venipuncture of the upper limb as far as possible, and the puncture force should be successful once.

④Guidance method：Guide and strengthen the cultivation of patient foresight thinking ability，Adjust and improve nursing procedures in practical care，people oriented，to realize the standardization and scientization of nursing mode.

Observation indicators and methods of detection

①Record the incidence of pulmonary and wound infections in both groups、Incidence of adverse events related to PICC catheterization and the wound healing time.Adverse events related to PICC catheter include of the catheter blockage、Unplanned extubation、PICC related thrombosis（Cathetered venous lumen without pressure closure phenomenon；No Doppler Pulse Spectrum Changes Caused by Respiratory Changes；No echo or low echo in venous lumen；No blood flow signal in venous segment）。

②visual simulation （VAS）[8]：Ten point system，Evaluate the severity of pain before intervention, 7d, 14d, 21d after intervention.，The higher the score, the heavier the pain。

③Criteria for functional recovery[9]：Outstanding:The wound recovered well without plastic surgery；Good:Burn wounds recovered well, but plastic surgery was still needed，Good for a slight impact on daily life；Pass:Burn wound recovery is general, need plastic surgery, and cannot be independent of daily life；Fail:Poor wound recovery and severe dysfunction。[10,11]

④Test method

Hemodynamic monitoring Methods Patients were placed in supine position. After routine disinfection of local skin with iodophor, a double lumen central venous catheter was inserted into the internal jugular vein to connect the monitor, and a PICC volume monitoring catheter was inserted into the femoral artery to connect the pressure sensor and the monitor.Average arterial pressure (mean arterial pressure,MAP) was detected by femoral catheter during monitoring；Thermal dilution measures theintra-arterialtemperature， draws the temperature change curve, and calculates the intrathoracic blood volume index (ITBVI), and extravascular lung water index (EVLWI).

Fasting venous blood 4 mL，Detection of platelet parameters by multiple daily automatic blood cell counters with Japanese SysmexKX21 blood wave。Centrifuge some blood samples（3000r/s，15min），Detection of D-dimer levels in the serum.

Statistical analysis

The data were processed by SPSS19.0. The measurement indexes were described by（ $\chi\pm s$）. The T-test was used for comparison. The enumeration data were compared by χ^2test. P < 0.05 was statistically significant.

RESULTS

Comparison of infection rate and wound healing time between two groups

Pulmonary infection rate in observation group (4.44 %) was lower than that in control group (17.78 %) ，Wound healing time （38.95±6.17） d shorter than control group（45.23±8.98）d，wound infection (8.89 %) was compared with that control group (15.56 %) ，the difference was not statistically significant（P>0.05）） 。Table 2

Comparison of the two groups of pain scores

Comparison before intervention, the pain score decreased at 7 d、14d、21d (P<0.05), and the observation group was lower than the control group（P<0.05）. Table 3

Comparison of excellent and good rate of functional recovery between two groups

The excellent and good rate of functional recovery in the observation group (93.33%) was higher than that in the control group (77.78%) ，which had statistical significance（P<0.05）. Table 4

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Comparison of adverse events related to PICC catheterization between the two groups

The incidence of PICC-related thrombosis (2.22 %) and the incidence of PICC-related total adverse events (8.89 %) in the observation group were lower than those in the control group （P<0.05） . Comparison with control group of Incidence of catheter blockage （6.67%） 、 Incidence of unplanned extubation（0.00%）, the difference was not statistically significant （P>0.05） 。 Table 5

Comparison of Platelet and D-D between Two Groups

Comparison of platelet and D-D between observation group and control group before intervention，the difference was not statistically significant （P>0.05）, Intervention of the 7d、14d two sets all platelet elevation（P<0.05）, but D-D concentration decreases（P<0.05））。Table 6

Comparison of hemodynamics between two groups

Comparison of hemodynamics between observation group and control group before intervention，the difference was not statistically significant （P>0.05）, Intervention of the 7d、14d two sets was increased of the intrathoracic blood volume index (ITBVI) （P<0.05）, but extravascular lung water index（EVLWI）and mean arterial pressure （MAP）the difference was not statistically significant （P>0.05）Table 7

DISCUSSION

Severe burn refers to the depth of the wound can reach the deep dermis of the skin. Skin blackening, whitening, nerve ending injury and blisters are the main clinical manifestations, which have a serious impact on the appearance of patients, and affect the normal work and life, increase the psychological burden of patients and reduce the quality of life[12].

PICC catheter is the main external channel for long-term nutrition supply in burn patients[13-15]。 It is reported that thrombosis is an independent risk factor affecting the treatment compliance of PICC catheter. Clinical treatment causes panic, tension, anxiety and other emotions to patients. Repeated puncture and catheter stimulation can cause intimal injury. Blood clots appear in the inner wall of the vessel where the catheter is located, and a vicious circle occurs. And due to the existence of catheter patient compliance is not enough, still need to improve[16,17]。

Predictive nursing intervention can change nursing staff from passive nursing intervention to active nursing intervention, mobilize the enthusiasm of nursing staff, improve the responsibility of nursing staff, and further improve the relationship between nurses and patients[18]。 The results showed that the pain scores of the two groups decreased at 7d, 14d and 21d after intervention.（P<0.05），and the observation group decreased more.It shows that predictive nursing intervention can reduce the pain of patients ' wound and improve the tolerance of patients after operation, which has positive significance to promote the recovery of prognosis., 分析其 The reason is that due to the large daily workload and heavy work of medical staff in routine nursing, patients with severe burns only pay attention to the treatment during hospitalization and wound healing, and lack of postoperative rehabilitation nursing, which cannot make patients realize the importance of rehabilitation nursing fundamentally.The postoperative rehabilitation process of patients with deep burn is long and arduous. Without professional guidance, it is easy to lead to the failure of rehabilitation training, aggravate burn sequelae and promote the occurrence of complications, and the prognosis recovery effect is poor.Predictive nursing intervention first increases the patient 's awareness of burns and the resulting negative psychology. We will give timely guidance and give full play to the patient 's subjective initiative to participate in the formulation of rehabilitation plans and objectives. At the same time, patients are given predictive antithrombotic therapy to promote the regression of tissue swelling around the wound, peripheral blood circulation and tissue regeneration, which is conducive to accelerating wound healing.[19]。

Within 24 hours after burn, patients ' cardiac preload parameters are often lower than normal reference values, and systemic circulation blood volume is obviously insufficient.Although MAP remained high during the study, it should be related to the use of vasoactive drug[1]。 Early administration of adequate fluid infusion therapy

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can restore hemodynamics and vascular function to a certain extent. Real-time dynamic monitoring and evaluation of hemodynamic and volume parameters through advanced technologies can ensure that appropriate fluid infusion in patients with severe patients to quickly restore blood volume and maintain appropriate perfusion of tissues and organs, and avoid the occurrence of various complications caused by excessive fluid load.The significant difference of preload parameters between the two groups also indicates that too much fluid infusion in the early stage of injury or increased vascular volume in the reabsorption period are also important for the treatment outcome of patients.During the study period，there was no statistically significant difference in lung-related index EVLWI and cardiac function index ITBVI after predictive nursing compared with the control group.It may be that the sample number in this study is small[20,21]

The findings ： Intervention of the 7d、14d two sets all platelet elevation（P<0.05）,but D-D concentration decreases（P<0.05）） The main objective of predictive nursing is to develop the best nursing intervention program according to the patient 's condition, so as to prevent the occurrence of adverse events such as disease sequelae and complications, and carry out targeted exercise intervention.，Predictive nursing intervention can effectively promote the blood circulation of upper extremity superficial vein, and has the effect of vasodilation, promote the regular movement of superficial vein blood vessels and fascia attached to the muscle group, change the blood stasis state through active and passive movement, promote superficial vein blood and lymph circulation, effectively reduce catheter blockage and thrombosis, but also reduce PICC catheter pain, infection, and avoid the occurrence of related thrombosis.

At present, there are few studies on the application of predictive nursing intervention in the management of critically ill burn patients. In this study, hemodynamic changes and adverse events were used as evaluation indexes of nursing intervention. In summary, predictive health intervention can reduce the pain degree of critically ill burn patients, reduce the incidence of adverse events such as infection and PICC related thrombosis, and promote wound recovery.

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Table 1
Comparison of baseline data between the two groups

Group	Number of cases	Men/Women	Age（year）	Time from burn to admission（h）	Total burn area（%）	III ° Burn area（%）
Control group	45	25/20	48.69±11.85	22.32±4.15	58.79±7.82	33.12±5.25
Observation group	45	22/23	47.41±12.05	21.98±4.52	59.02±8.71	34.01±5.62
χ^2/t		0.401	0.508	0.372	0.132	0.776
P		0.527	0.613	0.711	0.895	0.440

续表 1

Group	Number of cases	Causes of burn		Education		
		Hydrothermal scald	Flame burn	Junior high school and below	Technical secondary school and high school	Junior college or above
Control group	45	18（40.00）	27（60.00）	8（17.78）	16（35.56）	21（46.67）
Observation group	45	20（44.44）	25（55.56）	10（22.22）	12（26.67）	23（51.11）
χ2		0.182		0.885		
P		0.670		0.643		

Table 2
Comparison of infection rate and wound healing time between the two groups

Group	Number of cases	Infection status			Wound healing time（d）
		Pulmonary infection rate（%）	Wound infection（%）	infection rate（%）	
Control group	45	8（17.78）	7（15.56）	15（33.33）	45.23±8.98
Observation group	45	2（4.44）	4（8.89）	6（13.33）	38.95±6.17
χ2/t		4.050	0.932	5.031	3.867
P		0.044	0.334	0.025	0.000

Table 3
Comparison of pain scores between the two groups（ $\bar{\chi}$±s，branch）

Group	Number of cases	VAS score			
		Before intervention	Intervention 7d	Intervention for 14d	Intervention for 21d
Control group	45	7.23±1.56	4.69±1.23*	3.65±0.54*	2.34±0.38*

Observation group	45	7.14±1.82	4.01±0.86*	2.97±0.43*	1.71±0.31*
t		0.252	3.309	6.608	8.618
P		0.802	0.003	0.000	0.000
Note: Comparison with group before intervention					

Table 4
Comparison of excellent and good rate of functional recovery between the two groups [n (%)]

Group	Number of cases	Excellent	Good	Can	Difference	Excellent and good rate
Control group	45	11（24.44）	13（28.89）	11（24.44）	10（22.22）	35（77.78）
Observation group	45	19（42.22）	14（31.11）	9（20.00）	3（6.67）	42（93.33）
χ2		3.200	0.053	0.257	4.406	4.406
P		0.074	0.818	0.612	0.036	0.036

Table 5
Comparison of PICC related adverse events between the two groups [n (%)]

Group	Number of cases	Catheter blockage	Unplanned extubation	PICC related thrombosis	Total
Control group	45	6（13.33）	3（6.67）	6（13.33）	15（35.56）
Observation group	45	3（6.67）	0（0.00）	1（2.22）	4（8.89）
χ2		1.111	3.103	3.873	8.073
P		0.292	0.078	0.049	0.004

Table 6
Comparison of platelet and D-D between the two groups

Group	Number of cases	Platelet（×109/L）			D-D（ng/mL）		
		Before intervention	Intervention 7d	Intervention for 14d	Before intervention	Intervention 7d	Intervention for 14d
Control group	45	162.66±54.32	196.36±43.98*	246.89±55.98*	1945.39±945.36	642.32±247.06*	531.62±197.14*
Observation group	45	165.04±51.27	227.52±51.96*	274.96±51.06*	2001.14±897.46	601.42±156.35*	498.85±147.25*
t		0.214	3.071	2.485	0.287	0.938	0.893
P		0.831	0.003	0.015	0.775	0.351	0.374
Note: Comparison with group before intervention，*P<0.05。							

Table 7
Comparison of hemodynamics between the two groups（$\bar{\chi}$±s）

Group	Number of cases	MAP（mmHg）			ITBVI（ml/m2）			EVLWI（ml/kg）		
		Before intervention	Intervention 7d	Intervention for 14d	Before intervention	Intervention 7d	Intervention for 14d	Before intervention	Intervention 7d	Intervention for 14d
Control group	45	91.56±12.06	89.12±11.63	93.63±11.07	663.25±102.41	874.36±97.32*	901.23±114.13*	6.52±1.14	6.27±1.23	6.34±1.06
Observation group	45	92.05±11.45	90.25±12.56	91.74±13.05	671.02±95.63	892.63±105.24*	913.02±108.56*	6.43±1.09	6.32±1.09	6.41±1.14
t		0.198	0.443	0.741	0.372	0.855	0.502	0.383	0.204	0.302
P		0.844	0.659	0.461	0.711	0.395	0.617	0.703	0.839	0.764
Note: Comparison with group before intervention，*P<0.05。										