Evaluation of the Application Effect of Predictive Nursing of Risk Identification Theory in Neonates with PICC Tube Placement

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Abstract: *Objective:* To explore the effect of predictive nursing based on risk identification theory in neonates with PICC. *Methods:* From November 2024, our hospital began to collect the neonatal case data of PICC catheterization in pediatrics. By November 2025, a total of 84 cases were included, and they were randomly divided into two groups by the method of drawing single and double numbers. Among them, 42 cases were given routine catheterization nursing as the reference group; Another 42 cases were treated with predictive nursing based on risk identification theory as the experimental group. The bleeding, swelling degree, nursing quality score, and complications were compared between the two groups. *Results:* The ratio of 0-I grade bleeding and 0-I grade swelling in the experimental group was significantly higher than that in the reference group ($P < 0.05$). The scores of nursing quality in the experimental group were significantly higher than those in the control group ($P < 0.05$). The total incidence of complications in the experimental group was 4.76%, which was significantly lower than that in the reference group (16.67%) ($P < 0.05$). *Conclusion:* Predictive nursing based on risk identification theory can obviously reduce bleeding and swelling at the puncture point and improve the nursing quality, which should be actively promoted.

Keywords: Risk identification theory; Predictive nursing; PICC catheterization; Newborns; Effect

1. Introduction

PICC refers to the placement of a central venous catheter through a peripheral vein, which provides a stable and convenient way of nutrition and drug delivery for newborns. However, as an invasive operation, PICC catheterization in newborns is accompanied by the risk of various complications because their immune system is not yet mature and organ function is still developing [1]. These risks not only increase the pain of newborns, but also may affect normal treatment. In the process of risk management, risk identification is very important. In daily nursing practice, nurses often lack risk awareness, which leads to the implementation of preventive

measures being limited, and then affects the nursing effect. Predictive nursing, that is, by predicting potential risk events and formulating corresponding preventive measures, aims to reduce the incidence of adverse events and improve the quality of nursing [2]. In this study, 84 newborns who underwent PICC catheterization in the pediatric department of our hospital from November 2024 to November 2025 were taken as an example to compare and analyze the effect of predictive nursing of risk identification theory in practice, as follows.

2. Data and methods

2.1. General information

From November 2024, our hospital began to collect the neonatal case data of PICC catheterization in pediatrics. By November 2025, 84 cases were included and randomly divided into two groups by drawing single and double numbers. Among the 42 cases in the experimental group, there were 23 males and 19 females. The age ranged from 4 to 25 days, with an average age of 14.84 ± 0.21 days. There were 42 cases in the reference group, including 22 males and 20 females. The age ranged from 4 to 25 days, with an average age of 14.79 ± 0.35 days. Comparing the general data of the two groups ($P > 0.05$), the comparability is strong.

Inclusion criteria: (1) All patients have indications for PICC catheterization; (2) It is the first time to place tubes; (3) The tube placement time exceeds 7 days; (4) The family members of the newborn know the informed consent form and sign it voluntarily.

Exclusion criteria: (1) Newborns who have used drugs affecting the coagulation mechanism; (2) Newborns with respiratory distress syndrome; (3) Neonates with vascular malformation; (4) Newborns with coagulation dysfunction and infectious diseases.

2.2. Methods

The reference group carried out routine catheterization nursing, and the main measures were: a comprehensive evaluation of the newborn's condition, and the whole catheterization process was strictly carried out in accordance with PICC catheter operation procedures and guidelines. After the tube placement is completed, the puncture point is covered with gauze and carefully fixed with a transparent patch. At the same time, the blood vessels and their surrounding skin are evenly coated with polysulfonate mucopolysaccharide cream, and the catheter channel is carefully monitored to ensure that the catheter is unobstructed and prevent blockage or falling off [3].

The experimental group carried out predictive nursing based on risk identification theory, and the main measures were: (1) establishing a risk identification group. Set up a professional risk identification team, consisting of a senior attending physician, an experienced head nurse, three professional nurses in charge, and five responsible nurses. The head nurse will be the team leader. The person in charge will be responsible for organizing the team members to receive in-depth training, covering the latest theory of PICC tube placement, the prediction and treatment strategy of potential risk factors, etc. (2) Risk identification. Team members searched authoritative databases such as Wanfang and HowNet deeply, and searched with newborns, risk factors, and PICC catheterization as the core keywords. Combined with the clinical practice of our hospital, the risk of neonatal PICC catheterization and the influencing factors of its complications were discussed and analyzed in detail. These factors include bleeding at the puncture site, skin infection, catheter blockage, and so on. (3) Predictive nursing. (1) Phlebitis: due to unstable fixation of the catheter and excessive puncture times. Before the puncture operation, the nursing staff should properly appease the newborn, provide pacifiers in time

to divert their attention, and choose the appropriate type of catheter. Before the operation, the catheter should be soaked in normal saline. When selecting the puncture point, priority should be given to the peripheral vein, and the upper part of the puncture blood vessel should be treated with a hot compress. After successful puncture, the polysulfonate mucopolysaccharide cream should be evenly applied along the blood vessel direction, and the dressing should be properly covered [4]. (2) Catheter blockage: In view of improper tube sealing, infusion precipitation, and high drug concentration, nursing staff should strictly follow the operating procedures to ensure the accuracy of the tube sealing operation. After the infusion, use heparin saline empty needle to flush the pipeline at a positive pressure and uniform speed, and clean the catheter on time, three times a day. (3) Bleeding at the puncture site: In view of the frequent unconscious activities of newborns, the nursing staff adopted an improved pressurization method. The solid sterilized gauze ball was placed at the puncture site, fixed with 3M transparent application, and then pressed with an elastic bandage for 24 hours [5]. (4) Skin infection: Nurses must strictly follow aseptic operation procedures to ensure the integrity of the aseptic barrier to the greatest extent, and strictly implement standardized catheterization and maintenance procedures. Once the connector is contaminated by blood, it should be replaced immediately and disinfected thoroughly. Replace the closed joint of the diaphragm regularly, and the frequency of dressing replacement is once every 24 hours. At the same time, close attention should be paid to the condition of children. Once an abnormal fever occurs, nurses should quickly remove the catheter and evaluate whether it is an infection caused by the catheter.

2.3. Indicator observation

(1) oozing degree [6]: according to the severity, it is 0-III grade, and 0 grade means oozing less; Grade I is bleeding during activity; Level II is supine with oozing blood; Grade III refers to oozing when the limbs are laid flat. (2) Swelling degree [7]: according to the severity, it is 0-III, and 0 is no swelling; Grade I showed slight swelling at the intubation site, but it could disappear automatically within 24 hours; Moderate swelling occurred at the level II catheterization site, and it can disappear automatically within 2–3 days; Grade III is severe swelling at the intubation site, and the swelling symptoms last for more than 4 days. (3) Evaluation of nursing quality: The nursing quality of the two groups of nurses was evaluated from four aspects: catheter management, catheter placement specialty, catheter placement operation and comprehensive nursing. The score of each aspect was 0-100, and the higher the score, the higher the nursing quality. (4) Complications: Observe and count whether there are any complications such as puncture local bleeding, skin infection, catheter blockage, and phlebitis during the nursing period of the two groups, and make statistical analysis.

2.4. Statistical analysis

The research data were compared and analyzed by the SPSS 25.0 system, and the measurement data, such as nursing quality score, were expressed by (S), and the test was completed by t. The percentage (%) was used to represent the counting data, such as the incidence rate, and the test was completed by chi-square x^2. When the difference is $P < 0.05$, it has statistical significance.

3. Results

3.1. Puncture point situation

The ratio of 0-I grade bleeding and 0-I grade swelling in the experimental group was significantly higher than

that in the reference group ($P < 0.05$), as shown in **Table 1**.

Table 1. Table for comparative analysis of blood seepage and swelling degree of puncture points in two groups [n(%)]

Group	The number of cases	The puncture point oozes blood		The puncture point swells	
		0-Ilevel	II-IIIlevel	0-Ilevel	II-IIIlevel
Control group	42	31 (73.81%)	11 (26.19%)	28 (66.67%%)	14 (33.33%)
Experimental group	42	40 (95.24%)	2 (4.76%)	39 (92.86%)	4 (9.52%)
x^2	-	14.3681	15.5718	17.9142	16.1741
P	-	< 0.05	< 0.05	< 0.05	< 0.05

3.2. Comparison of nursing quality

The scores of nursing quality in the experimental group were significantly higher than those in the control group ($P < 0.05$), as shown in **Table 2**.

Table 2. Comparative analysis table of nursing quality scores between the two groups (Mean ± SD, score)

Group	The number of cases	Catheter management	The professional of catheter placement	Nursing catheter placement operation	The comprehensive nursing quality
Control group	42	85.86±1.46	88.75±1.06	85.62±1.36	87.86±1.13
Experimental group	42	94.52±1.55	94.25±1.53	93.47±1.42	94.51±1.38
t	-	8.2846	6.8215	7.2466	6.8417
P	-	< 0.05	< 0.05	< 0.05	< 0.05

3.3. Comparison of complications

The total incidence of complications in the experimental group was 4.76%, which was significantly lower than that in the reference group ($P < 0.05$), as shown in **Table 3**.

Table 3. Table of comparative analysis of complications between the two groups[n(%)]

Group	The number of cases	The puncture point oozes blood.	Skin infection	Catheter blockage	Phlebitis	Total incidence rate
Control group	42	3 (7.14%)	1 (2.38%)	1 (2.38%)	2 (4.76%)	7 (16.67%)
Experimental group	42	1 (2.38%)	0 (0%)	0 (0%)	1 (2.38%)	2 (4.76%)
x^2	-					8.7528
P	-					< 0.05

4. Discussion

PICC catheter technology has obvious advantages in clinical application, but there are still many hidden risks for the fragile newborn. It is very important to take effective preventive nursing measures to reduce catheter-related complications. Risk identification theory, that is, by evaluating and identifying the risk factors that may cause individuals to be hurt, to prevent them. Through in-depth analysis of the causes of risk events, predictive nursing formulates scientific and reasonable preventive strategies, aiming at eradicating potential risks and reducing the incidence of complications, which is of great significance for improving nursing quality [8].

The results of this study show that the ratio of bleeding and swelling in the puncture point of the experimental group is significantly higher than that of the reference group. The total incidence of complications in the experimental group was 4.76%, which was significantly lower than that in the reference group (16.67%). According to the analysis, the predictive nursing of risk identification theory and the construction of a risk identification team composed of professional nurses aim at deeply analyzing the potential risk factors in the process of PICC placement in newborns, and taking risk prevention and control as the core nursing goal. The group strictly followed the aseptic operation procedures to implement PICC tube placement, to ensure correct tube sealing, positive pressure maintenance, and uniform tube flushing after infusion. At the same time, increase the frequency of inspections, carefully observe the condition of the catheter, and prevent the catheter from bending or being compressed. Once the abnormality is found, it should be treated with polysulfonic acid mucopolysaccharide cream in time to reduce the occurrence of superficial phlebitis [9]. In addition, the improved pressure method is adopted to effectively avoid the formation of skin hematoma. Replace dressing and regularly disinfect the diaphragm sealed connector to avoid catheter blockage and reduce the risk of bleeding and swelling at the puncture site and related complications. The scores of nursing quality in the experimental group were significantly higher than those in the control group. The reason is that the predictive nursing of risk identification theory has significantly enhanced the ability of nurses to distinguish risk factors. This is helpful to accurately identify the possible adverse risks, whether explicit or implicit, in the process of catheterization. Through timely response to adverse risk factors and targeted protective measures, the overall quality of nursing service has been greatly improved.

To sum up, the predictive nursing of risk identification theory applied to neonates with PICC catheter can obviously reduce the bleeding and swelling at the puncture point, with fewer complications and obviously improve the nursing quality, which should be actively promoted.

5. Conclusion

In conclusion, the application of predictive nursing based on risk identification theory significantly reduces bleeding and swelling at the puncture site while enhancing overall nursing quality. This evidence-based approach demonstrates clear clinical benefits and warrants active promotion in practice.

Disclosure statement

The author declares no conflict of interest.

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