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Study on the Effect of Improved "Bird's Nest" Nursing in the Out-of-hospital Transport of Premature Infants

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Abstract: *Objective*: To explore the application effect of improved "Bird's nest" nursing in the transport of premature infants. *Methods*: Collecting 100 cases of premature infants, randomly divided into experimental group and control group, two groups of premature 50 cases each. The control group received the traditional "Bird's nest" nursing. Experimental group in modified the "bird's nest" nursing intervention, compared two groups of premature monitoring vital signs during the transfer process, transport after the body development indicators, the time and cure warmers intervention. *Results*: Compared with control group, experimental group premature temperature fluctuation is small, apnea and fewer times of low body temperature and oxygen saturation is higher, the contrast results with statistical significance ($P < 0.05$). There was no significant difference in physical development, time to get out of the incubator, and cure rate. *Conclusion*: Modified the "bird's nest" care in outside the hospital application, help to improve premature transfer process safety, and security for premature success implementation of transshipment is of great significance.

Keywords: Improved "bird's nest" nursing; Premature infants; Out-of-hospital transport

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1. Introduction

Premature refers to the gestational age before 37 weeks of a newborn, compared with full-term babies, preterm infants weight is lighter, the imperfection of the common functions such as metabolism, organ development, sucking and swallowing capability is weak. This special group for premature babies, in the process of transport, from the clinical perspective, combining with the characteristics of its posture the fragility of life and to create a warm, comfortable, quiet and transport links, to reduce the influence of external factors on premature infants body [1]. With the change of medical and health concept, people pay more and more attention to newborn health. Both clinicians and nurses should formulate scientific nursing plans from the perspective of life care and care, promote the development

of various organ functions of premature infants, and reduce a series of risks brought by premature birth [2]. At present, many provinces in the country have established a neonatal triple transit network, but premature treatment service quality remains to be improved. In the process of neonatal transporters, clinicians need to do a good job, life and respiratory monitoring, control good external environment and factors, avoid neonatal due to external stimuli, intracranial hemorrhage, infection of low body temperature or other problems [3]. In order to improve the delivery quality of premature infants and the success rate of treatment, it is not only necessary to pay attention to body temperature management, but also to establish a fine nursing model to keep them in a warm and comfortable environment. So, nursing staff should stick to the principle of analyzing the specific issues, for premature babies common risks and possible problems during the transfer process, the introduction of advanced nursing mode and technology, avoid premature complications due to loss of temperature, do scientific and effective nursing means, to speed up the recovery and development in preterm neonates. Based on bionics theory, NiaoChaoShi nursing mode arises at the historic moment, its main is to imitate neonatal environments in the matrix, and using the environment reduces the external environment stimulation of premature infants [4, 5]. However, in the process of practical application, due to the pertinence is not strong, ordinary NiaoChaoShi nursing exposed a series of problems, practical nursing mode and the overall effect needs to be optimized [6]. So, it is necessary for clinical services from clinical practice, the advanced nursing technology and means, in the "bird's nest" in the improvement of the nursing mode, design of multifunctional auxiliary pad position, add package bags, premature transit environment amenity, reduces the risk of a premature head deformation, make sure its in maintaining normal physiological function, To complete the transfer work safely and improve the quality of nursing clinical service and parents' satisfaction.

2. Materials and methods

2.1. Research samples

The sample selection in July 2021 to June 2022, from the outer court into neonatal intensive care unit of the newborn. Accords with a requirement according to certain criteria, the sifting, 100 cases of premature infants, and it can be divided into two groups: experimental group and control group 50 cases each.

Selection criteria are as follows: premature to meet at 28 weeks to 36 weeks and 6 days delivery; Their body weight should not exceed 2500g; Transshipment drive between 45 minutes to 4 hours; No severe asphyxia, necrotizing enterocolitis, and other symptoms occurred; Has been made and premature infants parents agree to and sign a consent form.

Exclusion criteria were: Combined with other congenital diseases or severe organ defects; With severe infection; Birth asphyxia rescue experience from time to tome, or severe complications after birth and congenital diseases of children.

2.2. Research groups

Strictly follow the established standard, after screening cases are grouped by random number table method. Specific operation is as its starting number, choose a triple digits in number order to accord with a standard number of patients, the random number in the table number number one to one correspondence with the patient. The grouping rule was that the random number was divided by the number of group 2, and the patients with the remainder of 1 were enrolled in the experimental group, and the patients with the remainder of 0 were enrolled in

the control group. If the number of patients in the two groups was inconsistent, it was adjusted until each group had 50 patients. To reduce the bias and confounding factors, the experiment uses a single blind method, namely blind spell on patients, and the team members are not blind.

2.3. Nursing methods

First of all, establish a nursing transfer team. According to the nursing preparation requirements, the transfer team is composed of two medical staff and a driver. The medical staff on call are a doctor and a nurse, who have more than 3 years of work experience in the department and have passed the examination of neonatal transport training. A driver must have rich and skilled driving experience and be familiar with the main road sections and road conditions. Secondly, prepare the medical facilities and equipment needed for neonatal transport, such as transport warm box, oxygen bag, first aid medicine, clothing package, transport ventilator, etc. In addition, the modified "bird's nest" was prepared and put into the transfer box before the visit. After the visit, the temperature is set according to the information of the preterm infant, such as weight and gestational age indicators.

3. Bird's Nest nursing method

3.1. Control group

The traditional "bird's nest" was used for nursing work. In the process of making and using, according to the size of 46cm × 28cm × 10cm, the shape of the bird's nest should be made of soft cotton cloth. In order to simulate the environment in the palace, the sponge pad is first placed in the transfer warm box, and then the soft cotton cloth is laid. The warm box is heated before use, and the heating is completed after the temperature reaches 33~34°. The premature infant was placed in the bionic bird's nest in the incubator, and the head and shoulders were supported with a soft pillow, so that the head and neck were elevated about 30° and the neck was slightly tilted back. The infant is then covered with a soft quilt to ensure that the trunk and limbs are naturally flexed and securely secured with a harness. The temperature control parameters of the incubator were precisely adjusted according to the birth weight and gestational age. The edge of the special nest was maintained at a height of 10cm, and the surround support was used to help premature infants maintain their intrauterine position, which effectively improved comfort and security, avoided stress reactions, and promoted stable vital signs. Environmental interventions were implemented simultaneously: shading cloth was covered around the incubator to reduce light stimulation, noise was maintained at a low level throughout the process, and continuous vital monitoring was implemented through the observation window.

3.2. Experimental group

On the basis of the traditional "bird's nest", the experimental group added a series of improved facilities, mainly including 3L bags, disposable latex gloves, flannelette, high-density sponge, etc. In the production process, a sponge of 80cm in length and 2cm in thickness was selected, rolled into a roller shape in four layers, and then fixed by twine. It is shaped into a specific shape, premature occipital to the lower limb length of long axis, left and right shoulder breadth for the short axis, and sewn with a height of about 4 cm on the interfaces of cushions, placed in premature infants under the shoulder. At the head end of the nest, sew an empty cloth bag approximately 20 cm in size. Fill two sterile latex gloves to 3/4 capacity with water to create a water pillow, and place them inside the bag with the fingertips overlapping. Invert the excess portion of the cloth bag about 10 cm below the water pillow

to secure it. Finally, place a 3-liter bag filled to one-third with water at a temperature of 33–34°C at the bottom of the nest.

3.3. Nursing management

Keep warm, maintain a clear airway, give oxygen timely, ensure unobstructed venous access, and strengthen disease monitoring. Closely monitor the patient's face, lip color, breathing, consciousness, muscle tension, and urine output, etc. Immediate intervention is required upon detecting any abnormalities in blood oxygen saturation, body temperature, heart rate, or respiration.

3.4. Observe the indicators

(1) Body temperature fluctuation, blood oxygen saturation, hypothermia, and apnea occurring during transport.

(2) The growth rate of head circumference, height, weight, and the time to return to birth weight during hospitalization after transport.

(3) The length of time required to leave the incubator, along with the cure and improvement rates at the time of discharge.

3.5. Statistical analysis

SPSS22.0 statistical software was used to analyze the data. Measurement data were expressed as mean ± standard deviation, and t-test was used for comparison between groups. Count data were expressed as rate (%), and χ^2 test was used. $P < 0.05$ was considered statistically significant.

4. Results

4.1. Compare the physiological signs during transport

After comparison, it was found that premature infants in the experimental group using the improved bird nest care model had better physiological indicators, with smaller temperature fluctuations, lower frequency of apnea, and higher oxygen saturation levels compared to those in the control group, such as **Table 1**.

Table 1. Physical signs of preterm infants in both groups

Group	Cases	Temperature fluctuations (°C)	Blood oxygen saturation (%)	Frequency of hypothermia (times)	Frequency of apnea (times)
Experimental group	50	0.33+ /-0.09	93.56+ /-4.65	3.43+ / -1.02	4.65+ / -2.43
Control group	50	0.67+ / -0.14	87.54+ /-4.21	6.67+ / -2.77	7.54+ / -2.81
t		16.73	7.47	9.33	6.20
P		< 0.05	< 0.05	< 0.05	< 0.05

Note: Compared with the control group, ^{a} $P < 0.05$

4.2. The physical development performance after transport was compared

The following comparison of physical development indicators, such as weight, height, and head circumference growth of the two groups of preterm infants after transport, was not significant, as shown in **Table 2**.

Table 2. Growth and development of the two groups

Group	Cases	Head circumference increase (g/d)	Height increase (mm/d)	Weight gain (mm/d)	Time to return to birth weight (d)
Experimental group	76	0.64+ /-0.09	1.75+ / -0.22	13.54+ / -2.43	8.54+ / -3.76
Control group	52	0.61+ / -0.11	1.69+ / -0.19	13.59+ / -2.52	9.01+ / -3.98
t		1.69	1.60	0.11	0.68
P		> 0.05	> 0.05	> 0.05	> 0.05

Note: Compared with the control group, ^{a} $P < 0.05$

4.3. The performance after transport intervention was compared

There was no significant difference between the two groups in terms of the duration of incubator use and the cure rate, as shown in **Table 3**.

Table 3. Treatment outcomes of preterm infants in the two groups

Group	Cases	Out of the incubator time (d)	Healing and improvement
Experimental group	76	12.67+ / -4.32	69(90.79)
Control group	52	13.54+ / -4.55	45(86.54)
t/ X^2		1.10	0.57
P		> 0.05	> 0.05

Note: Compared with the control group, ^{a} $P < 0.05$

5. Discussion

Preterm infants typically lack the ability to self-regulate, have a low level of development of various organs, and have low body function. They face the risk of various diseases and infections, and their conditions change rapidly. In neonatal care, premature infants are often transferred from basic-level hospitals to higher-level (tertiary) hospitals for advanced treatment [7]. During transport, hypothermia is a major risk factor contributing to the mortality of premature infants. This is primarily due to their underdeveloped thermoregulatory centers and impaired ability to regulate body temperature. As a result, they struggle to generate or dissipate heat effectively and are unable to adapt to changes in the external environment [8].

In the case of unstable body temperature, the physiological function of premature infants is normal, and the biochemical indicators may even fluctuate greatly, which can be solved by the Bird's nest nursing mode. By creating an environmental system close to the uterus, Bird's nest nursing ensures that the body temperature of the infant is in a constant range, reduces psychological tension and discomfort, and thus promotes the fluctuation of heart rate and respiration to stabilize. The application effect of this study found that there were some differences in body temperature fluctuation, apnea, blood oxygen saturation change, and other indicators between the premature infants who used the traditional and improved bird's nest in the transport, and the difference comparison results were statistically significant. In terms of the performance of premature infants in the experimental group and the control group, the infants in the modified bird's nest group performed better, such as less hypothermia, apnea, and low blood oxygen saturation. After separation from the mother, the complexity of the new environment will bring a series of adaptive problems to premature infants. The improved bird's nest nursing model can make premature

infants as close to the mother's intrauterine environment as possible to obtain the living experience, reduce the crying phenomenon caused by psychological and physical discomfort, and avoid the situation of body dislocation and the sharp drop in body temperature.

The application of improved "bird's nest" nursing mode in the out-of-hospital transport of premature infants reflects the deepening development of the concept of modern neonatal nursing [9]. Based on the principles of Individualized Neonatal Developmental Care and Assessment Program (NIDCAP), this nursing model establishes a proactive and adaptive transport protection mechanism by simulating the physiological support system of the intrauterine environment. Its core value lies in breaking through the passive protection model of traditional transport nursing and establishing an active support system oriented to the neurobehavioral development needs of premature infants [10].

In terms of physiological adaptation, the modified device realizes the dynamic balance of posture management through three-dimensional surface support technology. The adjustable support module designed according to the biomechanical principle can effectively disperse the mechanical stress caused by vehicle vibration during transport and maintain the physiological curvature of the spine. The microenvironment system constructed with temperature-sensitive composite materials on the contact surface can autonomically adjust the heat exchange efficiency according to the body temperature. This biomimetic design significantly improves the accuracy of body temperature regulation [11]. The respiratory support module optimizes the range of motion of the thorax through the coordinated adjustment of position angle and support pressure, and creates more favorable ventilation conditions for premature infants with immature respiratory muscles.

Neuroprotection mechanism is an important theoretical breakthrough of this nursing model. Based on the sensory integration theory, the buffer and isolation layer is designed with porous gradient noise reduction material, which can effectively attenuate the high-frequency components of environmental noise. Dynamic light intensity of illumination control system through real-time monitoring transport environment, automatically maintain appropriate light intensity of the development of the retina [12]. The tactile stimulation module integrates a contact interface with surface tension adaptation, which can not only provide necessary cognitive stimulation of boundary perception, but also avoid compression damage caused by traditional fixation devices. Together, these interventions build a sensory ecological environment that meets the neurodevelopmental needs of preterm infants [13].

In the transport safety dimension, the improved system integrates medical monitoring and developmental support through modular design. The embedded vital signs monitoring unit uses flexible sensing technology to break through the limitations of traditional monitoring equipment on body position management [14]. The standardized design of the emergency intervention interface ensures that the emergency equipment can be accessed quickly without destroying the integrity of the support structure. This system integration concept significantly improves the synergy efficiency of medical disposal and developmental support during transportation [15].

The model also contains important family participation values. The transparent design allows parents to visually observe the status of the infant, and the reserved interaction area of the contact interface supports the immediate implementation of kangaroo mother care. This design shift transforms parents from passive observers to active participants, laying the foundation for continuity of care. At the same time, the modular structure is easy to carry out personalized adjustment to meet the individual needs of premature infants with different gestational ages and weights.

Studies have shown that the application of improved "bird's nest" nursing in out-of-hospital transport is essentially an extension of the concept of developmental support in the neonatal intensive care unit to the mobile

health scenario. Its innovative value is not only reflected in the improvement of technology, but also in the construction of a new transfer nursing paradigm with the neurobehavioral development of premature infants as the core. This model provides support for the establishment of a regional neonatal transport network and has important guiding significance for the improvement of the perinatal medical service system.

6. Conclusion

The modification of the "bird's nest" care for out-of-hospital applications and the improvement of the premature infant transfer process significantly enhance the safety and success of transshipment. These advancements play a crucial role in ensuring better outcomes for preterm infants during transportation, highlighting their importance in neonatal care practices.

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