

Clinical Study on Prevention of Nasal Injury during Continuous Positive Airway Pressure in Neonates

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To explore a nursing method which for suitable for neonatal nasal continuous positive airway pressure to prevent neonatal nasal injury. 106 newborns treated with nasal continuous positive airway pressure admitted in our hospital from January 2020 to October 2020 were selected as the study subjects and divided into observation group (n=53) and control group (n=53) according to the randomized control principle, in which the control group of neonates used U-shaped nasal plugs during transnasal continuous positive airway pressure ventilation, while the observation group cut the hydrocolloid dressing into a bunny shape, punched holes according to the size of the children's nostrils and pasted them on the children's nose before using the nasal congestion. Choose the appropriate nasal congestion and fix it properly. Compare the total nasal continuous positive airway pressure treatment time, nasolabial fold and septum skin damage and their incidence and parents' satisfaction with nursing services between the two groups. There was no statistically significant difference in the time of nasal continuous positive airway pressure treatment and arterial blood gas arterial oxygen partial pressure, carbon dioxide partial pressure and pH value after 12-24 h of nasal continuous positive airway pressure treatment between the two groups ($p>0.05$); compared with the control group, the incidence of nasolabial sulcus skin injury and nasal septum skin injury in the observation group was significantly lower than that in the control group and the difference was statistically significant ($p<0.05$). The differences were statistically significant ($p<0.05$). At the same time, the satisfaction rate of family members of newborns in the observation group was significantly higher than that in the control group and the difference was statistically significant ($p<0.05$). In newborns receiving continuous positive airway pressure through the nose, the use of hydrocolloid dressings to protect the skin of the nasal congestion fixation method can significantly reduce the incidence of skin damage to the nasolabial fold and septum and improve the satisfaction of the newborn's family with nursing services. Improve the quality of care, worthy of promotion.

Key words: Neonate, positive airway pressure ventilation, nasal injury, nasal congestion

Nasal continuous positive airway pressure (NCPAP) is continuous positive pressure ventilation when the patient is breathing spontaneously. NCPAP is clinically used to treat neonatal critical diseases like neonatal respiratory distress syndrome (NRDS), premature infant apnea, neonatal wet lung, pulmonary edema, meconium aspiration syndrome and infectious pneumonia^[1]. With the sustaining development of medical technology, the safety of current NCPAP is relatively high, but it is still difficult to avoid the occurrence of nasal injury after NCPAP^[2]. The occurrence of nasal injury after NCPAP in early neonates is mostly caused by mechanical friction. In nursing intervention, trying to reduce the friction on the

nasal skin and nasal septum mucosa of neonates can play a protective role in the nose of neonates, which is beneficial to reduce the injury^[3]. The purpose of this study was to explore the nursing intervention methods for the prevention of neonatal nasal injury after the application of NCPAP and improve the quality of nursing. A total of 106 newborn premature infants treated with NCPAP in our hospital from January 2020 to October 2020 were selected as the research subjects. Inclusion criteria: Gestational age of 30 to 40 w; the first treatment was 0-7 d after birth. Exclusion criteria: complex congenital heart disease, severe neonatal respiratory distress syndrome, respiratory congenital malformation (tracheoesophageal fistula, posterior

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nostril atresia, cleft palate, etc.); during the period of hospitalization, parents required to be discharged from the hospital due to the subjective will of the parents or critically ill. 106 cases of premature infants were divided into two groups according to random number table, namely observation group and control group respectively, with 53 cases in each group. The observation group included 37 males and 16 females. The mean gestational age was (35.37±2.73) w; the average birth weight was (2531.48±375.20) g. Apgar scores of neonates were (7.25±2.60) at 1 min and (8.42±1.53) at 5 min. The control group had 35 males and 18 females. The mean gestational age was (33.25±2.24) w; The average birth weight was (2478.19±308.58) g. Apgar score of neonates was (7.37±2.38) at 1 min and (8.61±1.72) at 5 min. There was no significant difference in gender, gestational age, birth weight and Apgar score between the two groups ($p>0.05$) and all the family members of newborns have signed the informed consent. The neonates in the control group received U-shaped nasal congestion during CPAP, connected to the pressure generator and breathing circuit and at the same time, helped the neonates to wear the fixed cap and use a thin thread to connect the ventilator circuit Fixed on both sides of the hat. When newborns in the observation group received continuous positive airway pressure through the nose, before using the nasal congestion, the hydrocolloid dressing was cut into a bunny shape and punched according to the size of the children's nostrils and then attached to the children's nose. The nasal congestion should be properly fixed to prevent the congestion from moving. Make sure the child's nose is comfortable, help the newborn to put on the fixing cap, fix it with medical tape and then connect the pressure generator and breathing circuit. Observe the total time of NCPAP in two groups of newborns; the occurrence and severity of nasolabial fold injury after application of NCPAP. The severity of injury is divided into mild (redness of the skin surface), moderate (skin stasis) and severe (damage skin and flesh damage). Injury incidence rate=mild injury incidence rate+moderate injury incidence rate+severe injury incidence rate; Nasal septal skin injury evaluation: mild injury: neonatal nasal septal skin redness; Moderate injury: nasal septum skin bruising in newborn; Severe injury: neonatal septal skin rupture; Injury incidence rate=mild injury incidence rate+moderate injury incidence rate+severe injury incidence rate; Changes of arterial oxygen partial pressure (PaO_2), carbon dioxide partial pressure (PaCO_2) and pH value of newborns in the two groups

after 12~24 h of NCPAP treatment; Evaluation of nursing satisfaction of newborn family members: A self-designed nursing satisfaction questionnaire is used to conduct a one-to-one survey on the family members of the patients at discharge, including nursing technology, nursing service attitude, nursing content, etc., and the satisfaction level was divided into three levels: very satisfied, basically satisfied and dissatisfied. SPSS 20.0 software was used for statistical analysis and processing. Measurement data was expressed as ($\bar{x}\pm s$) and compared with t-test, enumeration data was expressed as % and compared with χ^2 test and rank sum test, $p<0.05$ was considered statistically significant. There were no significant differences in the treatment time, PaO_2 , PaCO_2 and pH values of the arterial blood gas between the two groups after 12 to 24 h of NCPAP treatment ($p>0.05$), as shown in Table 1. Compared with the control group, the incidence of neonatal nasolabial groove skin injury in the observation group was significantly lower than that in the control group, with statistical significance ($p<0.05$). As shown in Table 2. Compared with the control group, the incidence of nasal septum skin injury in the observation group was significantly lower than that in the control group, with statistical significance ($p<0.05$). As shown in Table 3. Compared with the control group, the satisfaction rate of neonatal parents to nursing services in the observation group was significantly higher than that in the control group, with statistical significance ($p<0.05$). As shown in Table 4. Positive pressure ventilation is one of the commonly used treatment methods for newborns^[4]. It can provide continuous positive pressure during the breathing process of newborns to promote airway expansion, while positive pressure ventilation with nasal congestion is a common form of positive pressure ventilation, which has been shown to be effective in the treatment of hyaline membrane disease, pulmonary edema and newborn diseases^[5-7]. However, NCPAP is also found to have some disadvantages during clinical use and nasal septal injury is very common in children^[6,8]. The reason of nasal septum injury is that the skin tissue of premature infants is delicate and the unavoidable pulling and friction in the process of NCPAP is easy to cause tissue injury. In addition, NCPAP catheterization will produce certain pressure on the nasal cavity, which will act on the skin of premature infants for a long time and may block tissue perfusion, leading to local ischemia and necrosis^[9-11]. Premature infants are more likely to have nasal injuries after NCPAP due to the prevalence of anemia. Therefore, targeted preventive care is needed in the clinical care

TABLE 1: COMPARISON OF RELATED INDEXES OF VENTILATION EFFECT

Group	PaCO ₂ /mmHg	PaO ₂ /mmHg	pH	NCPAP treatment time/h
Observation group	47.80±7.80	82.40±6.70	7.33±0.07	69.70±10.92
Control group	46.90±8.10	78.56±7.80	7.35±0.06	70.60±10.54
t	0.671	0.722	0.093	0.237
p	0.623	0.518	0.927	0.815

TABLE 2: COMPARATIVE ANALYSIS OF SKIN INJURY IN NASOLABIAL GROOVE BETWEEN THE TWO GROUPS

Group	Cases	No injury	Mild	Moderate	Severe	Injury incidence rate
Observation group	53	48 (90.57)	3 (5.66)	0 (0.00)	0 (0.00)	5.66
Control group	53	34 (64.15)	7 (13.21)	5 (9.44)	1 (1.88)	24.52
t				9.787		
p				0.001		

TABLE 3: COMPARATIVE ANALYSIS OF NASAL SEPTUM SKIN INJURY BETWEEN THE TWO GROUPS

Group	Cases	No injury	Mild	Moderate	Severe	Injury incidence rate
Observation group	53	47 (88.69)	4 (7.54)	1 (1.88)	0 (0.00)	9.43
Control group	53	31 (58.49)	8 (15.09)	6 (11.32)	1 (1.88)	28.30
t				12.237		
p				0.001		

TABLE 4: COMPARATIVE ANALYSIS OF THE SATISFACTION OF NEWBORN PARENTS TO THE NURSING SERVICES IN TWO GROUPS

Group	Cases	Very satisfied	Basically satisfied	Dissatisfied	Satisfaction rate
Observation group	53	49 (92.46)	2 (3.77)	2 (3.77)	96.23
Control group	53	35 (66.04)	13 (24.53)	5 (9.43)	90.57
t			31.791		
p			0.001		

process to reduce nose damage of newborns in the use of NCPAP. Routine nursing interventions for children with stable conditions, regular removal of nasal obstruction is the main method to temporarily relieve oppression and reduce the occurrence of nasal injury, but the effect is not good^[12]. In order to reduce the nasal injury of newborns treated with NCPAP, preventive care measures were used in the observation group: the size of the nostril was measured to ensure that the tube outside the rhinobyon was more than 2 cm from the nasal septum and the largest hole and lowest resistance were used to ensure adequate ventilation of the newborn. At the same time, according to the weight of the newborn, timely change the appropriate equipment model and every 2 h to detect whether the newborn

nostril fever, if fever, adjust the pipeline or replace the rhinobyon. In addition, when fixing the ventilator circuit, choose the right cap to avoid the rhinobyon falling off due to inappropriate. Besides, we chose a hydrocolloid dressing to protect the newborn's skin and to provide a skin barrier. This research shows that: skin damage rate of nasolabial sulcus, septum in children with new nasal fixation is only 5.66 % and 9.43 %, while the skin injury rates of nasolabial sulcus and nasal septum in children with traditional nasal fixation were as high as 24.52 % and 28.30 %. It is suggested that the use of new nasal fixation of appropriate type of equipment, appropriate hat and hydrocolloid dressing in continuous positive airway pressure (CPAP) can significantly reduce the skin damage in the nasolabial

groove and nasal septum and improve the family members of newborns satisfaction with nursing services at the same time, which is consistent with existing studies^[13-15]. In conclusion, in neonates receiving continuous positive airway pressure (CPAP) through the nose, the hydrocolloid dressing is cut into a bunny shape and perforated according to the size of the child's nostril, then attached to the child's nose with a new type of nasal fixation. The method can significantly reduce the damage of the nasolabial fold and septum skin and improve the quality of care and the satisfaction of the children's family with the nursing service. It is worthy of promotion.

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Conflicts of interest:

The authors report no conflicts of interest.

REFERENCES

- Green EA, Dawson JA, Davis PG, De Paoli AG, Roberts CT. Assessment of resistance of nasal continuous positive airway pressure interfaces. *Arch Dis Child Fetal Neonatal Ed* 2019;104(5):F535-9.
- Boyar V. Pressure injuries of the nose and columella in preterm neonates receiving noninvasive ventilation via a specialized nasal cannula: a retrospective comparison cohort study. *J Wound Ostomy Continence Nurs* 2020;47(2):111-6.
- Newnam KM, McGrath JM, Estes T, Jallo N, Salyer J, Bass WT. An integrative review of skin breakdown in the preterm infant associated with nasal continuous positive airway pressure. *J Obstet Gynecol Neonatal Nurs* 2013;42(5):508-16.
- Eze N, Murphy D, Dhar V, Rehan VK. Comparison of sprinting vs non-sprinting to wean nasal continuous positive airway pressure off in very preterm infants. *J Perinatol* 2018;38(2):164-8.
- Román-Pena P, Santín-Amo JM, Serramito-García R, Gelabert-González M. Tension pneumocephalus, an uncommon complication of oxygen therapy in preterm newborns. Presentation of a case and literature review. *Neurocirugía (Astur)* 2019.
- Guzoglu N, Uras N, Aksoy HT, Eras Z, Oguz SS, Dilmen U. Dopamine treatment does not need speed recovery of newborns from transient tachypnea. *J Perinat Med* 2016;44(4):477-80.
- Hsia SH, Lin JJ, Chan OW, Lin TY. Cardiopulmonary failure in children infected with Enterovirus A71. *J Biomed Sci* 2020;27:1-6.
- Shu XX, Chen C, Tang J, Wang H. Clinical effect of bubble nasal continuous positive airway pressure versus conventional nasal continuous positive airway pressure in respiratory support for preterm infants with neonatal respiratory distress syndrome. *Zhongguo Dang Dai Er Ke Za Zhi* 2018;20(6):433-7.
- Badr LK, Zeineddine MH, Abbas H, Charafeddine L. NeoSeal to prevent nasal injury in preterm infants receiving oxygen therapy. *Neonatal Network* 2016;35(4):228-33.
- Yong SC, Chen SJ, Boo NY. Incidence of nasal trauma associated with nasal prong versus nasal mask during continuous positive airway pressure treatment in very low birth weight infants: a randomised control study. *Arch Dis Child Fetal Neonatal Ed* 2005;90(6):F480-3.
- Squires AJ, Hyndman M. Prevention of nasal injuries secondary to NCPAP application in the ELBW infant. *Neonatal Network* 2009;28(1):13-27.
- Bonfim SD, Vasconcelos MG, Sousa NF, Silva DV, Leal LP. Nasal septum injury in preterm infants using nasal prongs. *Rev Lat Am Enfermagem* 2014;22(5):826-33.
- Zachau P, Gravergaard AE, Christesen HT. Nasal continuous positive airway pressure with head cap fixation as a contributing factor to extensive scalp necrosis in a preterm neonate with early-onset sepsis and scalp hematoma. *BMC Pediatr* 2019;19(1):1-3.
- MacLaren AT, Peters C, MacDonald PD. Nasal CPAP and preterm bradycardia: cause or cure. *Case Rep* 2014;2014:bcr2013202289.
- Khan J, Sundaram V, Murki S, Bhatti A, Saini SS, Kumar P. Nasal injury and comfort with jet versus bubble continuous positive airway pressure delivery systems in preterm infants with respiratory distress. *Eur J Pediatr* 2017;176(12):1629-35.

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