

Effect of Breast Milk Combined with Sodium Bicarbonate Oral Care on Prevention of Ventilator-associated Pneumonia in Neonates

Jianfen Hu*, Yiran Yang

Tongji Hospital, Tongji Medical College, Huazhong University of Science and Technology, Wuhan 430000, Hubei, China.

How to cite this paper: Jianfen Hu, Yiran Yang. (2025). Effect of Breast Milk Combined with Sodium Bi-carbonate Oral Care on Prevention of Ventilator-associated Pneumonia in Neonates, *Journal of Inorganic Chemistry and Materials*, 1(1), 21-24. DOI: 10.26855/jicm.2025.12.005

Received: September 6, 2025

Accepted: October 7, 2025

Published: December 19, 2025

***Corresponding author:** Jianfen Hu, Tongji Hospital, Tongji Medical College, Huazhong University of Science and Technology, Wuhan 430000, Hubei, China.

Abstract

Objective: To observe the effect of breast milk combined with sodium bicarbonate oral nursing on the prevention of ventilator-associated pneumonia in neonates. **Methods:** A total of 85 neonates receiving invasive mechanical ventilation in our hospital from January 2022 to January 2023 were enrolled, including 42 cases receiving sodium bicarbonate oral care as the control group and 43 cases receiving breast milk combined with sodium bicarbonate oral care as the observation group. The clinical indexes, ventilation-associated pneumonia and oral infection of the two groups were evaluated. **Results:** Compared with the control group, the clinical indexes of the observation group were better, and the incidence of ventilators associated pneumonia and oral infection was lower, with statistical significance ($P < 0.05$). **Conclusion:** Breast milk combined with sodium bicarbonate oral care is effective in preventing ventilator-associated pneumonia in neonates, which can improve clinical indexes, reduce the incidence of pneumonia and infection, and has high application value.

Keywords

Breast milk; Sodium bicarbonate; Oral care; A newborn; Ventilator-associated pneumonia

1. Introduction

Ventilator-associated pneumonia is common in patients using mechanical ventilation, with high morbidity and mortality rates. Neonates are in a stage of continuous development of their body functions, have low immunity, and are at a higher clinical risk. Once ventilator-associated pneumonia occurs, it poses a greater threat to the life and health of the child, aggravates the child's primary disease, increases the child's pain and discomfort, and the severity affects the prognosis [1]. Therefore, it is extremely important to implement active preventive measures in clinical practice. The factors that induce ventilator-associated pneumonia are complex, so in routine care, more interventions are made on the environment and ventilators to reduce risk factors. Some researchers have shown that oral care for children, using sodium bicarbonate and breast milk for cleaning and smearing, can effectively reduce the risk of ventilator-associated pneumonia [2-3]. This article mainly analyzes the specific effect of preventing neonatal ventilator-associated pneumonia by implementing oral care with breast milk combined with sodium bicarbonate, and the report is as follows.

2. Materials and Methods

2.1 General Data

A total of 85 newborns undergoing invasive mechanical ventilation at our hospital between January 2022 and January 2023 were enrolled. Forty-two newborns received oral care with sodium bicarbonate as a control group, and

43 newborns received oral care with breast milk combined with sodium bicarbonate as an observation group. The control group included 20 females and 22 males, with a gestational age of 28 to 39 years (31.63 ± 3.17) and a weight of 1031 to 3147 g (1946.57 ± 413.68). The observation group included 21 females and 22 males, with a gestational age of 29 to 38 years (30.17 ± 3.19) and a weight of 1035 to 3135 g (1976.35 ± 407.36). No statistically significant differences in general data were found between the two groups ($P > 0.05$). Family members of the newborns participated voluntarily. Inclusion criteria: (1) receiving invasive mechanical ventilation treatment; (2) newborn; (3) relatively stable vital status. Exclusion criteria: (1) accompanied by intrauterine infection, meconium aspiration pneumonia; (2) congenital disease; (3) death.

2.2 Methods

Both groups completed routine nursing care, mainly to prevent ventilator-associated pneumonia, and implemented nursing care in terms of environment, child position, hand hygiene management, etc. The ward environment needs to be kept clean and tidy, and maintain appropriate temperature and humidity, temperature 24-26°C, humidity 55%-65%. The head of the bed should be raised to maintain the comfort of the child. Nursing staff should pat the back and turn the child regularly, pay attention to hand hygiene management, and disinfect and clean the medical equipment in time. On the basis of routine nursing care, oral care work should be improved, oral and nasal cavity and airway secretions should be cleaned, and sterile cotton swabs should be used to clean the child's cheeks, tongue, gums, palate and other parts. Cleaning should be done every 6 hours and continue until the child is extubated.

The control group received sodium bicarbonate oral care: Oral hygiene was performed using a 2% sodium bicarbonate solution.

The observation group received breast milk combined with sodium bicarbonate oral care: In addition to the above, oral care was performed every 10 minutes using a sterile cotton swab to collect breast milk. Regarding breast milk collection, families should be instructed on proper pumping, storage, and cold chain transport. Nursing staff should provide families with standardized milk bottles and be trained and assigned a dedicated person to collect and collect breast milk. During each oral care session, a sterile syringe should be used to withdraw 2ml, allowing it to be rewarmed before use.

2.3 Observational Indicators

- (1) Clinical Indicators: Length of mechanical ventilation and hospital stay were recorded.
- (2) The incidence of ventilator-associated pneumonia and oral infections was recorded.

2.4 Statistical Methods

Data were analyzed using SPSS 21.0 software. Continuous data were compared using the t-test and expressed as $\bar{x} \pm s$. Rate and enumeration data were compared using the χ^2 test and expressed as percentages (%). $P < 0.05$ was considered statistically significant.

3. Results

3.1 Comparison of Clinical Indicators Between the Two Groups

Compared with the control group, the observation group had shorter durations of mechanical ventilation and hospitalization ($P < 0.05$). See Table 1.

Table 1. Comparison of Clinical Indicators Between the Two Groups ($\bar{x} \pm s$)

Group	Number of Cases	Mechanical Ventilation Duration (h)	Length of Hospitalization (d)
Observation Group	43	8.36±1.89	19.79±3.52
Control Group	42	11.28±2.79	27.46±5.28
<i>t</i>	-	6.351	13.605
<i>P</i>	-	0.001	0.001

3.2 Comparison of the Incidence of Ventilator-Associated Pneumonia and Oral Infection Between the Two Groups

Compared with the control group, the observation group had lower incidences of ventilator-associated pneumonia

and oral infection ($P < 0.05$). See Table 2.

Table 2. Comparison of the incidence of ventilator-associated pneumonia and oral infection between the two groups [n, (%)]

Group	Number of cases	Ventilator-associated pneumonia	Oral infection	Total incidence
Observation Group	43	2(4.65)	0(0.00)	4.65%
Control Group	42	8(19.05)	5(11.90)	30.95%
χ^2	-	4.242	5.439	10.113
P	-	0.039	0.020	0.001

4. Discussion and Conclusion

Neonatal ventilator-associated pneumonia is a common complication in patients undergoing mechanical ventilation. It has a high clinical risk and complex inducing factors. In severe cases, it can endanger the life of the child. How to prevent ventilator-associated pneumonia has attracted much attention [4].

Relevant data statistics show that the incidence of neonatal ventilator-associated pneumonia is as high as 30%, and the mortality rate is as high as 25%. It is an important factor causing death in mechanically ventilated neonates. The main cause of the disease is bacterial infection. For example, bacteria are present in the oral and nasal secretions, bed sheets, quilts, clothing, and medical equipment of neonates. If not managed in time, pneumonia can be further induced. Low immunity of neonates is also an important reason for the induction of pneumonia. Once ventilator-associated pneumonia occurs, it will cause great harm to the life and health of the child, affect their growth and development, and damage all functions of the body [5].

Conventional care includes environmental and body position improvements, mechanical disinfection, etc., which can reduce inducing factors, but clinical risks still exist. Physiological saline is usually used for disinfection in oral care, but because physiological saline can cause dehydration of the oral mucosa, the final effect is poor and can increase the risk of oral infection. The use of sodium bicarbonate in oral care can effectively balance the pH of the oral cavity and inhibit fungal infection. It is usually used in oral care of newborns with sterile cotton swabs, which can effectively reduce the risk of clinical infection [6-7].

Breast milk contains a variety of cytokines, which play an important role in improving the immunity of newborns and promoting their growth and development. It also has sufficient beneficial bacteria and can achieve better results in inhibiting oral bacteria. From this perspective, breast milk has a positive effect in preventing ventilator-associated pneumonia [8]. In terms of use, it is mainly applied to the oral area of the newborn after oral cleaning. It can have multiple effects such as regulating the body's immunity, anti-inflammatory and antibacterial. At the same time, breast milk can promote the restoration of normal intestinal flora in the newborn, promote the continuous growth and development of the newborn, and ultimately achieve better results. As for breast milk combined with sodium bicarbonate, the combined application can enhance the sterilization effect, more effectively inhibit the growth of various harmful bacteria in the oral cavity of newborns, reduce the risk of infection, and reduce the factors that induce ventilator-associated pneumonia. This study studied the application of breast milk combined with sodium bicarbonate oral care in newborns. The results showed that the mechanical ventilation time and hospitalization time of the observation group were shortened, significantly reducing the risk of ventilator-associated pneumonia, which also showed the clinical effect of implementing breast milk combined with sodium bicarbonate oral care.

Geng Dandan's study [9] clearly showed that the inducing factors of neonatal ventilator-associated pneumonia are closely related to the mechanical ventilation time. Therefore, shortening the mechanical ventilation time is more important in reducing ventilator-associated pneumonia. The incidence of ventilator-associated pneumonia and oral infection in the observation group was significantly lower, which further showed the clinical application advantage of breast milk combined with sodium bicarbonate. In the study of Chen Qiuna [10] et al., 96 newborns were studied. The results showed that breast milk combined with sodium bicarbonate oral care can shorten the hospitalization time, assist them in early extubation, and reduce the incidence of ventilator-associated pneumonia, which is consistent with the results of this study.

In summary, breast milk combined with sodium bicarbonate oral care is effective in preventing neonatal ventilator-associated pneumonia, can improve clinical indicators, reduce the incidence of pneumonia and infection, and has high application value.

References

- [1] Shen M, Tang YM, Liu YP, et al. Analysis of risk factors for ventilator-associated pneumonia. Chin Foreign Med J.

- 2023;42(13):50-3. (In Chinese)
- [2] Wu Y. Effect of breast milk combined with sodium bicarbonate oral care in preventing neonatal ventilator-associated pneumonia. *Kang Yi*. 2020;(16):158. (In Chinese)
- [3] Zhou J, Li DF, Ma J, et al. The role of breast milk combined with oral care in preventing neonatal ventilator-associated pneumonia. *Heilongjiang J Tradit Chin Med*. 2022;51(1):315-7. (In Chinese)
- [4] Tan YL, Zhou YQ, Zhang MS, et al. Analysis of the distribution and drug resistance of pathogens and related factors in neonatal ventilator-associated pneumonia in a hospital. *Antiinfect Pharm*. 2021;18(11):1631-4. (In Chinese)
- [5] Li G, Li M. Analysis of the application of sodium bicarbonate oral care in preventing ventilator-associated pneumonia in neonates. *Chin Foreign Med*. 2019;38(35):132-4. (In Chinese)
- [6] Dong J, Xing H. Observation on the application of combined use of hydrogen peroxide and sodium bicarbonate oral care in preventing ventilator-associated pneumonia in neonates. *Guizhou Med J*. 2022;46(10):1660-1. (In Chinese)
- [7] Liu F, Li DF, Du CY, et al. Effect of hydrogen peroxide combined with sodium bicarbonate oral care in neonates undergoing invasive mechanical ventilation. *Chin Minkang Med*. 2021;33(12):139-41. (In Chinese)
- [8] Wu TT, Pu Y. Effect of breast milk oral care on the treatment effect and mortality of ventilator-associated pneumonia in neonates. *Chin Community Doctor*. 2021;37(35):126-7. (In Chinese)
- [9] Geng DD. Analysis of high-risk factors for ventilator-associated pneumonia (VAP) in neonates in the neonatal intensive care unit (NICU). *J Math Med*. 2021;34(4):592-3. (In Chinese)
- [10] Chen QN. Study on the prevention of ventilator-associated pneumonia in neonates by breast milk combined with sodium bicarbonate oral care. *Chin Foreign Med Res*. 2019;17(34):100-2. (In Chinese)