

The Nursing Measures of Chronic Obstructive Pulmonary Disease with Respiratory Failure Treated by Noninvasive Ventilator

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ABSTRACT Objective: To analyze the nursing measures and curative effects of chronic obstructive pulmonary disease with respiratory failure treated by noninvasive ventilator; **Methods:** Retrospectively analyze the clinical data in 35 cases of chronic obstructive pulmonary disease with respiratory failure treated by noninvasive ventilator between June 2011 and June 2012 in the hospital; **Results:** All the patients' conditions were improved after the treatment and nursing, and the differences of pH value, PaO₂, PaCO₂ were significant ($p < 0.05$); **Conclusion:** Effective nursing measures can enhance the curative effects when the noninvasive ventilator is applied to the treatment of chronic obstructive pulmonary disease with respiratory failure.

KEYWORDS

Noninvasive ventilator
Chronic obstructive
Respiratory failure
Nursing measures

1. Introduction

Chronic obstructive pulmonary disease's symptoms, as a kind of respiratory disease, are mainly the obstruction of the respiratory tract and the air. If the disease develops continuously, it will lead to serious respiratory failure in the later period. However, with the development of the current medical technology, the curative effect of the noninvasive positive pressure ventilation (NIPPV) is very significant, and it is the best choice in the current clinical treatment. This study analyzes the excellent effects in 35 cases between June 2011 and June 2012 in the hospital of the non-invasive ventilator applied to the chronic obstructive pulmonary disease with respiratory failure, and reports as follows.

2. General data and methods

2.1. General data

All the patients in 35 cases in this group were patients who suffered from chronic obstructive pulmonary disease with respiratory failure and were treated by the noninvasive ventilator between June 2011 and June 2012. 26 males, and

9 females, age range: 43–81 years old, 66.9 ± 5.3 at average. All the patients were treated by NIPPV, and the utility time was 1–10 d, 6.5 ± 1.5 d at average.

2.2. Usage methods

Choose non-invasive ventilator to ventilate in the serious period, the patient should choose semi-recumbent position, the head of the bed should be lifted up about 30–40 degree, put the appropriate mask on the patient, and made good control on the headband's tightness. The parameters of the breathing machine should be set as follows: Concentration of oxygen, namely FiO₂ was set 40–55%; self-trigger/timing patterns (s/T); bi-level positive pressure ventilation, respiratory gas pressure and frequency of respiration respectively was 4–8 cm H₂O and 8–20 cm H₂O and 10–16 times/min, and the auxiliary pressure should be adjusted from low to high continuously to the point of the patient's optimum tolerance. Meanwhile, the patient must undergo regular treatment, including mainly the using of the medicine of nutrition supports, expectorant, anti-infection and bronchodilators. Besides, the drug sensitivity experiment should be conducted. Monitor strictly the index of conscious status, blood, urine volume and vital signs of the body and etc., and adjust the parameters of the machine according to the test results of the blood.

2.3. Nursing methods

2.3.1. Psychological nursing

The patients' dependence is critical to the curative effects,

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so the strengthen of the dependence can enhance the curative effects. It is best to select the conscious and cooperative actively patients and then set on the machine. It is necessary to make sure that the patient can insist on using and positively assist in the treatment by noninvasive breathing machine to succeed. Remind the patient that now it is the best time to take the noninvasive ventilation treatment, or the medical expenses will increase due to the deterioration of the disease, and it will affect the treatment in turn. As a nurse, inform the patient intently the main goal of the usage, and actively promote the advantages of the treatment to eliminate the patient's feeling of tension and fear, and guide them to breath reasonably, give positive support in the psychological sense, communicate with them regularly, meet their needs and answer the patient's questions patiently.

2.3.2. The mask should be adjusted appropriately

Ensure the respiratory tract unblocked, choose the appropriate mask, control the tightness of the fixed band and strictly observe the actual state of the patient's usage of the mask. If the fixed belt is too loose, especially in the case of uncooperative patients, the nurse should prevent the occurrence of mask loose, which can reduce the effect of ventilation. If the fixed band is too tight, it will lead to certain pressure on the nose and leads to swelling and congestion [1]. These are the symptoms which may occur in the treatment process, the patient cannot see so they do not cooperate. The nurse should put parts of the slim cotton on the bridge of the nose, relax the mask at any time, and take appropriate massage to avoid the occurrence of some symptoms.

2.3.3. Adjust the parameter of the breathing machine

Adjust the breathing state after connecting with the breathing machine, usually first take the measures of pressure support ventilation (PSV) combined with pressure end-expiratory positive (PEEP), fix by PEEP first, maintaining it in 4 cmH₂O, and from this starting-point, raise the inspiratory pressure gradually, the rising scope must be maintained in the extent of 1–2 cmH₂O, and observe in various environments for 10 min till when the patient cannot stand, then low the PSV gradually till when the patient feels comfortable; then slowly raise PEEP by special measures, and make the patient feel comfortable as far as possible [2]. Mind that the patient's concrete state should be taken into consideration when adjusting the pressure, besides observe the patient's vital signs. If there were an exist unusual signs, it should be resolved as soon as possible, and closely observe the patient's pulse, respiratory, SpO₂ and other indicators after NIPPV.

2.3.4. The respiratory tract should be kept unblocked

NIPPV usually can make the sputum sticky, which is not conducive to the discharge of the sputum. It often is affected by certain changes of the patient's ventilation needs, which leads to the large volume of the ventilation and not easy to be humidified. If NIPPV cannot improve the respi-

ratory failure resulting from the difficulties of the discharge of the sputum, it will not be able to avoid invasive ventilation. This requires that the amount of the liquid must be normal, the patient should be prevented from drinking too much, use well-functioning heated humidifier to assist the patient to cough, making sure the successful discharge of the sputum. Meanwhile, take physical treatment on the patient's chest to make the patient discharge the sputum successfully. Besides, discharge the sputum in the deep part of the lung by turning the body over and patting on the back to make the respiratory unblocked.

2.3.5. The routine supervision and nursing

Take good routine supervision and nursing in the process of treatment, and the inspection of the blood, SpO₂ and clinical actual conditions should be in place. If NIPPV is effective indeed, then it should be used for another 1–2 h, which is helpful to improve differences in the aspect of the patient's breathing and heart rate. If it is not so effective, then the lack of alveolar ventilation should be considered, which resulting from the unreasonable parameters of the breathing machine, the gas leakage of the pipe or the mask, so the nurse should adjust as soon as possible and improve by taking relevant measures. The most frequently taken measure is monitoring the changes of oxygenation after the NIPPV by SpO₂, if SpO₂ continues to increase after the machine is set on the patient, then whether there were an exists any gas leakage or obstruction of the sputum should be taken into consideration. The SpO₂ should be checked when the NIPPV is just applied to the treatment, besides, the FiO₂ should be adjusted to maintain the SpO₂ in the scope of 90%.

2.3.6. The nursing of the complications

(1) Compressive injury: The nurse should make the patient relax by the breathing machine, generally speaking, relax the patient every 4 hours, each time the length is about 10~30 min; control the headband, ensure the appropriate tightness to avoid the occurrence of gas leakage. If the patient's face is thin and there will be a gap around the mask. In this case, the nurse should fill the gap with gauze or cotton balls to prevent too much friction and damage; if the patient is torn, the nurse should smear erythromycin in the torn part to keep it clean, and pay attention to the dressing to avoid infection.

(2) Inhalation pneumonia: Make the patient lie on the side, or take the semi-recumbent position; discharge the condensed water completely in the pipes of the breathing machine to prevent the occurrence of mistaken aspiration; if the patient coughs seriously, turn off the machine immediately to avoid nausea and vomiting and other more serious symptoms, and turn on the machine till the symptoms are relieved [3].

(3) Abdominal distension: Abdominal distension can easily lead to mistaken respiratory. So adjust IPAP on the basis that the curative effects will not be influenced, make

sure that it cannot exceed 25 cmH₂O, and the nurse should give the patient correct guidance, make the patient close the mouth, breath through the nose, and reduce the number of swallowing as far as possible to prevent the inhalation of air in the stomach which can cause abdominal distension. If necessary, decompress the stomach, apply 10 g Glauber salt or fennel externally on the navel or anal tube, combined with gastric motility drugs.

2.3.7. The nursing after removing the machine

When the conditions improve, the respiratory functions recover to a certain extent, and the blood analyzing index and the control of the infection meet the requirements, the machine should be removed away. Explain the disease to the patient to improve the state of the disease by psychological nursing, then it is not necessary to take auxiliary breathing, let the patient and the families learn some relaxation skills to remove their psychological pressure, for example, if the patient's psychological dependence is strong, the intermittent offline mode can be taken. In the process of intermittent offline, the nurse should master all the monitoring index, after offline absorb oxygen by the pipe the concentration of which is 30–40%, control the SpO₂, make sure that its minimum is not less than 90%, the heart rate will not exceed 100 beats per minute, the respiratory frequency is 16–25 times per minute, and the offline time can be prolonged.

2.4. Statistics processing

Adopt SPSS 13.0 statistics software. Display by $\bar{x} \pm s$, and adopt χ^2 test. The difference is significant if $p < 0.05$.

3. Results

The patient were all turning better after the treatment and nursing. The difference of pH value, PaO₂, PaCO₂ before and after the treatment is significant ($p < 0.05$). See Table 1.

Table 1. The analysis on the arterial blood and comparison of the change in heart rate before and after the treatment.

Time	pH	PaO ₂ (mmHg)	PaCO ₂ (mmHg)	HR
Before the treatment	7.24 ± 0.11	57.6 ± 12.31	70.5 ± 13.1	91.1 ± 14.2
After the treatment	7.38 ± 0.12	76.3 ± 14.55	53.1 ± 12.7	75.2 ± 11.1

4. Discussions

The large consumption of respiration and respiratory track obstruction are the basic characteristics of chronic obstructive pulmonary disease complicated with respiratory failure, intrinsic positive end expiratory pressure and airway obstruction can lead to respiratory muscle fatigue, and then make the respiratory consumption increase. Currently, the most common used method applied in the treatment of chronic obstructive pulmonary disease com-

plicated with respiratory failure in clinical stage is the non-invasive ventilator, and its principle mainly includes: firstly assist the patient to overcome the resistance in the aspect of respiratory tract and pulmonary stretch, secondly, provide PEEP to make up for the consumption rise which results from PEEP, which can function in place of respiratory muscle, provide resting time for the respiratory muscle and promote the early recovery of respiratory muscle fatigue [4].

PEEP and pressure supporting ventilation is the main mode of non-invasive ventilator, and it comprises a suction pressure namely IPAP, which is very large, can play the role of pressure supporting ventilation, and can make the patient inhale easily oxygen needed; In the process of exhalation, exhalation pressure which is not so large, namely EPAP, functions as intrinsic positive end expiratory pressure, namely PEEP, it raises the functional rest air volume, avoids the lung atrophy, thereby reduces the work of breathing, exudation, oxygen consumption and the re-absorption of carbon dioxide, and promotes the recovery of the respiratory muscle fatigue as soon as possible, causes the increase of SaO₂ and decrease of PaCO₂. Besides, it is helpful to reduce the occurrence rate of the respiratory failure tracheotomy and the complications which are combined with the intubation, so as not to damage the respiratory tract's defensive function, ultimately preventing the occurrence of pneumonia and reducing the mortality rate.

In short, the clinical application of NIPPV is effective in the treatment of chronic obstructive pulmonary disease complicated with respiratory failure, which is not only beneficial to the reduction of the tracheotomy and intubation, but also to lower the occurrence rate of pneumonia, thereby reducing the patient's stay in the hospital. Therefore, the nurse must be very familiar with the operating skills in the process of working, give active guidance to the patients, and make them actively assist the doctors to carry out the treatment. Besides, the clinical monitoring and nursing should be strengthened. Only in this way can effectively prevent the complications, and enhance the patient's life quality.

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