Effect of Naloxone combined with noninvasive positive pressure ventilation therapy on blood gas indexes and serum indexes of COPD complicated with respiratory failure patients

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Objective: To analyze effect of Naloxone combined with noninvasive positive pressure ventilation therapy on blood gas indexes and serum indexes of COPD complicated with respiratory failure patients. Methods: 116 cases of COPD complicated with respiratory failure patients treated in our hospital from June 2012 to June 2014 were enrolled and randomly divided into observation group (58 cases) who received Naloxone combined with noninvasive positive pressure ventilation therapy, and control group (58 cases) who received plain noninvasive positive pressure ventilation therapy. Then differences of blood gas indexes, serum inflammatory factor levels and serum prognosis-related factor levels of both groups were compared. Results: 1) after treatment, artery blood PaO₂ and PH level of observation group were higher than those of control group; PaCO₂ level was lower than that of control group (P<0.05); 2) after treatment, serum factor levels of IL-13, IL-18, sICAM-1, PGE₂ and hs-CRP, etc of observation group were all significantly lower than those of control group (P<0.05); 3) after treatment, serum 1-AT, D-Dimer and BNP levels of observation group were lower than those of control group; FT₃ level was higher than that of control group (P<0.05). Conclusion: Naloxone combined with noninvasive positive pressure ventilation therapy helps to improve ventilation and oxygenation levels of COPD complicated with respiratory failure patients, reduce systemic inflammatory response and optimize prognosis-related indexes.

1. Introduction

Chronic obstructive pulmonary disease, i.e. COPD complicated with respiratory failure is a severe clinical disease. There is severe ventilation and gas exchange dysfunction in patients and severe cases can cause pulmonary cerebral disease and even death[1]. Noninvasive positive pressure ventilation, i.e. NPPV is the most common auxiliary ventilation mode adopted by COPD patients. It can alleviate respiratory muscle fatigue and is useful to improve patients’ hypoxia and hypercapnia conditions. Naloxone belongs to specific opioid receptor antagonist. It can directly and effectively reverse central respiratory inhibition caused by β-endorphins and improve patients’ hypoxia and carbon dioxide retention[2]. The research mainly analyzed effect of Naloxone combined with NPPV therapy on blood gas indexes and serum indexes of COPD complicated with respiratory failure patients. Details are as follows.

2. Materials and methods

2.1. Clinical data

116 cases of COPD complicated with respiratory failure patients treated in our hospital from June 2012 to June 2014 were enrolled. All patients’ families learned treatment process and signed informed consents. Enrolled patients were randomly divided into observation...
group and control group, each group with 58 cases. Observation group received Naloxone combined with noninvasive positive pressure ventilation therapy, including 30 males and 28 females, aging from 57 to 80 with age range of (68.76±8.11); control group received plain noninvasive positive pressure ventilation therapy, including 31 males and 27 females, aging from 59 to 82 with age range of (68.93±9.35). There were no statistical differences between the two groups’ baseline data (P>0.05). They were comparable.

2.2. Treatment method

Both groups received conventional treatment such as oxygen, anti-inflammation, spasmolysis, relieving asthma, respiratory stimulant and acid-base balance correction, etc. Based on conventional treatment, control group received NPPV, which was as follows: raising inspiration pressure gradually from 8-12 cmH2O to appropriate pressure (12-25 cmH2O), adjusting expiration pressure gradually from 4 cmH2O to 4-8 cmH2O, inspired oxygen concentration being 30%-60%, maintaining pulse oxygen saturation above 90%. Based on treatment of control group, observation group received Naloxone, which was as follows: adding 2 mg Naloxone into 100 mL NS, using micro-pump for IV infusion at 10 mL/h, 12 h at 1 time, 3 d for a course.

2.3. Observation indexes

2.3.1 Blood gas index

7 d before and after treatment, 2 mL of radial artery blood of both groups were extracted for blood gas analysis. PaO2, PaCO2 and PH values were compared.

2.3.2 Serum inflammatory factor index

After treatment, 5 mL of peripheral blood of both groups was extracted. ELISA was used to detect levels of inflammatory factors, including IL-13, IL-18, sICAM-1, PGE2 and hs-CRP.

2.3.3 Serum prognosis-related factor level

After treatment, 5 mL of peripheral blood of both groups was extracted. ELISA was used to detect α1-AT, D-Dimer, BNP and FT3.

2.4. Statistical analysis

Above data was statistically analyzed by SPSS18.0 software, measurement data for t test. Obtained results were considered to be significant at a level of P<0.05.

3. Results

3.1. Blood gas index

Blood gas level change is the most significant and direct change of COPD patients. Patients complicated with respiratory failure may show significant changes of PaO2 and PaCO2. Their levels are sensitive indicators to judge treatment effectiveness. T test showed that after receiving Naloxone combined with NPPV therapy, artery blood PaO2 and PH levels of observation group were higher than those of control group; PaCO2 level was lower than that of control group (P<0.05). Refer to Table 1 for details.

3.2. Serum inflammatory factor level

Chronic inflammation is the foundation of COPD. Acute and aggravated inflammatory response is one of the root causes of worsened COPD, and also contributes to the cause of respiratory failure. After treatment, both groups’ serum inflammatory factor levels were compared. T test showed that after receiving Naloxone combined with NPPV therapy, serum factor levels of IL-13, IL-18, sICAM-1, PGE2 and hs-CRP, etc were all significantly lower than those of control group (P<0.05). Refer to Table 2 for details.

3.3. Serum prognosis-related factor level

Illness of COPD patients, especially complicated with respiratory failure was severe. In the course of treatment, prognosis assessment should be done according to illness changes. The following are all
common clinical indexes that are closely related to prognosis. T test showed that after receiving Naloxone combined with NPPV therapy, serum α-1-AT, D-Dimer and BNP levels of observation group were lower than those of control group; FT3 level was higher than that of control group (P<0.05). Refer to Table 3 for details.

Table 3
Comparison of both groups’ serum prognosis-related factor levels after treatment.

<table>
<thead>
<tr>
<th>Group</th>
<th>α-1-AT (g/L)</th>
<th>D-Dimer (nmol/L)</th>
<th>BNP (pmol/L)</th>
<th>FT3 (pmol/L)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Observation group</td>
<td>1.33±0.39</td>
<td>3.29±0.41</td>
<td>78.6±8.61</td>
<td>4.28±0.47</td>
</tr>
<tr>
<td>Control group</td>
<td>1.46±0.41</td>
<td>6.77±0.82</td>
<td>105.9±11.53</td>
<td>2.25±0.26</td>
</tr>
<tr>
<td>t</td>
<td>5.773</td>
<td>7.294</td>
<td>7.395</td>
<td>6.295</td>
</tr>
<tr>
<td>P</td>
<td>&lt;0.05</td>
<td>&lt;0.05</td>
<td>&lt;0.05</td>
<td>&lt;0.05</td>
</tr>
</tbody>
</table>

4. Discussion

COPD is a respiratory system disease with high incidence rate in the world, ranking fourth in the causes of death. COPD complicated with respiratory failure can increase patients’ ventilation and gas exchange difficulty, resulting in continuous CO2 retention. Without timely intervention, it will progress to pulmonary cerebral disease. The death rate is high. NPPV is the main ventilation mode in treating COPD complicated with respiratory failure patients. When patients inhale, high enough pressure is given to overcome elasticity and airway resistance, effectively expanding the alveolar ventilation volume[3]. Besides, PEEPe provided by NPPV can compete with PEEPi, prevent airway occlusion, reduce respiratory muscle work, and contribute to the recovery of respiratory muscle function. NPPV can significantly improve COPD patients’ ventilation and gas exchange function, but illness of COPD complicated with respiratory failure patients is more severe, respiratory centre related function weakens and plain exogenous ventilation support is limited for the illness improvement. Naloxone belongs to synthetic specific opioid receptor antagonist. It can freely cross the blood-brain barrier, block morphine-like substances, excite respiratory center and effectively improve patients’ hypoxia and hypercapnia[4,5].

Central arousal effect of Naloxone can accelerate the recovery of patients’ consciousness and have the functions of protecting brains cells and reducing brain edema at the same time. The most accessible abnormal index of COPD patients is blood gas index, with typical expressions of low blood pressure, high CO2 and low PH values. At the same time, blood gas index values change according to patients’ illness changes. It is a sensitive index to reflect clinical curative effect. Above research first compared both groups’ blood gas levels before and after treatment, and results showed that before treatment, there were no differences between two groups’ blood gas levels; after treatment, values of all indexes of both groups were improved, but artery blood PaCO2 and PH levels of observation group were higher than those of control group; PaCO2 level was lower than that of control group (P<0.05), which indicated that Naloxone combined with NPPV therapy could more effectively improve patients’ oxygenation and enhance ventilation and gas exchange function[6].

IL-13 is closely related to body’s immune response and immune regulation processes. Studies have shown that IL-13 expression significantly increases after lung tissue is damaged, acute inflammatory response resulting in COPD outbreak; and animal experiments have confirmed that over expression of IL-13 can lead to large rat lung volume, excessive secretion of mucus and formation of emphysema[7]; IL-18 is a newly discovered cytokine, participating in progression of multiple immune diseases. It is mainly produced by monocytes/macrophages. It can make activated neutrophils directionally migrated to reactive region, release a series of activated products and lead to local inflammation. Studies have shown that IL-18 can not only induce T cell to produce IFN-γ, but also urge excessive secretion of inflammatory factors such as TNF-α and IL-8, etc; sICAM-1 is a cell adhesion molecule studied a lot in recent years, which can indicate body’s abnormal immune state[8]; sICAM-1 is closely related to COPD attack and plays an important role in COPD acute and aggravated inflammation process; PGE2, widely exists in all tissues and body fluids. Its content is highest especially in lung tissue. It is the cyclooxygenase metabolite of cellular phospholipid Arachidonic Acid (AA). PGE2 has the effects of expanding blood vessels, lowering blood pressure and reducing vascular permeability. In case of COPD, endothelial cell injury caused by inflammation and hypoxia stimulation can cause serum PGE2 level change; hs-CRP is an indicator of body’s acute inflammatory response. It is produced when cytokines such as IL-1 and IL-6, etc stimulate lung cells and activated macrophages. It is a sensitive indicator to reflect body’s inflammation levels[9,10]. Above research showed that after treatment, serum factor levels of IL-13, IL-18, sICAM-1, PGE2 and hs-CRP, etc were all significantly lower than those of control group (P<0.05), which indicated that Naloxone combined with NPPV therapy could effectively reduce patients’ systemic inflammatory response, optimize basic conditions of COPD and lay foundation for the improvement of patients’ overall status.

α-1-AT is a serine proteinase inhibitor synthesized by liver cells. It can effectively inhibit activity of multiple proteinases such as trypsin, thrombin and serotonin, etc. It can dispersion exist in lung tissue and combine with destructive proteolytic enzymes to prevent lung tissue damage and contribute to maintenance of normal structure and function of lung tissue[11]. D-Dimer is a specific degradation product of cross-linked fibrin. Significant increase of its content indicates that there is thrombus formation and dissolution in the body. It is useful for the early diagnosis of thrombosis diseases such as pulmonary embolism and deep vein thrombosis. Studies have claimed that D-Dimer is closely related to prognosis of COPD
patients. Long-term chronic hypoxia and CO₂ retention of COPD patients are improved and coagulation factor level in the body is lowered. Patients’ long-term hyperfibrinolysis will be improved, and thus D-Dimer level reduces[12]. BNP is an endocrine hormone with the effect of inhibiting sympathetic activity and antagonizing renin-angiotensin-aldosterone system. It can regulate blood volume, reduce load capacity and is closely associated with functions of multiple organs. Long-term hypoxia may promote BNP release. Breathing difficulty causes pleural pressure decrease, returned blood volume increase and cardiac stress increase, further promoting BNP secretion. Studies have shown that those COPD patients whose BNP levels are continuously elevated have poor prognosis[13]. Thyroid gland is body’s largest endocrine gland. When some organs are abnormal, secretion function of thyroid hormones are affected. Multiple chronic diseases can cause abnormal thyroid function test indicators. However, there is no clinical thyroid disease itself. This situation is considered to be the transport and metabolism of severe patients’ serum thyroid hormones in the body. The expression is TT₃ and FT₃ level decrease and TSH response of thyrotropin releasing hormone does not increase either[14]. Serum TT₃ and FT₃ levels of COPD patients are mostly lower than those of healthy people and are related to patients’ illness severity. Severely low levels of FT₃ and TT₃ can indicate severity of systemic diseases and patients’ poor prognosis. Above research showed that after treatment, serum α₁-AT, D-Dimer and BNP levels of observation group were lower than those of control group; FT₃ level was higher than that of control group (P<0.05), which indicated that Naloxone combined with NPPV therapy could effectively improve patients’ prognosis[15].

In conclusion, Naloxone combined with NPPV therapy helps to improve ventilation and oxygenation levels of COPD complicated with respiratory failure patients, reduce systemic inflammatory response and optimize prognosis-related indexes.

**References**


