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Clinical effect analysis of budesonide atomization inhalation in the treatment of neonatal pneumonia

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Abstract: To analyze the clinical effect of budesonide atomization inhalation in the treatment of neonatal pneumonia. This study was carried out from January 2018 to January 2023. Thirty-six children with severe neonatal pneumonia who were treated in hospitals during this period were selected into the study scope, and were divided into reference group and experimental group according to the two-color ball method, with 18 children in each group. The reference group was treated with routine symptomatic treatment, and the experimental group was treated with budesonide atomization inhalation on the basis of routine symptomatic treatment. The treatment effect, clinical symptom disappearance time, serum inflammatory index and complication rate of the two groups were observed and compared. The therapeutic effect of the experimental group was significantly better than that of the reference group ($P < 0.05$). The disappearance time of clinical symptoms such as wheezing, cough, lung rales and dyspnea in the experimental group was shorter than that in the reference group ($P < 0.05$). Serum inflammatory indexes of children in experimental group were lower than those in reference group ($P < 0.05$). The incidence of complications in the experimental group was significantly lower than that in the reference group ($P < 0.05$). Budesonide aerosol inhalation therapy for neonatal pneumonia is not only helpful to reduce the degree of inflammation in children, accelerate the disappearance time of clinical symptoms, but also helpful to avoid complications such as heart failure and optimize the clinical treatment effect, which is worthy of clinical promotion.

1. Introduction

Neonatal pneumonia is a common respiratory disease in neonatal period, which specifically refers to the lung infection of infants within 28 days after birth. Neonatal pneumonia is mainly caused by bacteria, viruses, fungi and other microbial infections. Typical clinical symptoms include shortness of breath, wheezing, fever, loss of appetite, hoarseness, milk rejection, poor response and spitting. Newborns with severe illness may also have symptoms such as respiratory failure or circulatory failure, which not only hinders the healthy growth of newborns, but also greatly increases the risk of disability and death [1-2]. In addition to direct health effects, neonatal pneumonia will also lead to long-term respiratory dysfunction and other complications, resulting in

the decline of children's quality of life and the increase of medical expenses [3]. The treatment of neonatal pneumonia mainly depends on antibiotics, antiviral drugs, oxygen therapy, expectorant therapy and other supportive treatments. However, clinical practice shows that the above conventional treatment methods still have many shortcomings, including drug side effects, variability of treatment response and drug resistance, and inability to fully control inflammatory reaction, which leads to persistent and repeated attacks of neonatal pneumonia [4]. In order to find a more effective and safe treatment, the medical community began to pay attention to budesonide atomization inhalation treatment in recent years. Budesonide is a glucocorticoid, which has been proved to be effective in controlling airway inflammation and improving lung function [5]. Atomization inhalation can directly act on the lungs, which can not only reduce systemic side effects, but also enhance the therapeutic effect. Therefore, 36 cases of neonatal pneumonia were selected as the study object, and the clinical application effect of budesonide atomization inhalation in the treatment of neonatal pneumonia was analyzed by grouping experiment. The analysis results are summarized as follows.

2. Information and Methods

2.1 General information

This study was carried out from January, 2018 to January, 2023. Thirty-six children with severe neonatal pneumonia who were treated in hospitals during this period were selected into the study scope, and were divided into reference group and experimental group according to the two-color ball method, with 18 children in each group. This study was approved by the local ethics committee. There were 10 male children and 8 female children in the reference group. The birth time was 1 ~ 23 days, and the average birth time was (7.31 0.28) days. The body weight is 2.425 ~ 4.617 kg, and the average body weight is (3.214 0.128) kg; The height is 45.18 ~ 54.09 cm, and the average height is (51.03 0.89) cm. Production mode: 13 cases of natural delivery and 5 cases of cesarean section. There were 11 male children and 7 female children in the experimental group. The birth time was 1 ~ 24 days, and the average birth time was (7.19 0.46) days. The body weight is 2.498 ~ 5.015 kg, and the average body weight is (3.182 0.484) kg. The height is 44.45 ~ 55.02 cm, and the average height is (51.18 0.29) cm. Production mode: 12 cases of natural delivery and 6 cases of cesarean section. There was no significant difference in the basic data such as sex and birth time of children ($P > 0.05$).

2.1.1 Inclusion criteria

(1) Neonatal pneumonia was diagnosed by imaging examination; (2) The child has not taken hormone drugs in the last week; (3) Parents of children expressed informed consent to the content of this study; (4) Persisting until the end of the study;

2.1.2 Exclusion criteria

(1) Children have allergic reactions to the drugs used in this study; (2) Crying is serious and cannot cooperate with clinical treatment measures; (3) Carriers of serious infectious diseases; (4) Immune insufficiency was diagnosed; (5) Missing or incorrect case data.

2.2 Methods

The reference group took routine symptomatic treatment: (1) Antibiotic treatment: According to the weight and condition of newborns, the medical staff made antibiotic treatment plans for each

newborn, including intravenous infusion or oral antibiotics, and selected antibiotics active against specific bacteria or viruses for children, and adjusted the dosage according to their pharmacokinetic characteristics. (2) Oxygen therapy: Continuously monitor the changes of children's blood oxygen saturation, and provide oxygen support for children by using nasal catheter or mask according to specific conditions, so as to ensure that children's blood oxygen saturation is always maintained within a safe range and avoid dyspnea. (3) Expectorant treatment: Ensure the air humidity in the ward of children, and at the same time, help sputum discharge by gently patting their chest and changing their body position, and give children sufficient water support.

(4) Supportive treatment: Give children symptomatic supportive treatment such as antipyretic, cough relieving and nutrition to relieve children's discomfort;

The experimental group was treated with budesonide atomization inhalation on the basis of routine symptomatic treatment: budesonide (manufacturer: Zhengda Tianqing Pharmaceutical Group Co., Ltd.; Approval number: Sinopharm Zhunzi H20203063; Product specification: 2ml: 1mg x5 pieces/box) was mixed with normal saline according to the ratio of 1: 1, and the children were given inhalation treatment by adding oxygen-driven atomizer, and the oxygen flow rate was set at 5 liters/minute, twice a day, once for 15 ~ 20 minutes, for seven consecutive days. During inhalation, medical staff need to ensure that the new child is in a comfortable position of lying down or half lying down, and keep a proper distance between the atomizer and the nose and mouth of the child to ensure effective absorption of drugs. After inhalation, the atomizer needs to be thoroughly cleaned and disinfected.

2.3 Observation indicators

The treatment effect, disappearance time of clinical symptoms, serum inflammatory index, and complication rate of children in both the reference group and the experimental group will be observed and compared.

(1) Therapeutic effect: markedly effective, effective and ineffective. The total effective rate of treatment = (markedly effective + effective) number of children/total number of children × 100%. The evaluation criteria are as follows: the clinical symptoms such as wheezing and dyspnea disappear completely, and the results of imaging and laboratory examination show that there is no inflammation in the lungs; Clinical symptoms such as wheezing and dyspnea basically disappeared, and imaging and laboratory examination results showed that mild lung inflammation was effective; Clinical symptoms such as wheezing and dyspnea have no obvious change or aggravation, and imaging and laboratory examination results show that lung inflammation has no change, which is invalid.

(2) The disappearance time of clinical symptoms such as wheezing, cough, lung rales, and dyspnea was recorded and counted through clinical observation.

(3) The serum inflammation index, specifically C-reactive protein, was detected by immunoturbidimetry before and after the children received treatment. The higher the index is, the more serious the lung inflammation of the children [6] is.

(4) The complications observed in the study included thrush, septicemia, and suppurative encephalitis. The incidence of complications = (thrush + septicemia + suppurative encephalitis)/total number of children × 100%.

2.4 Statistical analysis

The data were analyzed by SPSS24.0 statistical software. The measurement data were expressed by ($\bar{x} \pm s$), row t test, count data by (%), row x2 test. When $P < 0.05$, the difference was statistically significant.

3. Results

3.1 Comparison of therapeutic effects between the two groups of children

In the reference group, the therapeutic effect of 15 children was effective or above, and the total effective rate of this group was 83.33%; The treatment effect of 17 children in the experimental group is effective or above, and the total effective rate of this group is 94.44%. The treatment effect of children in the experimental group is significantly better than that of the reference group ($P < 0.05$), as shown in Table 1.

Table 1: Comparison of therapeutic effects between two groups of children [n (%)]

Group	Number of cases	Significant effect	Effective	Invalid	Total effective rate of treatment
Reference group	18	9(50.00)	6(33.33)	2(11.11)	83.33(15/18)
Experimental group	18	10(55.56)	7(38.89)	1(5.56)	94.44(17/18)
x2					5.498
P					< 0.05

3.2 Disappearance time of clinical symptoms in two groups

The disappearance time of clinical symptoms such as wheezing, cough, lung rales and dyspnea in the experimental group was shorter than that in the reference group ($P < 0.05$), as shown in Table 2.

Table 2: Disappearance time of clinical symptoms in two groups ($\bar{x} \pm s$, days)

Group	Number of cases	Breathing	Coughing	Lung rales	Dyspnea
Reference group	18	6.89 ±0.72	7.09 ±0.89	6.48 ±0.63	4.15 ±0.57
Experimental group	18	4.51 ±0.55	4.16 ±0.67	5.15 ±0.34	2.38 ±0.53
t		20.482	22.475	15.972	27.924
P		< 0.05	< 0.05	< 0.05	< 0.05

3.3 Comparison of serum inflammatory indexes between the two groups

Table 3: Comparison of serum inflammatory indexes between the two groups ($\bar{x} \pm s$)

Group	Number of cases	C-reactive protein (mg/L)	
		Before treatment	After treatment
Reference group	18	18.79 ±4.28	5.46 ±0.64
Experimental group	18	18.43 ±4.34	3.27 ±0.42
t		0.155	22.987
P		> 0.05	< 0.05

Before the treatment, there was no significant difference in serum C-reactive protein inflammation between the reference group and the experimental group, but both were higher than the normal value ($P > 0.05$); After taking treatment measures, the serum inflammatory indexes of the reference group and the experimental group decreased to a certain extent, and the serum inflammatory indexes of the children in the experimental group were significantly lower than those

in the reference group (P < 0.05), as shown in Table 3 for details.

3.4 Comparison of the incidence of complications between the two groups

The incidence of complications in the reference group and the experimental group were 22.22% and 5.56%, respectively, that is, the incidence of complications in the experimental group was significantly lower than that in the reference group (P < 0.05), as shown in Table 4.

Table 4: Comparison of the incidence of complications between the two groups [n (%)]

Group	Number of cases	Thrush	Septicemia	Purulent encephalitis	Incidence rate
Reference group	18	1(5.56)	1(5.56)	1(5.56)	16.67(3/18)
Experimental group	18	1(5.56)	0(0.00)	0(0.00)	5.56(1/18)
x2					6.136
P					< 0.05

4. Discussion

Neonatal pneumonia occupies an important position in respiratory diseases in neonatal period. According to recent statistical data, the incidence of neonatal pneumonia in China is about 2 ~ 4% [7]. Compared with adults or children, newborns have weak ability to adjust the external environment, and their physical functions are underdeveloped, so they are vulnerable to various pathogens, thus increasing the risk of pneumonia. The high incidence of neonatal pneumonia mainly includes maternal infection during fetus, perinatal aspiration pneumonia, cross infection after birth and other factors [8]. Considering the physiological characteristics and developmental status of newborns, timely treatment of neonatal pneumonia is crucial. Pneumonia may not only lead to neonatal dyspnea, hypoxia and malnutrition, but also lead to other systemic complications, further affecting the growth and quality of life of neonates. Therefore, it is of great significance for newborns to choose appropriate treatment methods, reduce the risk of complications and shorten the course of disease.

Budesonide, as a synthetic glucocorticoid, has been widely used in the treatment of many respiratory diseases. Budesonide mainly plays a therapeutic role by regulating inflammatory reaction, specifically by inhibiting the activation and migration of pro-inflammatory cells, reducing the secretion of cytokines and chemokines, and then reducing airway and lung parenchymal inflammation [9]. In addition, budesonide can also increase the relaxation of bronchial smooth muscle, thus relieving bronchospasm and reducing airway hyperresponsiveness. For neonatal pneumonia, airway inflammation and alveolar inflammation are the main pathological features. Budesonide can directly act on inflammatory cells and inhibit their activation, thus reducing inflammatory reaction and helping to restore the normal structure and function of the lungs [10]. Especially in early intervention, it can effectively prevent the further spread and aggravation of inflammation, reduce alveolar destruction and protect lung physiological function. Atomization inhalation, as a treatment method, has the advantage of delivering drugs directly to the lungs and increasing the concentration of drugs in local tissues of human body. Inhalation therapy can not only enhance the therapeutic effect of budesonide, but also significantly reduce systemic drug exposure, so as to reduce potential side effects on other organs [11]. After routine symptomatic treatment and budesonide inhalation treatment for neonatal pneumonia, it was found that the disappearance time of symptoms such as wheezing, cough, lung rales and dyspnea in the experimental group was shorter than that in the reference group (P < 0.05), which indicated that budesonide atomization inhalation treatment could not only improve the curative effect, but also shorten the course of disease and provide faster rehabilitation opportunities for neonates. In addition,

the serum inflammatory markers in the experimental group were lower than those in the reference group ($P < 0.05$), which further confirmed the role of budesonide in controlling inflammatory reaction. Finally, compared with the reference group, the incidence of complications in the experimental group was also significantly reduced ($P < 0.05$), which confirmed the safety of budesonide atomization inhalation treatment again.

To sum up, budesonide atomization inhalation treatment for neonatal pneumonia not only helps to reduce the degree of inflammation in children, speed up the disappearance time of clinical symptoms, but also helps to avoid complications such as heart failure and optimize the clinical treatment effect, which is worthy of clinical promotion.

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