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THE ROLE OF MICROCLIMATE IN CHILDREN WITH RECURRENT OBSTRUCTIVE BRONCHITIS

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ABSTRACT

Bronchobstructive syndrome is most common in children with acute obstructive bronchitis and bronchiolitis, but the proportion of patients with recurrent obstructive bronchitis has been increasing in recent years. The study evaluated the influence of ambient air microclimate parameters in the treatment and prevention of recurrent obstructive bronchitis in children. There were examined 50 patients with recurrent obstructive bronchitis, who were divided into 2 groups of 25 patients each, depending on the use of air purifier brand "Gree". The conducted study allows to reduce the severity and duration of recurrent obstructive bronchitis, which ultimately leads to a reduction in the duration of hospital treatment by an average of 1.5 days compared to standard therapy. A good microclimate also reduces recurrent episodes of bronchial obstruction, but the study also showed that there is a need to optimise the microclimate at home.

Key words: recurrent obstructive bronchitis, microclimate, air purification, recurrent episodes, prevention.

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РОЛЬ МИКРОКЛИМАТА У ДЕТЕЙ С РЕЦИДИВИРУЮЩИМ ОБСТРУКТИВНЫМ БРОНХИТОМ

АННОТАЦИЯ

Бронхообструктивный синдром наиболее часто встречается у детей с острым обструктивным бронхитом и бронхиолитом, однако в последние годы увеличивается доля больных рецидивирующим обструктивным бронхитом. В проведенном исследовании было оценено влияние показателей микроклимата окружающего воздуха в лечении и профилактике рецидивирующего обструктивного бронхита у детей. Было обследовано 50 больных с рецидивирующим обструктивным бронхитом, которых поделил на 2 группы по 25 больных, в зависимости от использования очистителя воздуха бренда «Gree». Проведенное исследование позволяет уменьшить тяжесть и длительность рецидивирующего обструктивного бронхита, что в конечном итоге приводит к снижению сроков стационарного лечения в среднем на 1,5 суток в сравнении со стандартной терапией. Хорошие показатели микроклимата также приводят к снижению повторных эпизодов бронхиальной обструкции, однако исследование также показало, что имеется необходимость в оптимизации микроклимата и в домашних условиях.

Ключевые слова: рецидивирующий обструктивный бронхит, микроклимат, очистка воздуха, повторные эпизоды, профилактика.

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BOLALARDA QAYTALANUVCHI OBSTRUKTIV BRONXITDA MIKROIQLIMNING ROLI

ANNOTATSIYA

Bronxo-obstruktiv sindrom ko'pincha o'tkir obstruktiv bronxit va bronxiolit bilan og'rigan bolalarda uchraydi, ammo so'nggi yillarda qaytalanuvchi obstruktiv bronxit bilan og'rigan bemorlarning ulushi ortib bormoqda. Tadqiqot bolalarda qaytalanuvchi obstruktiv bronxitni davolash va oldini olishda atrof-muhit havosi mikroiqlim ko'rsatkichlarining ta'sirini baholadi. Qaytalanuvchi obstruktiv bronxit bilan og'rigan 50 nafar bemor tekshirildi, ular "Gree" markali havo tozalagichdan foydalanishga qarab 25 bemordan iborat 2 guruhga bo'lindi. O'tkazilgan tadqiqot qaytalanuvchi obstruktiv bronxitning og'irligi va davomiyligini kamaytirishga imkon beradi, bu esa oxir-oqibat standart terapiya bilan taqqoslaganda statsionar davolanish vaqtini o'rtacha 1,5 kunga pasayishiga olib keladi. Tadqiqot shuni ko'rsatdiki mikroiqlimning yaxshi ko'rsatkichlari bronxial obstruktsiyaning takroriy epizodlarining pasayishiga olib keladi, shuningdek uyda mikroiqlimni optimallashtirish zarurati mavjudligini takidlaydi.

Kalit so'zlar: qaytalanuvchi obstruktiv bronxit, mikroiqlim, havoni tozalash, takroriy epizodlar, oldini olish.

Relevance. Bronchobstructive syndrome is most often found in children with acute obstructive bronchitis and bronchiolitis, but in recent years the proportion of patients with recurrent obstructive bronchitis has been increasing. Recurrent obstructive bronchitis is a multifactorial, eco-dependent disease, the leading pathogenetic link of which is recurrent inflammation of the mucosa of the bronchial tree, caused by a decrease in local defence factors and general immunological resistance of the body, in response to infectious, allergic, toxic, physical and neurohumoral effects, forming hyperresponsiveness of the respiratory tract [1,3].

It is important to note that repeated episodes of bronchobstructive syndrome accompanying respiratory viral infections, as a rule, form bronchial hyperresponsiveness, which determines the possibility of phenotypic realisation of bronchial asthma in young children [2,6]. Studies in recent years have allowed to establish a variety of pathogenetic mechanisms involved in the development of bronchobstructive syndrome in children. Bronchial hyperresponsiveness is a key mechanism in the pathogenesis of bronchial asthma, but it is often detected in children with recurrent bronchitis and in children with frequent illnesses [4,7]. The role of microclimate parameters in the pathogenesis of recurrent obstructive bronchitis is still not fully understood [5]. In the existing treatment and prevention protocols for recurrent bronchitis in children, the issue of environmental protection, including the influence of air pollution indicators on the course of the disease, remains open; in this regard, the relevance of this study is beyond doubt.

Objective. To evaluate the influence of ambient air microclimate parameters in the treatment and prevention of recurrent obstructive bronchitis in children .

Materials and methods of the study.

We examined children with recurrent obstructive bronchitis who were hospitalised in the departments I, II of emergency paediatrics and paediatric intensive care of the Samarkand branch of the Republican Scientific Centre for Emergency Medical Care, as well as in the pulmonology department of the Samarkand Regional Children's Multidisciplinary Medical Centre from January 2020 to July 2022. The criteria for hospitalisation and recruitment to the study group were as follows: diagnosis - recurrent obstructive bronchitis, RDAI score≥6 points, E:I index score>1.40, ineffectiveness of treatment at home for ≥48 hours, absence of severe background and intercurrent diseases, parental consent for research work, ability to obtain correct anamnestic data from the patients' parents. The design was consistent with a randomised controlled clinical trial.

The criteria for exclusion from the observation groups were the presence of chronic diseases of the cardiovascular and respiratory system, lack of parental consent in conducting research work, and inability to obtain accurate anamnestic data of the patients.

A total of 55 patients with recurrent obstructive bronchitis who fulfilled the inclusion criteria were included in the study, with 5 patients being excluded from follow-up for various reasons during the study. As a result, 50 patients were included in the study.

The patients were randomly divided into 2 groups. Group I (main) included 25 patients, who received standard therapy, while the air purifier of "Gree" brand was used to improve the microclimate in the patient's room. Group II (comparison) included 25 patients receiving standard therapy, no additional microclimate improvement was performed. Air purification was carried out in the automatic control mode of the device; for the purity of the experiment, air exchange with other rooms in the hospital, as well as with the outside air, was minimised.

Along with clinical and laboratory-instrumental methods of research, the following methods were used to evaluate the effectiveness of the therapy: respiratory disorders scale - RDAI, saturation method - SpO_2 and modified bronchophonography according to the E:I index method, which allowed to objectively assess the severity of bronchial obstruction. Objective signs of cough and sputum were assessed. Evaluation of cough severity in patients was assessed according to the ball system: 0 points - no cough, 1 point - single cough, 2 points - cough is expressed moderately and 3 points - frequent, painful cough, and sputum expectoration was assessed as follows: 0 points - no sputum, 1 point - easy expectoration, 2 points - difficult expectoration and 3 points - viscous undetectable sputum.

Results of the study and discussion.

As a result of the comparison of clinical signs in patients of the compared groups on admission to the hospital, there were no statistically significant differences in the main clinical, laboratory and instrumental indicators. The indicators shown in Table 1 indicated both the need for hospitalization and inpatient treatment and similar clinical symptoms and severity of condition in patients of both groups under study.

Table 1

Main parameters of patients with recurrent obstructive bronchitis on admission to hospital (M±m)

№	Parameters (points)	Group I	Group II	P
1	Cough	1,8±0,1	1,7±0,1	>0,5
2	Sputum	1,4±0,1	1,5±0,1	>0,5
3	Wheezing during inhalation	0,73±0,03	0,79±0,04	>0,5
4	Wheezing during exhalation	1,7±0,1	1,8±0,1	>0,5
5	Number of lung fields involved	1,8±0,1	2,1±0,1	>0,5
6	Supraclavicular retractions	1,3±0,1	1,2±0,1	>0,5
7	Intercostal retractions	0,8±0,04	0,9±0,08	>0,5
8	Subcostal retractions	1,3±0,1	1,2±0,1	>0,5

9	SpO_2 (%)	94,4±1,3 [88-99]	94,8±1,0 [89-99]	>0,5

Note: P - reliability of differences between groups I and II.

The study investigated air cleanliness and relative humidity indices depending on the use of air purifier. After obtaining the data, a comparative analysis of the results obtained in patients of both groups was carried out (Table 2). As can be seen from the data obtained, a statistically significant difference was observed in a number of indicators, such as the concentration of PM 2.5 particles in the air in the patients' room was more than 3.5 times lower in group I patients compared to group II patients (P<0.001), which is a particularly important criterion for the treatment and prevention of respiratory system diseases. The concentration of larger PM 10 particles was 3.5 times lower in patients whose rooms were air purified with air purification equipment compared to patients without air purification (P<0.001), and it should be noted that the content of the smallest PM 1.0 particles remained practically unchanged despite the air purification procedure (P>0.2). The levels of formaldehyde (HCHO) and volatile organic compounds (TVOC) in the air were significantly lower in the air of the rooms of patients who received air cleaning compared to those in the comparison group (P<0.001). Ultimately, the favourable effect of the air purification system on the microclimate and air parameters in the patients' rooms was reflected in the improvement of the air quality index (AQI), which as a result was reduced by almost 3 times, the mean value of which was observed in the favourable zone (<25), which was significantly lower in comparison with patients from group II (P<0.001). The operation of the device air purification was practically not reflected in the change of room temperature and carbon dioxide concentration (P>0.5), which was explained by the mechanics of interaction of the device filtration system with the environment.

Table 2. Comparative characterisation of air cleanliness and relative humidity indices in the ward of patients of the compared groups

№	Indicators	Group I (Main)		Group II (Comparative)		P
		M	m	M	m	
1	PM 1.0 (нг/м3)	9,7	0,4	10,3	0,5	>0,2
2	PM 2.5 (нг/м3)	5,7	0,4	21,4	0,8	<0,001
3	PM 10 (нг/м3)	4,2	0,3	15,5	0,9	<0,001
4	HCHO (мг/м3)	0,06	0,002	0,13	0,005	<0,001
5	TVOC (мг/м3)	0,17	0,02	0,24	0,02	<0,001
6	AQI	24,5	1,3	61,9	2,9	<0,001
7	Temperature (°C)	21,9	1,0	21,8	1,3	>0,5
8	CO2 (ppm)	1979,9	42,1	2039,9	57,5	>0,5
9	Humidity (%)	50,3	2,3	32,5	1,3	<0,001

P - reliability of differences between the compared indicators of the studied groups

The study aimed at studying the differences in the dynamics of elimination of the main clinical manifestations of the disease showed that the patients of the compared groups had significant differences in the time of elimination of all the main clinical symptoms. Thus, the normalisation of the general condition was 1.1 days faster in patients whose room was air purified compared to patients from the comparison group (P<0.01). The elimination of respiratory insufficiency, as well as accompanying this syndrome (cyanosis, tachypnoea) also directly depended on the air purity indicators, so this symptomatology was eliminated much faster if the air in the patient's room was cleaner, so these symptoms were eliminated significantly faster in group I patients compared to group II patients (P<0,001). Cough reflex also depended on the presence of air purification system, so this symptom was eliminated faster in patients with working air purification system in the ward, on average by 1.2 days, resolving faster in comparison with group II patients (P<0.05). Improvement of clinical symptoms by all parameters resulted in a significant reduction of hospitalization time in group I patients (by 1.5 bed-days) compared to group II patients (P<0.01).

Conclusion. The conducted study allows us to conclude that the use of air purification system to improve microclimate indicators in the ward of patients with recurrent obstructive bronchitis allows to improve air quality indicators (AQI), reduce the concentration of both organic and inorganic air pollutants, optimize the relative humidity indicator in the room. Significant improvement of microclimate indicators allows to reduce the severity and duration of recurrent obstructive bronchitis, which ultimately leads to a reduction in the duration of hospital treatment by an average of 1.5 days compared to standard therapy. A good microclimate also leads to a reduction in recurrent episodes of bronchial obstruction, but the study also showed that there is a need to optimize the microclimate at home. Thus, the study has shown high promise in studying the positive effect of optimal microclimate on the course of recurrent obstructive bronchitis, therefore there is a need for further research in this area.

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