



TO THE QUESTION OF BRONCHIAL OBSTRUCTION IN THE ASPECT OF PEDIATRICS

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✓ *Resume*

The article includes data from a literature analysis on aspects of pathologies of the respiratory system in children, which are important for physicians, especially pediatricians, and the study of this problem as a whole in medicine remains an open question.

Key words: respiration, bronchial obstruction, early age, aspects, population, form, treatment.

К ВОПРОСУ БРОНХИАЛЬНОЙ ОБСТРУКЦИИ В АСПЕКТЕ ПЕДИАТРИИ

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✓ *Резюме*

В статье включены данные литературного анализа по аспектам патологий органов дыхания у детей, которые имеют важное значение у медиков особенно у педиатров, а также изучения этой проблемы в целом в медицине остается открытым вопросом.

Ключевые слова: дыхание, бронхиальная обструкция, ранний возраст, аспекты, популяция, форма, лечение.

ПЕДИАТРИЯ АСПЕКТИДА БРОНХИАЛ ОБСТРУКЦИЯ МАСАЛАСИГА ТЕГИШЛИ БЎЛГАН ЗАМОНАВИЙ ЁНДОШУВНИНГ ТАҲЛИЛИ

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Мақолада шифокорлар, айниқса педиатрлар учун муҳим бўлган болаларда нафас олиш аъзолари патологиялари бўйича адабиётлар таҳлили маълумотлари киритилган, шунингдек, ушбу муаммони тиббиётда ўрганиш очик савол бўлиб қолмоқда

Калит сўзлар: нафас, бронхиал обструкция, эрта ёшидаги болалар, аспектлар, популяция, шакли, давоси

Relevance

Pathologies of respiratory organs take a leading position in the structure of young children's morbidity. Within the acute period these pathologies are often complicated with bronchial obstructive syndrome, both with infectious etiology and with allergic origin.

Statistics showed that up to 30% of young children at least once had obstructive bronchitis, while bronchial asthma, clinical equivalent of which is BOS, was registered almost in 10% of the whole children's population.

At the modern stage the notion of bronchial obstructive syndrome is complex one, and it can accompany various nosologic forms of respiratory pathologies, including a complex of symptoms of particularly outlined clinical manifestations of disorders in bronchial air flow originating from narrowing or occlusion of respiratory pathways.

Clinicists noted the fact, that exactly uniformity of clinical symptoms of bronchial obstruction in bronchial asthma and obstructive bronchitis complicates duly verification of the diagnosis, and, consequently, makes design of adequate pharmaceutical program for emergency cases and rehabilitation impossible, therefore determining prolongation of the terms of treatment and severity of the pathologic process.

The range of diagnostic methods for differential diagnosis of bronchial obstructive syndrome in early childhood is quite scarce and it is often based exclusively on clinical presentation combined with history data. Besides routine paraclinical tests (common blood analysis, x-ray of thoracic cage, etc) for clarification of etiological origin and severity of the disease some immunogram parameters such as total immunoglobulin A, M, G, E, phagocyte activity of neutrophils, circulating immune complexes can be used. Until recently there were no objective assessment methods for dysfunctions of external breathing within that age period in practical medicine, and that potentiated continuous search for available and non-invasive diagnostic methods.

Symptoms of UI and significance of diagnostic methods

It was noted in references that, bronchial obstructive syndrome (BOS) or syndrome of bronchial obstruction is a complex of symptoms linked to disorders in bronchial air flow of functional or organic origin. Due to the fact that clinical manifestations of BOS consist of prolonged expiration, appearance of expiratory noise (whistling, noisy breathing), short-breathing attacks, participation of auxiliary muscles in respiratory act, there is often development of almost non-productive coughing. In case of expressed obstruction in bronchi there can be noisy expiration, rise of breathing rate frequency, fatigue of respiratory muscles, and decrease of PaO₂. In English references that complex of symptoms is called wheezing (syndrome of wheezing breathing), as wheezing sounds, distant or auscultated ones serve to be the basic clinical symptom of BOS.

Specialists also noted the fact, that the term “bronchial obstructive syndrome” could not be used as an independent diagnosis, that is why there is no current statistics of its prevalence in population. It should be noted, that BOS is very heterogeneous and it can be manifestation of a variety of diseases.

Statistical references state, that according to some authors, frequency of BOS development with a background infectious diseases of lower respiratory ways in young children varies from 5% to 40% . Children with complicated allergic family history, as a rule have BOS more often (в 30 — 40% of the cases). It is also characteristic for children, who suffer respiratory infections quite often (more than 6 times a year).

The further literature analysis showed, that anatomical physiological factors predisposing to the development of BOS in children with recurrent obstructive bronchitis were hyperplasia of mucous tissue, predominant secretion of viscous phlegm, relatively narrow respiratory pathways, less capacity of smooth muscles, low collateral ventilation rate, local immunity failure, and specific structure of diaphragm.

Influence of premorbid background factors on the development of BOS is accepted by majority of researchers. These are complicated allergic history, hereditary predisposition to atopy, bronchial hyperactivity, perinatal pathology, rickets, hypotrophy, thymus hyperplasia, early formula feeding, respiratory diseases in the age 6-12 months.

The authors also mentioned that the leading role in BOS development in young children is played by environmental factors (effect of allergens and non-specific factors). At the same time early development of asthma was registered in children living in places with high rate of mite allergens. One of the most important among the environmental factors, which can lead to the development of BOS, is unfavorable ecologic environment and passive smoking in the family. The influence of tobacco smoke causes hypertrophy of bronchial mucous glands, disorder of mucociliary clearance, and inhibits movement of mucous. Passive smoking promotes destruction of bronchial epithelium. Tobacco smoke is inhibitor of neutrophils chemotaxis. Under its influence the number of alveolar macrophages rises, but their phagocyte activity decreases. Long-term effect of tobacco smoke on immune system causes decrease in the activity of T-lymphocytes, it suppresses synthesis of antibodies, stimulates synthesis of immunoglobulin E, and increases activity of nervus vagus. The most perceptive ones are children within the first year of life.

Besides that, authors wrote, that BOS development risk factors include preterm birth, little body weight at birth, asphyxia, artificial lung ventilation after birth, and bronchial-pulmonary dysplasia. Children with birth underweight often have symptoms of functional immaturity of inner organs, including lungs, which is significant for the further development of respiratory pathologies, bronchial hyper reactivity, and pulmonary dysfunctions.

Recently there is notable growth of interest in the system of interaction between inflammation and neuropeptides, which perform integration of neural, endocrine, and immune systems. Within initial years of life that interrelation is more expressed and it determines predisposition to the development of bronchial obstruction.

In local and foreign literature authors stated, that the reason for the development of BOS in children of any age could be bacterial sensitizing. Development of bacterial allergy can be initiated by both pathogenic and non-pathogenic strains of micro organisms. Children with bronchial asthma often have IgE-antibodies to bacterial allergens.

Some perinatal factors can promote development of BOS in children. Ante and intranatal fetal hypoxia conditioned by complicated pregnancy and birth, cardiovascular and bronchial-pulmonary diseases of mother also contribute to more severe progression of bronchial obstruction in children.

Clinical specialists noticed an interesting fact, that genesis of bronchial obstruction has various pathogenic mechanisms, which relatively can be classified to functional or reversible (bronchial spasm, inflammatory infiltration, edema, mucociliary failure, hypersecretion of viscous mucous) and irreversible ones (congenital bronchial stenosis, bronchial obliteration, etc). Physical symptoms of bronchial obstruction are conditioned by requirement of increased intrathoracic pressure for expiration, which is provided by intensive work of respiratory muscles. Increased intrathoracic pressure promotes suppression of bronchi, leading to their vibration and appearance of whistling sounds.

Differential diagnostics of BOS with allergic and infectious genesis

Symptoms	Infection	Allergy
Epidemiological	Contact with ARVI patient	Contact with household, pollen and other allergens
Heredity	Not complicated	Hereditary predisposition to atopy
Clinical	Rise of temperature, intoxication, and other symptoms of infectious process	Normal temperature, no intoxication
Stability of clinical symptoms of BOS (coughing, wheezing, tympanitis, dry whistling and various rales)	Characteristic cyclicity of pathologic process	Typical liability of clinical symptoms within a day and in dynamic follow up
Adaptation to bronchial obstruction	Expressed respiratory failure	Sufficient adaptation to BOS
BOS duration	More that 1-2 weeks	Very unclear, depends on exposition and allergen elimination
Recurrent persisting virus	rare	Very typical
Fluorescent immunoassay of nasopharyngeal washout	Antigens of RS viruses, parainfluenzae, adenovirus, etc.	More often negative
Rise of antibodies titer to viruses in compliment fixation reaction, IHAR	characteristic	Not characteristic
Immunological tests	There can be decrease of cellular immunity, rise of CIC	Rise of Ig E, there can be decrease of Ig A, CIC were more often normal
Eosinophilia	atypical	Very typical
Dermal tests with household and other atopic allergens	negative	positive
Sensitizing to atopic allergens in vitro tests	Absent	present
Bronchial hypersensitivity	atypical	Typical
Helminthic invasion	As in population	Can be more often

Some authors suggested that BOS is a protective function in case of infection in respiratory pathways. It is considered, that narrowing of small bronchi is accompanied by a sudden rise of air

velocity in them, which contributes to better clearance of bronchial tree and protection of lower parts from micro organisms.

Often, especially in pediatrics, specialists perform differential diagnostics of BOS of allergic and infectious genesis. The table below provides symptoms on the basis of which a practitioner can successfully solve the problem.

Assessment of the efficacy of therapy

In relation to the presence of various causes of OS development treatment of patients should include:

- differentiated approach, taking into account all possible mechanisms of pathogenesis of bronchial obstruction;
- primary aiming elimination of the causes of BOS development.

In order to eliminate BOS manifestations the greatest attention in clinic is paid to bronchodilator agents, the main feature of which is ability to eliminate spasm of bronchial muscles and make air flow to lungs easier. It is rational to use inhaled bronchodilators, as exactly that way promotes:

- fast start of effecting;
- creation of effective concentration of active substance in bronchial tree with its insignificant concentration in circulating blood;
- minimization of side-effects;
- convenience of dosage.

According to mechanism of action modern bronchodilators are divided to the agents reproducing effect of adrenergic stimulation (sympathomimetics or β 2-agonists), blocking bronchial narrowing effect of acetyl cholin on bronchi (anticholinergic agents), combined agents and theophyllines (methyl xanthines). In its turn, all these agents are divided to drugs with short and prolonged action.

Inhaled β 2-agonists with short-time effect are salbutamol and fenoterol. Their basic features include stimulation of β 2-adrenoreceptors, relaxing of smooth muscles in bronchi, decrease of air ways hyper reactivity, improvement of mucociliary clearance, decrease in vascular permeability and plasma exudation (antiedematous effect), stabilization of mast cells' membranes, and decrease of inflammatory mediators secretion. Advantages of these agents are fast (in 3-5 min) expressed bronchodilator effect for 3-6 hours. However, the agent of that group are characterized by quite significant number of side-effects, particularly in case of frequent (above 4 times a day) administration. Those side-effects include tremor, due to direct effect of the agent on β 2-adrenoreceptors of skeletal muscles, tachycardia, which can be relevant both to direct effect on atrial β -adrenoreceptors, and under the influence of reflexive response as a result of peripheral vasodilatation via β 2-receptors. Less frequent and less expressed complications of short-time effect β 2-agonists therapy are hypokalemia, hypoxemia and irritability, and fast decrease in therapeutic effect in case of repeated application of the medicines.

Inhaled β 2-agonists with long-lasting effect include salmeterol and formeterol. Their characteristic feature is long-lasting therapeutic effect (about 12 hours), in relation to which it is rational to use them in combination with anti-inflammatory agents for planned therapy for patients suffering BA and/or COPD. Salmeterol and formeterol (which is characterized by fast effect) are able to relax smooth muscles in bronchi, to intensify mucociliary clearance, to decrease vascular permeability and release of mediators from mast cells and basophiles, to provide long-lasting protection from trigger factors, leading to bronchial obstruction. Main anticholinergic agents are ipratropium bromide (short-term effect – 8 hours) and tiotropium bromide (long-lasting effect – 24 hours). Bronchodilator mechanism of cholinolytics is conditioned by block of muscarine cholin receptors, as a result of which reflexive narrowing of bronchi, caused by stimulation of irritative cholinergic receptors, is suppressed, while tension of nervus vagus is decreased.

Characteristic features of cholinolytics include slow effect (in 30-60 min), absence of cardiotoxicity, which makes them best choice agents for patients with cardiologic and circulatory disorders, and patients of old and senile age, no addiction and decrease of efficacy in recurrent usage, few side-effects such as dry mouth and bitter taste. It should be noted, that positive effects of anticholinergic agents are not limited by bronchodilator effect. They are also able to decrease sensitivity of cough receptors and secretion of viscous phlegm, and to decrease consumption of oxygen by respiratory muscles.

Disadvantage of short-time effect anticholinergic agents is slower start of its effect in comparison to β 2-agonists. Long-term effecting anticholinergic agents (tiotropium bromide) recently took a stable position in the same line with β 2-agonists with long-term effect in BOS therapy.

Combined bronchodilators include combination of ipratropium bromide and fenoterol, which combines all advantages of β_2 -agonists and anticholinergic agents. Effect of the agents in that combination is synergistic.

Methyl xanthines (theophylline) per os or parenterally have relatively weak bronchodilator effect compared to the aforesaid agents, but they have positive effect on respiratory muscles, improve phlegm excretion, stimulate respiratory center, and have weak anti-inflammatory effect. Unfortunately, in our country theophyllines with short-time effect are almost basic agents for elimination of bronchial obstruction. Reasons of that are low cost, efficiency, easy application, lack of doctors' knowledge about multiple side-effects, and availability of other safer BOS therapeutic methods. Thus, theophyllines with short and prolonged effect, possessing bronchodilator and insignificant anti-inflammatory activity, often cause nausea, vomiting, headache, excitement, gastro esophageal reflux, frequent urination, arrhythmia, tachycardia, and so on. In relation to that theophylline agents are recommended only as additional bronchodilators for the treatment of BA and COPD in cases, when standard inhalation bronchodilator therapy is not sufficiently effective for some patients.

As it was mentioned before within BOS therapy there is often necessity of combination of bronchodilators with anti-inflammatory agents, including cromons and especially inhaled glucocorticoids (IGCS). Though that group of medicines does not possess direct bronchodilator effect, it is able to intensify bronchial dilatation significantly by means of effective influence on inflammatory process in bronchial tree.

Modern approaches to the therapy of patients with bronchial obstruction should be differentiated and include compulsory application of bronchodilator and, if indicated, anti-inflammatory, antibacterial, antiviral, and mucolytic agents.

Thus, based on the reference data, it can be concluded, that duly diagnostic and prophylaxis of the pathology is compulsory both in pediatrics and medicine as a whole.

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