The State of External Respiration Function in Children with Infectious-Associated Recurrent Obstructive Bronchitis During Acute Period

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Introduction

Recurrent obstructive bronchitis is the pathological process which is characterized by periodic attacks of wheezing (bronchoobstructive syndrome) (the development of wheezing) [1, 2].

When there is infection of lower respiratory airways, symptoms of wheezing are in 34% children, more than half of which have recurrent episodes of the disease [3].

Diagnostics of wheezing based on clinical signs, results of physical examination during the period of attack do not cause difficulties for qualified physician. But, in the period between attacks patients do not have signs of the disease, during clinical examination there are not changes, as a result, this condition is so called as remission.

There are some recommendations that pathological processes at recurrent obstructive bronchitis are not confined by attacks but also can last during remission period [4]. At this time objective investigation is non-informative, that’s why it is necessary to use instrumental methods among which spirometry is important one.

Spirometry is objective method of investigation, which determines the patency of airways for the rate of exhaled air, for architectonics of curve flow -volume, for definition and calculation of some indices
The task of spirometry is to determine the patency of airways and also define some syndromes of disorders of external respiration function [6].

Nowadays spirometry is done on computers in which high-sensitive sensors are used, all indices of function of external respiration are calculated automatically. Received results are compared with proper values, according to European Respiratory Association and American Thoracal Association based on age and anthropometric peculiarities of child (sex, body height and body weight) [7, 8].

**The purpose of the investigation.**

The investigation of spirometric indices during remission period was done in order to determine patency of respiratory tract in period of remission.

**The object and method of the investigation.**

90 children were involved in this investigation. The age was from 5 years old and 10 months to 11 years old and 6 months. 50 girls (51,9%) and 40 boys (48,1%) were involved in the investigation. Children who suffered from obstructive bronchitis (according to results) were involved in the investigation.

According to investigation’s tasks the same groups of children were formed. The first group included 45 children (50%) according to anamnisis results and also infectious-associated type of recurrent obstructive bronchitis was diagnosed, but in 45 (50%) allergic variant was defined.

Spirometry was done to all children using spirometer Spirolab MIR-II of Italian production that corresponds to modern worldwide demands.

The investigation was done in the morning in fasting state or in 2-3 hours after meals. Before investigation children should avoid drug’s intake, which can affect respiratory tract (beta-2-agonists, glucocorticoids, spasmolytics, expectorate drugs). When it is impossible, children were not allowed to do this procedure.

Before the investigation children were in the rest during 15-20 minutes. Auscultation of lungs was done in order to determine the presence of bronchoobstructive changes. After that child was explained this procedure, its techniques, several exhalations should be done through mouthpiece which is not applied to the device. When investigator realized that a child did this technique correctly, mouthpiece was applied to the sensor and threefold measurement of statistical (VC, FVC) and dynamic indices were done (FEV1, PEF, FVC 25-75%, MEF 25%, MEF 50%, MEF 75%).

Inhalation of beta-2-agonist of salbutamol in the dose of 200 mkg by metered aerosol inhaler and spacer device was done. Salbutamol is the most effective broncholytic drug, which suppresses attacks of brochoobstruction. Spacer device use provided insured drug admission to lower regions of respiratory tract in spite of patients’ age.

In 10 minutes recurrent (second) spirometric investigation of the patient was done. Output indices, their accession after salbutamol inhalation were evaluated, after that it should be concluded that a patient had signs of bronchoobstructive syndrome and signs of hidden bronchospasm. Decrease of dynamic indices during the first examination determined bronchoobstructive syndrome, normal indices of dynamic indices during the first examination and their accession defined hidden bronchospasm that was 20%.

**Results of the investigation and their discussion.**

Average values of statistic and main dynamic indices of external respiration in children which were involved during remission period before and after salbutamol inhalation were presented in the table 1.
Table 1.
Average values of statistic and main dynamic indices of external respiration in children with infectious-associated and allergic recurrent obstructive bronchitis during remission period before and after salbutamol inhalation

<table>
<thead>
<tr>
<th>Index</th>
<th>Children with infectious associated recurrent obstructive bronchitis n=45 M±m</th>
<th>Children with allergic recurrent obstructive bronchitis n=45 M±m</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>before</td>
<td>after</td>
<td>before</td>
</tr>
<tr>
<td></td>
<td>after</td>
<td></td>
<td>after</td>
</tr>
<tr>
<td>VC %</td>
<td>94,04±1,00</td>
<td>93,16±1,07</td>
<td>91,31±1,14</td>
</tr>
<tr>
<td>FVC %</td>
<td>88,67±1,53</td>
<td>93,42±0,69</td>
<td>91,04±1,30</td>
</tr>
<tr>
<td>FEV1 %</td>
<td>81,58±1,45</td>
<td>95,08±0,75</td>
<td>87,51±1,17</td>
</tr>
<tr>
<td>FEV1/FVC</td>
<td>82,84±1,41</td>
<td>98,22±0,92</td>
<td>85,67±1,02</td>
</tr>
<tr>
<td>FVC 25-75%</td>
<td>84,80±1,27</td>
<td>96,97±0,99</td>
<td>86,71±0,99</td>
</tr>
<tr>
<td>PEF %</td>
<td>82,29±1,42</td>
<td>97,73±0,85</td>
<td>84,87±1,06</td>
</tr>
</tbody>
</table>

Indices:
before – indices are measured before salbutamol inhalation
after – indices are measured after salbutamol inhalation
n.s. – differences between groups were not significant

Analyzing average values of the function of external respiration in children with infectious-associated and allergic recurrent obstructive bronchitis during remission period it was indicated that indices after salbutamol inhalation was in the norm. During statistic calculation it was determined salbutamol inhalation did not significantly influence on lung volume indices (VC, FVC) in children of the both group. But it was determined accession of average values of dynamic indices (FEV1, FEV1/FVC, FVC 25-75%, PEF) after salbutamol inhalation. However, average accession was minor than 20%, which according to recommendations are critical relatively the presence of hidden bronchoobstruction.

Analysis of individual indices was done during which a child did not have signs of the decrease of statistic indices of external respiration.

At the same time 13 children (28,89%) with infectious-associated recurrent obstructive bronchitis and 7 patients (15,56%) with allergic variant of disease during the first stage of examination had decreased dynamic indices that defined the presence of bronchoobstruction.

Accession of FEV1/FVC, that exceeded 20% was determined in the period of remission in 18 children (40%) with infectious-associated recurrent obstructive bronchitis and 12 patients (26,67%) with allergic one. So, hidden bronchospasm was defined in 5 children (11,11%) with infectious-associated recurrent obstructive bronchitis and 6 patients (13,33%) with allergic one.

Unfortunately, dynamic indices cannot show the level on which the development of bronchoobstruction occurs that’s why the investigation of additional dynamic indices of external respiration in children with ROB in the period of remission was done (table 2).
Table 2.
Average values of additional dynamic indices of external respiration in children with infectious-associated and allergic recurrent obstructive bronchitis during remission period

<table>
<thead>
<tr>
<th>Index</th>
<th>Children with infectious-associated recurrent obstructive bronchitis n=45 M±m</th>
<th>Children with allergic recurrent obstructive bronchitis n=45 M±m</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1 before</td>
<td>2 after</td>
<td>3 before</td>
</tr>
<tr>
<td>MEF 25%</td>
<td>80,82±1,85</td>
<td>97,6±1,09</td>
<td>84,58±1,53</td>
</tr>
<tr>
<td>MEF 50%</td>
<td>78,64±1,72</td>
<td>95,51±1,10</td>
<td>83,13±1,22</td>
</tr>
<tr>
<td>MEF 75%</td>
<td>83,91±0,99</td>
<td>96,46±1,02</td>
<td>84,84±0,89</td>
</tr>
</tbody>
</table>

Notes: 
before – indices were measured before salbutamol inhalation 
after – indices were measured after salbutamol inhalation

Analyzing average values of additional dynamic indices of external respiration it was determined children with infectious-associated recurrent obstructive bronchitis had decrease index MEF 50% that determines the abnormality of bronchial patency. Salbutamol inhalation leads to the improvement of bronchial patency on all levels.

Results of analysis of individual indices of bronchial patency in children with infectious-associated and allergic recurrent obstructive bronchitis were presented in table 3. Defects of bronchial patency were determined.

Table 3.
Number of children with infectious-associated and allergic recurrent obstructive bronchitis who had defects of bronchial patency based on results of spirometry during remission period

<table>
<thead>
<tr>
<th>Index</th>
<th>Children with infectious-associated recurrent obstructive bronchitis n=45 n (%)</th>
<th>Children with allergic recurrent obstructive bronchitis n=45 n (%)</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1 before</td>
<td>2 after</td>
<td>3 before</td>
</tr>
<tr>
<td>MEF 25%</td>
<td>16 (35,56%)</td>
<td>0 (0%)</td>
<td>8 (17,78%)</td>
</tr>
<tr>
<td>MEF 50%</td>
<td>19 (42,22%)</td>
<td>0 (0%)</td>
<td>11 (24,44%)</td>
</tr>
<tr>
<td>MEF 75%</td>
<td>9 (20%)</td>
<td>0 (0%)</td>
<td>9 (20%)</td>
</tr>
</tbody>
</table>

Notes: 
before – indices were measured before salbutamol inhalation 
after – indices were measured after salbutamol inhalation
It was indicated that part of children of both groups in the period of remission had the decrease of bronchial tree patency on the different level. Among defined defects obstruction of medial caliber was dominant. After salbutamol inhalation bronchoobstruction signs disappeared in all patients.

But children who had signs of recurrent obstructive bronchitis of infectious -associated genesis defect of bronchi patency of small and medial caliber was more often than in children who have allergic mechanism of the disease development but differences were not accurate.

Conclusions.

So, the absence of clinical signs of bronchoobstructive syndrome, normal results of objective investigation in children with recurrent obstructive bronchitis correspond to clinical remission of the disease. But the part of patients had subclinical defect of bronchial patency as a result it can be decrease of resistance of the organism to stress that requires organism oxygenation. In particular, it requires intensive mental activity and physical activity. Correspondingly, defined subclinical defects can affect children’s’ life activity. The method of spirometry assists in diagnosing not only the presence of bronchial patency defect but also in indicating its localization.

Literature


