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Effect of salbutamol on lung function parameters of healthy children

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Abstract In the present study, the effect of 200 µg salbutamol compared to placebo was evaluated on lung function parameters of 37 healthy children aged 7–14 years. Salbutamol or placebo were administered, using a single blind study design, and spirometry was performed before and after 10 min of inhalation. At the time of the study, all children were symptom-free and had not suffered from any respiratory infection during the previous 4 weeks. The administration of salbutamol resulted in a significant increase of mean forced expiratory volume in 1 s (111%–115%, \( P < 0.05 \)), maximal expiratory flow at 50% of forced vital capacity (101%–110%, \( P < 0.05 \)) and maximal expiratory flow at 25% of forced vital capacity (96%–115%, \( P < 0.05 \)). The administration of placebo resulted in no significant change in lung function parameters. Conclusion: The administration of 200 µg salbutamol results in the occurrence of a small but significant bronchodilatation in healthy, non-asthmatic children.

Abbreviations \( FEV_1 \) forced expiratory volume at 1 s · \( MEF \) maximal expiratory flow

Introduction

Due to their important bronchodilating effect, short-acting beta-agonists have become the first choice medication to treat symptoms in childhood asthma [2, 5, 9, 11]. Furthermore, beta-agonists have been shown to prevent bronchospasms (i.e. immediate asthmatic reactions) caused by allergen inhalation and exercise [6,10]. In addition, beta-agonists are also frequently used in daily practice to treat cough in asthmatic and in non-asthmatic (i.e. healthy) children. However, only limited information is available on the effect of beta-agonists in healthy children [1, 3, 4,8]. The aim of the present study was to evaluate the effect of 200 µg salbutamol, using a placebo-controlled single blind study design, on lung function parameters of healthy children aged 7–14 years.

Subjects and methods

Subjects

Information brochures about the study were distributed in two primary schools in Antwerp. From 67 children, written informed consent of both the child and parents was obtained. Further selection of these children was performed by questionnaire ruling out any respiratory or allergic disease in the child, the parents and siblings. Furthermore, only children free of any respiratory infection during at least the previous 4 weeks were included. Applying these inclusion criteria, 37 healthy children were studied. All children were of caucasian origin. Anthropometric data of the subjects are shown in Table 1. The study was approved by The Ethics Committee of the University Hospital Antwerp.

Lung function testing and study protocol

Lung function tests were performed with a Masterscope (Jaeger) by the same investigator (KD). The children were standing upright and a noseclip was put on. After 5 s of breathing at tidal volume, maximal forced expiration manoeuvres were performed. The children were instructed to inspire to total lung capacity from end-tidal volume, immediately followed by a forced expiration up to the residual volume. This manoeuvre was repeated until three representative flow-volume curves were obtained.

For ethical reasons, the administration of the medication was single blinded (i.e. non-blinded investigator). Ten children, selected at random, were given a placebo. Two separate doses of salbutamol (total dose of 200 µg) or placebo were administered using a large volume spacer (Volumatic, Glaxo Wellcome). During the administration of each dose, the children kept on breathing into the large volume spacer for 15 s. Fifteen minutes after administration of the medication, a new series of forced expiration manoeuvres were performed. The lung function parameters forced expiratory volume at 1 s (\( FEV_1 \)) and maximal expiratory flow at 50% of forced vital capacity (\( MEF_{50} \)) and at 25% of forced vital capacity (\( MEF_{25} \)) of the best flow-volume curves before and after inhalation were compared. The best flow-volume curve was considered to be the...
Table 1 Anthropometric data of the subjects

<table>
<thead>
<tr>
<th>Subjects (n = 37)</th>
<th>Mean (range)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (years)</td>
<td>9.7 (7–14)</td>
</tr>
<tr>
<td>Height (cm)</td>
<td>143.6 (120–180)</td>
</tr>
<tr>
<td>Weight (kg)</td>
<td>38.2 (20–69)</td>
</tr>
</tbody>
</table>

Table 2 Lung function parameters of the 37 children before and after administration of salbutamol

<table>
<thead>
<tr>
<th>Lung function parameter</th>
<th>Basal</th>
<th>After salbutamol</th>
<th>Difference</th>
</tr>
</thead>
<tbody>
<tr>
<td>FEV₁ (%)</td>
<td>111±13</td>
<td>115±13</td>
<td>4±6*</td>
</tr>
<tr>
<td>MEF₅₀ (%)</td>
<td>101±22</td>
<td>110±19</td>
<td>9±14**</td>
</tr>
<tr>
<td>MEF₂₅ (%)</td>
<td>96±29</td>
<td>115±38</td>
<td>19±20***</td>
</tr>
</tbody>
</table>

*p < 0.01
**p = 0.02
***p < 0.01

A total of 37 children (20 boys and 17 girls) with a negative personal and family history for any respiratory or allergic disease and free from an acute respiratory infection for at least the previous 4 weeks, were included in the present study. There was no difference between boys and girls in mean values of FEV₁, MEF₅₀, and MEF₂₅. Therefore, for further analysis, no distinction for gender was made. All children showed an FEV₁ of >84%. Details of basal lung function parameters are shown in Table 2. After inhalation of salbutamol, a small but significant increase in lung function parameters was detected (Table 2). However, only one child showed an increase in FEV₁ of more than 12%. After administration of placebo to ten randomly selected subjects, no significant changes in lung function parameters were found (Table 3).

Table 3 Lung function parameters of ten randomly selected children before and after administration of placebo

<table>
<thead>
<tr>
<th>Lung function parameter</th>
<th>Basal</th>
<th>After placebo</th>
<th>Difference</th>
</tr>
</thead>
<tbody>
<tr>
<td>FEV₁ (%)</td>
<td>118±19</td>
<td>119±17</td>
<td>1±3.88*</td>
</tr>
<tr>
<td>MEF₅₀ (%)</td>
<td>105±24</td>
<td>103±25</td>
<td>–2±9*</td>
</tr>
<tr>
<td>MEF₂₅ (%)</td>
<td>99±30</td>
<td>101±27</td>
<td>2±12*</td>
</tr>
</tbody>
</table>

*p > 0.05 (not significant)

Discussion

Inhalation of salbutamol in healthy children resulted in the occurrence of a small but significant increase in lung function parameters. FEV₁ is considered to be the most relevant lung function parameter for demonstrating a bronchodilating response [1,7]. In the present study, a mean increase of 4% in FEV₁ after inhalation of salbutamol was observed, which is comparable to results of similar studies [3,4,8]. In asthmatic subjects, an increase of 12% or more in FEV₁ after bronchodilation is considered to be a significant clinical bronchodilating response [1,12]. In the present study, an increase of 12.4% in FEV₁ was noticed in only one child. The increase in MEF₅₀ after inhalation of salbutamol was similar to that found in similar studies, but the increase in MEF₂₅ after bronchodilation was slightly higher in the present study [3,4,8]. The fact that in the present study, a bronchodilation could be detected, suggests the effectiveness of beta-agonists in healthy children. This may be an argument to use beta-agonists in healthy children during episodes of acute respiratory symptoms, such as during periods of cough (or wheezing) following acute respiratory infections. Nevertheless, clinical studies on this subject are necessary before advising the use of beta-agonists in healthy children.

The administration of 200 µg salbutamol to healthy children aged 7–14 years resulted in a significant increase in FEV₁, MEF₅₀ and MEF₂₅, suggesting effectiveness of beta-agonists in healthy children.

References