Short Report

Effect of menthol vapour on airway hyperresponsiveness in patients with mild asthma

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Introduction

Menthol (2-isopropyl-5-methyl-cyclohexanol), a cyclic alcohol widely appreciated for its ability to produce a cooling sensation, has been used as a constituent of food and drink, tobacco and cosmetics. This compound can reduce flatulence and colic pain in patients with irritable bowel syndrome probably through blockade of Ca^2+ channels on intestinal smooth muscle (1). A recent report indicates that menthol vapour possesses an antitussive action (2). The objective of the present study was to investigate the effect of menthol on airway hyperresponsiveness in asthma.

Patients and Methods

Twenty-three non-smoking subjects with chronic mild asthma (twelve males, eleven females; aged 19-46 years) (3) were enrolled into the trial after obtaining written informed consent. None of the patients had had either exacerbation of wheezing or respiratory infection in the preceding 4 weeks. Each subject had only occasional symptoms, which were controlled by β2-adrenoceptor agonists from metered dose inhalers on demand.

The study had a randomized, placebo-controlled design, which was approved by Tokyo Women's Medical College Ethics Committee. After a 2-week run-in period, subjects were randomized to receive nebulized menthol (10 mg, twice a day, Hohei Co., Tokyo, Japan) or matching placebo for 4 weeks. This dose of menthol was chosen based on the report by Laude et al. (2). Each subject was given a mini-Wright peak flow meter to record peak expiratory flow rate (PEFR) twice a day (at awakening and on going to bed) before inhalation of menthol, placebo or β2-agonists. Patients were asked to record three values, and the better two reproducible (± 20 1 min^-1) values on each occasion were kept for analysis. The amplitude of changes in daily PEFR (ΔPEFR) was calculated from the following formula: (highest value - lowest value) × 100/(highest value). Vital capacity (VC) and forced expiratory volume in one second (FEV1) were measured by spirometry before and at the end of the treatment period. In addition, methacholine inhalation tests were performed with the Wright's nebulizer at tidal volume breathing for 2 min according to a standardized procedure (4), and a provocative concentration that caused a 20% decrease in FEV1 (PC20) was determined.

Patients attended the clinic on a weekly basis. Asthma symptoms, possible adverse effects and changes in concomitant medication were evaluated from asthma diaries, and full blood count, serum biochemistry and urinalysis were performed.

All data were expressed as mean ± SE. Statistical analysis was performed using a paired Student's t-test, and a P value of less than 0.05 was considered significant.

Results

Two patients in the menthol group were withdrawn because of an uncomfortable sensation in the upper airway, thus 21 patients completed the full protocol. As shown in Table 1, there were no significant differences in VC, FEV1, ΔPEFR and PC20 between the menthol group and the placebo group. In the placebo group, these values were unchanged throughout the trial. In contrast, menthol therapy did not significantly alter VC or FEV1, but produced a decrease in ΔPEFR from 17.4 ± 3.3 to 11.2 ± 3.3% and an increase in PC20 from 5.1 ± 1.2 to 10.7 ± 2.8 mg ml^-1 (P<0.05, n=11 in each case).
Table 1 Clinical data before and after treatment with menthol or placebo

<table>
<thead>
<tr>
<th></th>
<th>Menthol group Before</th>
<th>Menthol group After</th>
<th>Placebo group Before</th>
<th>Placebo group After</th>
<th>Difference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lung function</td>
<td></td>
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<tr>
<td>VC (% predicted)</td>
<td>94.4 ± 1.2</td>
<td>95.3 ± 0.9</td>
<td>n.s.</td>
<td>93.8 ± 1.0</td>
<td>95.0 ± 1.1</td>
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<tr>
<td>FEV₁ (% predicted)</td>
<td>81.6 ± 2.1</td>
<td>84.2 ± 3.0</td>
<td>n.s.</td>
<td>85.5 ± 1.8</td>
<td>84.4 ± 2.6</td>
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<td>ΔPEFR (%)</td>
<td>17.4 ± 3.3</td>
<td>11.2 ± 3.3</td>
<td>P&lt;0.05</td>
<td>16.8 ± 2.7</td>
<td>17.0 ± 3.6</td>
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<tr>
<td>PC₂₀ (mg ml⁻¹)</td>
<td>5.1 ± 1.2</td>
<td>10.7 ± 2.8</td>
<td>P&lt;0.05</td>
<td>5.8 ± 1.1</td>
<td>6.5 ± 2.5</td>
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<tr>
<td>Wheezing episodes (week⁻¹)</td>
<td>3.3 ± 0.3</td>
<td>1.8 ± 0.7</td>
<td>P&lt;0.05</td>
<td>2.9 ± 0.3</td>
<td>2.7 ± 0.5</td>
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<tr>
<td>MDI inhalation (puff week⁻¹)</td>
<td>5.2 ± 0.4</td>
<td>2.1 ± 0.3</td>
<td>P&lt;0.01</td>
<td>4.8 ± 0.5</td>
<td>4.4 ± 0.3</td>
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</table>

VC: vital capacity; FEV₁: forced expiratory volume in one second; ΔPEFR: diurnal variation in peak expiratory flow rate; PC₂₀: provocative concentration of methacholine required to cause a 20% fall in FEV₁; MDI: metered-dose inhaler; n.s., not significant. Values are expressed as mean ± se; n=11 for menthol group and n=10 for placebo group.

None of the patients showed apparent adverse effects in either group. In the menthol group, patients had fewer wheezing episodes and less consumption of bronchodilators after the treatment.

Discussion

Our study indicates that menthol might be beneficial in the treatment of mild asthma. As our preliminary experiment showed that menthol vapour did not produce acute bronchodilatory effects, we examined a long-term effect of this compound on airway hyperresponsiveness in asthmatic patients. We found that 4-week inhalation of menthol vapour decreased diurnal variation in PEFR, a value that reflects airway excitability (5), but had no significant effect on FEV₁. Thus, menthol may lead to an improvement of airway hyperresponsiveness without altering the magnitude of airflow limitation. This notion is also supported by the finding that the PC₂₀ values for methacholine were increased after treatment with menthol.

Although the mechanism of efficacy of menthol on airway hyperresponsiveness is uncertain, menthol and other aromatic vapours have been used in the symptomatic treatment of upper respiratory infections because of its ability to stimulate laryngeal cold receptors (5). Recent evidence suggests that menthol inhibits the cough reflex (2). In addition, menthol can decrease intracellular free Ca²⁺ concentration through an inhibition of voltage-dependent Ca²⁺ channels, thereby producing hyperpolarization of various types of cells (7,8). Therefore, these mechanisms could be operating in the observed effect of menthol in the present study.

References