

## ◎ 総 説

## Action mechanisms of complex spa therapy on bronchial asthma. 1. Relationship to evaluation of spa therapy

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**Abstract :** Action mechanisms of complex spa therapy (swimming training in a hot spring pool, inhalation with iodine salt solution, and fango therapy) were studied in relation to patient age, clinical asthma type, and airway inflammation. Actions of spa therapy were observed by two clinical effects : direct and indirect effects. Improvement of subjective symptoms, ventilatory function, and bronchial hyperresponsiveness was observed as direct effects of spa therapy, and improvement of suppressed function of adrenocortical glands as indirect effects of the therapy. The clinical effects of spa therapy were higher in patients over the age of 40. Regarding clinical asthma type, the effects were larger in patients with type Ib and type II asthma than in those with type Ia. The efficacy of spa therapy was closely related with airway inflammation in patients with type Ib and type II asthma.

**Key words :** complex spa therapy, clinical asthma type, ventilatory function, bronchial hyperresponsiveness, adrenocortical glands

### Introduction

Bronchial asthma is characterized by wheezing and transient dyspnea. The new concept that airway inflammation plays a major role in bronchial asthma<sup>1-3)</sup>, even in mild asthma<sup>4, 5)</sup>, has been widely accepted in recent years. Cells such as lymphocytes, neutrophils,

eosinophils and basophils that are observed in bronchoalveolar lavage (BAL) fluid have been identified as inflammatory cells<sup>6-10)</sup>.

In view of medication, asthma can be controlled with the usual antiasthma drugs. However, despite newly developed drugs for the treatment of asthma, there are some patients whose asthma attacks cannot be

controlled without resorting to glucocorticoids. In these steroid-dependent intractable asthma (SDIA) subjects, efforts to reduce the dose of glucocorticoids have been made to avoid the adverse side effects of the drugs, but most of these efforts have been unsuccessful except patients whose attacks can be controlled with a large dose of inhaled glucocorticoid (Beclomethason).

Our previous studies have shown that spa therapy, i.e., swimming training in a hot spring pool, is effective in patients with bronchial asthma: improvement in clinical symptoms and findings<sup>11-15</sup>, in ventilatory function<sup>16, 17</sup>, and in adrenocortical function together with a reduced necessity for glucocorticoids is usually observed after spa therapy<sup>18</sup>.

**Spa effects and patient age**

The efficacy of spa therapy correlates with patient age. Spa therapy is more effective in patients over the age of 41 compared to those under the age of 40<sup>19</sup>, as shown in Fig. 1. Regarding age at onset of the disease, spa therapy is less effective in patients whose age at onset is under 30 years (Fig. 2). Our studies on clinical effects of spa therapy on 30 elderly patients (over the age of 65) with asthma have shown that spa efficacy is observed in all patients with type Ia-2, Ib and II. Of the 21 patients with type Ia-1, however, 17 (81.0%) showed marked or moderate efficacy of spa therapy, suggesting that spa therapy is more effective in patients with type Ia-2, Ib and II than in those with type Ia-1 (simple bronchoconstriction) in the elderly<sup>20</sup>.

**Complex spa therapy**

Complex spa therapy comprises swimming

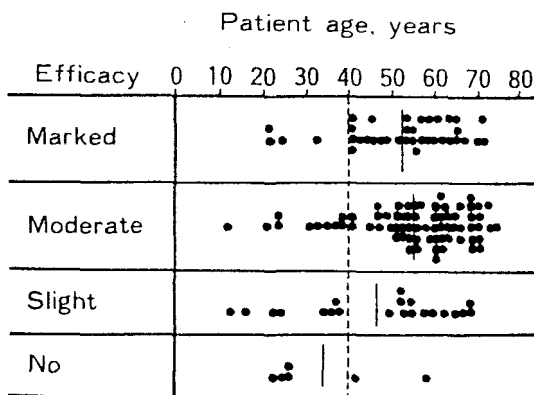


Fig. 1. Clinical effects of spa therapy on bronchial asthma and patient age

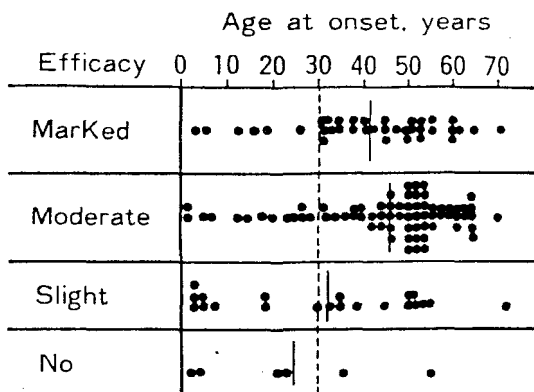


Fig. 2. Clinical effects of spa therapy on bronchial asthma and age at onset of the disease

training in a hot spring pool, inhalation of iodine salt solution and fango therapy<sup>21</sup>. Swimming training is carried out in a hot spring pool for 30 min a day and 5 times a week. Inhalation of 1.0 ml of iodine salt solution (kl 135mg/l, NaCl 14.664 g/l) is performed twice a day. Clinical symptoms and ventilatory function are improved by inhalation of iodine salt solution for 2 weeks<sup>22</sup>. In fango therapy, fango taken from Ningyo pass and heated to 70-80°C is packed with cloth (40-43°C). The back of patients

is covered with the fango, and warmed for 30 min 5 times a week. The values of ventilatory parameters except %FVC are increased by fango therapy<sup>23)</sup>. Of six ventilatory parameters, the values of % $\dot{V}_{50}$  and % $\dot{V}_{25}$  tend to show the highest increase after fango therapy.

Complex spa therapy is effective in patients with bronchial asthma, particularly in those with steroid-dependent intractable asthma (SDIA)<sup>21, 24)</sup>. Our studies on 52 patients with SDIA, Clinical effects of the therapy were found in 36 of the 52 (69.2%) patients with SDIA. The efficacy was higher in the patients between the ages of 41 and 50 (87.5%) and between 51 and 60 (84.2%) than in those in the other age groups (Fig. 3).

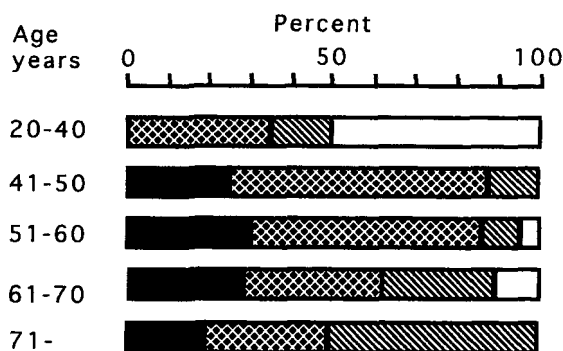


Fig. 3. Clinical efficacy; marked (■), moderate (▣), slight (▤) and no efficacy (□), of complex spa therapy on patients with SDIA in relation to age.

The clinical effects of spa therapy differs according to the type of therapy used<sup>25)</sup>. The mean efficacy rate of spa therapy A (swimming training in a hot spring pool) (administered from 1982 to 1985) was 68.2%; the rate was 87.5% for spa therapy B (swimming training+inhalation of iodine salt solution) (1986 to 1989) and 94.3% in complex spa

therapy (1990-).

### Action of spa therapy

Action of spa therapy is clinically observed by direct effects for airways and indirect effects for the other organs except airways.

#### 1. Direct effects of spa therapy

##### 1) Ventilatory function

In addition to improvement of clinical symptoms, ventilatory function is also improved by spa therapy<sup>26)</sup>. In type Ia, not so high increase in FEV1.0% and moderate increase in %MMF, % $\dot{V}_{50}$  and % $\dot{V}_{25}$  are observed after spa therapy. The highest increase in FEV1.0% among three asthma types, accompanied with marked improvement of %MMF, % $\dot{V}_{50}$  and % $\dot{V}_{25}$ , is found in type Ib. In type II, the improvement of % $\dot{V}_{25}$  is more predominant after spa therapy, compared to the improvement of %MMF and % $\dot{V}_{50}$  (Fig. 4).

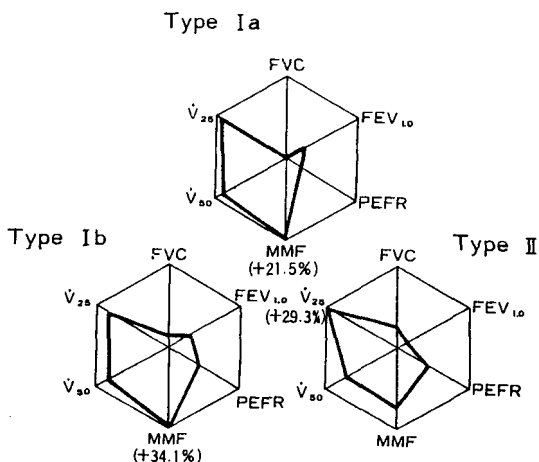


Fig. 4. %Improvement of ventilatory function in each clinical asthma type after spa therapy. The value of parameter showing maximum % improvement is presented as 100%.

## 2) Bronchial hyperresponsiveness

Bronchial hyperresponsiveness is estimated by bronchial reactivity to methacholine. Different concentrations of methacholine (49, 98, 195, 390, 781, 1563, 3125, 6250, 12500 and 25000  $\mu\text{g}/\text{ml}$ ) are challenged to airways. The increase of total respiratory resistance (Rrs) after methacholine inhalation is measured by the oscillation method<sup>27)</sup>. A methacholine concentration causing a significant increase in Rrs is assessed as Cmin (minimum concentration). Spa efficacy is evaluated by examining bronchial reactivity to methacholine before and after the therapy<sup>28)</sup>. The mean Cmin (minimum concentration of methacholine inducing bronchospasm) in 16 patients with asthma was clearly decreased from 470  $\mu\text{g}/\text{ml}$  before spa therapy to 1514  $\mu\text{g}/\text{ml}$  after the therapy. The clear decrease in Cmin of methacholine was observed in 4 of the 9 patients (44.4%) under the age of 59, and in 2 of the 7 subjects (28.6%) over age 60.

## 2. Indirect effects of spa therapy

### 1) Function of adrenocortical glands

Despite adverse side effects of glucocorticoids, it is very difficult to stop or reduce the drugs in patients with steroid-dependent intractable asthma (SDIA). Among the side effects of glucocorticoids<sup>29, 30)</sup>, suppression of adrenocortical glands, and of humoral and cellular immunity are very important<sup>31-33)</sup>, since they are closely related to the pathology of the asthmatic airways, and increase complexity and severity of the disease. The increase in serum cortisol levels is observed by spa therapy. The degree of the increase in cortisol levels

varies according to the level before spa therapy. In patients with low serum cortisol levels, a marked and significant increase is found compared to the levels before therapy. No significant increase is, however, observed in patients with the levels of more than 10.0  $\mu\text{g}/\text{dl}$  (Fig. 5).

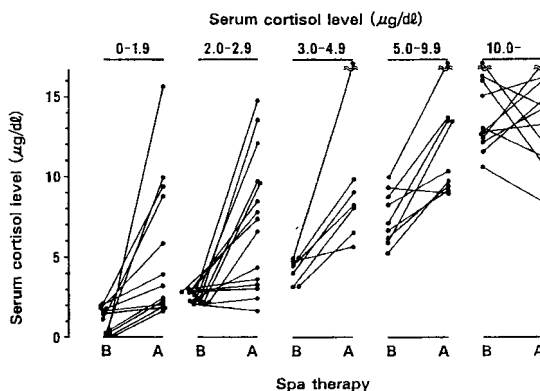


Fig. 5. Increase in serum cortisol levels after spa therapy in patients with bronchial asthma. B: before, A: after.

## Conclusion

Action of spa therapy is observed as two kinds of clinical effects; direct effects for airways and indirect effects for the other organs except airways. Direct effects of spa therapy are evaluated by improvement of symptoms, ventilatory function, and bronchial hyperresponsiveness. In contrast, indirect effects of the therapy are estimated by improvement of suppressed function of adrenocortical glands.

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## 気管支喘息に対する複合温泉療法の作用機序

### 1. 温泉療法の評価方法との関連

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複合温泉療法(温泉プール水泳訓練, ヨードゾル吸入, 鈹泥湿布療法)の作用機序が, 年齢, 臨床病型, 気道炎症反応との関連のもとに検討された。温泉療法の作用機序は, 2種類の臨床効果,

すなわち, 直接効果と間接効果により観察された。自, 他覚症状の改善, 換気機能の改善, そして, 気道過敏性の改善などが, 温泉療法の直接効果として, また, 副腎皮質機能の改善が間接効果として観察された。温泉療法の臨床効果は, 40才以上の症例においてより有効であり, また, 臨床病型別では, Ia型に比べ, Ib型およびII型においてより有効であった。Ib型やII型の気管支喘息では, 温泉療法の作用機序と気道炎症反応との間に密接な関連が認められた。

索引用語: 複合温泉療法, 臨床病型, 換気機能, 気道過敏性, 副腎皮質