
◎原 著

Clinical features of asthma patients with a low %FVC. In relation to clinical asthma type and disease severity.

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Abstract : Clinical features of asthma patients with a low %FVC (<75%) were studied in relation to clinical asthma type and disease severity. 1. The value of %FVC was not related to patient age. 2. A significant association between %FVC value and clinical asthma type was found. The value of %FVC was significantly lower in subjects with type II asthma (bronchiolar obstruction) than in those with type Ia-1 and type Ia-2 (simple bronchoconstriction) ($p < 0.001$). 3. %FVC value significantly correlated with disease severity. The value in the subjects tended to decrease as their asthma conditions were more severe. 4. The %FVC value in the subjects was improved after treatment (complex spa therapy). These results demonstrate that a significant correlation is present between low %FVC and disease severity in asthma patients with a low %FVC..

Key words : Low %FVC, Bronchial asthma, Clinical asthma type, asthma severity, Spa therapy

Introduction

Asthma is characterized by airway hyper-responsiveness to a wide variety of stimuli. When a relevant allergen is inhaled by asthma patients, airway narrowing develops at two different phases ; within 30 min of the inhalation (immediate asthmatic reaction, IAR), and within 6 to 8 hours (late asthmatic reaction, LAR)¹⁻³⁾. Airway hyper-responsiveness is caused by recurrent

inhalation of allergen, and the magnitude and duration of hyperresponsiveness are speculated to be related to the LAR^{4, 5)}, which is associated with migration of inflammatory cells, predominantly activated T lymphocytes and eosinophils, into the airways^{6, 7)}.

Symptoms of asthma, wheezing and transient dyspnea, are closely related to such pathophysiological changes of the airways as bronchoconstriction, edema of mucous

membrane, and hypersecretion⁸⁻¹⁰. These pathophysiological changes induce airway narrowing. This condition induced by inhalation of allergen and the other stimuli can be estimated by measuring ventilatory function, routinely by a 20% fall in forced expiratory volume in 1 second (FEV1.0), which is the most common in clinical examination.

A predominant decrease in FEV1.0 represents airway narrowing in patients with asthma. Many of patients with asthma show a predominant decrease in FEV1.0%, however, some of patients have a predominant decrease in forced vital capacity (FVC). In this study, clinical features of asthma patients with low FVC were analyzed in relation to clinical asthma type and disease severity.

Subjects and Methods

The subjects of this study were 22 asthma patients (9 females and 13 males) with a low %FVC under 75%. Their mean age was 60.0 years (range 23-77 years), and the age at onset was 44.4 years (range 3-73 years). The subjects were divided into 4 groups according to the value of %FVC; A (70-75%), B (60-69%), C (50-59%) and D (<50%), and 4 groups by age; 20-49, 50-59, 60-69, and 70+ years;

Asthma classification was performed by the method previously described^{8, 10}; Ia. simple bronchoconstriction type, Ib. bronchoconstriction+hypersecretion type, and II. bronchiolar obstruction type. In this study, type Ia was further divided into two subtypes according to expectoration per day; Ia-1 (0-49ml) and Ia-2 (50-99ml).

Ventilatory function tests, using a Box Spiror 81S (Chest Co) were carried out in all

patients when they were asymptomatic.

Results

Table 1 shows characteristics of subjects classified by the value of %FVC. Mean age and age at onset were lowest in patients of group A (%FVC ; 60-69%), however, any correlation between age or age at onset and %FVC values was not found. Serum levels of IgE and cortisol were lower in patients of group D (%FVC < 40%) compared to those of group C (50-59%).

Table 1. Characteristics of asthma patients with low %FVC studied.

%FVC	No of patients	Age (years)	Age at onset (years)	IgE (IU/ml)	S-Cortisol
A(70-75%)	9	61.4	45.3	224 (31-546)	5.9 (1.7-17.5)
B(60-69%)	5	50.8	34.2	643 (181-1963)	7.8 (1.0-14.0)
C(50-59%)	5	63.4	53.6	1180 (317-2798)	10.6 (4.1-16.2)
D(< 50%)	3	65.7	43.3	95 (72-108)	5.3 (1.3-12.3)

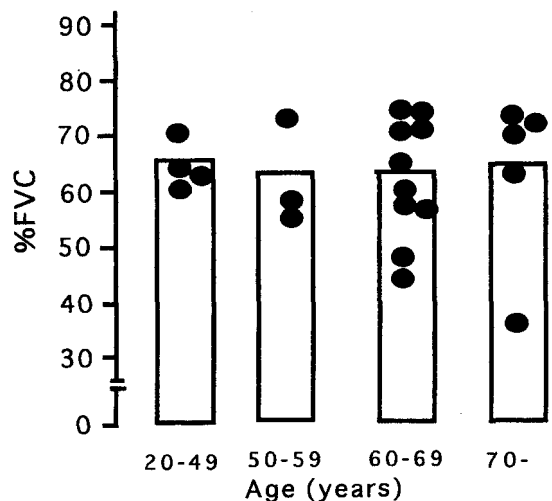


Fig. 1. Correlation between %FVC value and age in asthma patients with low %FVC

The mean value of %FVC was $65.3 \pm 4.7\%$ in patients between the ages of 20 and 49, $61.9 \pm 9.1\%$ in those between 50 and 59, $61.9 \pm 10.5\%$ in those between 60 and 69, and $62.1 \pm 15.3\%$ in those over age 70. There was no significant difference among four age groups (Fig. 1).

A correlation between %FVC value and clinical asthma type was recognized. The %FVC value was significantly lower in patients with type II asthma than in those with type Ia-1 ($p < 0.001$) and type Ia-2 ($p < 0.001$). The value in type Ib (59.0%) was lower than that in those with type Ia-2 (67.5%), however, this was not significant (Fig. 2).

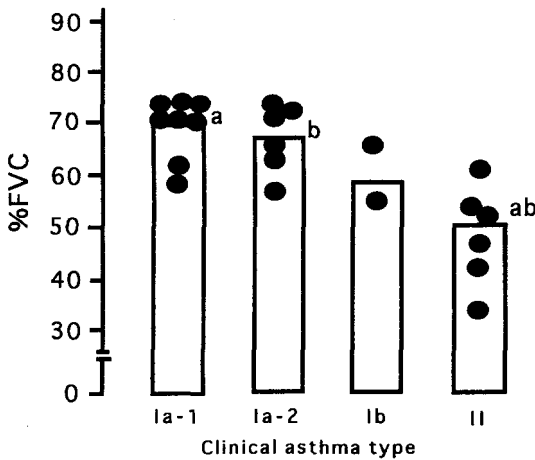


Fig. 2. Correlation between %FVC value and clinical asthma type in patients with low %FVC. a and b, $p < 0.001$.

The value of %FVC correlated with asthma severity in patients with low %FVC. The value tended to more decrease as asthma conditions were more severe. The value was 55.3% in patients with severe asthma and 70.3% in those with slight asthma. This difference was significant ($p < 0.01$) (Fig. 3).

To assess whether a low %FVC value in

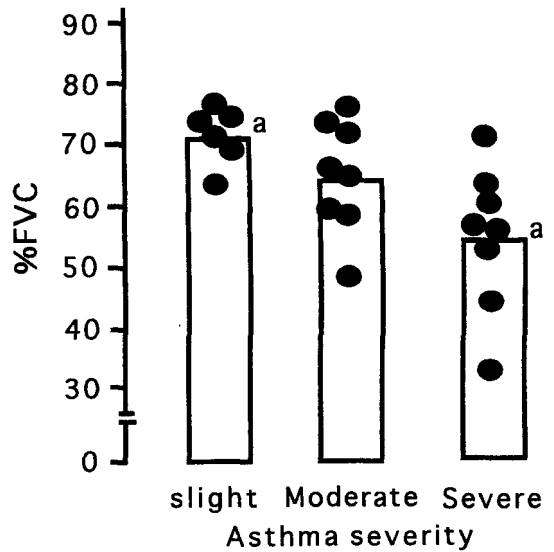


Fig. 3. Correlation between %FVC value and asthma severity in patients with low %FVC. a, $p < 0.01$.

these patients is reversible or not, the value was compared before and after treatment (complex spa therapy)^{11,12}. %FVC value tended to increase after the treatment in all groups classified by the level of %FVC. A significant increase in %FVC after the treatment was found in patients with the value between 70 and 75% ($p < 0.001$), and in those under 49% ($p < 0.05$) (Fig. 4).

Discussion

Bronchial inhalation challenge with allergen causes acute bronchoconstriction and late asthmatic reactions¹⁻³). Allergen-induced airway narrowing is usually evaluated by a 20% fall of FEV 1.0. However, recent studies by Gibbons et al. demonstrate that measure of a 20% fall in FEV1.0 during allergen-induced asthmatic reactions does not evaluate excessive bronchoconstriction, which is the most important abnormality in

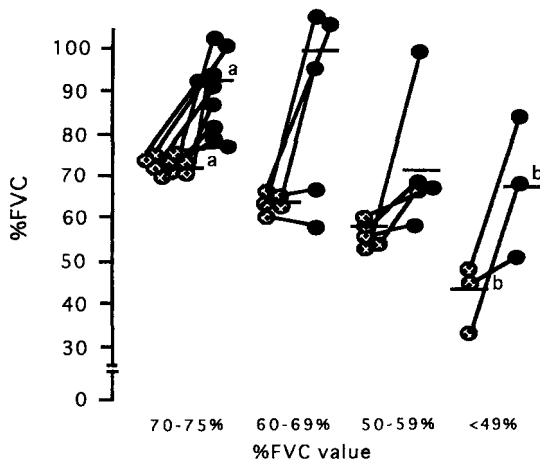


Fig. 4. Improvement of %FVC in asthma patients with low %FVC after treatment (complex spa therapy). The value before treatment (●) significantly increased after the therapy (●).
a, $p < 0.001$, b, $p < 0.05$.

asthma, since it puts patients at risk for serious illness¹³. They recommend that measuring %fall in FVC when FEV1.0 falls by 20% is a safe method of detecting excessive bronchoconstriction.

When airway smooth muscle contraction produces unlimited bronchoconstriction to the extent that airway closure occurs, this results in an increase in residual volume (RV) with a corresponding decrease in vital capacity (VC). It has been shown that RV increases^{14, 15} and VC falls¹⁶ significantly in asthma patients during allergen-induced bronchoconstriction.

In this study, association between decrease in %FVC and disease severity was examined in asthma patients whose %FVC was under 75%. A decrease in %FVC was not related to patient age, suggesting that decrease in

%FVC is not due to aging. In clinical asthma type of asthma, %FVC value was significantly lower in patients with type II asthma, many of which are severe, than in those with type Ia-1 and type Ia-2. Decrease in %FVC also correlated with disease severity; decrease in %FVC was greater as asthma conditions were more severe.

It has been clinically observed that some patients with asthma show a predominant fall in FEV1.0/FVC, whereas others show a predominant fall in FVC. A fall in FVC reflects excessive airway narrowing, which is an important determinant of asthma severity¹³. Thus, patients with greater fall in FVC during bronchial challenge test are more likely to have exacerbations than those with relatively smaller falls in FVC.

Our results also show that patients with a greater decrease in %FVC have more severe asthma, often requiring systemic glucocorticoid therapy, than those with smaller fall in %FVC. This suggests that evaluation of decrease in %FVC is important to treat asthma patients.

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肺活量（FVC）低値を示す気管支喘息の臨床的特徴

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%肺活量が75%以下の低値を示す気管支喘息について，その臨床的特徴を，臨床病型や重症度との関連のもとに検討した。

1. %肺活量と年齢との間には関連は見られなかった。
2. %肺活量と臨床病型との間には有意の関連が

見られ，Ⅱ型喘息（細気管支閉塞型）における%肺活量は，Ia-1型やIa-2型などの単純性気管支攣縮型に比べ，有意に低い値を示した。

3. %肺活量はまた喘息の重症度と有意の関連を示した。これらの症例では，喘息の重症度が増すにつれて，%肺活量は減少する傾向が見られた。

4. これら症例の低値を示す%肺活量は，治療（複合温泉療法）により改善される傾向が見られた。

以上の結果より，これらの症例（%肺活量が75%以下）では，%肺活量と喘息の重症度との間にある程度の関連があることが明らかになった。

索引用語：%FVC低値，気管支喘息，臨床病型，重症度，温泉療法