
◎原 著

Characteristics of asthma classified by a score relating to clinical findings and examinations

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Abstract : Twenty six patients with bronchial asthma was classified by clinical symptoms and signs (clinical diagnosis), and the classification by clinical diagnosis was compared with the classification by a score calculated from clinical findings and examinations (score diagnosis). 1. Of 12 subjects with type Ia classified by clinical diagnosis, 8 cases with 0 to 49 ml/day of expectoration were evaluated as type Ia by score diagnosis. While four type Ia cases with 50 to 99ml/day of expectoration were classified as type Ib by score diagnosis. The increased incidence of eosinophils in bronchoalveolar lavage fluid (BALF) of these four cases was similar to the incidence in type Ib cases with hypersecretion. 2. All of 6 subjects with type Ib by clinical diagnosis were estimated as type Ib by score diagnosis. 3. Of 8 cases with type II by clinical diagnosis, 7 cases were assessed as type II by score diagnosis. One case with type II by clinical diagnosis and with the score of 10 points was evaluated as questionable type II by score diagnosis.

Key words : asthma classification, bronchoconstriction, hypersecretion, bronchiolar obstruction, score diagnosis

Introduction

Bronchial asthma has been often classified by the criterion described by Swineford in Japan¹⁾. According to this criterion, bronchial asthma is classified into three types, atopic, infectious and mixed types. The criterion for asthma classification has been suggested

not to be suitable for clinical application because of unclear definition about mixed and infectious types.

Asthma classification is also carried out according to presence or absence of IgE-mediated reaction^{2,3)}, atopic and non-atopic, or extrinsic and intrinsic. In atopic or extrinsic asthma, IgE-mediated allergic

reaction can be found by clinical examinations such as skin test for allergens, serum IgE levels, specific IgE antibodies for allergens, histamine release from basophils induced by allergens and anti-IgE⁽⁴⁻⁸⁾ and provocation test. Diagnosis of non-atopic or intrinsic asthma is, however, very difficult in some adult asthmatics, because we don't have any procedures to clarify absence of IgE-mediated reactions.

The authors have tried to classify asthma into three types according to clinical symptoms and signs⁹⁻¹²⁾. In the present study, asthma classification is performed by a score relating to clinical findings and examinations, and the classification by a score was compared with the classification by clinical symptoms.

Subjects and Methods

The subjects were 26 patients with bronchial asthma (15 females and 11 males). Their mean age was 49.0 years with a range of 23 to 67 years. The mean level of serum IgE was 445 IU/ml (18-2439U/ml). Of the 26 subjects, 19 were sensitive to allergens with a RAST score of 2+ or more. The subjects were classified into three asthma types by clinical symptoms and signs (clinical diagnosis)⁹⁻¹²⁾. The criterion was as follows; type Ia (simple bronchoconstriction) asthmatics, whose symptoms, wheezing and dyspnea, mainly elicited by bronchoconstriction, type Ib (bronchoconstriction + hypersecretion) cases, whose symptoms are due to hypersecretion (more than 100ml/day), in addition to bronchoconstriction, and type II (bronchiolar obstruction) cases, whose symptoms are mainly elicited by bronchiolar obstruction. In the diagnosis of each asthma type, type Ia was assessed as the fundamental type.

When hypersecretion or bronchiolar obstruction was added to the symptoms of a type Ia case was evaluated as type Ib or type II. A case with both hypersecretion and bronchiolar obstruction was diagnosed as type II.

The subjects were also classified by a score calculated from clinical findings and examinations (score diagnosis). In the score diagnosis for asthma classification, a score from 1 to 5 points was given to each positive finding and examination. Cases with score from 0 to 4 points was diagnosed as type Ia, cases with score from 5 to 11 points as type Ib, and cases with score of 12 points or more as type II, as shown in Table 1.

Table 1. Score for classification of asthma

1. Expectoration more than 100 ml a day ¹⁾	5 points
2. Expectoration between 50 and 99 ml a day	4 points
3. Presence of sputum in many areas of the airways on auscultation	1 point
4. Difficulty in expectoration all day long	1 point
5. Transient bubbling rales in both lower lung fields on auscultation	4 points
6. Alveolar breath sounds in both lower lung fields are markedly decreased or disappeared on auscultation	4 points
7. The value of % \dot{V}_{25} less than 10%	4 points
8. The frequency of neutrophils in BALF more than 20%	4 points

¹⁾ Mean for three days during asthma attacks. All of clinical findings described above should be observed for longer than three days during asthma attacks.

Classification score: from 0 to 4 points: type Ia
: from 5 to 11 points: type Ib
: 12 points or more: type II

Bronchoalveolar lavage (BAL)^{13,14)} was carried out in all subjects except one case who had anaphylactic reaction to lidocaine. Informed consent for the BAL examination was accepted by all subjects. After a bronchoscope was routinely wedged in a segment of right middle lobe, 4x50ml aliquots of sterile isotonic saline at 37°C were introduced into the segment, and immediately aspirated into siliconized glassware. After filtration through sterile steel mesh, the aspirates were centrifuged at 1200 rpm for 10 min at 4°C. The cell pellet was resuspended in Tris ACM. Smear preparations were made using the cell suspension.

The slides were air-dried, and stained with May Giemsa. A differential cell count was performed on 500 cells excluding epithelial cells. The results were expressed as a percentage of the total cells.

Total IgE concentration in sera was measured by radioimmunosorbent test (RIST). Specific IgE antibodies for allergens was estimated by radioallergosorbent test (RAST).

Results

Table 2 shows the characteristics of each asthma type classified by clinical diagnosis. In this study, type Ia cases were divided into two subtypes, cases with sputum from 0 to 49ml/day and from 50 to 99ml/day according to the amount of expectoration a day. The mean age in each asthma type ranged from 37.8 years to 54.6 years. The mean level of total IgE was from 173 IU/ml to 792 IU/ml, and any significant difference was not observed among them (Table 2).

Table 2. Asthma classification by clinical symptoms and signs (clinical diagnosis)

Asthma type	Sputum (ml/day)	No of cases	Sex		Age, years	IgE (IU/ml)
			F	M		
Ia	0-49	8	5	3	48.8	173±71*
	50-99	4	2	2	37.8	792±612
Ib	100+	6	6	0	51.2	635±831
II	-	8	2	6	54.6	403±360

* Mean±sd

A score calculated from clinical findings and examinations as shown in Table 1 was given to each subject. The type Ia cases with sputum from 0 to 49ml/day (case no, 1-8) showed the score from 0 to 2 points, and they were classified as type Ia by score diagnosis. While the score of type Ia with

sputum from 50 to 99ml/day (case no, 9-12) was from 5 to 6 points. These cases evaluated as type Ia by clinical diagnosis were classified as type Ib by score diagnosis. The type Ib cases estimated by clinical diagnosis (case no, 13-18) showed the score from 6 to 7 points, and they were also diagnosed as type Ib by score diagnosis. The score of type II cases evaluated by clinical diagnosis was from 13 to 17 points except one case whose score was 10 points. Therefore, they were classified as type II by score diagnosis. One case showing the score of 10 points was assessed as questionable type II by score diagnosis (Fig 1).

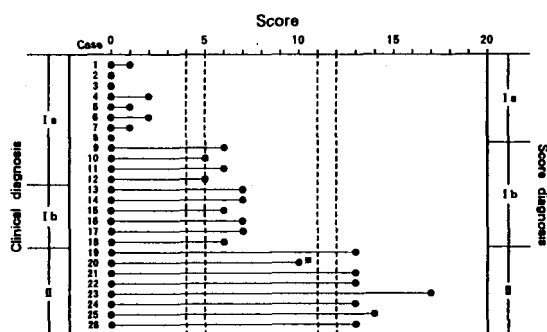


Fig 1. Scores of all subjects with different asthma types classified by clinical diagnosis. *This case was classified as questionable type II by diagnosis.

Ventilatory function was compared between asthma types classified by clinical and score diagnosis. The value of FEV_{1.0%} was not different between the two classification methods. The value of % \dot{V}_z in asthma classified by clinical diagnosis was similar to the value in types by score diagnosis. The value of % \dot{V}_z was, however, significantly lower in type II cases compared with the value in type Ia (in both clinical and score diagnosis; $p < 0.01$), and the value in type Ib (in clinical

diagnosis ; $p < 0.02$, in score diagnosis ; $p < 0.02$) (Table 3).

Table 3. Comparison of ventilatory function between clinical (A) and score diagnosis (B)

Asthma type	No of cases	FEV _{1.0%}		%V ₂₅	
		A	B	A	B
Ia	12	73.1 [*] ± 8.9	71.4 ± 7.0	32.8 ^a ± 15.6	31.2 ^c ± 9.7
Ib	8	70.2 ± 8.0	72.7 ± 9.8	29.3 ^b ± 10.0	31.9 ^d ± 16.7
II	8	65.1 ± 8.6	65.5 ± 9.1	14.8 ^{ab} ± 6.2	15.2 ^{cd} ± 6.5

* Mean ± s.d, a, b and c; $p < 0.01$, d; $p < 0.02$

Incidence of neutrophils and eosinophils in BALF was compared between clinical and score diagnosis. The incidence of neutrophils in BALF was not different in each asthma type between the two classification methods. A significant difference was, however, found in the frequency of neutrophils in BALF among asthma types classified by both clinical and score diagnosis. The frequency of neutrophils in the type II cases was significantly higher than the frequency in the type Ia cases (in both clinical and score diagnosis ; $p < 0.001$), and in the type Ib cases (in clinical diagnosis ; $p < 0.01$, in score diagnosis ; $p < 0.001$). The incidence of eosinophils was not

Table 4. Comparison of %neutrophils and %eosinophils in BALF between clinical (A) and score diagnosis (B)

Asthma type	%Neutrophils		%Eosinophils	
	A	B	A	B
Ia	1.9 ± 1.6 ^a	2.1 ± 1.8 ^c	17.0 ± 22.0	5.0 ± 2.9 ^e
Ib	11.8 ± 11.8 ^b	8.1 ± 10.5 ^d	17.1 ± 13.6	27.6 ± 22.5 ^e
II	40.7 ± 19.8 ^{ab}	44.9 ± 17.7 ^{cd}	10.3 ± 13.0	11.3 ± 13.6

* Mean ± s.d, a, c and d; $p < 0.001$, b; $p < 0.01$, e; $p < 0.05$

significantly different in each asthma type between clinical and score diagnosis. A significant difference was observed in the incidence of eosinophils in BALF between type Ia and type Ib classified by score diagnosis, although any difference was not found between the two asthma types when the subjects were classified by clinical diagnosis (Table 4).

Discussion

Bronchial asthma is characterized by transient wheezing and dyspnea. The symptoms are mainly elicited by bronchoconstriction, mucus hypersecretion in airways and edema of mucous membrane. In addition to these pathophysiological changes of asthma, number of cases with bronchiolar obstruction during asthma attacks has been increasing in recent years, and these patients show a tendency to be more intractable for treatment^{11,15}.

The authors have tried classify asthma into three types by clinical symptoms and signs, which are associated with pathophysiological changes in the airways of asthmatics⁹⁻¹². The asthma classification by clinical symptoms and signs (clinical diagnosis) has several problems for clinical application. Firstly, in the clinical diagnosis, cases with expectoration over 100ml/day are classified as type Ib. bronchoconstriction + hypersecretion. While cases with expectoration from 50 to 99ml/day are evaluated as type Ia. simple bronchoconstriction. It is a problem to debate in the clinical diagnosis whether these cases with sputum from 50 to 99ml/day have a characteristic of type Ia or type Ib. Clinical observations have demonstrated that some cases with expectoration from 50 to 99ml/day show the clinical feature of type Ib

rather than type Ia. Thus, in the score diagnosis, the score of 4 points was given for the findings of 50 to 99ml/day expectoration.

The incidence of eosinophils in BALF of the type Ia cases by clinical diagnosis was not different from the incidence in the type Ib cases. On the contrary, the incidence of eosinophils in the type Ib was significantly higher than the incidence in the type Ia when the subjects were classified by score diagnosis (Table 4). The results suggest that cases expectoration from 50 to 99ml/day classified as type Ia by clinical diagnosis have a similarity to type Ib in an increased eosinophils in BALF.

Secondly, some difficulties have been suggested in diagnosis for cases with type II bronchiolar obstruction when asthma classification is performed only by clinical symptoms and signs. In the present study, asthma classification was carried out by a score relating to clinical findings and examinations. The results from the present study show that score diagnosis makes it easier to evaluate type II cases compared with clinical diagnosis. It is a further problem how to evaluate cases with type II classified by clinical diagnosis and with a score less than 12 points.

References

1. Swineford O Jr. Classification and etiologic diagnosis of asthma. *Virginia Monthly* 82 : 64-71, 1955.
2. Ishizaka T, Ishizaka K, Conrad DH, Froese A. A new concept of mechanism of IgE-mediated histamine release. *J Allergy Clin Immunol*. 64 : 320-326, 1978.
3. Ishizaka T. Analysis of triggering events in mast cells for immunoglobulin E-mediated histamine release. *J Allergy Clin Immunol*. 67 : 90-96, 1981.
4. Tanizaki Y, Komagoe H, Morinaga H, Kitani H, Goda Y, Kimura I. Allergen- and anti-IgE-induced histamine release from whole blood. *Int Archs Allergy Appl Immunol*. 73 : 141-145, 1984.
5. Tanizaki Y, Komagoe H, Sudo M, Morinaga H, Kitani H, Nakagawa S, Takahashi K, Kimura I. Reactivity of sensitized human basophils, as expressed by histamine release. *Jpn J Allergol*. 33 : 463-468, 1984.
6. Tanizaki Y, Komagoe H, Sudo M, Morinaga H, Kitani H, Nakagawa S, Matsuoka T, Tada S, Takahashi K, Kimura I. Candida-induced histamine release from basophils : Relationship to house dust- and anti-IgE-induced secretion. *Acta Med Okayama* 39 : 191-197, 1985.
7. Tanizaki Y, Komagoe H, Sudo M, Kitani H, Nakagawa S, Tada S, Takahashi K, Kimura I. Basophil histamine release induced by *Candida albicans*. Relation to specific IgE and IgG antibodies. *Jpn J Allergol*. 34 : 422-427, 1985.
8. Tanizaki Y, Komagoe H, Sudo M, Morinaga H, Kitani H, Kimura I. Comparison of basophil histamine release induced by the cross-linking of IgE receptors. *Acta Med Okayama* 39 : 441-446, 1985.
9. Tanizaki Y, Komagoe H, Sudo M, Morinaga H, Shiota Y, Tada S, Takahashi K, Kimura I. Classification of asthma based on clinical symptoms : Asthma type in relation to patient age and age at onset of disease. *Acta Med Okayama*. 38 : 471-477, 1984.
10. Tanizaki Y, Komagoe H, Sudo M, Morinaga H. Clinical effect of spa therapy on steroid-dependent intractable asthma. *Z Physiother*. 37 : 7425-438, 1985.

11. Tanizaki Y, Sudo M, Kitani H, Araki H, Oki K, Soda R, Tada S, Takahashi K, Kimura I. Clinical studies on steroid-dependent intractable asthma. Comparison between early and late onset asthma. *Jpn J Allergol.* 38 : 68-73, 1989.
12. Tanizaki Y, Sudo M, Kitani H, Kawachi K, Mifune T, Takeyama H, Kohi F, Tada S, Takahashi K, Kimura I. Characteristic of cell components in bronchoalveolar lavage (BALF) in patients with bronchial asthma. *Jpn J Allergol.* 39 : 75-81, 1990.
13. deMonchy JGR, Kauffman HF, Venge P, Koefler GH, Shuiter HJ, Jansen HM, deVries K. Bronchoalveolar eosinophilia during allergen-induced late asthmatic reaction. *Am Rev Respir Dis.* 131 : 373-376, 1985.
14. Tanizaki Y, Sudo M, Kitani K, Kuwachi K, Mifune T, Okuda H, Takahashi K, Kimura I. Clinical characteristics of bronchial asthma in the elderly in relation to cell component in the airways. *Jpn J Geriatr.* 27 : 589-594, 1990.
15. Tanizaki Y. Improvement of ventilatory function by spa therapy in patients with intractable asthma. *Acta Med Okayama.* 40 : 55-59, 1985.

臨床所見および検査成績からのスコアによる喘息分類の特徴

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気管支喘息36例を対象に, 臨床病態による喘息の分類(臨床診断)を試み, この分類と臨床所見および臨床検査より求めたスコアによる分類(スコア分類)との比較検討を行った。

1. 臨床分類でIa.単純性気管支攣縮型と診断された12症例のうち, 1日喀痰量0-49mlの8症例は,

スコア分類では同様にIa.型と分類された。一方, 1日喀痰量50-99mlの4症例はスコア分類ではIb.型(気管支攣縮+過分泌型)と分類された。これら4症例のBALF中好酸球増多はIb.型に類似した病態であった。

2. 臨床診断によりIb.型に分類された6症例はいずれもスコア診断でもIb.型と分類された。
3. 臨床診断によりII.型(細気管支閉塞型)と分類された8症例のうち, 7症例はスコア診断でもII.型と分類されたが, 1症例はスコア10でII.型の診断基準に合わず, questionable II.型と診断された。

キーワード: 喘息分類, 気管支攣縮, 過分泌, 細気管支閉塞, スコア診断