

Improvement of Asthma Management in Actual Practice Consistent with Prevalence of Anti-inflammatory Agents—Based on Questionnaire Surveys in Niigata Prefecture, Japan from 1998 to 2002—

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ABSTRACT

Background: Because bronchial inflammation was recognized as a basic component of bronchial asthma, the strategy for asthma management has changed in the last two decades. In Japan there are few clinico-epidemiological reports of changes in the management of bronchial asthma in actual practice.

In this study, we analyzed practical asthma management in Japan, and examined changes in the prevalence of asthma medication and relation between these changes and the level of asthma control and management.

Methods: From 1998 to 2002, questionnaires on asthma control, asthma related emergent episodes and satisfaction in daily life. Questionnaires were distributed to adult asthmatic patients. Questionnaires about the patients' profiles and medication were also given to the patients' doctors.

Results: The total number of patient responders was approximately 2500–3300 per year. The rate of peak flow meter (PEFM) use was under approximately only 40% and plateaued from 2000 to 2002. The percentage of inhaled corticosteroid use and leukotriene receptor antagonist use increased, from 62.0%, 27.2% to 77.4%, 40.6% respectively. Indicators for asthma control, including presence of attacks and sleep disturbance, were significantly improved. Limited to PEFM users, there was an improvement hospitalization, ambulance use or ED visits and in satisfaction in daily life based on a Quality of Life (QOL) indicator.

Conclusions: These results indicate that the prevalence of anti-inflammatory agents, including inhaled corticosteroids and leukotriene receptor antagonist, was associated with an adequate improvement in asthma control in clinical practice. In asthma management in clinical practice, prevalence of PEFM may play an important role in the improvement of asthma related emergent episodes or QOL.

KEY WORDS

asthma death, bronchial asthma, inhaled corticosteroid, leukotriene receptor antagonist, questionnaire

INTRODUCTION

The morbidity of bronchial asthma in Japan is reportedly about 3% in adults and 5% in children, a situation that clearly has been increasing.¹ Many studies have

attributed this to an increase in exposure to allergens derived from animals and microorganisms associated with changes in the living environment and lifestyles.^{2,3} The management and treatment of bronchial asthma has changed due to the fact that in re-

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Table 1 Summary of the attending institutes and numbers of questionnaires each year

year	1998	1999	2000	2001	2002
total numbers of prepared questionnaires	6000	6300	6100	8000	6000
total numbers of answered questionnaires	3347	3224	3069	3293	2593
numbers of institutions (large-sized hospitals: beds \geq 200)	32	33	32	32	27
numbers of answered questionnaires	1940	2009	1900	2171	1626
numbers of institutions (small/middle-sized hospitals: beds $<$ 200)	35	34	30	24	24
numbers of answered questionnaires	780	689	668	650	602
numbers of institutions (clinics: no beds)	86	86	47	44	27
numbers of answered questionnaires	627	526	501	448	365

cent years the disease has been recognized as chronic airway inflammation caused by inflammatory cells including mainly eosinophils and lymphocytes.^{4,5} Guidelines for bronchial asthma in many countries^{6,7} recommend anti-inflammatory treatments using inhaled corticosteroids ICSs (inhaled corticosteroid) as the main treatment. Some studies have recently reported that the use of inhaled steroids in patients with initial symptoms of bronchial asthma, or what is generally termed early intervention, improved subsequent respiratory function.⁸

The mainstays of the management/treatment of bronchial asthma include, (i) the evaluation and monitoring of asthma, (ii) the management of factors influencing the severity of asthma, (iii) drug therapy, and (iv) patient education. Because the management/treatment of asthma in adults generally requires a long-term period, quality of life (QOL), leading to normal activity levels, must be taken into consideration. However, medical providers are sometimes neither able to meet the patient's needs in the actual clinical setting, nor provide patients with adequate education. Given these problems associated with the treatment/management of bronchial asthma, which have been minimally discussed and analyzed in Japan, the Niigata Asthma Treatment Study Group conducted a questionnaire survey among adult patients with bronchial asthma who visited medical institutions in Niigata Prefecture in September and October starting in 1998. The attending physicians of these patients were also included in the survey. To clarify the changes in the prevalence of asthma medication and the relation between these changes and the level of asthma control and management, this paper reports on the analysis of the results of successive changes obtained from surveys conducted from 1998 to 2002 in Niigata Prefecture, Japan.

METHODS

This questionnaire-based investigation was performed over five consecutive years, from 1998 to 2002 in Niigata Prefecture, Japan, under the Ethical Principles for Medical Research Involving Human Subjects, DECLARATION OF HELSINKI. The numbers and

the kinds of involved institutions each year are shown in Table 1. The numbers of prepared and answered questionnaires are also indicated in Table 1. The contents of the questionnaire are shown in Table 2 (originally in Japanese). To avoid annual influence, the questionnaire was presented annually in Japanese. However, two questions, smoking status and the last onset of episodes associated with asthma death (Table 2, Question 3, 6–8) were added later (from 2000 and from 2001). And to exclude seasonal influences, questionnaires during each of the five years were carried out over 2 months from September to October. The subjects were recruited from a group of patients with adult bronchial asthma (sixteen years and upward) who regularly (usually once or twice per 4 weeks) visited the participating institutes for asthma management. On their regular visit during the study period, they were asked by their physician to attend this study. The recruited patients were asked to complete a questionnaire by themselves (Table 2). Therefore, the understanding of the used technical terms such as “attack” or “unconsciousness” in the questionnaire (Table 2) was dependent on each patient self-understanding.

For an evaluation of asthma control during each year, patients were asked about the mean peak flow value and the presence of asthma attacks during the two weeks prior to answering the questionnaire. The patients were also asked about their asthma condition during the one-year period prior to answering the questionnaire by choosing 1 of 3 answers: “few attacks,” “seasonal attacks” and “frequent attacks.” The questionnaires asked about asthma-related symptoms including coughing and sputum in the morning and at night, and about sleep disturbance in the two weeks prior to answering the questionnaire.

The questionnaires also inquired about asthma related emergent episodes including ambulance use, emergency department visits and hospitalization, and related events with fatal asthma attacks including unconsciousness or respirator management and anti-inflammatory-agent induced asthma attacks AIA (aspirin induced asthma). The subjects were asked to answer “yes” or “no” to the following five questions;

Table 2 Contents of the questionnaires used for asthmatic patients in this study (Original questionnaires were described in Japanese.)

Age: years old Gender: male/female

Question 1
 When were you diagnosed as bronchial asthma?
 Year: Month: Day:

Question 2
 1) Do you use a peak-flow meter?
 (Yes, No)
 2) Please describe the mean value of your peak-flow meter during the last 2 weeks.
 morning: night:

Question 3
 Choose in followings
 1) How did your asthma attacks appear during the last 12 months?
 (frequent attacks, seasonal attacks, few attacks)
 2) How many times were your asthma attacks during the last 2 weeks?
 (5–7/week, 3–4/week, 1–2/week, absent)
 3) What kinds of the degree was your asthma attacks during the last 2 weeks?
 (impossible to move, impossible to lie down, possible to lie down, strider, dyspnea on exertion)
 4) Have you ever been hospitalized due to asthma?
 (yes, no)
 5) Have you ever been taken by ambulance or visited an emergency room due to an attack?
 (yes, no)
 6) Have you ever had a respirator due to an asthma attack?
 (yes, no)
 7) Have you ever been unconscious due to an asthma attack?
 (yes, no)
 8) Have you ever had an attack induced by anti-inflammatory drugs including painkillers, antipyretics, or cold medicine?

Question 4
 How was your asthma condition during the last 2 weeks?
 (very good, fairly good, mediocre, slightly bad, bad)

Question 5
 Choose your symptoms during the last 2 weeks in followings
 1) in the morning
 (cough, sputa, chest tightness, stridor, dyspnea, absent)
 2) at night
 (cough, sputa, chest tightness, stridor, dyspnea, absent)
 3) sleep disturbance
 (impossible to fall asleep sometimes due to dyspnea, impossible to have a good sleep due to dyspnea, waking up in the night due to chest oppression, absent)

Question 6
 Do you satisfy in daily life?
 (very satisfide, fairly satisfied, mediocre, slightly unsatisfied, unsatisfied)

“Have you ever been hospitalized due to asthma?”, “Have you ever been taken by ambulance or visited an emergency room due to an attack?” “Have you ever used a respirator due to an asthma attack?”, “Have you ever been unconscious due to an asthma attack?” and “Have you ever had an attack induced by anti-inflammatory drugs including painkillers, antipyretics, or cold medicine?” Therefore, aside from questions about asthma control, the experiences were asked in Question 3, 4–8 (Table 2).

To evaluate problems concerned with asthma man-

agement and treatment considering QOL related with normal activity levels, the questionnaires asked about satisfaction in patients' daily life that was used as a measure of QOL. The subjects answered by choosing 1 of 5 answers: “very satisfied,” “fairly satisfied,” “mediocre,” “slightly unsatisfied,” and “unsatisfied.”

Concurrent with the patients' completing the questionnaire, their physicians were asked to answer the details of current treatment mainly as controller, the type of asthma (atopic or nonatopic) in accordance with the elevation of serum total IgE or the significant

Table 3 Adult bronchial asthma severity assessment committee's standards of the Japanese Society of Allergology

frequency	degree of symptom			
	A	B	C	D (D1/D2)
5–7/week	severe	severe	moderate	moderate
3–4/week	severe	moderate	moderate	mild
1–2/week	severe	moderate	mild	mild

A: impossible to move due to dyspnea, B: impossible to lie down due to dyspnea, C: possible to lie down even with dyspnea, D1: stridor alone, D2: chest tightness alone

detection of specific IgE for allergens, and the severity of asthma in accordance with the adult bronchial asthma severity assessment committee's standards of the Japanese Society of Allergology. As shown in Table 3, the severity is, in principle, classified according to the combination of frequency and degree of attacks during the worst consecutive prior 4 weeks. However, in cases of administration of corticosteroids, total dosages of corticosteroids including inhaled corticosteroids were used to decide the severity independent of the situation of asthma attacks. A case was decided as severe when more than 10 mg/day was used and moderate from 5 mg/day to 10 mg/day, respectively, calculated as prednisolone.

The results are expressed as arithmetic means (\pm SD) for continuous variables. The differences between dichotomous variables were analyzed by chi-square test. A Kruskal-Wallis test was used to test for the equality of distributions of continuous variables. The pairwise year-to-year comparison was performed by chi-square test and Wilcoxon's rank sum test with Bonferroni's correction for the significance level. All statistical analyses were performed with the statistical software BMDP 3S (BMDP, Los Angeles, CA, USA) and Statxact (Cytel Software Co., Cambridge, MA, USA).

RESULTS

CHANGES IN PATIENT BACKGROUND

Changes in patient background are summarized in Table 4. The number of patients who responded was approximately 2500–3300, aged between 54–56 years on average, with a mean duration of disease of approximately 11–16 years (Table 4-a). Percentage of females increased and in 2002 females were apparently dominant. Over the survey years here was a significant increase in the cases of atopic disease type and moderate cases. Although peak flow meter (PEFM) was used in about 31% of the patients in 1998 and the rate significantly increased by about 10% over the next two years, there was no further increase in 2001 and 2002 (Table 4-b). The later results indicate that a limitation could exist in the promotion of PEFM.

CHANGES IN DRUG MEDICATION

The results concerning changes of drug medication as controller were shown in Table 5. The proportion of patients using ICSs and LTRAs (leukotriene receptor antagonists) significantly increased from 62.0%, 27.2% to 77.4%, 40.6% respectively, over four years. These results indicate that an anti-inflammatory strategy for asthma treatment is becoming widely accepted in actual clinical management. The proportion of oral steroid use which is indicative of steroid-dependent asthma decreased successively from 18.8% to 10.4%. During this period, the rate of oral sustained-released theophylline OSRT (oral sustained-released theophylline) use was more than 70%, but the proportion showed a significant decrease.

CHANGES IN %PEF (PERCENTAGES FOR THE PREDICTED PEAK FLOW VALUE) AND PRESENCE OF ASTHMA ATTACKS DURING THE TWO WEEKS PRIOR TO ANSWERING THE QUESTIONNAIRE

The data are summarized in Table 6-a. Changes in %PEF in the morning and at night gradually increased although the percentages of PEFM users were not more than approximately 40%. There was a significant decrease in the proportion of patients who experienced asthma attacks during the two weeks prior to answering the questionnaire. These results suggest that the control of bronchial asthma improved over the years from 1998 to 2002.

CHANGES IN ASTHMA ATTACKS DURING THE ONE-YEAR PERIOD PRIOR TO ANSWERING THE QUESTIONNAIRE

To clarify asthma control in the long term, asthma attacks over the 1 year prior to answering the questionnaire were classified as described in the methods section. The percentage of patients answering, "frequent attacks" and "few attacks" in 1998 was 18.9% and 31.9%, respectively. The former decreased and the latter increased every year, and reached 8.7% and 46.2% in 2002, respectively (Table 6-b), (indicating that the prevention of asthma attacks in the long term also improved).

CHANGES IN ASTHMA-RELATED SYMPTOMS AND SLEEP DISTURBANCE DURING THE TWO WEEKS PRIOR TO ANSWERING THE QUESTIONNAIRE

Because sleep disturbance and asthma-related symptoms in the morning and at night are likely to appear in asthmatics, we examined the proportion of patients who had such symptoms. The rate of symptomatic related patients in the morning and night significantly decreased from 55.8%, 42.8% to 40.8%, 25.8% respectively and sleep disturbance also significantly improved from 33.1% to 11.8% (Table 6-c). These results

Table 4-a Patient background I

year	gender: % (N: male/female)	age (mean + / - SD)	duration (mean + / - SD)
1998	50.0/50.0 (1670/1673)	54.4 + / - 17.6	11.5 + / - 12.3
1999	51.0/49.0 (1643/1581)	53.9 + / - 17.6	10.9 + / - 11.9
2000	49.1/50.9 (1508/1561)	55.8 + / - 16.7	15.9 + / - 18.4
2001	49.3/50.7 (1580/1623)	55.3 + / - 17.5#	12.1 + / - 12.8*, #, \$
2002	46.2/53.8 (1198/1394)*, ###	56.0 + / - 16.8¥	12.7 + / - 13.7¥

* $p < 0.05$ vs. 1998, # $p < 0.05$ vs. 1999, ### $p < 0.001$ vs. 1999, \$ $p < 0.05$ vs. 2000, \$ $p < 0.05$ vs. 2001, ¥ $p < 0.05$ vs. 2002 by means of Bonferroni's correction for multiple chi-square tests.

Table 4-b Patient background II

year	type: % (N: atopic/nonatopic)	severity: % (N: mild/moderate/severe)	number of PEF user (%)
1998	68.1/31.9 (2197/1029)	48.8/41.1/10.1 (1542/1299/318)	1032 (30.8)
1999	71.6/28.4 (2247/892)**	45.3/44.6/10.1 (1435/1415/321)*	1123 (34.8)***
2000	69.1/30.9 (2005/898)#	44.5/46.1/9.4 (1307/1354/277)***	1238 (40.3)***, ###
2001	72.5/27.5 (2277/863)***, \$\$\$	41.3/49.4/9.3 (1319/1576/297)***, ###, \$	1277 (39.1)***, ###
2002	72.6/27.4 (1800/681)***, \$\$\$	40.1/49.8/10.1 (1003/1248/253)***, ###, \$	1020 (39.3)***, ###

* $p < 0.05$ vs. 1998, ** $p < 0.01$ vs. 1998, *** $p < 0.001$ vs. 1998, # $p < 0.05$ vs. 1999, ### $p < 0.001$ vs. 1999, \$ $p < 0.05$ vs. 2000, \$\$\$ $p < 0.01$ vs. 2000, \$\$\$ $p < 0.001$ vs. 2000

Table 5 Changes in drug medication in asthmatic patient

year	Rate of each drug use (%)			
	ICS †	OCS †	LTRA †	OSRT †
1998	62.0	18.8	27.2	79.6
1999	66.5	14.8	33.7	79.3
2000	71.4	12.3	34.1	75.7
2001	73.5	12.0	37.2	72.8
2002	77.4	10.4	40.6	71.9

†: $p < 0.001$ by means of Cochran's linear trend tests. ICS: inhaled corticosteroid, OCS: oral corticosteroid, LTRA: leukotriene receptor antagonist, OSRT: oral sustained-released theophylline

also indicated an improvement in asthma control.

CHANGES IN ASTHMA RELATED EMERGENT EPISODES INCLUDING AMBULANCE USE, EMERGENCY DEPARTMENT VISITS AND HOSPITALIZATION, AND EPISODES RELATED WITH NEAR FATAL ASTHMA ATTACKS INCLUDING ATTACKS WITH UNCONSCIOUSNESS, RESPIRATOR MANAGEMENT AND AIA ATTACKS

The treatment of asthma also aims at avoiding asthma-related emergent episodes, especially asthma deaths in addition to the prevention of asthma attacks and maintenance of normal lung function. The proportions of patients who had visited an emergency department (ED) or who had used an ambulance did not significantly decrease when compared to 1998 data. The proportion of patients who had been hospi-

talized due to asthma attacks showed no significant decrease when compared with 1998 data (Table 7-a). Moreover, there were no consistent tendencies in the proportion of patients who had experienced near fatal asthma attacks directly associated with asthma-related death, such as attacks with unconsciousness, respirator management and AIA (Table 7-b). Considering that there were no further increases of PEFM use in 2001 and 2002 (Table 4-b), the comparisons between PEFM users and non-users were performed. Although there were no significant changes of attacks with unconsciousness, respirator management and AIA in both groups, significant decreases of hospitalization in 2002 and of ambulance use or ED visits in 2001 were found only in PEFM users (Tables 7-c, d).

CHANGES IN SATISFACTION OF DAILY LIFE

Another target of asthma treatment is to allow patients to gain normal activity levels. In this context, satisfaction of daily life in the questionnaires is one of the most important factors of QOL indicators. In 1998, responses of "very satisfied" and "fairly satisfied" were recorded in 14.8% and 56.9% of respondents respectively. Responses of "mediocre", "slightly unsatisfied" or "unsatisfied" were cited in 15.7%, 9.1% and 1.4% respectively. There were no significant percentage changes when compared with the previous year (Table 8-a). The same analyses were performed as the analysis of the changes in asthma related emergent episodes and episodes related with near fatal asthma attacks. The satisfaction of daily life in 2001 was significantly improved not in regard to

Table 6-a Changes in peak flow values and presence of asthma attacks during the two weeks prior to answering the questionnaire

year	%PEF (morning, mean + / - SD)	%PEF (night, mean + / - SD)	PA (%)
1998	76.4 + / - 20.9	79.6 + / - 20.0	36.4
1999	76.0 + / - 19.9	81.1 + / - 19.2	31.7***
2000	79.6 + / - 20.1	81.6 + / - 20.1	27.7***
2001	79.2 + / - 21.2*	81.5 + / - 21.3	24.4***, ###, \$
2002	80.8 + / - 19.2	82.6 + / - 19.2	22.5***, ###, \$\$

* $p < 0.05$ vs. 1998, *** $p < 0.001$ vs. 1998, ### $p < 0.001$ vs. 1999, \$ $p < 0.05$ vs. 2000, \$\$ $p < 0.01$ vs. 2000 by means of Bonferroni's correction for chi-square tests. % PEF: percentage of predicted peak flow value, PA: presence of asthma attacks during the two weeks prior to answering the questionnaire

Table 6-b Changes in asthma attacks during the one year period prior to answering the questionnaire

year	seasonal/few/frequent/not answered (%)
1998	1117/1067/631/532 (33.4/31.9/18.9/15.9)
1999	1086/1127/544/467 (33.7/35.0/16.9/14.5)
2000	1033/1202/401/433 (33.7/39.2/13.1/14.1)*, #
2001	1021/1417/351/480 (31.2/43.3/10.7/14.7)*
2002	771/1197/225/399 (29.7/46.2/8.7/15.4)*, #

* $p < 0.05$ vs. 1998, # $p < 0.05$ vs. 1999 by means of Bonferroni's correction for Kruskal-Wallis tests.

PEFM non-users but in PEFM users (Tables 8-b, c).

DISCUSSION

This study analyzed the changes in patients with bronchial asthma in the Niigata Prefecture, Japan using data from surveys conducted from 1998 to 2002. Participating patients totaled more than 2500 each year from many different medical institutions in various parts of Niigata Prefecture, Japan (Table 1). One of important problems of this study was the quality of the used questionnaires, *i.e.* the used questionnaire was not validated, because at the beginning of this study there were no validated questionnaires to evaluate for asthma management of each asthmatic patient in practice. It was suitable, however, that the analytical results can reflect to some degree an actual situation of medication and management for bronchial asthma, because the contents in the questionnaire (Table 2) were often used for the management of asthma in clinical practice.

Although the changes in the degree of severity were likely to be worse in this study, it was thought to be an apparent increase. The classification of severity used in this study was based not only on the frequency and degree of symptoms (Table 3) but also on the total doses of corticosteroid required for asthma control, as mentioned in the method section. Therefore, we think that an introduction or an increased dose of inhaled corticosteroids resulted in the shift to a worse severity classification. Another

important factor is the spread of self-management using PEFM. Sudre *et al.* reported that self-management by PEFM significantly reduced hospitalization of patients with asthmatic attacks and resulted in a decrease in medical expenses.⁹ Considering this, influence of PEFM use can be excluded after 2000 because no significant changes were found. However, the changes in hospitalization are not thought to be associated directly with those in the use of PEFM. This will be discussed in later. Note the rate of PEFM use plateaued and was under about 40% in 2000, 2001 and 2002. Although asthma management by PEFM is one of the important evaluation methods for pulmonary function in several guidelines,^{6,7} this indicates that there was a certain limitation of this management using PEFM and that another method such as spirometry might be considered. In practice, measurement of FEV1 by pulmonary function test would play a same important role as PEFM.

The survey results showed a gradual improvement in the control of bronchial asthma, as is clearly shown by the presence of asthma attacks, situations of asthma attacks during the two weeks and the one year prior to answering the questionnaire, the asthma related symptoms and sleep disturbance. This improvement is likely to be associated with the prevalence in anti-inflammatory agents such as ICSs and LTRAs, although the same patients had not been surveyed consecutively throughout the study period. The important point in treatment analysis was the increase in ICS use and the decrease in oral corticosteroid OCS (oral corticosteroid) use. This is because guidelines for asthmatic treatment steadily spread among physicians in the Niigata Prefecture, Japan and these physicians began to use ICSs in early stages. In addition, the introduction of fluticasone has allowed (available on 1999 in Japan) the reduction in and withdrawal OCSs in patients with severe asthma and led to an overall reduction in OCS use. This study revealed a remarkably high rate of OSRT use, which has been traditionally used in Japan, but a significant decrease in it occurred. These results also indicated that the strategy for asthma treatment includ-

Table 6-c Changes in asthma-related symptoms and sleep disturbance during the two weeks prior to answering the questionnaire

year	ARS (morning: %)	ARS (night: %)	sleep disturbance (%)
1998	58.4	42.8	33.1
1999	55.4**	39.7***	30.6
2000	54.2***, ###, \$\$\$	39.3***	29.4*
2001	42.4***, ###, \$\$\$	28.7***, ###, \$\$\$	14.6***, ###, \$\$\$
2002	40.8***, ###, \$\$\$	25.8***, ###, \$\$\$	11.8***, ###, \$\$\$, ¥

* $p < 0.05$ vs. 1998, ** $p < 0.01$ vs. 1998, *** $p < 0.001$ vs. 1998, #### $p < 0.001$ vs. 1999, \$\$\$ $p < 0.001$ vs. 2000, ¥ $p < 0.05$ vs. 2001 by means of Bonferroni's correction for multiple chi-square tests. ARS: asthma related symptoms during the two weeks prior to answering the questionnaire

Table 7-a Changes in hospitalization, ambulance use or ED visits

year	hospitalization (%)	ambulance use or ED visits (%)
1998	47.0	40.9
1999	45.9	39.6
2000	45.7	37.4
2001	43.3	37.1
2002	43.1	39.1

No significant differences were observed between any of groups by means of Bonferroni's correction for multiple chi-square tests. ED: emergency department

ing ICSs and LTRAs was accepted by many physicians. However, considering the high rate in OSRT use, this medicine added to ICSs, which was reported to be more effective than doubling dosage of ICSs,^{10,11} may play an important role in the improvement of asthma control in this study. However, a long-acting inhaled beta2 agonist has recently been available in Japan and may partly replace theophylline in future.

One of the important aspects of the management of bronchial asthma is asthma-related emergent episode (Tables 7-a,7-b). These episodes can be closely related not only with overall medical costs¹² but also with in part asthma-related death.¹³ In fact, asthma-related death has decreased with approximately 4,000 patients dying from asthma annually in Japan.¹⁴ The number is larger than other advanced countries and urges effective measures to be taken to reduce deaths caused by asthma. Unfortunately, Table 7-a did not indicate a significant improvement in the management of asthma related with emergency episodes in asthma attacks with all surveyed patients. There were almost no changes in the frequency of near-fatal asthmatic conditions associated with serious attacks involving unconsciousness and management with a respirator, and there were no significant changes either in the frequency of AIA that is also known as one of near fatal asthma attacks (Table 7-b). These findings appear to be contradictory both to improvements in the management of asthma shown in this

study and to previous reports.^{15,16} This was mainly why only experiences but not onset time of these episodes were required in the questionnaire used. Patients in the same medical institutions may have been removed every year and the same patients may have been included to some extent in the survey. It might take a longer time to detect a significant reduction in asthma-related emergent episodes. It was conclusive that the questionnaire we performed was inadequate to evaluate the changes in asthma associated emergent events in the present study design. However, considering the plateau prevalence of PEFM (Table 4-b) and the decreased rates of hospitalization and of ambulance use or ED visits in the PEFM users (Table 7-c), PEFM use may play an important role in the improvement of these points.

Like other chronic diseases, the evaluation of QOL in the management of asthmatic patients has been stressed in recent years. The evaluation of QOL is performed using questionnaires containing questions about physical and psychological conditions to evaluate overall function and life conditions with respect to the patient's lifestyle. The Nottingham Health Profile method and SF-36 Health Status Questionnaire¹⁷ method have been used in recent years. To evaluate more patients, the degree in satisfaction of daily life was used as a plausible measure for QOL in this study. There were no significant improvements in satisfaction in daily life. Apart from the validation of this question, as previously reported that ICSs and LTRAs can contribute QOL improvement,^{18,19} there are several possible explanations for our results. One is that this question was too simple to reflect QOL. Another is that satisfaction in daily life responses were directed not to QOL associated with asthma but to QOL independent asthma. In sum, the method to evaluate the changes in QOL in asthmatic patients in this study was thought to be inadequate. However, as the same point was discussed in the analysis of the changes in asthma related emergent episodes, a partial improvement of satisfaction of daily life in PEFM users (Table 8-b) may also indicate a potent contribution to the improvement of QOL.

In summary, questionnaire surveys conducted

Table 7-b Changes in attacks with unconsciousness, respirator management and AIA attacks

year	attacks with unconsciousness (%)	respirator management (%)	AIA attacks (%)
1998	6.78	5.86	8.63
1999	7.32	6.34	8.87
2000	6.81	6.35	8.73
2001	6.55	5.57	8.19
2002	6.91	6.36	8.95

No significant differences were observed between any of groups by means of Bonferroni's correction for multiple chi-square tests. AIA: aspirin induced asthma

Table 7-c Changes in hospitalization, ambulance use or ED visits in PEFM users and PEFM non-users

year	hospitalization (%)		ambulance use or ED visits (%)	
	PEFM users	PEFM non-users	PEFM users	PEFM non-users
1998	62.6	40.5	51.8	37.9
1999	58.8	40.0	49.9	38.4
2000	59.9	37.5	46.1	36.5
2001	56.8	37.3	45.8**	35.8
2002	54.5*	38.6	48.8	37.5

* $p < 0.05$ vs. 1998, ** $p < 0.01$ vs. 1998 by means of Bonferroni's correction for multiple chi-square tests. ED: emergency department, PEFM: peak flow meter

Table 7-d Changes in attacks with unconsciousness, respirator management and AIA attacks in PEFM users and PEFM non-users

year	attacks with unconsciousness (%)		respirator management (%)		AIA attacks (%)	
	PEFM users	PEFM non-users	PEFM users	PEFM non-users	PEFM users	PEFM non-users
1998	10.61	4.71	8.72	4.46	12.21	6.82
1999	11.55	5.11	9.13	5.22	12.34	7.27
2000	9.69	5.76	8.22	5.56	11.88	7.91
2001	9.87	4.92	8.47	4.44	11.86	6.40
2002	10.54	5.56	10.09	5.08	12.16	7.35

No significant differences were observed between any of groups by means of Bonferroni's correction for multiple chi-square tests. AIA: aspirin induced asthma, PEFM: peak flow meter

Table 8-a Changes in satisfaction in daily life in all patients

year	very satisfied/fairly satisfied/mediocre/ slightly unsatisfied/unsatisfied (%)
1998	494/1906/524/306/47 (15.7/56.9/15.7/9.1/1.4)
1999	436/1866/485/319/45 (13.5/57.9/15.0/9.9/1.4)
2000	403/1738/476/306/57 (13.1/56.6/15.5/10.0/1.9)
2001	479/1916/492/246/45 (14.6/58.6/15.1/7.5/1.4)
2002	423/1415/431/191/29 (16.3/54.6/16.6/7.4/1.1)

No significant differences were observed between any of groups by means of Bonferroni's correction for Kruskal-Wallis tests

Table 8-b Changes in satisfaction in daily life in PEFM users

year	very satisfied/fairly satisfied/mediocre/ slightly unsatisfied/unsatisfied (%)
1998	149/591/147/108/17 (14.7/58.4/14.5/10.7/1.7)
1999	151/676/145/117/19 (13.6/61.1/13.1/10.6/1.7)
2000	172/702/180/135/29 (14.1/57.6/14.8/11.1/2.4)
2001	195/758/181/96/17 (15.6/60.8/14.5/7.7/1.4)#, \$
2002	173/561/173/83/7 (17.4/56.3/17.4/8.3/0.7)

$p < 0.05$ vs. 1999, \$ $p < 0.05$ vs. 2000 by means of Bonferroni's correction for Kruskal-Wallis tests, PEFM: peak flow meter

from 1998 to 2002 among adult patients with bronchial asthma and their attending physicians in the Niigata Prefecture Japan were analyzed on a successive

basis. Not only control of asthma attacks but also asthma-related symptoms and sleep disturbance were improved, with the consequence of spread use of

Table 8-c Changes in satisfaction in daily life in PEFM non-users

year	very satisfied/fairly satisfied/mediocre/ slightly unsatisfied/unsatisfied (%)
1998	299/1123/322/163/26 (15.5/58.1/16.7/8.4/1.3)
1999	233/974/287/171/21 (13.8/57.8/17.0/10.1/1.2)
2000	183/812/299/136/22 (13.2/58.8/16.6/9.8/1.6)
2001	229/876/249/114/24 (15.3/58.7/16.7/7.6/1.6)
2002	193/623/207/79/17 (17.2/55.7/18.5/7.1/1.5)

No significant differences were observed between any of groups by means of Bonferroni's correction for Kruskal-Wallis tests, peak flow meter

ICSs and LTRAs. There was a certain limitation in the popularization of PEFM, indicating that other methods, such as measurement of FEV_{1.0}, to evaluate pulmonary function may be required in asthma management. No improvement was observed concerning both inhibition of asthma-related emergent episodes and QOL in all surveyed patients, indicating that the questionnaire used this time was inadequate to evaluate these issues in this study design. However, the limited but significant improvement in asthma related emergent episodes and in satisfaction of daily life in PEFM users of the patients may indicate that the prevalence of PEFM may play an important role in these points. Given the current status, it is necessary to continue and improve these questionnaire surveys and perform more precise analyses to aim at higher-quality medicine.

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