

Use of Pressurised Aerosol Inhalers among Patients Attending the Chest Clinic and Primary Care Department of University Hospital, Kuala Lumpur

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Summary

Eighty consecutive patients who came to collect their prescriptions for pressurised aerosol inhalers at the Pharmacy of the University Hospital, Kuala Lumpur, were interviewed regarding their use of the pressurised inhaler. Their inhaler technique was also assessed. A significant proportion inhaled the steroid aerosol before the bronchodilator and 23.5% used the steroid inhaler for relief of acute dyspnoea. Only 28.8% of the 80 patients performed correctly all 6 steps necessary for the proper use of inhalers. The most common mistake was the failure to inhale slowly and deeply. Patients who had used the device for more than 5 years performed better, while correct inhaler technique was not dependent on the patient's sex, age or level of education.

Key words: Aerosol therapy.

Introduction

Inhalation therapy offers the advantages of selective delivery of medication to the lungs, small dosage of medication required, infrequent systemic side effects, and a rapid onset of action^{1,2}. Its use has become increasingly widespread in the daily management of patients who suffer from asthma and chronic airflow limitation. With correct use of metered dose inhalers, only 8.8% of the aerosolised dose reaches the small conducting airways and the alveoli³. Unfortunately, correct use of an inhaler is much more difficult than swallowing a tablet. It has been shown that many adult and paediatric patients do not use their inhalers correctly despite instruction and practice⁴⁻⁸. Incorrect technique results in substantially less drug reaching the lung and decreased drug efficacy⁹.

We undertook this study in an attempt to assess the understanding of the principles of inhalation therapy and its practice, and the extent of incorrect use of pressurised aerosol inhalers by patients who had been attending the Chest Clinic and the out-patient clinic of the Primary Care Department.

Patients and Methods

Eighty consecutive patients who came to collect their prescriptions for pressurised aerosol inhalers at the pharmacy of the University Hospital, Kuala Lumpur, during a 4 month period from February to May 1992 inclusive, were included in the study. The patients, comprising of 31 males and 49 females aged between 10 to 84 years (mean 49 years), suffered either chronic asthma or chronic obstructive pulmonary disease and had been attending the Chest Clinic or the Primary Care Clinic. These clinics were run by separate teams of doctors which consisted of specialists and medical officers. On occasions, house officers also helped to run the Chest Clinic. All the patients were using pressurised aerosol inhalers, without an extension tube, supplied by the hospital pharmacy on a regular basis.

The following questions were asked and the answers recorded:

1. Their level of education;
2. the duration they had been using pressurised aerosol inhalers;
3. whether they were on one or more types of pressurised aerosol inhalers;
4. who first instructed them on the use of pressurised aerosol inhalers;
5. patients who were on a combination of bronchodilator and steroid inhalers were asked which inhaler they used or were supposed to use first;
6. whether they knew which inhaler to use as a reliever of acute dyspnoea; and
7. patients who were on steroid inhalers were questioned whether they rinsed their mouths after using the steroid inhalers.

The patients were then requested to demonstrate the use of a pressurised aerosol inhaler. Recordings on whether the manoeuvres were correctly performed were made on a checklist consisting of the necessary steps for proper inhaler technique for closed mouth inhalation^{3,7,9}. These steps included:

1. Shake the inhaler.
2. Breathe out to residual volume or functional residual capacity.
3. Close the lips on the inhaler and begin to breathe in and then activate the inhaler.
4. Inhale slowly and deeply.
5. Hold the breath for 5 to 10 seconds.
6. Wait 1 minute before administering the second puff.

Although all steps were equally weighted for computation of performance score, they do not imply equal clinical importance for the efficacy of metered dose inhaler.

The performance score, although discrete, had a wide range of possible values from 0 to 6, and was treated as a continuous variable. Unpaired Student's *t* test was used to compare the means of performance score of the male and female patients. Simple linear regression analysis of the performance score against age of the patient was carried out. One way analysis of variance (ANOVA) was used to determine if significant

relationship existed between the performance scores and the duration of inhaler use and also the educational level of the patient. The means of performance score of the various groupings for these 2 variables were compared by applying Neuman-Keuls multiple range test. Probability values of less than 0.05 were considered to be statistically significant.

Results

Patient characteristics

Seventy five patients had prescriptions from the Chest Clinic, while 5 patients were prescribed inhalers by the Primary Care clinic. Twenty three patients (28.8%) had primary school education, 27 (33.8%) had secondary school education, 7 (8.7%) were college-educated, 1 (1.2%) was a university graduate and 22 (27.5%) had no formal education. Nine patients (11.2%) had used the inhaler for more than 5 years, 21 (26.2%) patients had used it for between 1 to 5 years, 27 (33.8%) had used it for between 6 months to a year, 23 (28.8%) had used it for less than 6 months. For 76 patients, the doctor was the one who first instructed them on the technique of using a pressurised aerosol inhaler. For the remaining patients, one was taught by the pharmacist, one by a friend and 2 by the nurse.

Types of inhaler used

The types of inhaler used were those delivering salbutamol (72 patients [90%]), those delivering ipratropium bromide (13 patients [16.3%]) and those delivering beclomethasone dipropionate (70 patients [87.5%]). The majority of the patients (84%) were using more than 1 type of inhaler (Table I). Sixty four patients (80%) were prescribed a combination of bronchodilator (salbutamol and/or ipratropium) and corticosteroid (beclomethasone) inhalers to be used on a regular basis.

Table I
The types of pressurised aerosol inhalers used

Types of inhaler	No of patients	(%)
Salbutamol alone	5	(6.3%)
Ipratropium bromide alone	2	(2.5%)
Salbutamol and ipratropium bromide	3	(3.7%)
Beclomethasone dipropionate alone	6	(7.5%)
Salbutamol and beclomethasone	56	(70.0%)
Salbutamol, ipratropium and beclomethasone	8	(10.0%)
Total	80	(100.0%)

Knowledge and practice on the use of inhalers

Three-quarters of the 64 patients who used both bronchodilator and corticosteroid inhalers regularly replied that the bronchodilator aerosol was to be inhaled first, followed by the corticosteroid aerosol. A quarter of these patients said that inhalation of the steroid aerosol should precede that of the bronchodilator aerosol.

Although about two-thirds (46) of the 64 patients who were on a combination of bronchodilator and steroid inhalers used either one or both bronchodilator inhalers for relief of acute dyspnoea, the rest of them gave varied answers. Of 70 patients who had been using steroid inhalers regularly, only 23 (32.9%) claimed to rinse their mouths after inhaling the steroid aerosol.

Inhaler technique

The percentage of patients who omitted the various steps which were considered to constitute correct inhaler technique are shown in Table II. The overall performance of the group is shown in Table III. There was no significant relation between performance and sex of the patient (mean performance score for male \pm SD=4.36 \pm 1.31 [n=31], mean performance score for female \pm SD=4.47 \pm 1.56 [n=49];p=0.73). Regression analysis of the performance score against age of the patients did not reveal a significant relation between performance and this variable.

Table II
Number and percentage of patients who omitted the various steps in the correct use of a pressurised aerosol inhaler

Steps in inhaler technique	No of patients who omitted	(%)
1. Shake the inhaler	7	(8.8%)
2. Exhale to residual volume or functional residual capacity	31	(38.8%)
3. Start inhaling and then actuate inhaler	19	(23.8%)
4. Inhale slowly and deeply	69	(86.3%)
5. Hold breath for 5-10 seconds	17	(21.3%)
6. Wait 1 minute before second puff	36	(45.0%)

Table III
Performance of the 6 steps that constitute correct use of a pressurised aerosol inhaler

No of steps performed correctly	No of patients	% of patients	Cumulative % of patients
0	1	1.2%	1.2%
1	3	3.7%	4.9%
2	3	3.7%	8.6%
3	14	17.5%	26.1%
4	15	18.8%	44.9%
5	21	26.3%	71.2%
6	23	28.8%	100.0%
Total	80	100.0%	

Tables IV and V show the relations between the performance score and the duration of inhaler use, and the level of education respectively. While the performance by patients who had used the inhaler for more than 5 years was significantly better than that of those who had used it for a shorter duration (p<0.02), the patients' levels of education or the lack of it did not influence their performance.

Table IV
Relation between performance score and duration of use of pressurised aerosol inhaler

Duration of inhaler use	Mean performance score±SD	(n)
Less than 6 months	4.13±1.74	(23)
Between 6 months and 1 year	4.44±1.31	(27)
Between 1-5 years	3.95±1.28	(21)
More than 5 years	5.78±0.44	(9)

ANOVA, $F_{3,76}=3.991$; P value=0.0108.

Table V
Relation between performance score and level of education

Level of education	Mean performance score±SD	(n)
No formal education	3.96±1.81	(22)
Primary school	4.30±1.36	(23)
Secondary school	4.78±1.22	(27)
College/university	4.86±1.13	(8)

ANOVA, $F_{3,76}=1.639$; P value=0.19.

Discussion

The pressurised aerosol inhaler consists of a drug either suspended or dissolved in chlorofluorocarbon propellant at a high pressure¹⁰. Each time the inhaler is actuated, a metered quantity of the drug is released in the form of a spray. Pressurised aerosol inhalers are popular because of their compactness, unobtrusiveness, portability and apparent simplicity of use. However, studies have shown that a significant proportion of patients who are prescribed pressurised aerosol inhalers do not use them correctly⁴⁻⁸. This study showed that only 28.8% of our patients who were attending the Chest Clinic and the out-patient clinic of the Primary Care Department performed correctly all the 6 steps which we considered were the proper technique for using the pressurised aerosol inhaler.

The efficacy of the pressurised aerosol inhaler depends very much on the amount of drug that is deposited in the lungs. Even when used optimally, only about 10% or less of the dose enters the lungs, while most of the dose is deposited in the mouth and upper airways¹¹. The most important steps in the technique include correctly timed aerosol release coordinated with slow, deep inhalation, followed by a period of breath-holding^{9,12}. Faulty technique will result in increased deposition of therapeutic aerosols in the oropharynx and the large conducting airways¹³. The most common mistakes in our patients were breathing in too fast and failure to wait 1 minute before the second puff. The former mistake resulted in deposition of the majority of the dose on the back of the throat and substantially less drug reaching the lung¹³. The failure to inhale slowly and deeply was also one of the more frequent mistakes shown by others⁷. One study¹⁴ found that a fast inspiratory flow rate was associated with a reduced response from a bronchodilator aerosol. The same study showed that the lung volume at the time of aerosol release and the time interval between the 2 puffs had no significant effect on bronchodilator response.

Although the most important error confounding the use of a metered dose inhaler is failure to coordinate or synchronise the actuation of the inhaler with inhalation⁴, this mistake was committed by less than a fifth of our patients.

As in previous studies^{7,15}, our results showed that correctness of the use is not dependent on sex, age or level of duration of the patient. In agreement with a previous study which showed that correct users were more likely to have used inhalers for a longer period of time¹⁵, a better performance was seen in our patients who had used the inhaler for more than 5 years. Repeated instruction on proper inhaler technique over the long period of use could be the explanation for this finding in our study.

The responsibility of instructing patients on the use of metered dose inhalers falls on the prescribing doctor. Lack of education by health care professionals is the principal reason for inhaler misuse by patients. The quality of the initial instruction has been found to be important for the outcome of inhalation therapy^{6,16}. The poor performance scores in many patients may mean that the initial instructors could have been incompetent or inadequate effort was made to instruct the patient. In one study¹⁷, only 40% of nonpulmonary attending physicians could perform more than 7 of 11 steps deemed necessary for correct inhaler technique. The level of training of the doctor who first instructed the patient was not within the scope of our study. Any additional instruction and the number of times when reeducation was carried out and by whom were also not studied.

Compared to reading from the drug package inserts, verbal instructions and the demonstration of the use of the aerosol inhaler by a health care worker reduce the incidence of incorrect technique in patients¹⁶. Frequent reinforcement of proper technique is important because patient performance of correct inhaler technique deteriorates over time^{5,15}.

This study confirms the impression that the incorrect use of aerosol inhalers by patients is common. Repeated tuition and regular checks of inhaler technique play a very important role in promoting and maintaining the correct use of metered dose inhalers by patients who are prescribed these devices. The cost saved and the increased benefit in terms of patients' health with the reduction of incorrect use of these inhalers would be tremendous.

Acknowledgement

We would like to thank the Primary Care Department for allowing us to study their patients. We gratefully acknowledge Mr Ong Leong Huat of the Department of Social and Preventive Medicine, Faculty of Medicine, University of Malaya, for helping in the statistical analysis of the data, and the following pharmacy staff members for helping out in the study: K.K. Maniam, Umil Kalthom BHB and Rismaton BMB.

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