

Assessment of Metered Dose Inhaler Technique in Family Health Service Patients in Singapore

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ABSTRACT

Objective: To assess the metered-dose inhaler technique in polyclinic patients with chronic lung disease.

Method: A cross-sectional study was conducted in three polyclinics. The inhalation technique was assessed in six steps.

Results: Only 7.1% of patients could perform all six steps correctly. Percentage of patients performing each of the following steps correctly were: preparation (89.1%), exhalation (53.8%), lip closure (69.2%), inhalation (57.7%), breath-holding (32.1%) and puff interval (35.4%).

Conclusion: This study showed a high incidence of incorrect usage of metered dose inhaler amongst polyclinic patients.

Keywords: asthma, chronic obstructive lung disease, metered-dose inhaler technique

INTRODUCTION

Bronchial asthma and chronic obstructive airway disease are the two most common chronic lung diseases encountered in the government polyclinics in Singapore. The treatment usually includes the use of bronchodilators and steroids, which are best delivered through the inhalational route. In the polyclinics, metered-dose inhalers are routinely prescribed for this purpose. In 1997 alone, more than 35,000 beclomethasone and 83,000 salbutamol inhalers were dispensed at the polyclinics. However, anecdotally, it has been observed that a significant number of these patients do not have a proper technique despite regular attendance at the clinic. This is also reflected in other studies⁽¹⁻³⁾.

As proper drug delivery is the first step towards effective pharmacological treatment, it is important to assess the patient's inhaler technique before establishing a drug regime. According to the Asthma Guidelines suggested by Thorax, 1997⁽⁴⁾, assessment of the inhaler technique, together with treatment compliance and allergen avoidance, should be done before any change is made to the treatment plan.

OBJECTIVE

This study aims to assess the metered dose inhaler technique in polyclinic patients with chronic lung

disease and also identify possible correlations with poor inhaler technique.

METHOD

This study was carried out from October 1997 to December 1997 at three polyclinics in Singapore – Hougang, Queenstown and Toa Payoh. It involved patients aged 12 years and above, who were diagnosed to have bronchial asthma or chronic obstructive lung disease (COLD). The diagnosis was based on documentation in the case notes and only those who had been treated with metered dose inhaler for at least 6 months were included in the study. Patients using spacer devices were excluded from this study.

The assessment of inhaler technique was standardised by first breaking it down into six discrete steps⁽²⁾. The three investigators then came to a common agreement as to the correct procedure for each step. The steps are:

1. Remove the cap and shake the inhaler (at least 3 times).
2. Exhale to functional residual capacity.
3. Seal the mouthpiece against closed lips.
4. Actuate and inhale slowly to total lung capacity.
5. Hold the breath for 4 to 10 seconds after maximal inhalation.
6. Check with the patient the duration between the first and second puffs. The interval is one minute.

One point is given for each correct step, with a maximum of 6 points. Weighting of the steps was not carried out as every step must be performed correctly to achieve an adequate drug delivery to the airway.

The doctors from the respective polyclinics interviewed 156 consecutive patients who satisfied the selection criteria. The patients' age, highest education attained, duration of disease and duration of inhaler usage were noted. The patients were then asked to demonstrate how they would normally use the inhaler. The technique employed was observed without interruption and was scored accordingly. The assessment was done by the three investigators. For those patients having an acute exacerbation, their techniques were assessed after nebulisation was given.

The results of the study were analysed using SPSS Window version 6.0.

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RESULTS

Demographics

The mean age of the study population was 48.5 years (SD 17 years). Their age profile is shown in Table I.

The length of MDI usage showed a bimodal distribution with peaks at 3–5 years and 10 years. In view of this distribution, correlation studies were not attempted with the length of MDI usage as one of the variables.

The majority of the study population had secondary education or less. Their profile is presented in Table II.

MDI Technique

Only a small minority (7.1%) of patients could perform all six steps correctly i.e. obtained the maximum 6 points (Table III). Of the six steps, breath holding and puff interval were the weakest steps with only 32.1% and 35.4% of patients respectively performing it correctly. The best step was preparation with 89.1% of patients performing it correctly.

A negative correlation was noted using Spearman's rank sum test between age and total score i.e. older patients tended to have a lower score as compared to younger patients ($p < 0.001$).

On further analysis, some patterns could be discerned with respect to the possible effect of age on different steps of inhaler technique (Table V).

Table IV – Percentage of patients performing each step of MDI delivery correctly

Step	% successful
Preparation	89.1%
Exhalation	53.8%
Lip closure	69.2%
Inhalation	57.7%
Breath holding	32.1%
Puff duration	35.4%

The percentage of patients performing steps such as preparation, lip closure and puff interval were evenly distributed among the different age groups. Younger patients especially those who were less than 30 years tend to perform better for steps such as inhalation, exhalation and breath holding.

There was no association noted between educational level and total score using Chi square test. This finding however needs to be interpreted with care as the number of patients with higher than secondary education is small.

DISCUSSION

The introduction of metered dose inhalers is a major innovation in the therapeutic management of bronchial asthma and chronic obstructive airway disease. These devices enable the direct delivery of medication to the respiratory system, hence reducing the first pass effect while minimising systemic side effects. However as only 8.8% of the aerosolised dose reaches the small conducting airway and alveoli even with the proper use of the MDIs⁽⁵⁾, it is important that the patient performs the MDI technique correctly. The results of this survey shows that MDI technique among FHS patients is far from ideal as only 7.1% of patients have a perfect score of 6. Consequently, many patients may not be receiving the optimal dose of medication.

This study also shows a highly significant negative correlation between age and total score. This can be due to better dexterity and co-ordination in the execution of the steps. This is supported by the finding that younger patients tend to perform steps such as inhalation, breath holding and exhalation better than older patients. Diminishing learning capacity and memory due to increased age are possible attributing factors. Therefore, MDI should remain as the preferred method of delivery of medication for young patients. However in the elderly, we may need to consider using the MDI with a spacer device even at the initial stage.

There is much work to be done by the polyclinic doctors, nurses and pharmacists in educating patients on the proper techniques in using MDIs. Patient education should be emphasised at the first consultation as it has been shown that the quality of initial instruction has an impact on the outcome of inhalation therapy⁽⁶⁾. Education should include verbal instruction and demonstration of proper use

Table I – Age profile of study cohort

Age group	Number	%
12–19	12	7.7
20–29	15	9.6
30–39	18	11.5
40–49	34	21.8
50–59	33	21.2
60–69	25	16.0
70–79	15	9.6
80–89	4	2.6

Table II – Educational profile of study cohort

Educational level	Number	%
No formal education	30	19.2
Primary	39	25.0
Secondary	74	47.4
Pre-U/Polytechnic	11	7.1
Tertiary	2	1.3

Table III – Distribution of total score of study cohort

Points	Number of patients	%
0	3	1.9
1	16	10.3
2	30	19.2
3	32	20.5
4	28	17.9
5	36	23.1
6	11	7.1

Table V – Percentage of patients performing steps of MDI delivery correctly by age groups

Age group	No. of patients	Preparation	Exhalation	Lip closure	Inhalation	Breath holding	Puff interval
12 – 19	12	91.7	91.7	91.7	91.7	83.3	25.0
20 – 29	15	100	66.7	86.7	66.7	46.7	60.0
30 – 39	18	94.4	55.6	72.2	55.6	38.9	27.8
40 – 49	34	91.2	62.5	73.5	62.5	20.6	29.4
50 – 59	33	84.8	36.4	48.5	36.4	30.3	30.3
60 – 69	25	88.0	48.0	64.0	48.0	12.0	52.0
70 – 79	15	73.3	53.3	73.3	53.3	40.0	33.3
80 – 89	4	100	25.0	75.0	25.0	0	25.0

of MDI by the health care provider⁽⁷⁾. Patients should also be encouraged to demonstrate their proficiency in MDI usage regularly. Breaking up the procedure into the six steps as identified in this study may help the health care provider to better communicate, identify and rectify any deficiencies in MDI technique. Additional studies would be needed to confirm this hypothesis.

Limitations of study

Possible confounders that were not adjusted for in this study are prior counselling by health care personnel, frequency of MDI usage and duration of disease. Out of the 156 patients in this study, only 8 reported no prior counselling. Of those who were counselled, most were unable to elaborate the contents of the counselling. As such, comparison of MDI scores for patients with and without prior counselling was not carried out. Some patients in this study were also unsure as to their frequency of MDI usage and duration of their disease.

Recommendations

Firstly, effort and resources must be directed towards educating these patients to raise their proficiency level in using their MDIs. This can be achieved by individual counselling or group education such as asthma workshops. Health care providers should be well versed in the steps involved in using the MDI correctly⁽⁸⁾.

Breaking down MDI technique into discrete steps may assist patients in improving their MDI technique by making the task more manageable. This would enable health care providers to identify and focus on the weaker steps. Further studies would be needed to validate this. Another study to assess the patient's compliance with the MDI would be helpful.

As older patients have greater difficulty in using MDIs proficiently, the addition of a spacer device should be considered at an early stage rather than persisting with MDI alone.

CONCLUSION

This study highlighted the high incidence of incorrect usage of metered dose inhalers amongst patients attending three government polyclinics. The weakest step were breath holding and puff interval. Older patients had more difficulty executing MDI technique compared to younger patients.

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