

A review of the metered dose inhaler technique in asthmatic and COPD patients

Lara Angelle Micallef

Abstract

Aim: To assess the pressurised metered dose inhaler (pMDI) technique using a large volume spacer (LVS) in asthma and Chronic Obstructive Pulmonary Disease (COPD) patients who were admitted in medical wards or attending the outpatient clinic.

Method: Asthma or COPD patients were randomly recruited over an eight-month period from the wards and outpatients clinics at Mater Dei Hospital. Only patients using the pMDI were included. Data was collected using a questionnaire filled in by an interviewer who also assessed the inhaler technique using a checklist of 8 steps necessary for appropriate pMDI use.

Results: A total of 174 patients, 118 (67.4%) of which are asthmatics while 56 (32%) are COPD patients, were involved. A total score of 8 was achieved by 21 of the asthma patients and 3 of the COPD patients. 154 (88%) of all the patients owned a LVS but only 100 (57.5%) of all the patients used the LVS with pMDI regularly.

Conclusion: This study shows that despite the fact that it is a well-known fact that appropriate drug delivery is key to controlling Asthma and COPD, patients still tend to have poor pMDI technique hence the need for patient education with repeated assessment of the technique in follow-up clinics and prior to discharge.

Key words

inhaler technique, Metered dose inhaler, patient education

Introduction

Asthma and Chronic Obstructive Pulmonary Disease (COPD) are among the most common chronic diseases that lead to recurrent hospital admissions and presentations to the local health centres (LHC). Asthma is a chronic inflammatory disorder associated with airway hyper-responsiveness leading to airflow obstruction that is reversible.¹ COPD, on the other hand, is a chronic obstructive disorder that is treatable and preventable in which airflow remains persistently decreased. In COPD, lung function deteriorates progressively. COPD is the 4th leading cause of death worldwide, according to the World Health Organisation,² even though it is a preventable and treatable disease.³ Both disorders are treated mainly with inhaled medications in several forms, including the pressurized Metered Dose Inhaler (pMDI). Unfortunately, appropriate delivery of the chosen drug depends heavily on the patient's inhaler technique. Both the Global initiative for Asthma (GINA) and the Global Initiative for Chronic Obstructive Lung Disease (GOLD) suggest that the correct use of inhalers is an important feature in preventing exacerbations of both asthma and COPD. Several studies have shown that poor use of the inhaler device is a main feature in poorly controlled disease.⁴⁻⁹ The pMDI is one of the most commonly used device in management of asthma and COPD. This can unfortunately be difficult for patients to use and even with repeated demonstration and assessment some patients will still find co-ordination of the whole technique challenging, failing to master it despite repetition.¹⁰

A study performed locally states that 244 asthmatic patients (from a population of >400,000) presented to the emergency department with an acute exacerbation of asthma over a 10 month period, from January to October, of which 51.6% needed medical admission and 8.6% discharged themselves against medical advice.¹¹ Sub-optimal disease control has a negative impact on patient's quality of life, health care costs and a burden on society when this leads to, for example, increased absence from work. This study was aimed at finding out whether there is any statistically significant difference

Lara Angelle Micallef M.D.
University Collage of London
London

lara.a.micallef@gmail.com

between patients who were admitted to hospital as opposed to those who attended regular outpatient clinic and were never admitted to hospital. The pMDI used in combination with the large volume spacer was the technique assessed in this study.

Method

This study was conducted from April to November 2013 in Mater Dei Hospital (MDH). Patients were recruited from the asthma clinic, the lung function lab and from the medical wards of MDH. Only the patients suffering from asthma and COPD using the pMDI were involved in the study. There is no patient duplication as patients were randomly assessed on different days. Patients from the wards were recruited by checking the hospital treatment charts and their past medical history. No other inhaler type technique was assessed.

Box 1: Checklist of 8 steps used to assess the inhaler technique

Checklist for MDI with LVS technique

1. Shaking the inhaler
2. Locking the lips appropriately around the mouth piece
3. Exhale fully prior to pressing the canister
4. Holding the MDI between the index and thumb and pressing the canister
5. Inhaling via the spacer as soon as the canister is pressed
6. Taking a deep breath slowly and deeply in
7. Holding the inhaled air for 5 – 10 seconds after
8. Re-shaking the inhaler for the second puff

The assessment was done through a formulated questionnaire, which was filled in by an interviewee at the bedside or at the outpatient clinic. The questionnaire (see Appendix) included an assessment of the inhaler technique through a checklist of 8 key steps (Box 1) ticked while the patients demonstrated how they used their inhaler. A score out of 8 was recorded for each patient. Patients were informed of the purpose of this questionnaire and consented prior to asking them the questions. A small number of patients on the wards had to be excluded from the study either due to the fact that a nurse or carer did the inhaler for them or because they were too ill to be interviewed. Most patients did not have their large volume spacer (LVS) with them at the time of interview especially the ones attending the

outpatient clinic. These patients were still asked to demonstrate and explain how they would use it.

Results

A total of 174 questionnaires were collected and analysed. The age range was from 16 – 97 years. 118 (67.4%) of the patients had asthma while 56 (32.0%) had COPD. Of the inpatients, 40% were asthmatics and 60% were COPD patients. 86.5% of the outpatient clinic patients were asthmatics and 13.5% were COPD patients.

Tables below show the age groups of the patients suffering from asthma and COPD respectively and the number of these patients who were admitted at the time of the study. It is clear that most of the inpatients suffering from either disease are over 60 years of age.

Table 1: Number of patients in the different age groups who were involved in the study and the number of patients who were admitted at the time of survey.

Asthma patients		
Age groups	No. of patients	No. of inpatients
10 - 20	11	0
21 - 30	9	2
31 - 40	9	1
41 - 50	9	1
51 - 60	24	4
61 - 70	28	6
71 - 80	20	8
81 - 90	8	6
Totals:	118	28 (24%)

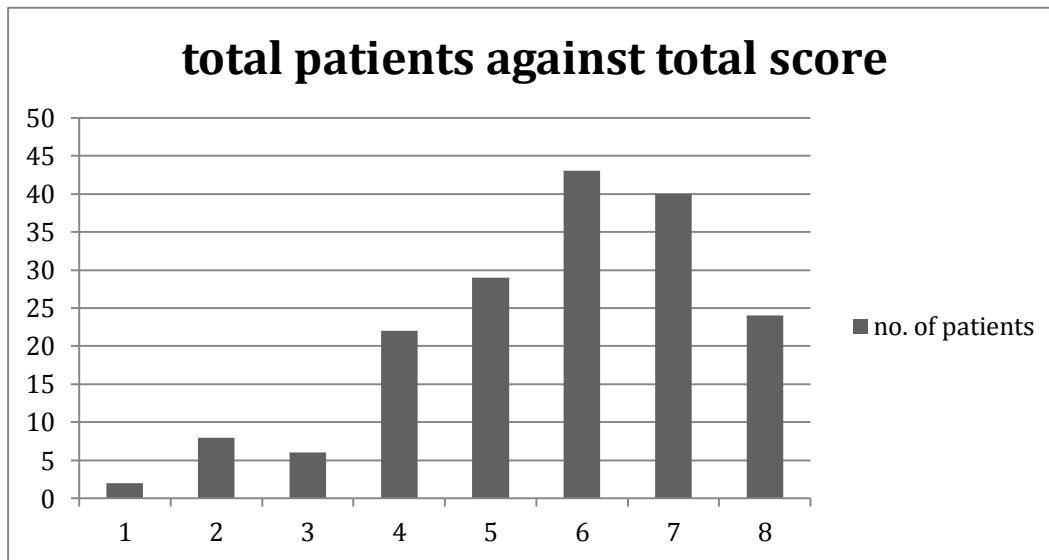
COPD patients		
Age groups	No. of patients	No. of inpatients
41 - 50	1	1
51 - 60	6	2
61 - 70	17	11
71 - 80	18	16
81 - 100	14	12
Totals:	56	42 (75%)

The patients were also asked whether or not they have a large volume spacer and whether they use it regularly with their pMDI. Results are shown in the table below. As, shown in Graph 1, only 24 (13.7%) of the patients involved managed to score a total of 8. 40 (22.8%) scored a 7 out of 8 showing that they could nearly do the inhaler rather well but the rest, 111 (63.5%) patients scored 6 or less. The most common score in COPD patients was 4 (21.4% of the COPD patients) while in asthmatics the most common score was 6 (27.1% of the asthmatic patients) as shown in Graph 2.

Table 2: Summary of the number of patients who own a LVS and the percentage of them who actually use the LVS regularly

Asthma			COPD		
Age groups	Owns a spacer	% of patients who own a spacer and always use it	Age groups	Owns a spacer	% of patients who own a spacer and always use it
10 - 20	10 (91%)	60%	41 - 50	1 (100%)	100%
21 - 30	7(78%)	43%	51 - 60	5(83%)	60%
31 - 40	9(100%)	78%	61 - 70	15(88%)	67%
41 - 50	8 (89%)	63%	71 - 80	18(100%)	44%
51 - 60	23(96%)	70%	81 - 100	10(71%)	50%
61 - 70	23(82%)	78%			
71 - 80	19(95%)	63%			
81 - 90	6(75%)	100%			

Graph 1: Graph showing the total number of patients (both COPD & Asthma) against the total score achieved



Graph 2. Graph showing asthmatic and COPD patient percentage across all age groups against total score acquired on assessment

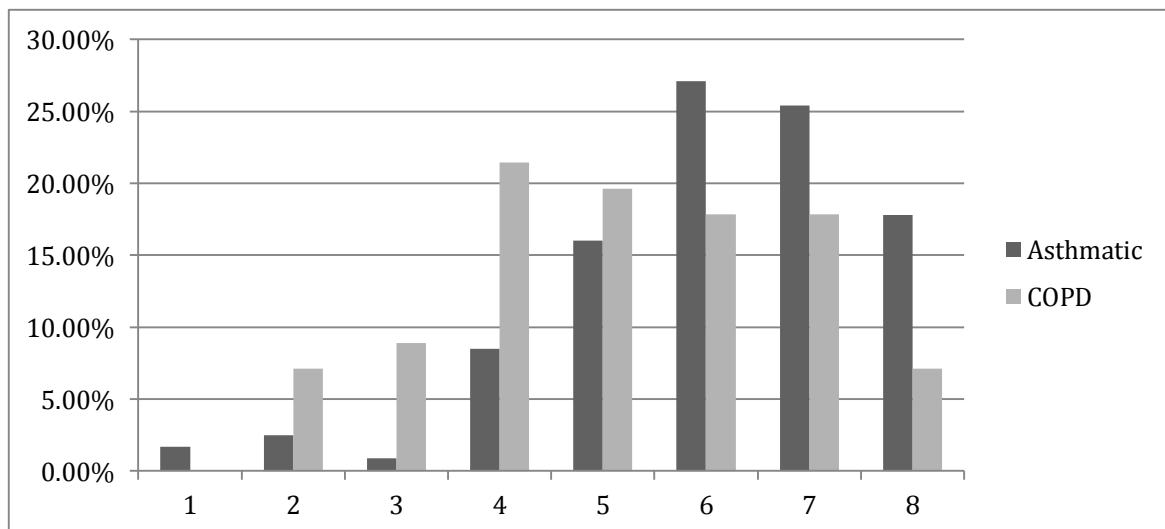


Table 3: The highest score obtained by the asthma patients in each age group with the percentage of patients who managed to obtain that score and the commonest score for each age group with the percentage of patients who obtained that score

Asthma				
Age groups	Highest score obtained	% of patients who obtained the highest score	Most common score obtained (out of 8)	% of patients with the commonest score
10 - 20	8	9%	7	36%
21 - 30	8	22%	4	33%
31 - 40	8	22%	7	33%
41 - 50	8	11%	6	44%
51 - 60	8	38%	8	38%
61 - 70	8	7%	6	36%
71 - 80	8	20%	6	35%
81 - 90	7	13%	6	14%

Table 4: The highest score obtained by the COPD patients in each age group with the percentage of patients who managed to obtain that score and the commonest score for each age group with the percentage of patients who obtained that score

COPD				
Age groups	Highest score obtained	% of patients who obtained the highest score	Most common score obtained (out of 8)	% of patients with the commonest score
41 - 50	5	100%	N/A	N/A
51 - 60	8	17%	6	33%
61 - 70	8	12%	7	24%
71 - 80	7	28%	7	28%
81 - 100	7	8%	4	36%

Table 3 and Table 4 summarise the scores obtained according to the age group for asthma and COPD patients separately. 9(38%) asthmatic patients aged between 51 and 60 obtained a full score of 8. The COPD patients had overall very poor scores and only 3 obtained the full score.

Out of the 8 steps that were checked, most patients did not exhale prior to pressing the canister in preparation for a deep inhalation. 109 (62.6%) of all the patients missed this step. Re-shaking the inhaler before the second puff and taking a deep breath slowly were other two very commonly missed steps, with 40.5% and

39.4% respectively.

Another aspect that was considered in this study is the patients' perception of how well they can use their inhaler and LVS. 163 (93.6%) patients rated their inhaler technique at 7 or more out of 10 (10 being the highest mark).

Discussion

An inappropriate inhaler technique tends to be a significant feature in patients suffering from asthma or COPD needing hospital admission or frequent nebulised bronchodilators from the LHC. The main aim was to get

a picture of the local situation, as so far there is not much local data on this matter. A similar study published in 2005 regarding the paediatric population showed that only 17% of the patients had a poor technique.¹² In this small study, 38.5% of the patients scored less than 6 indicating that a significant amount of patients do not use their inhaler appropriately. This is a known cause of repeated admissions.

The need to collect more data on the local situation is all too evident, as is the importance of better patient education, which can prevent morbidity and mortality in these patients, embitter their quality of life and, just as importantly, aid cost-reduction and effectively reduce the burden on the local health-care system.

Patients should have their inhaler technique assessed repeatedly. Patient education is the main tool to target this problem. Programmes and different methods can be used to explain to patients and ensure improvement in technique, ultimately enabling patients to master the proper method. Moreover, even if a patient does on one occasion demonstrate that the proper technique has been grasped, regular re-assessment is important and recommended as patients have been shown to lose the adequate technique over time.¹⁰ Inhaler technique, as well as the aerosolised particle size, are main factors in particle deposition within the lungs.¹³

Two teaching strategies – the brief intervention and the teach-to-goal methods were investigated by Press *et al.* (2012), with the teach-to-goal method having been found to be the most effective method overall. This approach involves repeated demonstration and allowing the patient to demonstrate it back thus enhancing the memory on allowing the patient to “teach it back” to the healthcare professional.¹⁴ A study by Cordina *et al.* (2001) indicated that pharmacist intervention in monitoring asthma management in general was well received by the patients involved and had good influence on the patients’ inhaler technique.¹⁵

While performing the questionnaires for this study it was noted that most of the patients, especially the inpatients, had a low level of literacy. No statistical evidence was recorded, but on asking whether a leaflet with written instructions on how to use the pMDI would help, 47.1% of them said that it would be of no use to them as they would not be able to read this. In fact, patients with a low level of education tend to have poorer inhaler technique – illiteracy being a proven impediment in the management of asthma and COPD.^{16–19} This further shows the importance of verbal explanation.

The patient has to co-ordinate a number of steps which may be difficult, especially in the elderly who may have better delivery with the use of a LVS.²⁰ The pMDI is the most commonly used inhaler device in the elderly population.¹⁸ Several studies that correlate age to

the appropriateness of the inhaler technique show the elderly tend to have poorer skill.^{21–25} In this study, when age is correlated to the total score, there is a rather weak negative correlation between the two ($r = -0.234$).

The type of inhaler used in a patient should be tailored to his/her ability, age and need. The patient’s capacity to use the particular inhaler should be taken into consideration by the prescribing physician.⁸ Exhaling, pressing the canister and inhaling are the main three steps that need to be co-ordinated in chronological order for optimal delivery. In this particular study it was shown that most patients tend to not exhale in preparation for a deep inhalation. There seems to be a misconception among patients on how the necessary drug gets to its target organ.

Another point highlighted in this study is the patients’ perception on how well they can use their MDI. Most patients over estimate how good their inhaler technique is. In fact when considering the actual scores and the self-rating values there is a substantial difference. 93.6% of the patients gave themselves high marks, that is 7-10 out of 10, for their inhaler technique when in actual fact only 36.8% got a good score, that is 7-8 out of 8, for their technique on assessment. This is also shown in other studies which indicate that the correlation between patient’s perception and actual performance is poor.^{10, 21} This highlights the fact that even patients who have been using their inhaler for a long time need continuous reviewing of their technique.

While the present study is indicative and does provide a valuable insight into the local situation (especially on consideration of the fact that up till now no other similar studies have been conducted locally), it also suffers from a number of limitations. One of the main limitations is the sample size. This study was not performed on a large scale. Neither was it performed over a long period of time. Another limitation is the fact that not enough demographic data was documented. Gender, occupation and level of education were not recorded. These could have shown which sector of the population is most at risk of repeated admissions and which patients need to be focused on the most. Also the questionnaire used is not a validated standard questionnaire.

Conclusion

Despite the well-known fact that a good pMDI technique is of utmost importance, patients still tend to have a relatively poor technique. Overall this study highlights the need for continuous patient education when it comes to appropriate drug delivery in Asthma and COPD and serves as a reminder to clinicians in general of the importance to monitor inhaler technique often. It might be a good idea to device programmes catering for different patients with different needs and possibly training specialised nurses, pharmacists and

GPs to monitor this technique. Well-targeted programmes can go a long way towards improving the inhaler technique, thereby decreasing the morbidity and mortality in these two treatable, preventable and controllable diseases.¹⁵ This study also emphasises the need for more local statistics to give us healthcare professionals a clearer picture of the severity of these two very common illnesses, this with the ultimate aim of improving the asthmatic or COPD patient's quality of life.

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References:

- Global Initiative for Asthma *Global strategy for asthma management and prevention*, 2012. Available from: <http://www.ginasthma.org/documents/4> [Accessed on: 30th November 2013]
- World Health Organisation, 'Top 10 Causes of Death' 2000 – 2011. Available on: www.who.int/mediacentre/factsheets/fs310/en/index.html [Accessed on: 30th November 2013]
- Global Initiative for Chronic Obstructive Lung Disease *Global Strategy for the Diagnosis, Management and Prevention of COPD*, 2014. Available from: <http://www.goldcopd.org/> [Accessed on: 30th November 2013]
- AL-Jahdali H, Ahmed A, AL-Harbi A, Khan M, Baharoon S, Bin Salih S, et al. Improper inhaler technique is associated with poor asthma control and frequent emergency department visits. *Allergy, Asthma & Clinical Immunology*. 2013; 9:8-14
- Giraud V, Roche N. Misuse of corticosteroid metered-dose inhaler is associated with decreased asthma stability. *European Respiratory Journal*. 2002; 19(2):246-51
- Melani AS, Bonavia M, Cilenti V, Cinti C, Lodi M, Martucci P. Inhaler mishandling remains common in real life and is associated with reduced disease control. *Respiratory Medicine*. 2011; 105(6):930-8.
- Lenney J, Innes JA, Crompton GK. Inappropriate inhaler use: assessment of use and patient preference of seven inhalation devices. *Respiratory Medicine*. 2000; 94(5):496-500.
- Dolovich MB, Ahrens RC, Hess DR, Anderson P, Dhand R, Rau JL, et al. Device Selection and Outcomes of Aerosol Therapy: Evidence-Based Guidelines. (American College of Chest Physicians/American College of Asthma, Allergy, and Immunology) *Chest Journal*. 2005 Jan; 127:335–371.
- Molimard M, Le Gros V. Impact of Patient-Related Factors on Asthma Control. *Journal of Asthma*. 2008; 45(2): 109-113.
- Virchow JC, Crompton GK, Dal Negro R, Pedersen S, Magnan A, Seidenberg J, Barnes PJ. Importance of inhaler devices in the management of airway disease. *Respiratory Medicine*. 2008; 102(1):10-9.
- Gouder C, Micallef J, Ascjak R, Preca JF, Pullicino R, Montefort S. A local perspective to asthma management in the accident and emergency department in Malta. *Lung India*. 2013; 4:280-5.
- Vella C, Grech V. Assessment of use of spacer devices for inhaled drug delivery to asthmatic children. *Pediatric Allergy Immunol*. 2005; 16: 258-261.
- Cochrane MG, Bala MV, Downs KE, Mauskopf J, Ben-Joseph RH. Inhaled corticosteroids for asthma therapy: patient compliance, devices, and inhalation technique. *Chest*. 2000; 117(2):542-50.
- Press VG, Arora VM, Shah LM, Lewis SL, Charbeneau J, Naureckas ET, et al. Teaching the Use of Respiratory Inhalers to Hospitalized Patients with Asthma or COPD: a Randomized Trial. *Journal of General Internal Medicine*. 2012; 27(10): 1317–1325.
- Cordina M, McElnay JC, Hughes CM. Assessment of a Community Pharmacy-Based Program for Patients with Asthma. *Pharmacotherapy*. 2001; 21(10):1196–1203.
- Flor Escriche XRMM, Gallego Alvarez L, Alvaraz Laque I, Juvanteny G, Fraga Martinez M et al. Do our asthma patients still use inhalers incorrectly? *Atecion Primaria*. 2003; 32:269-74.
- Hashmi A, Soomro JA, Memon A, Soomro TK. Incorrect Inhaler Technique Compromising Quality of Life of Asthmatic Patients. *Journal of Medicine*. 2012; 13:16-21.
- Williams MV, Baker DW, Honig EG, Lee TM, Nowlan A. Inadequate literacy is a barrier to asthma knowledge and self-care. *Chest* (1998) 114:1008-1015.
- Richards JR, Luskin MJ, Krivoshto IN, Derlet RW. Improving Metered Dose Inhaler technique in the Emergency department: A prospective study. *Western Journal of Emergency Medicine*. 2004; 5(2): 27-33.
- Ho SF, O'Mahony MS, Steward JA, Breay P, Burr ML. Inhaler technique in older people in the community. *Age and Ageing*. 2004; 33(2): 185–188.
- Batterink J, Dahri K, Aulakj A, Rempel C. Evaluation of the Use of Inhaled Medications by Hospital Inpatients with Chronic Obstructive Pulmonary Disease. *Canadian Journal of Hospital pharmacy*. 2012; 65(2) 111-118.
- Molimard M, Raheison C, Lignot S, Depont F, Abouelfath A, Moore N. Assessment of handling of inhaler devices in real life: an observational study in 3811 patients in primary care. *Journal of Aerosol Medicine*. 2003; 16(3):249–254.
- Van Beerendonk I, Mesters I, Mudde AN, Tan TD. Assessment of the inhalation technique in outpatients with asthma or chronic obstructive pulmonary disease using a metered-dose inhaler or dry powder device. *Journal of Asthma*. 1998; 35(3):273–279.
- Wieshammer S, Dreyhaupt J. Dry powder inhalers: which factors determine the frequency of handling errors? *Respiration*. 2008; 75(1):18–25.
- Goodman DE, Israel E, Rosenberg M, Johnston R, Weiss ST, Drazen JM. The influence of age, diagnosis, and gender on proper use of metered-dose inhalers. *American Journal of Respiratory and Critical Care Medicine*. 1994; 150(5 Pt 1):1256–1261.

Appendix:

Questionnaire:

- 1) Age:
- 2) Inpatient/Outpatient
- 3) Diagnosis: Asthma/COPD
- 4) Attends regular asthma/lung clinic: yes/no
- 5) Do you have a spacer? Yes/no
- 6) Do you use the spacer with your MDI? Always/often/sometimes/never
- 7) Do you think you know the technique well enough? Rate from 1 – 10
 1 2 3 4 5 6 7 8 9 10

8) Inhaler technique: (tick 1 for every correct move)

- Shaking the inhaler
- Locking the lips appropriately around the mouth piece
- Exhale fully prior to pressing the canister
- Holding the MDI between the index and thumb and pressing the canister
- Inhaling via the spacer as soon as the canister is pressed
- Taking a deep breath slowly and deeply in
- Holding the inhaled air for 5 – 10 seconds after
- Re-shaking the inhaler for the second puff

Total score: