

## EVALUATING THE TECHNIQUE OF USING INHALATION DEVICE (MDI) WITHOUT HOLDING CHAMBER/SPACER IN ASTHMA AND CHRONIC OBSTRUCTIVE PULMONARY DISEASE

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### Abstract

**Background:** Both asthma and Chronic Obstructive Pulmonary Disease (COPD) are best treated with the use of aerosolized drugs delivered directly into the airways via various devices. The most commonly used device still is a press and breath Metered Dose Inhalers (MDI). Most people find it difficult to carry a holding chamber/spacer and usually prefer to use MDI without it. Although MDIs are cheap and their use is simple, the users need to understand and practice the various simple steps properly for optimal drug delivery. Suboptimal use of the device may result in poor drug delivery into the airway, increased inhaler use, decreased bronchodilation, reduced patient's adherence to the treatment regimen and poor disease control. The objective of this study was to evaluate and analyse inhalation technique used by patients with asthma and COPD in a tertiary care center. **Materials and Methods:** This study was carried out at the out-patient department of the chest unit at Bhima Bhoi Medical college Bolangir, odisha between June 2017 and November 2017. Two hundred consecutive patients using MDIs were requested to demonstrate their inhaler technique. Patients' MDI inhaler technique was recorded against standardized twelve step checklist and analyzed. **Result:** Of the total 200 enrolled participants, 136 (74%) had erroneous MDI use technique. Of those with sub-optimal technique, majority (77%) failed to demonstrate breathing in slowly filling lung with medication following actuation of MDI. 68% were unable to demonstrate ability to hold breath for 10 seconds or as per their tolerance. 64% failed to take a break for 30-60 second before next actuation. Other less common errors included not breathing out fully before holding MDI in mouth, failure to shake inhaler up and down before use and inappropriate pressing of canister for actuation. **Conclusion:** Majority of the patients using MDI devices (without holding chamber/ spacer) make errors while using the device compromising drug delivery in airways. When prescribing MDIs, proper training in its use must be ensured.

## INTRODUCTION

Inhaled medications are the mainstay of treatment in the management of obstructive airways diseases. Drugs reach in high concentration at desired site without systemic side effects. The drug deposition in airways is determined by multiple factors including the device used, aerosol formulation, particle size, use of a spacer, especially with metered-dose inhalers (MDI) and patient's inhalation technique. Various devices to deliver drugs into the airways are available. Press and breath MDIs are

the most commonly used device for administering aerosolized drugs. Their effectiveness can be compromised if the inhalers are not used correctly. Proper use of inhaler must be taught to individuals on one-to-one basis. Prescribers must ensure that MDI is best suited to the patient and the user is able to understand and perform the steps correctly. Uncorrect use of inhalers is commonly seen and has resulted in poor treatment outcomes. It may also lead to loss of faith in effectiveness of inhaled therapy and unnecessary escalation of therapy.<sup>[1,2]</sup>

## MATERIALS AND METHODS

This is a cross-sectional observational study. It was conducted at the out patients department of Bhima Bhoi medical College and Hospital. The study population consisted of 200 consecutive ambulatory patients using any MDI without holding chamber/spacer for either asthma or COPD. Before the patients saw their doctor, a nurse took consent and participants were enrolled in study. Following enrollment, they were asked 'please show me exactly how you use your MDI (without spacer) at home'. Those who did not have their own inhaler were provided a placebo. Patient's inTwelve step check list Yes No 1 Removes caps of inhaler 2 Shakes inhaler up and down 3 Breathes out fully 4 When breathing out fully, does so away from MDI 5 Puts MDI mouthpiece into mouth, closes lips around mouthpiece 6 Presses down on canister one time 7 Breathes in SLOWLY, filling lungs with medicine 8 Holds breath for at least 10 seconds (with or without inhaler in mouth) 9 Removes MDI from mouth before breathing normally 10 Breathes normally for at least 30-60 seconds 11 Repeats steps 2-10 for second puff 12 Rinse mouth (if using a steroid medication)haler technique was recorded against standardized 12 step checklist.

## RESULTS

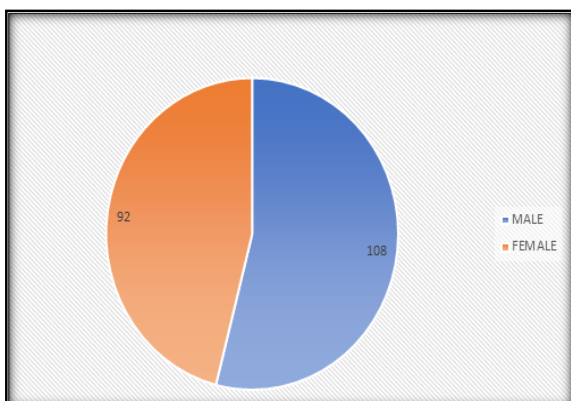


Figure 1: Gender distribution of study cases

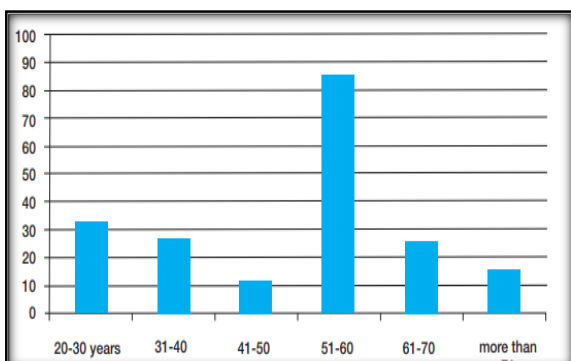


Figure 2: Age distribution of the presenting cases

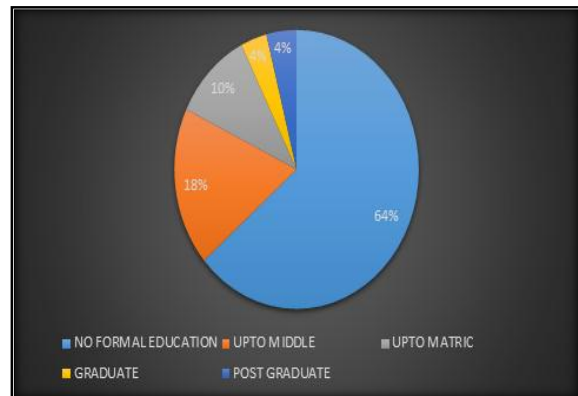


Figure 3: Education of study cases status

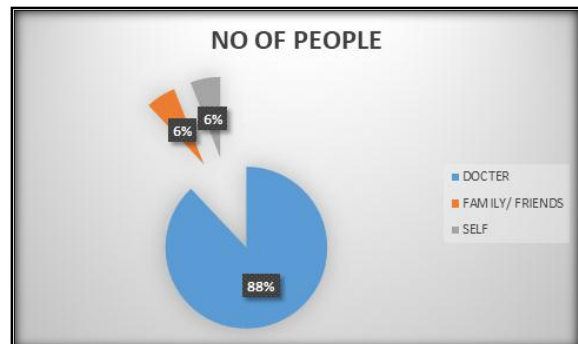


Figure 4: Prescription status of Inhaler

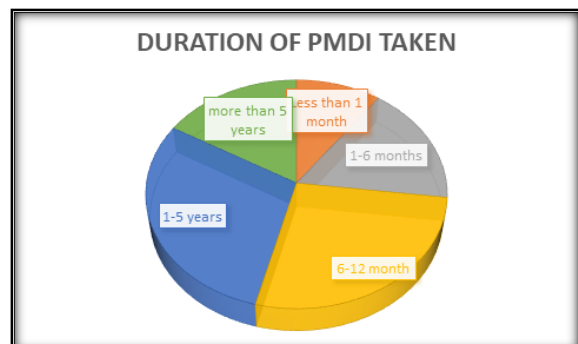


Figure 5: Duration of MDI use among study population

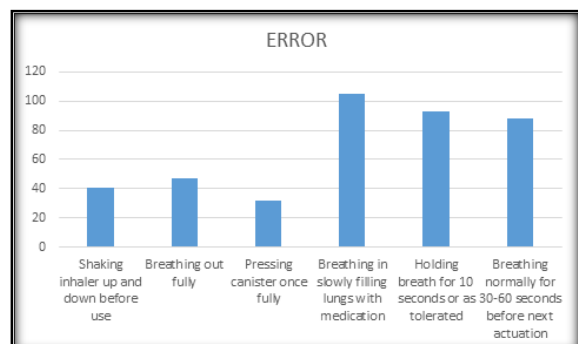


Figure 6: Distribution of errors among participants not using MDI optimally n=136

Amongst the 200 selected participants, 84(42%) were men and 116 (58%) were women [Figure 1]. The overall mean age was 56 years (range: 22-82 years) [Figure 2]. 124 (62%) had no formal education.58 (29%) had some form of formal

education. There were 7 (3.5%) graduates and 8 (4%) postgraduates amongst the study population [Figure 3]. 176 (88%) were prescribed inhalers by a doctor. 24 (23%) were using an MDI either on advice of a family member or friend or on their own initiative [Figure 4]. 113 (56.5%) were using MDI inhaler for more than six months (Figure 5). Majority (56%) were trained in use of MDI by the doctor who initially prescribed inhaler. 12% had no formal training (self-trained) and 13% learnt technique from family/friend familiar with inhaler use [Figure 6]. Only 64 (32%) were using MDIs optimally and 136 (74%) had erroneous technique

for various reasons. Of those who used inhalers sub-optimally, 105 (77%) failed to breath in slowly filling in lungs with medication following actuation of MDI. 93 (68%) failed to demonstrate breath holding for 10 seconds or as much as they could tolerate. 88 (64%) did not breath normally for 30 -60 seconds before next actuation. The error of not breathing out fully away from MDI prior to pursing lips around MDI was recorded in 47 (34%). Not shaking inhaler up and down before use and failure to press canister once adequately accounted for 41(30%) and 32 (24%) errors respectively [Figure 7].

**Table 1: Demographic details of the patients**

		Count	Column N %
Sex	F	13	50%
	M	13	50%
Age group	<20	4	15.4%
	21-30	3	11.5%
	31-40	3	11.5%
	41-50	7	26.9%
	51-60	5	19.2%
	>61	4	15.4%

**Table 2: Radiological findings**

	Frequency	Percentage
Calculus	4	15.4%
Obstructive Calculus	3	11.5%
Cyst	7	26.9%
Infiltrating lesion	1	3.8%
Calculus & Cyst & Ureteral wall thickening	3	11.5%
Calculus & Ureteral wall thickening	1	3.8%
Obstructive Calculus & Cyst	1	3.8%
Obstructive Calculus & Ureteral wall thickening	4	15.4%
PUJ Obstruction & Infiltrating lesion & Stricture	1	3.8%
PUJ Obstruction & stricture	1	3.8%

**Table 3:**

CT scan		Noncontrast MR Urography		Total
		Present	Absent	
Obstructive Calculus < 3mm	Present	2	1	3
	Absent	0	0	0
Obstructive Calculus 3 - 3.5 mm	Present	4	0	4
	Absent	0	0	0
Obstructive Calculus > 3.5 mm	Present	4	0	4
	Absent	0	0	0
Non-obstructive Calculus < 3mm	Present	0	10	10
	Absent	0	1	1
Non-obstructive Calculus 3 - 3.5 mm	Present	0	1	1
	Absent	0	0	0
Non-obstructive Calculus > 3.5 mm	Present	5	0	5
	Absent	0	0	0

**Table 4:**

CT scan		Non-contrast MR Urography		Total
		Present	Absent	
PUJ Obstruction	Present	4	0	4
	Absent	0	0	0
Cyst	Present	12	0	12
	Absent	0	0	0
Infiltrating lesion	Present	1	0	1
	Absent	1	0	1
Ureteral wall thickening	Present	3	0	3
	Absent	0	0	0
Stricture	Present	3	0	3
	Absent	1	0	1

## DISCUSSION

Obstructive airways diseases are best treated with inhaled therapy. This method of drug delivery is not only very effective but also gives fewer side effects compared to systemic therapy. Although other delivery devices are also available in market, the MDIs are most commonly used. It is of paramount importance that whenever MDIs are prescribed, it must be ensured that the user is trained in its use. Failure to use inhaler properly and in its result, failure to control disease may lead to false belief in lack of effectiveness of inhalers.<sup>[3,4]</sup> In our study we enrolled patients before seeing the doctor in clinic to assess patients' prior knowledge and skill of using inhaler. Those participants with faulty techniques were trained in proper use of inhaler once the study data was collected. We did not look for any improvement in technique following the use of a spacer. We found that the mean age of our study population was 56 years. With increasing age learning new skill may prove difficult. Also problems with dexterity, arthritis, muscle weakness, impaired vision etc may cause hurdle in proper use of inhalers as has been noted in other studies.<sup>[5]</sup> Also we found that more than half of study population had no formal education and this could have contributed towards their poor understanding of disease and proper use of prescribed MDI. Although, one may argue that the skill of using an MDI does not need high level of intellect and highly educated people may also find it difficult to use MDIs. Previous studies have found that common mistakes in following the steps for proper use of MDI results in poor drug delivery. Errors in failure to shake inhaler before use, keeping canister upside down, failure to breath out, taking slow breath in and holding it, not resting for 30-60 seconds before second actuation have all been reported.<sup>[6]</sup> All the participants of the study did remove the cap of the inhaler before use. Shaking inhaler before use was lacking in (41) 30% participants. Shaking is advisable for proper mixing of drug before actuation of MDI to ensure delivery of a therapeutic dose. It is observed that failure to shake inhaler may reduce the drug dose by 36%.<sup>[7]</sup> In two similar studies, one from Karachi, Pakistan and other from Brazil, patients did not shake MDI prior to use in 20% cases.<sup>[7]</sup> Exhalation to get rid of maximal air from lung in order to be able to breath medicated air in is an important step. 47(34%) of our participants failed to perform this important step satisfactorily. In a study from Texas failure to exhale was also found to be the most common missed step as about 66% patients. After 8 exhalation the next step was to hold the inhaler in mouth and then activating the device by pressing canister while simultaneously taking slow deep breath in.<sup>[8]</sup> This very important step also could not be performed optimally by majority (77%) of our participants. This proved to be the most common error in our study. Similarly, from

Nigeria a study also concluded that synchronous activation of inhaler and breathing in deeply and slowly could not be performed in majority of their patients. Similar were the findings from a study from Pakistan where 41% participants were unable to take this step correctly.<sup>[9]</sup> Next step was to hold the breath for 10 seconds. In our study 93 (68%) could not do so. In two different studies this step could not be performed well in 42 and 26% of study population. Once the first puff is inhaled correctly, it is recommended that patient takes normal breath for 30-60 seconds before taking the next puff.<sup>[10]</sup> 88 (64%) of our participants did not wait for this duration. They either pressed canister twice initially or pressed the canister second time without breathing normally for 30-60 seconds in between. The gap between two puffs is essential. This helps patient to get ready for the second puff and also helps better drug deposition. 24% of a study population from Pakistan and 80% from Saudi Arabia did not take gap between 30-60 seconds before taking second puff.<sup>[11-13]</sup> We also noticed in our study that 24 (12%) were self-trained and 25 (13%) were trained by their friends or family members. If training is provided by a physician or pharmacist, the risk of committing error is less. If you are self-trained or get training from someone not familiar with correct technique, the chances are you may miss some essential steps and may not get optimal drug delivery.<sup>[14,15]</sup> This study confirmed the fact that a vast majority of patients fail to follow all the steps necessary to use MDIs optimally. Although the MDIs are simple, cheap and effective but learning the skill of its proper use is tricky, time and resource consuming. Out of all the drug delivery devices now available in market, if MDI is prescribed, proper training in its use must be provided. On every patient's encounter with a health care professional the inhaler technique must be checked and if any errors are found they must be rectified.

## CONCLUSION

The use of MDIs, though appears very simple but it requires good understanding of the technique of its use. Failure to perform even one step correctly may evaluate the technique of using inhalation device (MDI) without holding chamber/spacer in asthma *PJCM* 2018; 24 (4) 196 result in failure or reduction in the efficacy of inhaled therapy. It is therefore advised that every opportunity should be utilized to ensure that the inhaler is being used correctly before escalation or change of therapy is considered.

## REFERENCES

1. 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 Clin Immunol*. 2013; 9: 8.

2. Melani Andrea S, Bonavia M, Cilenti V, Cinti C, Lodi M, Martucci P, et al. Inhaler mishandling remains common in real life and is associated with reduced disease control. *Respir Med.* 2014;105:930-8.
3. Brocklebank D, Ram F, Wright J, Barry P, Cates C, Davies L et al. Comparison of the effectiveness of inhaler devices in asthma and chronic obstructive airways disease: a systematic review of the literature. *Health Technol Assess* 2001; 5(26):1-149.
4. Giraud V, Roche N. Misuse of corticosteroid metered-dose inhaler is associated with decreased asthma stability. *Eur Respir J.* 2002;19:246-51.
5. Franks M, Briggs P. Use of a cognitive ergonomics approach to compare usability of a multidose dry powder inhaler and a capsule dry powder inhaler: an open-label, randomized, controlled study. *Clin Ther.* 2004; 26: 1791-9.
6. Rau JL. Practical problems with aerosol therapy in COPD. *Respir Care.* 2006;51:158-72.
7. Muhammad Zain Farooq, Muhammad Saad Farooq et al: Assessment of inhalation technique among patients of chronic respiratory disorders in Civil Hospital Karachi: A cross sectional study. *JPM* 66: 1502; 2016
8. Bonds Rana S, Asawa A, Ghazi A. Misuse of medical devices: a persistent problem in selfmanagement of asthma and allergic disease. *Ann Allergy Asthma Immunol.* 2015;114:74-6.e2.
9. Pauwels R, Newman S, Borgström L. Airway deposition and airway effects of antiasthma drugs delivered from metered-dose inhalers. *ERJ.* 1997; 10: 2127-38.
10. Onyedum C, Desalu O, Nwosu N, Chukwuka C, Ukwaja K, Ezeudo C. Evaluation of inhaler techniques among asthma patients seen in Nigeria: an observational cross sectional study. *Ann Med Health Sci Res.* 2014; 4:67-73.
11. Everard ML, Devadason SG, Summers QA, Le Souëf PN. Factors affecting total and "respirable" dose delivered by a salbutamol metered dose inhaler. *Thorax.* 1995; 50: 746-9.
12. Wvsthma.org, (2015). Metered Dose Inhaler with Spacer. [online] [cited 2015 March 13]; Available from: URL: <http://www.wvsthma.org/Asthma10MeteredDoseInhalerwithSpacer-/tabid/1757/Default.aspx>
13. Abdulaziz Al-Wasil M, Al-Mohaimeed A. Assessment of inhalation technique in primary care asthmatic patients using meter-dosed inhalers with or without a spacer. *Ann Saudi Med* 2003;23(3- 4):264-9.
14. Gupta Vitull, Gupta Sonia, Jassi Yashpal, Tewari Jigyas. To study the type of inhaler devices used and errors in inhaler technique committed by patients of chronic pulmonary diseases in Punjab [http://www.japi.org/march\\_2009/respiratory\\_posster\\_sessions.html](http://www.japi.org/march_2009/respiratory_posster_sessions.html).
15. Plaza V, Sanchis J. Medical personnel and patient skill in the use of metered dose inhalers: a multicentric study. CESEA Group. *Respiration* 1998;65(3):195e8. 16) Piyush Arora, Lokender Kumar\*, et al: Evaluating the technique of using inhalation device in COPD and Bronchial Asthma patients. *Respiratory Medicine* (2014)