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Study of Correction of Inhalation Technique in the Patients of COPD/Asthma

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Abstract: *Inhaled drug delivery is the cornerstone treatment for asthma and chronic obstructive pulmonary disease (COPD). Most patients with asthma or COPD do not use their inhalers properly, and most have not checked or corrected their technique by a health professional. When incorrect inhaler technique is used then COPD/asthma symptom control is poor due to risk of severe flare-ups and hospitalisation. Incorrect inhaler technique when using inhaled corticosteroids increases the risk of side effects like dysphonia and oral thrush. Checking and correcting inhaler technique can improve COPD/asthma outcomes. So this study was planned to be undertaken to assess correction of inhalation technique in the patients of COPD/asthma. Total 150 consecutive patients on inhalation technique attending the Department of Pulmonary Medicine, Government Medical College Patiala were enrolled for the study. The study showed that commonly prescribed device was DPI, and most commonly preferred and correctly used device was also DPI. Most common device in which failure was maximum to correct the technique was MDI with spacer.*

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I. Introduction

Inhaled therapy is a mainstay in the management of asthma and COPD.[1–3] Metered dose inhalers (MDIs), dry powder inhalers (DPIs), and nebulizers are the most common inhaler devices used to administer aerosolized medication in routine respiratory practice.[1–5] With the help of different inhalation devices drugs

delivered directly to the lungs, this leading to minimal required amount of drugs for optimal desired results and minimal side effect. Majority of COPD and asthma patient do not use these inhalation devices correctly. For correct use of these devices DPI, MDI, Autohaler, Turbohaler, patient need multiple education session for learning and maintaining of inhalation technique. For correct use of pressurised MDI required simultaneously device activation and inspiration, which may be difficult for many patients. In addition the co-ordination problem in elderly patient, osteoarthritis patient, weak hands do not have the grip-strength or dexterity needed to fire the inhaler. Apart from patient issue other factor contributing towards poor inhalation technique include lack of knowledge and correct inhalation technique in healthcare professional and patient inhalation preference.
Patient should be taught the correct technique of inhalation by treating physician, every treating physician should revised the correctness of inhalation technique whenever patient come for follow up visit especially when patient is not responding to the prescribed treatment however a busy clinician do not find time to teach the technique of inhalation to the or referred it to the paramedical person's or direct the patient to follow the guidelines available on the package materials of the device so it is important that patient should be taught correct inhalation technique and to observe the correctness of inhalation technique during follow up visit.

II. Aims And Objective

- Comparison of correction of inhaler technique with various inhaler devices
- Reason for wrong technique
- Reason for failure to correct the previous used devices

III. Methods And Materials

This was a prospective study. 150 consecutive adult (age >18 yr) stable patient of COPD and asthma on inhalation therapy attending to the Department of Pulmonary Medicine, Government Medical College, Patiala at least 1 month were included. The patients were defined of having asthma or COPD according to the Global Initiative for Asthma (GINA) management and the Global initiative for Chronic Obstructive Lung Disease (GOLD) management respectively. The study was approved by institution's ethical committee. Informed consent was obtained from the patients. Initially, the use of inhalation devices was evaluated in a practical manner, by asking patients to demonstrate their inhaler technique with a placebo device. A trained pulmonary physician acquainted with proper use of inhaler devices and on how to score each step of the inhalation process audited the patient inhalation technique. The procedure was assessed through filling out a checklists form containing all steps for correct usage of different inhalation devices that has been validated in the literature for checking the use of such devices. Subsequently, patients were interviewed and demographic characteristics (age, occupation, diagnosis, treating physician specialty, type and place of inhalation devices prescribed as well as the duration of its usage) were recorded as well as questionnaires regarding patient knowledge of inhalation devices was completed some patients were using more than one type; in these cases the study was confined to one device only.

IV. Results

Total 150 patients were included in the study, out of which 76 (50.67%) were male and 74 (49.33%) were female. Average age was 50.99± 15.49 years. 69.33% out of total had asthma, while the remaining 30.67% had COPD. Demographic data and characteristics of patients, inhaled devices, and treating physicians are listed in table no. 1. DPIs were used by 64% patients. While, MDI with spacer and MDI were used by 28.67% and 7.33% of patients respectively. The percentages of mistakes per step in using MDI, MDI with Spacer and DPI are shown in table 3 – 6, respectively. Step 10: Exhale and wait 20 s for 2nd use and Step 11: Shake the inhaler before 2nd use were the most frequently committed mistakes in MDI with Spacer and Step 10 in MDI, While Step 4: Exhalation to RV was in DPI . The percentages of mistakes in these steps were 100%, 100%, and 86.46 respectively. The percentage of correct vs. incorrect use among different inhaled devices including all steps and essential steps are described in Figure: 1. the incorrect use was considered if an error in at least a single step was done. There was a non-significant statistical difference between errors committed by COPD and asthma patients when using MDI and MDI with Spacer, while P value observed in case of DPI/ Single dose was 0.538.

Table 1: Demographic and characteristic of the patients

Age (mean ± S.D) years	50.99± 15.49
Sex (M/F)	50.67/49.33
Duration in months (mean ± S.D)	41.18 ± 52.86
Diagnosis (%)	
Asthma	69.33
COPD	30.67
Type of Practice (%)	
Private	30.0
Indoor patient department	08.0
Outdoor patient department	62.0
Type of Device used (%)	
MDI	7.33
MDI with Spacer	28.67
DPI	64.0
Who taught technique (%)	
Chemist	2.66

Junior resident	17.33
Paramedical Staff	0.67
Prescribing Doctor	78.0
Paramedical staff	0.67
Other	0.67

Table 2: Comparison between an errors when using different inhalation devices at each step

Steps		MDI (11)	MDI with Spacer (43)	DPI/Single Dose(96)	P value
1	Yes	11	42	95	0.766
	No	0	1	1	
2	Yes	5	18	55	0.219
	No	6	25	41	
3	Yes	7	27	91	<0.001
	No	4	16	5	
4	Yes	8	30	13	<0.001
	No	3	13	83	
5	Yes	3	4	90	<0.001
	No	8	39	6	
6	Yes	11	40	78	0.069
	No	0	3	18	
7	Yes	9	18	55	0.041
	No	2	25	41	
8	Yes	3	13	31	0.928
	No	8	30	65	
9	Yes	4	5	31	0.029
	No	7	38	65	
10	Yes	1	0	-	0.046
	No	10	43		
11	Yes	0	0	-	-
	No	11	43		

Table 3: Percentage of mistakes per step of use in MDI

Steps	Mistakes per step (%)
1	0
2	54.55
3	36.36
4	27.27
5	72.73
6	0
7	18.19
8	72.73
9	63.64
10	90.91
11	100.0

Table 4: Percentage of mistakes per step of use in MDI with Spacer

Steps	Mistakes per step (%)
1	2.32
2	58.14
3	37.21
4	30.23
5	90.70
6	6.98
7	58.14
8	69.77
9	88.37
10	100.0
11	100.0

Table 5: Percentage of mistakes per step of use in DPI/Single Dose

Steps	Mistakes per step (%)
1	1.04
2	42.71
3	5.21
4	86.46
5	6.25
6	18.75

7	42.71
8	68.75
9	68.75

Table 6: Comparison between asthma and COPD patients who committed at least one error when using different inhalation devices

	Percentage of at least single error in usage		
	Asthma (104)	COPD (46)	P value
MDI	0/8	0/3	-
MDI with Spacer	0/26	0/17	-
DPI/Single dose	2/70	0/26	0.538

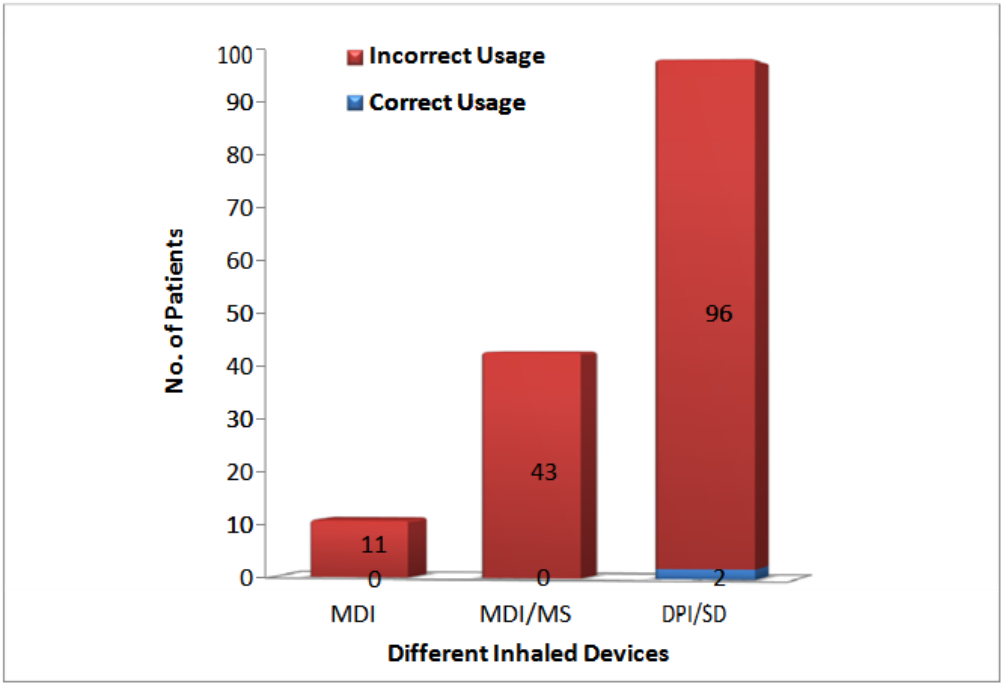

Figure 1: Correct V/S Incorrect use among different inhaled devices Discussion

In this study it was found that almost all the patients used inhaler devices incorrectly in case of MDI and MDI with Spacer while a few cases of 1.33% used correctly in case of DPI. In study by Onyedum et al [(6)] (2014) assessed the inhaler techniques among asthma patients. They concluded that majority of asthma patients use their inhalers inaccurately. Hence present study is also similar to this study. In study by Manriquez et al [(7)] (2015) determined the most common errors in among the adult patients were failing to exhale fully before using the inhaler. In our study it was observed that in case of DPI the most frequently used incorrect step was also step 4 (exhale fully before using the inhaler). W hile in case of MDI and MDI with Spacer the most frequently used incorrect step were step 10 and step 10 and 11(Step 10: Exhale and wait 20 s for 2nd use and Step 11: Shake the inhaler before 2nd use) respectively . Hence present study is also similar to study by Manriquez et al .In study by Madkour and Galal[(8)] in 2015 performed checklist audit regarding the Egyptian patients' usage technique of the inhalation devices. They concluded that improper inhaler technique is common among COPD/Asthma patients. Discrepancy between patients understanding and actual usage technique of different inhalation devices was noted. Present study is also similar to study by Madkour and Galal et al. As it was found in our study that about 98.67 % patients of COPD/asthma used inhaler devices incorrectly. In study by Pothirat et al[(9)] in 2015 concluded that the inhalation technique in COPD patients without face-to-face training was mostly unsatisfactory, especially in patients with low education levels. The Handihaler was the inhaler device associated

with the lowest technique failure, which is similar to present study. Sanchis et al[(10)] in 2016 assessed the most common errors in inhaler use over the past 40 years in patients treated with MDIs or dry powder inhalers (DPIs). They concluded that the incorrect inhaler technique is unacceptably frequent and has not improved over the past 40 years. Which is also similar to present study and pointing to an urgent need for new approaches to education and drug delivery.

Van Der Palen et al[(11)] in 2016 assessed critical errors. If the patient made errors, the investigator demonstrated the correct use of the inhaler, and the patient demonstrated inhaler use again. Fewer COPD patients made critical errors with ELLIPTA after reading the PIL vs: DISKUS, 9/171 (5%) vs 75/171 (44%); MDI, 10/80 (13%) vs 48/80 (60%); Turbuhaler, 8/100 (8%) vs 44/100 (44%); Handihaler, 17/118 (14%) vs 57/118

(48%); Breezhaler, 13/98 (13%) vs 45/98 (46%; all P<0.001). Most patients (57–70%) made no errors using ELLIPTA and did not require investigator instruction. Instruction was required for DISKUS (65%), MDI (85%), Turbuhaler (71%), Handihaler (62%) and Breezhaler (56%). Fewer asthma patients made critical errors with ELLIPTA after reading the PIL vs: DISKUS (3/70 (4%) vs 9/70 (13%), P=0.221); MDI (2/32 (6%) vs

8/32 (25%), P=0.074) and significantly fewer vs Turbuhaler (3/60 (5%) vs 20/60 (33%), P<0.001).In present study ratio is slightly different in compare to above study. In present study No. of patients used correctly inhaler devices, asthma; MDI (0/8), MDI with Spacer (0/26), DPI/single dose (2/70) and COPD; MDI (0/3), MDI with Spacer (0/17), DPI/single dose (0/26). Usmani et al **(12)** in 2018 showed an important association between inhaler errors and worsened health outcomes. Given the negative impact diminished disease outcomes impose on resource use and findings highlight the importance of achieving optimal inhaler technique, and a need for a consensus on defining critical and non-critical errors.

Present study is also similar in showing the importance of association between error In correct use of inhaler devices and disease outcome.

Ocakli et al in 2018[(13)] showed that Metered dose inhaler (MDI) was the most common type of inhaler used by a similarly high percentage of patients in both COPD (83.2%) and asthma (77.3%) groups. Failure to exhale before inhaling through device

(75.8% and 68.5% for MDIs; 73.2% and 71.8% for Aerolizer®/Handihaler®; 53.1% and 66.7% for Turbuhaler®) was the most common error in inhaler technique, in both COPD and asthma groups. Device-specific errors in inhaler techniques were more common in asthma patients as compared with COPD patients, particularly for MDIs (*P*-values ranged from 0.046 to 0.0005). In our study 69.33% out of total had asthma, while the remaining 30.67% had COPD. DPIs were used by 64% patients while , MDI with spacer and MDI were used by 28.67% and 7.33% of patients respectively. Step

10: Exhale and wait 20 s for 2nd use and Step 11: Shake the inhaler before 2nd use were the most frequently committed mistakes in MDI with Spacer and Step 10 in MDI, While Step 4: Exhalation to RV was in DPI . The percentages of mistakes in these steps were 100%, 100%, and 86.46 respectively.

V. Conclusion

In conclusion, our findings revealed that most commonly prescribed devices were DPI, MDI and MDI with spacer. Among them DPI was most commonly preferred device. DPI was also the most common correctly used device. Study revealed that MDI and MDI with spacer were the most common devices in which failure to correct the technique was observed maximum and reasons for the failure were lack of knowledge, elderly patient, weak hands do not have the grip-strength, lack of efforts by the patients(mainly old age).

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