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"ASSESSMENT OF INHALER TECHNIQUES AND ADHERENCE: A CROSS-SECTIONAL STUDY AT TERTIARY CARE HOSPITAL IN SUBURBAN SETUP".

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Abstract

Introduction: Asthma and chronic obstructive pulmonary disease (COPD) are highly prevalent chronic respiratory conditions that affect millions of people worldwide. Effective management significantly depends on patients adopting proper inhaler techniques and adherence. This study aims to observe the inhaler usage techniques and adherence in patients with asthma and COPD.

Methods: This was an observational cross-sectional study conducted by the department of pharmacology in collaboration with respiratory medicine on patients having confirmed diagnosis of asthma or COPD. In this study, we observed inhaler technique using the Modified Typical Errors Inhalational Techniques (TEIT). The patient with a TEIT score >15 was classified as the wrong user. Adherence was assessed by a predefined structured questionnaire (test of adherence to inhalers), which included 10 questions.

Results: 202 out of 218 enrolled patients were on metered dose inhalers (MDI), 13 on dry powder inhalers (DPI), and 3 were on MDI with spacers. In patients on MDI, 47 (23.27%), on DPI 6 (46.15%), and on MDI with spacer 1 (33.33%) were right users. Hence, out of 218 patients, 75.23% of the patients were wrong users as per TEIT scoring. Out of 202 MDI users, 47 (23.27%), out of 3 MDI with spacers, 1 (33.33%), and out of 13 DPI users, 2 (15.38%) patients were adherent; therefore, 77.06% were non-adherent while 22.94% were adherent.

Conclusion: 75% patients used improper inhaler techniques and 77% patients were non-adherent to the prescribed therapy, thereby indicating the need for proper communication and training to be adopted by health care professionals.

Keywords: Asthma; COPD; Inhaler Techniques; Aerosol Therapy; Adherence.

INTRODUCTION –

Asthma and chronic obstructive pulmonary disease (COPD) are acute and acute chronic medical conditions, respectively, primarily characterized by breathlessness, coughing, and shortness of breath. It is due to hyperresponsiveness, airway remodelling, and inflammation of the airways.[1]

Globally, it affects about 300 million people. In India, the prevalence of asthma affects 2% of adults and 6% of children. In 2019, the prevalence of COPD in north India was 9.4%. COPD was the third leading cause of death, and it contributed to 3.23 million deaths, with 80% occurring in low- and middle-income countries. [2-6] Studies have shown that around half of individuals with asthma and COPD either do not take their medicine at all or do not take it as prescribed. This leads to poor control of symptoms, which is a major challenge in the management of asthma and COPD. [7] In many research, it has been found that there are many contributing factors for incorrect usage techniques of inhalers, like lack of knowledge, lack of follow-up, and patients not being able to comprehend the technique told by health care professionals, as well as inadequate time on the health care side to communicate correctly about techniques.[8,9] The metered dose inhaler (MDI) and dry powder inhaler (DPI) are commonly used for asthma and COPD management, with MDI requiring breathing coordination, while DPI and MDI with spacer simplifies the operation by eliminating the need for coordination.[10,11]

When a patient follows a doctor's advice, they are said to be adhering to their treatment.[12] According to previous studies, the adherence rate among individuals with COPD is over 50%, with a range of 30-70% in the case of asthma.[13]

This study aims to observe the inhaler usage techniques and assess the adherence in patients diagnosed with asthma and COPD.

MATERIALS AND METHODS

This is a cross-sectional observational study aimed to observe aerosol therapy techniques used by patients with asthma and COPD attending Respiratory Medicine O.P.D. for different aerosol delivery devices. Assessment of inhaler techniques and adherence was done by the Department of Pharmacology. Ethical approval was obtained from the Institutional Ethics Committee (letter no. IEC/GMC, Kannauj /14). Written informed consent was taken before enrolling them as study participants.

Inclusion criteria

1. Patients aged between 18 to 60 years
2. Established patients diagnosed with Chronic Obstructive Pulmonary Disease (COPD) or Asthma.
3. Patients who were willing to participate in our study and gave their written informed consent

Exclusion criteria

1. Newly diagnosed cases
2. Patients with respiratory failure requiring admission in intensive care unit ICU
3. Patients of respiratory Tract Infection (RTI)
4. Patients with sign/ symptoms of Influenza like illness (e.g., fever, chills, malaise, non-productive cough, sore throat and rhinitis)
5. Active pulmonary tuberculosis
6. Occupational disease
7. Patients not willing to give informed consent.

We observed incorrect inhaler technique using TYPICAL ERRORS IN IHALATIONAL TECHNIQUES (TEIT), originally devised by Price et al. and later modified by Morton et al. We used the above same criterion as TYPICAL ERRORS IN IHALATIONAL TECHNIQUES (TEIT), giving scores to the checklist, and the scores were assessed in percentage. [14,15].
Morton et al. in this scale mentioned 7 errors in inhalation techniques with MDI, 14 in MDI with spacer, and 15 in DPI. We assigned 1 mark for each error, and the total score for each subject was converted in percentage. Minimum error limit being 15%, so subjects having TEIT scores less than or equal to 15% were termed "right users," and TEIT SCORE greater than 15% were termed "wrong users.

Table 1. Checklist of Typical Errors in Inhaler Technique [TEIT]

Type of devices	*Common critical errors identified*
Metered dose inhaler (MDI) without a spacer [Each error score 1 x 7= 7]	• *Fails to shake MDI before dose* • *Doesn't remove the cap* • *Doesn't place correctly into the mouth or seal mouth* • *Timing of actuation incorrect or failure to actuate* • *Inhaling too quickly, to slowly or not inhaling at all* • *Not holding breath after inhalation* • *Doesn't know when to order a new MDI*
Metered dose inhaler (MDI) with a spacer [each error 1x 14]	• *Failure to remove the inhaler cap or shake the MDI before use* • *Fails to ensure the MDI is correctly inserted into the spacer device with a tight seal* • *Doesn't use the device with the inhaler upright at 90°* • *Actuates more than one dose into the spacer at the same time* • *Actuates the dose into the spacer before the mouthpiece is placed in the mouth or mask over the face* • *Fails to make sure there is a tight seal with their lips around the mouthpiece, or on the face if with a mask* • *Uses the spacer with no dose actuated* • *Inhales too quickly* • *If using tidal breathing; inhales too quickly or uses shallow breaths* • *Failure to keep the head upright* • *Doesn't prime the spacer correctly* • *Keeps the spacer in a plastic bag which increases static* • *Doesn't wash the spacer enough or too often and doesn't leave to air dry* • *Doesn't replace the spacer if faulty or damaged or as recommended*
Dry powder inhalers (DPI) [Each error scores 1x 13]	• *Not correctly removing the device cap if appropriate, sliding the cap back fully if necessary or shaking the DPI during preparation* • *Not fully twisting to release the dose* • *When the DPI is primed turning it upside down* • *Holding the device in the mouth while priming* • *Breathing into the device* • *Failing to ensure a tight seal with the lips around the mouthpiece* • *Not breathing out fully before inhalation* • *Inhaling through the nose* • *Not keeping head upright with chin tilted slightly upwards* • *Not taking a hard fast and full inhalation for as long as the patient can achieve* • *Not holding their breath for >5 s* • *Not priming before the next dose if more than one being taken* • *Not knowing when the DPI needs reordered*

For assessing the adherence to therapy, we provided a predefined, structured questionnaire of "Test of Adherence" (TAI) to the patient.[16] The questionnaire consists of 10 questions with a minimum of 1 and maximum of 5 marks, with 50 marks indicating adherence and less than 50 marks indicating non-adherence. Patient procured their own inhaler device from pharmacy of college. Since spacer was not available in pharmacy and patient had to buy the spacer, hence no. of patient in this category was less.

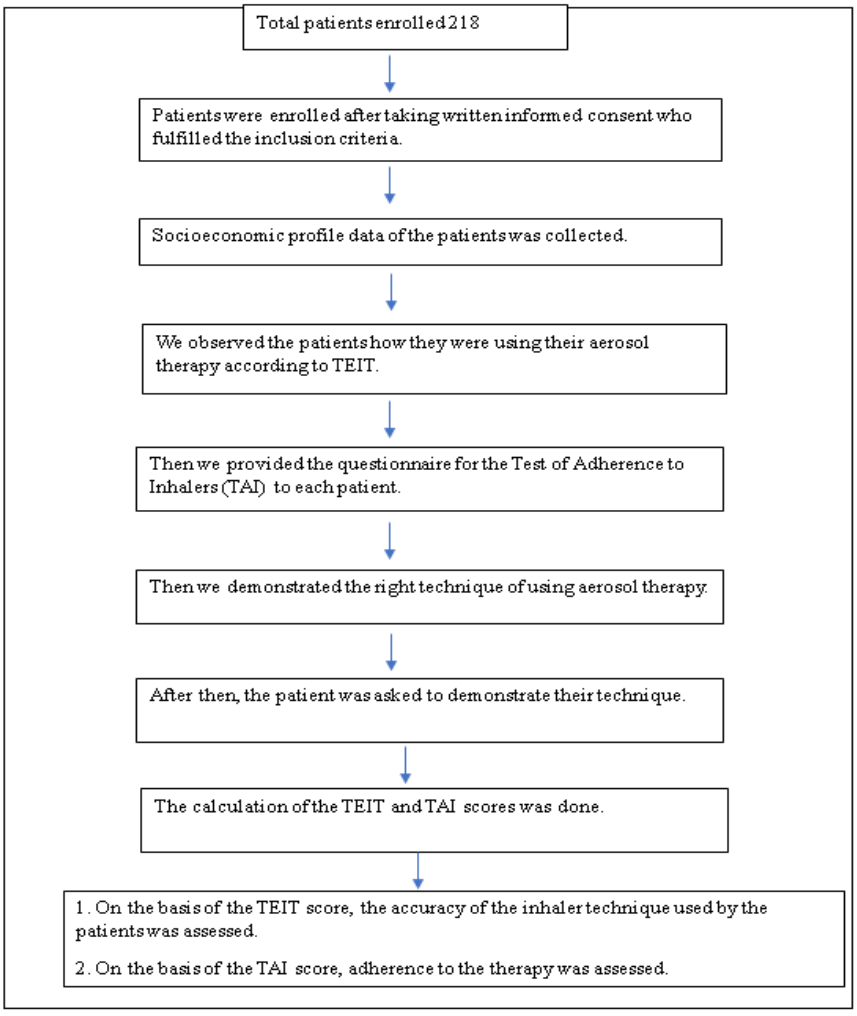
Table 2. Questionnaire Test of Adherence to Inhalers (TAI)

*1. **During the last 7 days, how many times did you forget to take your usual inhalers?***
All (1) More than half (2) Approximately a half (3) Less than half (4) None (5) 1 to 5
2. Do you forget to take inhalers?
Always (1) Mostly (2) Sometimes (3) Rarely (4) Never (5) 1 to 5
3. When you feel good about your illness, do you stop taking your inhalers?
Always (1) Mostly (2) Sometimes (3) Rarely (4) Never (5) 1 to 5
4. When you are on vacation or weekend, do you stop taking your inhalers?
Always (1) Mostly (2) Sometimes (3) Rarely (4) Never (5) 1 to 5
5. When you are nervous or sad, do you stop taking your inhalers?
Always (1) Mostly (2) Sometimes (3) Rarely (4) Never (5) 1 to 5
***6. Do you stop taking your inhalers because of fear of side effects**?*
Always (1) Mostly (2) Sometimes (3) Rarely (4) Never (5) 1 to 5
7. Do you stop taking your inhalers because of considering they are useless to treat your condition?
Always (1) Mostly (2) Sometimes (3) Rarely (4) Never (5) 1 to 5
8. Do you take fewer inhalations than those prescribed by your doctor?
Always (1) Mostly (2) Sometimes (3) Rarely (4) Never (5) 1 to 5
9. Do you stop taking your inhalers because you believe they interfere with your everyday or working life?
Always (1) Mostly (2) Sometimes (3) Rarely (4) Never (5) 1 to 5
10. Do you stop taking your inhalers because you have difficulties to pay them?
Always (1) Mostly (2) Sometimes (3) Rarely (4) Never (5) 1 to 5

Data was collected by the principal investigator by direct observation of inhaler technique using a checklist to note deviations from the correct procedure.

Figure 1- Study Procedure

The study procedure involved several steps:



Statistical analyses were carried out using SPSS software. Comparing technique correctness and adherence across patient demographics and different types of inhalers, chi-square tests were applied.

RESULTS

The sociodemographic profile of the study involving 218 subjects is as follows: Age-wise distribution of participants along with percentage were 18-20 (6.88%), 21-30 (15.14%), 31-40 (17.89%), 41-50 (23.8%), and 51-60 (36.2%) years, with a majority between the 51-60-year age group. Disease-wise distribution of the participants found that 139 (63.8%) were diagnosed with bronchial asthma, while 79 (36.2%) were diagnosed with COPD. The gender-wise distribution of the participants revealed that there were 127 males (58.3%, and the rest 91, (41.7%) were females. Pertaining to different types of aerosol devices, users (202)92.7% used a metered dose inhaler (MDI), 3 (1.4%) used MDI with a spacer, and 13.60% used a dry powder inhaler.

In our study, out of 218 patients, 54 (24.77%) were identified as right users, and 164 (75.23%) were identified as incorrect users. [Fig 2] The TEIT score had a mean of 0.38 ± 0.18.

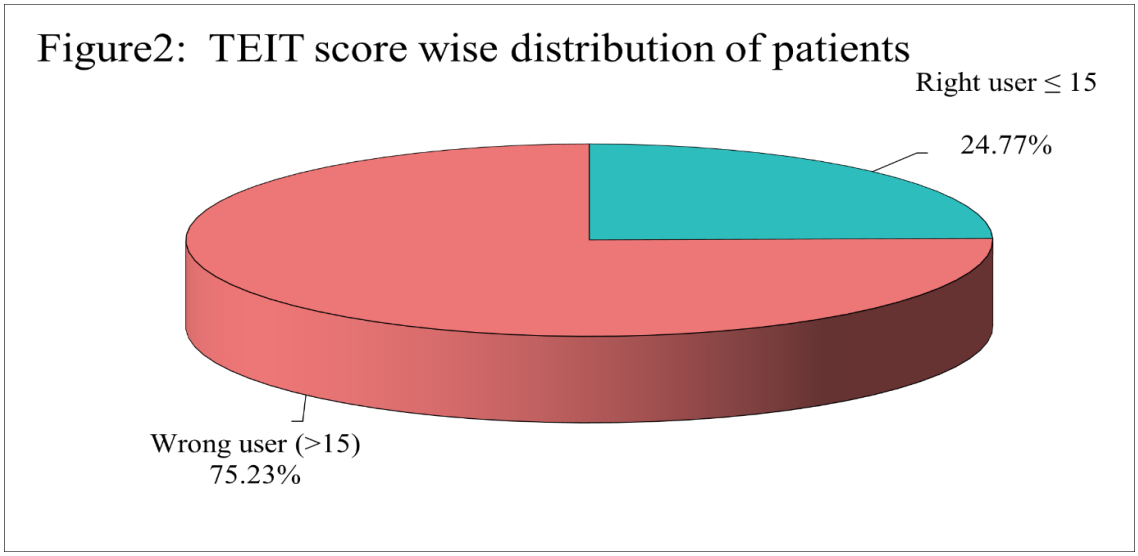


Table 3: Association of right users and wrong users with age, gender, diagnosis, mode of aerosol

Factors	Right user n(%)	Wrong user n(%)	Total	p-value
Age groups				
<=20yrs	6(40)	9(60)	15(6.88)	0.0130*
21-30yrs	14(42.42)	19(57.58)	33(15.14)	
31-40yrs	12(30.77)	27(69.23)	39(17.89)	
41-50yrs	9(17.31)	43(82.69)	52(23.85)	
51-60yrs	13(16.46)	66(83.54)	79(36.24)	
Gender				
Male	32(25.20)	95(74.80)	127(58.26)	0.8630
Female	22(24.18)	69(75.82)	91(41.74)	
Mode of aerosol				
MDI	47(23.27)	155(76.73)	202(92.66)	0.1690
MDI with Spacer	1(33.33)	2(66.67)	3(1.38)	
DPI	6(46.15)	7(53.85)	13(5.96)	
Diagnosis				
Asthma	38(27.34)	101(72.66)	139(63.76)	0.2440
COPD	16(20.25)	63(79.75)	79(36.24)	
Total	54(24.77)	164(75.23)	218(100)	

*p<0.05

The proportion of correct users was highest in the 21- to 30-year-old age group (42.42%) and lowest in the 51-60-year age group (16.46%). Males had a higher proportion of correct users (25.20%), while females had the lower (24.18%). Among the different aerosol devices, DPI users had the highest correct user (46.15%), while MDI users had the lowest correct user (23.27%). Correct users in the asthma group were higher (27.34%) than COPD group (20.25%).
Among the 218 patients studied, the majority of patients, 168 (77.06%), were non-adherent to their inhaler therapy, with only 50 (22.94%) showing adherence. The TAI score recorded a mean of 45.14 ± 5.28.

Table 4: Association of levels of TAI with age, gender, diagnosis, mode of aerosol

Factors	Adherent n(%)	Non adherent n(%)	Total	p-value
Age groups				
<=20yrs	5(33.33)	10(66.67%)	15(6.88)	0.6020
21-30yrs	9(27.27)	24(72.73)	33(15.14)	
31-40yrs	6(15.38)	33(84.62)	39(17.89)	
41-50yrs	13(25)	39(75)	52(23.85)	
51-60yrs	17(21.52)	62(78.48)	79(36.24)	
Gender				
Male	32(25.20)	95(74.80)	127(58.26)	0.3480
Female	18(19.78)	73(80.22)	91(41.74)	
Mode of aerosol				
MDI	47(23.27)	155(76.73)	202(92.66)	0.7350
MDI with Spacer	1(33.33)	2(66.67)	3(1.38)	
DPI	2(15.38)	11(84.62)	13(5.96)	
Diagnosis				
B. Asthma	31(22.30)	108(77.70)	139(63.76)	0.7680
COPD	19(24.05)	60(75.95)	79(36.24)	
Total	50(22.94)	168(77.06)	218(100)	

The study found that 77.06% of patients were non-adherent to their inhalers, with the highest adherence among patients aged <20 years (33.33%) and the lowest among those aged 31-40 years (15.38%). The study also found that males had slightly higher adherence (25.20%) compared to females (19.78%). Among modes of aerosol, MDI with Spacer users had the highest adherence (33.33%), and DPI users showed the lowest adherence levels (15.38%). In bronchial asthma, 22.30% of patients were adherent, and in COPD, 24.05% of patients were adherent.

DISCUSSION

In our study, the average age was 43.49 ± 13 years, with the older age group 51-60 representing the largest proportion (36.24%). In a similar study done by Sinha et al. (2017), the mean age of their study participants was 46 ± 13 years. [17] Price et al. (2018) showed the mean age being 57 years.[18]
In our study of 218 patients, the majority of patients 202 (92.66%) used pressurized metered dose inhalers (pMDI). 13 (5.96%) patients used DPI, and only 3 (1.38%) patients used MDI with a spacer. The reason for fewer users in MDI with spacers was the unavailability of spacers in hospital formulary. In a similar study done by Ganguly et al. (2014), among 105 participants with bronchial asthma and COPD using different types of inhalers, the majority used pMDI: 50 (47.62%), 31 (29.52%) were using DPI, and 24 (22.8%) used MDI with a spacer. [19]
In our study of 218 patients, 24.77% (54 patients) were identified as right users (with TEIT scores ≤15), while 75.23% (164 patients) were classified as wrong users (with TEIT scores >15). In a similar study done by Dalal et al. (2022), Among 113 patients, only 40 (35.39%) patients were able to perform inhaler technique correctly and 73(64.61%) patients were using incorrect technique.[20] The reason of more wrong users in our study may be because patients hailed from suburban area and were unable to comprehend the techniques told by the health care professionals. It was found that there was lack

of understanding among patients for following correct technique. Also, in suburban area due to lack of manpower there was time constraints among treating physicians.

In our study, patients using MDI 155 (76.73%) were using it incorrectly, and only 47 (23.27%) were using it correctly. Among patients using MDIs with a spacer, 1 (33.3%) demonstrated proper usage, while the rest, 2 (66.7%), did not use them correctly. Patients using DPI perform comparatively better, with 6 (46.15%) of users correctly using the device and 7 (53.85%) displaying incorrect technique. Compared to dry powder inhalers and MDI with spacers, MDIs were more incorrectly used.

The reason for more wrong users in the MDI group was because of much complication and coordination in user techniques. DPI in our study was found to be user-friendly due to its simpler technique. This data needs more validation due to fewer subjects using DPI in our study. We found that the most common error among incorrect MDI users was action with inspiration, which is consistent with findings from most reviews.

However, in our study, due to the unavailability of Spacer in hospital formulary, we could only get 3 subjects in this group, which is inconclusive to form an inference.

The Test of Adherence to Inhalers (TAI) score was used in our study to evaluate participant adherence to inhaler usage. Out of 218 patients, 168 (77.06%) had a TAI score of less than 50, indicating that they were not adhering to their therapy; the remaining 50 patients (22.94%) had a score of 50, indicating adherence.

In research with 357 patients, Rafi et al. (2022), the majority of the patients (86%) reported poor adherence to their inhalation therapy (TAI score ≤ 45). Almost 8% of them reported good adherence (TAI score 50), and 6% showed moderate adherence (TAI score 46–49).[21]

Poor adherence to inhalation therapy is caused by a number of causes, including: Chronic disease requires continuous treatment and follow-up, with myths and stigma surrounding inhalers preventing consistent use. Lack of awareness, illusion of recovery, and ineffective inhaler technique deter patients from using inhalers consistently.

In conclusion, the study highlights the importance of providing patients with thorough education and tailored interventions from healthcare professionals to enhance proper usage of inhalers among individuals with asthma and COPD. Continuous patient education programs are crucial, emphasizing detailed instructions and regular demonstrations of inhaler use.

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