

ASSESSMENT OF INHALER TECHNIQUE AND TREATMENT ADHERENCE IN ADULT ASTHMA PATIENTS AND ITS EFFECT ON SYMPTOM CONTROL

General Medicine

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ABSTRACT

Background: Most adults with asthma are given an inhaler and very little else. Whether the drug actually reaches the airway depends on how the device is handled and on whether the patient keeps taking it. Both are easy to check in an outpatient clinic and both are often skipped. **Methods:** We studied 100 adults on inhaled therapy for asthma at HCG Hospital, Ahmedabad. Each patient demonstrated their own device against a 10-step checklist, and three of those steps were treated as critical. Adherence was measured with the 10-item Medication Adherence Report Scale for asthma (MARS-A) and symptom control with the Asthma Control Test (ACT). Spirometry, exacerbations, emergency visits and rescue inhaler use over the previous year were recorded. Pearson correlation, one-way ANOVA, chi-square tests and univariate odds ratios were used, with $p < 0.05$ taken as significant. **Results:** Mean age was 43.3 ± 12.7 years and 42 patients were men. Patients performed 6.65 ± 2.06 of the 10 steps correctly. At least one critical error was made by 61 (61.0%) patients, and only 8 (8.0%) completed every step. Technique was graded good in 26 (26.0%) patients, fair in 13 (13.0%) and poor in 61 (61.0%). Adherence was good in 25 (25.0%) patients. Asthma was uncontrolled (ACT 19 or less) in 64 (64.0%). The technique score correlated with ACT ($r = 0.503$, $p < 0.001$) and so did the MARS-A score ($r = 0.449$, $p < 0.001$). Mean ACT fell from 20.9 ± 2.8 in the good technique group to 16.5 ± 3.9 in the poor technique group ($p < 0.001$). Poor technique (OR 4.34, 95% CI 1.82 to 10.37) and a MARS-A score below 45 (OR 6.26, 95% CI 2.33 to 16.83) were the two factors associated with uncontrolled asthma. **Conclusion:** Handling errors and missed doses were common in this clinic population, and both tracked closely with poorer symptom control. Watching the patient use the inhaler takes two minutes and should happen before any step-up in therapy is considered.

KEYWORDS

Bronchial Asthma, Inhaler Technique, Medication Adherence, Asthma Control Test, Metered Dose Inhaler

INTRODUCTION

Asthma treatment has a strange gap in it. The drugs work, the guidelines are clear, and yet a large share of patients in any general medicine outpatient clinic still wheeze at night and still reach for the reliever several times a week. The Global Initiative for Asthma frames the whole management cycle around control, meaning current symptoms plus future risk, and asks clinicians to reassess control at every visit before changing the dose [1]. The Asthma Control Test gives a simple way to do that. It is five questions, it takes a minute, and it has been validated against specialist assessment [2]. What the ACT score cannot tell you is why control is poor.

Two of the commonest reasons sit outside the prescription. The first is inhaler technique. A systematic review covering four decades of studies found that the proportion of patients using their device correctly has barely moved since the 1970s, hovering around a third [3]. Not every mistake matters equally. Errors that stop the drug reaching the lower airway, such as breathing out into a dry powder inhaler or firing a metered dose inhaler after the breath has already started, are usually classed as critical, and a review of health outcomes linked these specific errors to more exacerbations and more unscheduled care [4].

The second reason is adherence. A systematic review of severe exacerbation risk showed that patients who take less of their prescribed inhaled steroid have more of them [5]. Adherence in asthma is not simply forgetfulness. Beliefs about steroids, cost, symptom-driven dosing and the number of devices in the bag all contribute, and a review of observational data grouped these determinants and showed how inconsistently they are measured [6].

The two problems tend to travel together, though they are rarely reported together. A clinic study found that patients with improper technique had worse control and turned up more often in the emergency department [7]. Indian data point the same way. A tertiary care study in western Maharashtra found high error rates among patients whose asthma was already uncontrolled [8]. Another Indian study reported that technique score was linked to both control and

quality of life [9], and a third showed that a single training session improved the number of steps performed correctly [10]. What is still missing from most of this work is a single cohort in which technique, adherence and control are all measured at the same visit. That is what we set out to do. Our aim was to grade inhaler technique and adherence in adults attending a tertiary care asthma clinic in Ahmedabad, and to see how each of them relates to symptom control, lung function and exacerbations over the preceding year.

MATERIALS AND METHODS

Study Design and Setting

This was a hospital based, cross-sectional, observational study carried out in the Department of Medicine at HCG Hospital, Ahmedabad. Adults attending the outpatient clinic over a twelve month period were screened. Institutional Ethics Committee approval was obtained before enrolment and every participant gave written informed consent.

Participants

We included patients aged 18 years and above with physician-diagnosed bronchial asthma who had been on an inhaled corticosteroid, alone or with a long-acting beta-2 agonist, for at least three months and who owned the device they were using. Patients with a primary diagnosis of chronic obstructive pulmonary disease, bronchiectasis, active tuberculosis or interstitial lung disease were excluded. We also excluded anyone who had been admitted or treated for an exacerbation within the previous four weeks, pregnant women, and patients whose hand strength or cognition made an unassisted device demonstration impossible. A consecutive sample of 100 patients was studied.

Inhaler Technique Assessment

Each patient was handed a placebo device of the same type they used at home and asked to show how they take a dose. No prompting was given. A single trained observer scored the demonstration against a 10-step checklist adapted from published device-specific checklists for pressurised metered dose inhalers and dry powder inhalers [11]. Scoring approaches for inhaler technique vary widely between studies, so we followed a review of scoring methods and used a simple count of

steps performed correctly out of 10, together with a separate flag for critical errors [12]. Three steps were treated as critical because failure at any of them is likely to prevent the drug from reaching the lower airway: actuation not coordinated with the start of inhalation, an inhalation that is too fast and shallow (or not forceful enough for a dry powder device), and breathing out into the mouthpiece just before inhaling. Technique was graded good when 8 or more steps were correct with no critical error, fair when 5 to 7 steps were correct with no critical error, and poor when any critical error occurred or when 4 or fewer steps were correct.

Adherence and Control

Adherence was measured with the 10-item Medication Adherence Report Scale for asthma, which has been checked against pharmacy refill and electronic monitoring data in adults with asthma [13]. Each item is scored 1 to 5 and the total runs from 10 to 50. We called a score of 45 or more good adherence, 38 to 44 suboptimal and below 38 poor. Symptom control was measured with the Asthma Control Test, which has been compared against clinical, functional and biological markers of control [14]. A score of 20 or above was taken as well controlled, 16 to 19 as partly controlled and 15 or below as poorly controlled. Patients scoring 19 or less were grouped together as uncontrolled for the risk factor analysis.

Other Measurements

Age, sex, education, smoking status, height, weight, duration of asthma, duration of inhaler use, device type, current GINA treatment step and comorbid allergic rhinitis or gastro-oesophageal reflux were recorded. Patients were asked whether anyone had ever demonstrated the device to them formally. Spirometry was performed on a calibrated instrument and post-bronchodilator FEV1 percent predicted and FEV1/FVC were noted. Exacerbations, emergency visits, hospital admissions, oral steroid courses and short-acting beta agonist canister use over the previous twelve months were taken from case records and patient recall.

Statistical Analysis

Data were entered in Microsoft Excel and analysed with Python 3.11 (SciPy 1.11). Continuous variables are given as mean $\pm$ standard deviation and categorical variables as number and percentage. Pearson and Spearman coefficients were used for correlation. Group means were compared by one-way ANOVA with Kruskal-Wallis as a check, and proportions by chi-square or Fisher exact test. Unadjusted odds ratios with 95 percent confidence intervals were calculated for factors associated with uncontrolled asthma. A two-sided p value below 0.05 was treated as significant.

RESULTS

Baseline Profile

One hundred adults were studied. Mean age was 43.3 ± 12.7 years, 42 were men and 58 were women. Mean body mass index was 26.1 ± 4.1 kg/m² and 62 (62.0%) were at or above 25 kg/m². Asthma had been present for 6.9 ± 4.1 years on average and patients had been using an inhaler for 4.7 ± 3.3 years. A pressurised metered dose inhaler without a spacer was the commonest device, used by 46 (46.0%) patients, while only 15 (15.0%) used a spacer. Allergic rhinitis was present in 57 (57.0%) and reflux in 30 (30.0%). Only 41 (41.0%) patients recalled ever being shown how to use the device. Full baseline details are in Table 1.

Table 1: Baseline Demographic, Clinical and Treatment Profile of the Study Population (n = 100)

Variable	Value (n = 100)
Age, years (mean $\pm$ SD)	43.3 $\pm$ 12.7
Age 60 years or above, n (%)	11 (11.0%)
Male, n (%)	42 (42.0%)
Female, n (%)	58 (58.0%)
Education: illiterate, n (%)	6 (6.0%)
Education: up to primary, n (%)	17 (17.0%)
Education: secondary, n (%)	39 (39.0%)
Education: graduate or above, n (%)	38 (38.0%)
Current smoker, n (%)	9 (9.0%)
Body mass index, kg/m ² (mean $\pm$ SD)	26.1 $\pm$ 4.1
Body mass index 25 kg/m ² or above, n (%)	62 (62.0%)
Duration of asthma, years (mean $\pm$ SD)	6.9 $\pm$ 4.1
Duration of asthma 10 years or more, n (%)	21 (21.0%)
Duration of inhaler use, years (mean $\pm$ SD)	4.7 $\pm$ 3.3

Device: pMDI alone, n (%)	46 (46.0%)
Device: pMDI with spacer, n (%)	15 (15.0%)
Device: DPI (Rotahaler / Revolizer), n (%)	28 (28.0%)
Device: pMDI and DPI both, n (%)	11 (11.0%)
GINA treatment step (mean $\pm$ SD)	3.18 $\pm$ 0.87
GINA step 4 or 5, n (%)	34 (34.0%)
Allergic rhinitis, n (%)	57 (57.0%)
Gastro-oesophageal reflux, n (%)	30 (30.0%)
Prior formal inhaler training, n (%)	41 (41.0%)
FEV1, % predicted (mean $\pm$ SD)	70.2 $\pm$ 10.5
FEV1/FVC ratio (mean $\pm$ SD)	0.68 $\pm$ 0.04
Exacerbations in past year (mean $\pm$ SD)	1.25 $\pm$ 1.17
At least one exacerbation in past year, n (%)	68 (68.0%)
At least one emergency visit in past year, n (%)	41 (41.0%)
Hospitalised in past year, n (%)	25 (25.0%)
Oral steroid courses in past year (mean $\pm$ SD)	0.80 $\pm$ 1.02
SABA canisters per year (mean $\pm$ SD)	3.2 $\pm$ 1.5
Nights with symptoms per week (mean $\pm$ SD)	1.97 $\pm$ 1.28

SD, standard deviation; pMDI, pressurised metered dose inhaler; DPI, dry powder inhaler; GINA, Global Initiative for Asthma; FEV1, forced expiratory volume in one second; FVC, forced vital capacity; SABA, short-acting beta-2 agonist.

Inhaler technique

Patients performed 6.65 ± 2.06 of the 10 checklist steps correctly. Only 8 (8.0%) patients completed the whole sequence without a single mistake. At least one critical error was made by 61 (61.0%) patients, with a mean of 0.92 ± 0.87 critical errors per patient. The commonest lapse was failure to rinse the mouth after using the steroid inhaler, seen in 50 percent of patients. Next came not breathing out fully before starting the inhalation, in 43 percent. Among the three critical steps, poor coordination between actuation and inhalation was the most frequent at 35 percent, then breathing out into the mouthpiece at 29 percent and an inadequate inspiratory effort at 28 percent. Table 2 lists every step and Figure 1 shows the same data ranked by frequency. Technique was graded good in 26 (26.0%) patients, fair in 13 (13.0%) and poor in 61 (61.0%).

Table 2: Frequency of Individual Errors on the 10-step Inhaler Technique Checklist (n = 100)

Step assessed	Error type	Patients with error, n (%)
Did not check the dose counter or shake the inhaler before use	Non-critical	36 (36.0%)
Did not breathe out fully before starting the inhalation	Non-critical	43 (43.0%)
Did not seal the lips properly around the mouthpiece	Non-critical	24 (24.0%)
Actuation not coordinated with the start of inhalation	Critical	35 (35.0%)
Inhalation too fast and shallow, or not forceful enough for a DPI	Critical	28 (28.0%)
Did not hold the breath for about 10 seconds after inhaling	Non-critical	40 (40.0%)
Held the inhaler in the wrong position or upside down	Non-critical	13 (13.0%)
Did not wait 30 to 60 seconds between two puffs	Non-critical	37 (37.0%)
Did not rinse the mouth after using the steroid inhaler	Non-critical	50 (50.0%)
Breathed out into the mouthpiece just before inhaling	Critical	29 (29.0%)
At least one critical error	Critical	61 (61.0%)
All 10 steps performed correctly	None	8 (8.0%)

Critical errors are those judged likely to prevent the drug from reaching the lower airway. Percentages are of the whole study population.

Adherence and Symptom Control

Mean MARS-A score was 41.3 ± 4.6 . Adherence was good in 25 (25.0%) patients, suboptimal in 52 (52.0%) and poor in 23 (23.0%). Mean ACT score for the whole group was 17.9 ± 4.0 . Asthma was well controlled in 36 (36.0%) patients, partly controlled in 37 (37.0%) and poorly controlled in 27 (27.0%). Taken together, 64 (64.0%) patients had an ACT score of 19 or below. Table 3 sets out the three distributions

with the mean ACT score in each stratum.

Table 3: Distribution of Inhaler Technique Grade, Treatment Adherence and Asthma Control, with Mean ACT Score in Each Stratum (n = 100)

Category	n (%)	Mean ACT score ± SD
Inhaler technique grade		
Good	26 (26.0%)	20.9 ± 2.8
Fair	13 (13.0%)	18.7 ± 3.6
Poor	61 (61.0%)	16.5 ± 3.9
Adherence category (MARS-A)		
Good (MARS-A 45 to 50)	25 (25.0%)	20.6 ± 4.0
Suboptimal (MARS-A 38 to 44)	52 (52.0%)	17.6 ± 3.5
Poor (MARS-A < 38)	23 (23.0%)	15.7 ± 3.8
Asthma control category (ACT)		
Well controlled (ACT 20 to 25)	36 (36.0%)	-
Partly controlled (ACT 16 to 19)	37 (37.0%)	-
Poorly controlled (ACT 5 to 15)	27 (27.0%)	-

ACT, Asthma Control Test; MARS-A, Medication Adherence Report Scale for asthma; SD, standard deviation. Technique grade: good, 8 or more of 10 steps correct with no critical error; fair, 5 to 7 steps correct with no critical error; poor, any critical error or 4 or fewer steps correct.

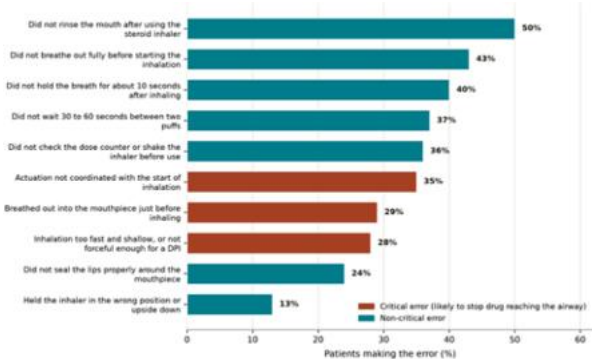


Figure 1: Frequency of Individual Inhaler Technique Errors Among 100 Adults with Asthma

Outcomes Across Technique and Adherence Groups

Mean ACT score fell steadily from 20.9 ± 2.8 in patients with good technique to 18.7 ± 3.6 with fair technique and 16.5 ± 3.9 with poor technique (F = 14.32, p < 0.001). Uncontrolled asthma was present in 9 (34.6%) of the good technique group and 47 (77.0%) of the poor technique group (chi-square = 14.29, p < 0.001). Exacerbations followed the same gradient, from 0.62 ± 0.80 per year in the good technique group to 1.46 ± 1.19 in the poor technique group (p = 0.004). FEV1 percent predicted was 74.9 ± 10.1 and 67.9 ± 10.2 in the two extreme groups (p = 0.012).

The adherence groups separated in much the same way. Mean ACT was 20.6 ± 4.0 with good adherence and 15.7 ± 3.8 with poor adherence (F = 10.50, p < 0.001). Uncontrolled asthma rose from 8 (32.0%) to 20 (87.0%) across the same three groups (chi-square = 16.99, p < 0.001). Reliever use told a similar story, with 2.5 ± 1.2 canisters a year in the good adherence group against 3.7 ± 1.5 in the poor adherence group (p = 0.012). Table 4 gives the full comparison and Figure 2 shows how the three control categories are distributed within each technique and adherence group.

Table 4: Symptom Control, Lung Function and Exacerbation Burden Across Inhaler Technique Grades and Adherence Categories

Outcome	Group 1	Group 2	Group 3	F	p value
Panel A: by inhaler technique grade	Good (n = 26)	Fair (n = 13)	Poor (n = 61)		
ACT score	20.9 ± 2.8	18.7 ± 3.6	16.5 ± 3.9	14.32	<0.001
FEV1, % predicted	74.9 ± 10.1	71.6 ± 9.7	67.9 ± 10.2	4.61	0.012
FEV1/FVC ratio	0.69 ± 0.05	0.68 ± 0.04	0.67 ± 0.04	2.14	0.123

Exacerbations in past year	0.62 ± 0.80	1.54 ± 1.27	1.46 ± 1.19	5.72	0.004
Emergency visits in past year	0.31 ± 0.55	0.85 ± 0.69	0.52 ± 0.70	2.91	0.059
SABA canisters per year	2.3 ± 0.8	3.4 ± 1.2	3.5 ± 1.6	7.04	0.001
Nights with symptoms per week	1.19 ± 0.80	1.62 ± 0.87	2.38 ± 1.36	9.84	<0.001
MARS-A score	43.5 ± 4.3	40.0 ± 2.9	40.7 ± 4.8	4.33	0.016
Uncontrolled asthma, n (%)	9 (34.6%)	8 (61.5%)	47 (77.0%)	14.29*	<0.001
Panel B: by adherence category	Good (n = 25)	Suboptimal (n = 52)	Poor (n = 23)		
ACT score	20.6 ± 4.0	17.6 ± 3.5	15.7 ± 3.8	10.50	<0.001
FEV1, % predicted	75.9 ± 12.3	68.4 ± 9.4	68.0 ± 8.6	5.41	0.006
FEV1/FVC ratio	0.69 ± 0.05	0.68 ± 0.04	0.68 ± 0.04	0.55	0.579
Exacerbations in past year	0.84 ± 0.94	1.31 ± 1.18	1.57 ± 1.27	2.52	0.086
Emergency visits in past year	0.36 ± 0.64	0.48 ± 0.64	0.74 ± 0.75	2.04	0.136
SABA canisters per year	2.5 ± 1.2	3.2 ± 1.5	3.7 ± 1.5	4.63	0.012
Nights with symptoms per week	1.48 ± 1.23	1.96 ± 1.28	2.52 ± 1.16	4.21	0.018
Steps correct (of 10)	7.16 ± 2.32	6.56 ± 2.07	6.30 ± 1.66	1.15	0.321
Uncontrolled asthma, n (%)	8 (32.0%)	36 (69.2%)	20 (87.0%)	16.99*	<0.001

Values are mean ± standard deviation unless stated. F values are from one-way ANOVA. *Chi-square statistic. ACT, Asthma Control Test; MARS-A, Medication Adherence Report Scale for asthma; SABA, short-acting beta-2 agonist.

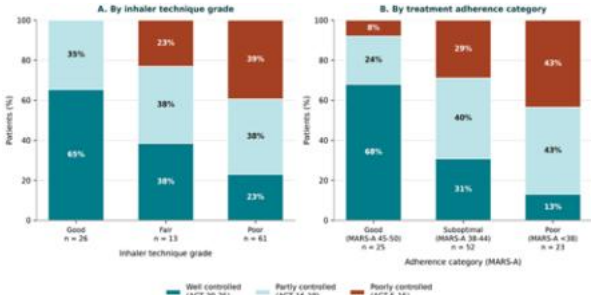


Figure 2: Distribution of Asthma Control Categories by Inhaler Technique Grade (A) and by Treatment Adherence Category (B)

CORRELATIONS

The number of steps performed correctly correlated positively with ACT score (r = 0.503, p < 0.001) and negatively with the number of exacerbations in the previous year (r = -0.443, p < 0.001). The MARS-A score behaved similarly against ACT (r = 0.449, p < 0.001) and against exacerbations (r = -0.232, p = 0.020). Technique score and MARS-A score were only weakly related to each other (r = 0.185, p = 0.065), which suggests the two problems are largely independent. Both correlated modestly with FEV1 percent predicted (technique r = 0.299, MARS-A r = 0.302). Older age was associated with a lower technique score (r = -0.220, p = 0.028), while the number of years a patient had been using an inhaler showed no relationship with technique at all (r = -0.052, p = 0.608).

Factors Associated with Uncontrolled Asthma

On univariate analysis, two factors stood out. Poor inhaler technique carried an odds ratio of 4.34 (95% CI 1.82 to 10.37, p = 0.001) for uncontrolled asthma, and a MARS-A score below 45 carried an odds ratio of 6.26 (95% CI 2.33 to 16.83, p < 0.001). None of the demographic or comorbidity variables reached significance. Table 5 lists all of them. Patients who had received formal inhaler training had a higher MARS-A score (43.1 ± 4.6 versus 40.1 ± 4.3, p = 0.001), but the difference in technique score did not reach significance (6.95 ± 2.28 versus 6.44 ± 1.88, p = 0.241). Mean technique score also did not differ significantly between the four device types (F = 2.36, p = 0.076).

Table 5: Univariate analysis of factors associated with uncontrolled asthma (ACT score 19 or below, n = 64) FactorUncontrolled among exposed, n/N (%)Uncontrolled among unexposed, n/N (%)Odds ratio (95% CI)p value

Factor	Un-controlled among exposed, n/N (%)	Un-controlled among unexposed, n/N (%)	Odds ratio (95% CI)	p value
Poor inhaler technique (critical error or <5 of 10 steps)	47/61 (77.0%)	17/39 (43.6%)	4.34 (1.82 to 10.37)	0.001
Two or more critical errors in the same demonstration	21/28 (75.0%)	43/72 (59.7%)	2.02 (0.76 to 5.37)	0.231
MARS-A score below 45 (adherence not good)	56/75 (74.7%)	8/25 (32.0%)	6.26 (2.33 to 16.83)	<0.001
No prior formal inhaler training	41/59 (69.5%)	23/41 (56.1%)	1.78 (0.78 to 4.08)	0.246
pMDI used without a spacer	29/46 (63.0%)	35/54 (64.8%)	0.93 (0.41 to 2.10)	1.000
Age 60 years or above	8/11 (72.7%)	56/89 (62.9%)	1.57 (0.39 to 6.34)	0.742
Current smoker	7/9 (77.8%)	57/91 (62.6%)	2.09 (0.41 to 10.63)	0.482
Allergic rhinitis	40/57 (70.2%)	24/43 (55.8%)	1.86 (0.81 to 4.26)	0.204
GERD	20/30 (66.7%)	44/70 (62.9%)	1.18 (0.48 to 2.91)	0.892
BMI 25 kg/m ² or above	41/62 (66.1%)	23/38 (55.5%)	1.27 (0.55 to 2.94)	0.725
Asthma duration 10 years or more	12/21 (57.1%)	52/79 (65.8%)	0.69 (0.26 to 1.85)	0.631
GINA treatment step 4 or 5	23/34 (67.6%)	41/66 (62.1%)	1.27 (0.53 to 3.05)	0.745
Education up to primary or illiterate	17/23 (73.9%)	47/77 (61.0%)	1.81 (0.64 to 5.10)	0.378

CI, confidence interval; ACT, Asthma Control Test; MARS-A, Medication Adherence Report Scale for asthma; pMDI, pressurised metered dose inhaler; GINA, Global Initiative for Asthma. p values are from the chi-square test, or the Fisher exact test where any expected cell count was below 5. Odds ratios are unadjusted.

DISCUSSION

The headline finding is dull and important at the same time. Most of our patients could not use their inhaler properly, most were not taking it as prescribed, and the ones who failed on either count had worse asthma. Only 8 (8.0%) patients got all ten steps right. An error of the kind that stops drug reaching the airway was made by 61 (61.0%) of them.

Our error profile matches the large CRITIKAL analysis, which examined technique in more than three thousand patients and identified insufficient inspiratory effort with dry powder devices and actuation-inhalation discoordination with metered dose inhalers as the errors most strongly linked to uncontrolled asthma and exacerbations [15]. We found discoordination in 35 percent, which sits inside the range reported by a systematic review and meta-analysis of device errors across asthma and COPD [16]. The steps patients most often skipped in our clinic, rinsing the mouth and holding the breath, are not critical for drug delivery but they matter for local side effects and for peripheral deposition, and their frequency is a reasonable marker of how carelessly the whole sequence is being performed.

The link between technique and control has been reported before. A multicentre study of asthma and COPD patients found that control worsened as the number of handling errors rose [17]. An analysis restricted to asthma patients on pressurised and dry powder devices reported the same association and showed it held for both device families [18]. A real-life study in patients switched to a combination device found technique, patient preference and control moving together [19]. Our gradient in mean ACT score, from 20.9 ± 2.8 down to 16.5 ± 3.9 , is of a similar size. The odds ratio of 4.34 for uncontrolled asthma with poor technique is also consistent with a community pharmacy study that looked at determinants of poor technique and poor adherence in obstructive lung disease and found the two clustering in the same patients [20].

Adherence contributed independently. In our cohort the correlation between technique score and MARS-A score was weak ($r = 0.185$), so a patient can be faithful about taking the inhaler and still be wasting the dose. A Japanese study that measured both adherence and handling errors reached the same conclusion, reporting that each contributed separately to control [21]. A large claims-linked analysis in moderate to severe asthma showed that lower inhaled corticosteroid adherence predicted more exacerbations [22]. Our exacerbation gradient across adherence groups points the same way, although recall over twelve months is a soft measure.

Age deserves a comment. Technique score fell with age in our data ($r = -0.220$), and a systematic review addressing exactly this question concluded that older patients do make more errors, mostly because of grip strength, coordination and cognition rather than lack of instruction [23]. Years of inhaler use bought no benefit at all in our cohort ($r = -0.052$). People do not get better at this on their own. That is the argument for checking technique at every visit rather than only at the first prescription.

The practical point is that both problems respond to simple action. A Cochrane review of interventions to improve inhaler technique in asthma found that face-to-face demonstration with repeated checking works better than written or verbal instruction alone, although the effect on clinical outcomes was less certain [24]. A pharmacist-delivered technique intervention in the community produced measurable improvement in asthma outcomes with very little extra time per patient [25]. In our clinic, only 41 (41.0%) patients had ever been shown the device. That number alone is a service audit finding.

Limitations

This was a single-centre study with 100 patients, so the confidence intervals around the odds ratios are wide and the fair technique group was small. The design is cross-sectional, which means we can describe association but not direction. Poorly controlled patients may use their inhaler more often and more hurriedly, which could itself degrade technique. Adherence was self-reported, and MARS-A scores tend to run higher than pharmacy refill data would suggest. Exacerbation and emergency visit counts relied partly on recall. Technique was scored by a single observer, so inter-observer agreement was not tested. We did not repeat the assessment after training, so we cannot say how much of the deficit is correctable in this particular population.

CONCLUSION

Inhaler handling errors and missed doses were both common among adults attending this asthma clinic, and each was linked to worse symptom control, lower FEV1 and more exacerbations. The two problems were largely independent of one another, so checking only one of them will miss half the patients who need help. Watching the patient take a dose and asking a short set of adherence questions costs a few minutes. Both should be done before the dose is stepped up or the diagnosis is called severe asthma.

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