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Assessment of Metered Dose Inhaler Technique in Childhood Wheeze: A Prospective Observational Study

	
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ABSTRACT

Wheezing is the most common problem in childhood and administration of corticosteroids, beta 2 agonists via inhalation is considered as the optimal route for appropriate drug delivery. In children most commonly used is metered dose inhaler. Improper inhaler device use is one of the most common causes that hinders better wheeze control. It may decrease drug delivery, patient's adherence to treatment regimen and drug effectiveness. The objective of our study is to assess the improper use of inhaler techniques and to educate caretaker/patient about the proper use of metered dose inhaler technique. Information was gathered by a well-prepared checklist. The whole patients are categorized into those who are using the face mask and not using the face mask. A scoring system used to analyze the proper use of inhaler technique. There is a high prevalence of faulty usage of inhaler technique among patients. Clinical pharmacist educated people doing their technique better (61.2%) and they have the higher score.



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INTRODUCTION:

Wheezing is a high pitched whistling sound that occurs when smaller airways are narrowed by the presence of either bronchospasm, swelling of mucosal lining, excessive amounts of secretions, or inhaled foreign body. It is heard mostly on expiration as a result of critical airway obstruction^[1]. Wheezing is common in infancy and childhood except in neonatal period when it is relatively rare. About 19% of 10-year-old children suffer wheezing with an average age of onset of 3 years^[2]. Not every wheeze is indicative of asthma but is a prediction of asthma in persistent wheezers^[3]. Infants are prone to wheeze because of anatomic factors related to chest wall and lungs in addition to immunologic and molecular influences in relation to older children^[4]. Obstruction to flow is affected by airway caliber and complaints of infants lung. Marginal additional narrowing can cause flow limitation and subsequent wheezing^[5].

Inhalers are portable devices that deliver medication directly to the lungs in a form that a person breathes in, unlike a pill or liquid that's swallowed. In children most commonly used is metered dose inhaler. Metered dose inhaler (MDI) was introduced to deliver asthma medications in a convenient and reliable multi-dose preparation. The pressurized metered dose inhaler (pMDI) consists of several components such as the container, propellants, drug formulation, metering valve and actuator. An MDI should use with a spacer in order to get the dose of medicine into the lungs. A spacer slows down the medicine delivered from a MDI, thus the medicine stays in the spacer and child can easily breathe it into lungs. If the patient is not using a spacer, the medication sprays directly into Childs' mouth, and less of it reaches lungs. When the child is taking corticosteroid inhaler, a spacer is recommended. When inhalation corticosteroid is sprayed directly into the mouth, the medicine is deposited in the mouth which leads to irritation and infection in the mouth. Younger children (under 5 years old) may need to use a spacer with a facemask because they cannot seal their lips tightly while using a mouthpiece. Using a spacer with a mouthpiece delivers the medicine more effectively while using a spacer mask medicament get deposited into the nose^[6].

MATERIALS AND METHODS:

A prospective observational study was conducted in a tertiary care hospital in a period of 6 months. Data collection was done by a well-prepared questionnaire. Data collection form was used to gather the information regarding the demographic details, socio-economic status,

family history, drugs prescribed, score chart of metered dose inhaler technique, and other information. Questionnaire completion and technique assessment were done. After completion of the checklist, individuals were provided with a feedback regarding the technique and corrections need to make if necessary. The assessment was made using evaluation score chart as per the National Asthma Education Prevention Program (NAEPP) criteria. For every correct step, a score of '1' was given and a score of '0' was given for the incorrect step. The inclusion criteria are children of age category between 6months and 18yrs, children attending outpatient department, diagnosed with wheeze and prescribed with an MDI device on a daily basis. Patient those who are not using inhalation medications and patients using MDI for the first time are excluded from our study. The whole patients were categorized into two based on the usage of a face mask.

RESULTS:

A total of 116 patients were included in our study. They were categorized into two based on those who were using a face mask (40) and those who were not using face mask (n=76).

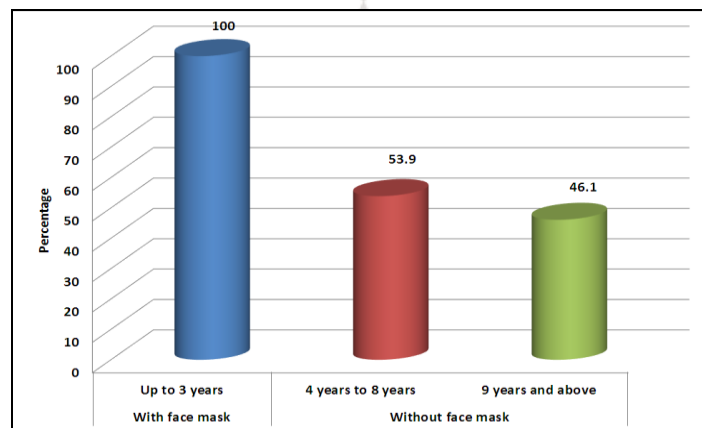


Figure 1: Age distribution based on use of facemask

The patients were divided into two categories depending on the use of facemask. All patients below 3 years wore a facemask. But 53.9% of patients in the age group 4-8 years and 46.1% of those who were above 9 years did not use a facemask.

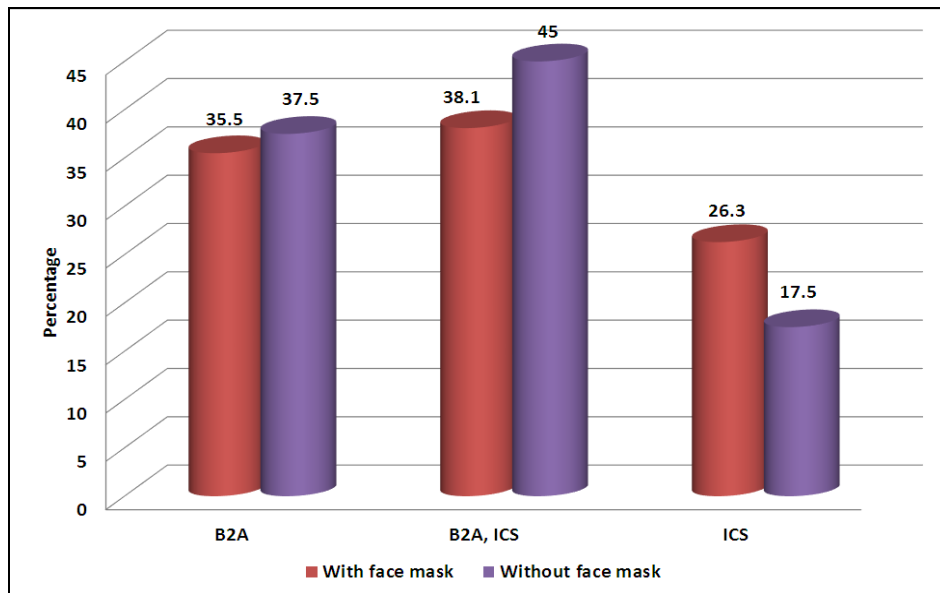


Figure 2: Type of medications

Here 35.5% of patients with facemask were taking beta 2 agonists whereas 37.5% of patients without a facemask was also taking it. But more patients without a facemask (45%) were using the combination therapy of B2A and inhaled corticosteroids than those with a facemask (38.1%). In case of ICS alone, 26.3% patients used facemask while only 17.5% used it without a facemask.

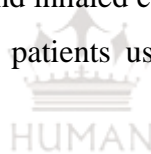


Table 1: Checklist for Inhalation Steps

Inhalation Steps	Without Face Mask (N=76)		With Face Mask (N=40)	
	I (N)	C (N)	I (N)	C (N)
Device technically functional	1	75	1	39
Device cleaned properly	13	63	2	38
Push the two halves of spacer	13	63	5	35
Spacer locked	21	55	13	27
Remove cap of inhaler	28	48	28	12
Shake inhaler	47	29	23	17
Hold inhaler in upright position and connect it to the opposite end of spacer	38	38	17	23
Extend neck to sniffing position	18	58	5	35
Exhale gently	10	66	3	37
Remove cap of spacer and place mouthpiece of spacer in mouth	23	53	12	28
Close lips tightly, to get tight seal	16	60	16	24
Press down canister	10	66	5	35
Breath in deeply through mouth, inhaling medicine through spacer	24	52	18	22
Take 7-10 breaths	27	49	29	11
Wash mouth	58	18	29	11

I (N) – Number of patients doing the steps incorrectly

C (N) – Number of patients doing the steps correctly

From table 1, among patients without the face mask, the most common errors identified were not washing mouth after technique in 58 patients, followed by 47 for not shaking the inhaler. For patients with face mask, the most common errors were not washing mouth after the technique and failure to take 7-10 breaths were in 29 patients followed by failure to remove the cap of the inhaler in 28 patients.

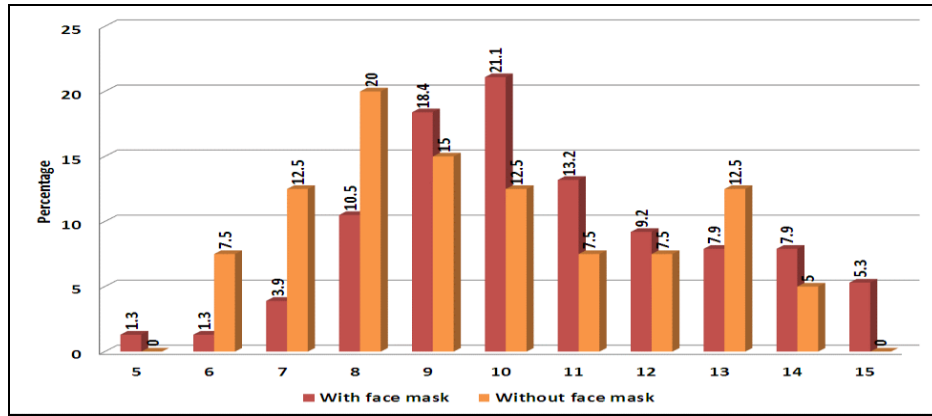


Figure 3: Total Score

From figure 3, 4 patients received a full score of 15 and 1 patient received the least score of 5 among patients without face mask while 2 patients received a full score of 14 and 3 patients received the least score of 6 in the category of patients with a facemask.

Table 2: Education vs. Total Score

Total score	Education		
	Degree	Higher Secondary	Postgraduate
5	0	1	0
6	0	4	0
7	2	6	0
8	5	11	0
9	6	14	0
10	8	10	3
11	6	4	3
12	4	1	5
13	3	3	5
14	0	3	5
15	1	1	2

Table 2 shows the relation between parental education and total score. In this, 2 posts graduated parents got the higher score of 15, and 5 got a score of 14. All of them got more than a score of 10. In case of degree holders, all parents got a score more than 7. But those with a higher secondary education got the least scores such as 5 for 1 patient and 6 for 4 patients.

Table 3: Explanation vs. Total Score

Total Score	Explanation	
	P	PO
5	0	1
6	0	4
7	2	6
8	6	10
9	6	14
10	17	4
11	10	3
12	9	1
13	11	0
14	6	2
15	4	0

P-pharmacy

PO- physician office

It was observed from the fig 3 that patients who were educated by the clinical pharmacist got the higher score of 15(6 patients). But patients who were educated by nurses got a fewer score such as 5 for 1 and a score of 6 for 4 patients respectively.

Table 4: Means of instruction vs. Total Score

Total Score	Means of instruction	
	PD	OD
5	1	0
6	4	0
7	5	3
8	14	2
9	18	2
10	17	4
11	12	1
12	9	1
13	10	1
14	2	6
15	1	3

PD- Practical demonstration

OD- Oral demonstration.

From the chi-square results, it was observed that p-value is less than 0.05. Hence there is an association between mode of instruction and total score. 3 patients got a higher score of 15 in an oral demonstration and 1 patient got 15 in a practical demonstration. Only 1 patient got the least score of 5 in practical demonstration whereas none got that in case of oral presentation.

DISCUSSION

Wheeze is the most frequently occurring respiratory disease in childhood and represent major public health burden. Wheezing in infancy could be a sign of the diverse clinical condition. The aim of our study was to evaluate the quality of metered dose inhaler technique and environmental triggers associated with childhood wheeze.

Our study shows that majority of children with wheeze, who have received inhalation instruction were able to use pMDI technique correctly. The most common errors in inhalation technique in the study were not washing the mouth after technique, not shaking the inhaler prior to use followed by inability to take 7-10 breaths and failure to remove the cap of an inhaler.

Patients used B2A +ICS were 47 and 42 patients used B2A and 27 used ICS alone as shown in figure 2. In accordance with a similar study conducted by Violaine Giraud *et al.*, concluded that inhaled corticosteroid and bronchodilator given in combination provide the advantage of direct delivery to the target organ, thus ideally maximizing the desired effects and minimizing potential adverse effects^[8].

In table 1, for patients without face mask the most common errors identified were not washing mouth after technique 58 patients, followed by not shaking inhaler 47. For patients with face mask most common errors were not washing mouth, failure to take 7-10 breaths 29 patients, followed by failure to remove the cap of inhaler 28 patients. In our study, we observed that majority of the patient had an improper inhaler technique when checked at random. Similar results have been observed in studies conducted by Larsen *et al.*, in US population with 501 subjects, with up to 76% of patient committing errors in inhaler use. It's a common observation that patients are not instructed regarding inhaler use at the time of initial therapy. This does underlie the need for devoting more time to baseline demonstration and education when inhaler is prescribed for first time^[9].

From chi-square test, it is observed that there is association between education and total score as shown in table 2. In the study, MandeepWalia *et al.*, highlights the importance of receiving training in children with asthma for proper performance of inhalation technique. He also concluded that key determinant of successful inhalation is regular monitoring, education, reinforcement of inhalation technique, irrespective of socio-economic category of patient^[9].

Violaine Giraud *et al.*, in his thesis conveys that an association is observed between explanation and total score which is shown in table 3. Inhaler technique is mainly associated with adherence and it influences asthma control. Inhaler training by clinical pharmacist is feasible and seems to improve inhaler technique asthma control and adherence^[10].

In table 4, 93 caretakers were given practical demonstration and 23 caretakers with oral demonstration. In our study, we concluded that practical demonstration improves inhaler technique that instruction is given by oral demonstration. This is in accordance with a study conducted by G P Jolly *et al.*, in India. He concluded that practical demonstration significantly improve inhaler technique after a systematic education session. Inhaler technique has also been found to deteriorate over time, so instructions needed to be repeated over time. A checklist based error can reduce errors in inhalation technique.^[11]

CONCLUSION:

This study showed that the majority of patients used their inhaler incorrectly. There is a high prevalence of faulty usage of inhaler technique among patients. Patient dependent factors such as failure to remove cap of inhaler, not holding inhaler in upright position, inhaling too fast, failure to ensure tight seal when mouthpiece is inserted into spacer, failure to actuate just one dose into the spacer were identified as the cause of incorrect inhaler technique use. There is an urge for creating awareness among all healthcare professionals involved in patient care. Repeated demonstration of proper inhaler technique using a standard checklist significantly reduced the errors during inhaler use.

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