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Abstract

Introduction: Asthma and other chronic airway diseases can be effectively treated by inhaler therapy. Inhaler therapy depends on appropriate use of the inhaler. For asthma, inhalation therapy is the foundation of treatment. Yet all too often, patients do not get the full value of their inhaled medications because they use their inhaler incorrectly. The objective of this study was to evaluate the knowledge among asthmatic children and their parents regarding asthma inhaler therapy and appropriateness of its use.Method: Cross-sectional study was conducted on assessment of adequate use of asthma inhalational medication in children.Results: Sixty one asthmatic children were involved in the study with a mean age of 4.67 + 3.69 years; 35 (57.4

Index terms— inhalation, treatment, medications, inhaler.

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Method: Cross-sectional study was conducted on assessment of adequate use of asthma inhalational medication in children.

Results: Sixty one asthmatic children were involved in the study with a mean age of 4.67 + 3.69 years; 35 (57.4%) were males and 26 (42.6%) were females. Of 61 asthmatic children 44 (72.1%) were preschool children, 32 (52.5%) asthmatic children were living in a number of family 1-5, 28 (45.9%) were living in a family number of 5-10 and only 1 (1.6%) lived in a family number of >10. Nineteen (31.1%) asthmatic children had a family history of asthma. Fifty three (86.9%) asthmatic children were not rinsing the mouth after inhaling, 44 (72.1%) were not cleaning the device at all, 40 (65.6%) had slow rate of breathe through the inhaler and 23 (37.7%) did not shake before inhaling.

Conclusion and Recommendations: There were significant mistakes related to inhaler use that are easy to avoid. These mistakes were due to the device used, lack of giving appropriate instructions, some parents give too much responsibility to the child for monitoring and treating their asthma. The inhalation device used in our setting should be modernized, i.e. spacer with/ without mask. Provide simple and airway inflammation. In children it is most commonly intermittent, but may be persistent. Asthma affects an estimated 300 million people worldwide, causing an estimated 250,000 deaths annually (all ages) (1). Around 15 million disability adjusted life years (DALYs) are lost annually (1).

The optimal treatment of asthma depends on a number of factors, including child's age, severity and frequency of asthma attacks. For most children, asthma treatment can control symptoms, allowing the child to participate fully in activities and sports. Successful treatment of asthma involves three components:

1. Controlling and avoiding asthma triggers 2. Regularly monitoring asthma symptoms and lung function 3. Understanding how to use medications to treat asthma Asthma and other chronic airway disease can be effectively treated by inhaler therapy (2). Inhaler devices come in a variety of types, such as metered dose inhalers (MDI) or dry powder inhalers (DPI). Irrespective of the type of inhaler device used, the outcome of inhaler therapy largely depends on appropriate use of inhaler. Appropriate use primarily involves the correct inhalation technique. A

poor inhalation technique reduces drug deposition in the lungs (3). Moreover, the more mistakes made in the inhalation technique the lower the beneficial effect on lung function (4). From adults it is known that 89% of the patients make at least one mistake in the inhalation technique (5).

Appropriate inhaler use also involves actual use compared with advised regimen of the prescriber. Several studies shown that, even with adequate inhaler use (between 50 and 80% of prescribed doses), compliance with inhalation corticosteroids (ICS) is far from perfect (6). When inhaled therapy is used the administered therapeutic dose is small as compared with other routs of administration and consequently the incidence of systemic side effects is very low. This is particularly important in the case of ICS treatment compared with oral administration; delivery of the drug directly to the airways by inhalation has a more rapid a) Background sthma is the condition of subjects with wide spread narrowing of the bronchial airways, which changes in severity over short period of time (either spontaneously or under treatment). Asthma causes wheezing, and often cough and breathlessness too, due to airway obstruction with smooth muscle contraction A onset of action which is advantageous when bronchodilators are used to treat acute attack of bronchoconstriction. Also, inhalation of a beta-2 agonist offers marked protection against exercise induced asthma which is common in children. In contrast oral administration of high doses of the same drug has no or a marginally protective effect against this condition (7). For this reasons inhalation therapy constitutes the cornerstone of asthma management in children of all ages.

More than 100 different inhaler/ drug combinations are now available for the treatment of asthma. Although such a variety increases the likelihood of finding an appropriate inhaler for each individual patient, it also increases the complexity of inhaler choice for clinicians and it may also reduce the physician's or nurse's experience in each individual inhaler. Therefore, it may be better for the individual clinician to focus on a limited number of inhalers to get better experience with the devices used.

The following three inhalation systems constitute the cornerstone of inhalation therapy in children with asthma.

1. Conventional Pressurized metered dose inhaler (pMDI). 2. PMDI with a spacer attached 3. Dry powder inhaler (DPI) These three inhaler systems differ with respect to construction, aerosol cloud generation, optimal inhalation technique and ease of use. Still, with appropriate tuition and training, virtually all pediatric patients including children less than one year old can be taught effective inhaler use with one of these three systems. The precondition for this is accurate knowledge about nature and magnitude of the problems that children of various age groups experience when using these devices correctly (7).

1 b) Statement of Problem

Asthma is a chronic disease and increasing in all parts of the globe, especially in children and older people. Three hundred million people have asthma worldwide (1).

In Europe vaccination programs, better nutrition, and antibiotic treatment have reduced mortality from acute respiratory infection while the asthma incidence increased at the same time (8).

According to the International Study of Asthma and Allergy in Children (ISAAC) the prevalence of data is limited in developing countries. The study conducted prevalence data in seven African countries and found out that Ethiopia 9.1%, Kenya 15.8%, Nigeria 13%, South Africa 20.3%, Algeria 8.7%, Morocco 10.4% and Tunisia 11.9%) (9).

For asthma, inhalation therapy is the foundation of treatment. Yet all too often, patients do not get the full value of their inhaled medications because they use their inhaler incorrectly. Faulty inhaler technique is the major problem in public health (4).

Most asthmatic children and their caregivers do not give stress the importance of exhaling gently; for a few second before inhaling (deeply and slowly for MDI, deeply and rapidly for most DPI) (10).

Forgetting to exhale before inhaling is a common and significant mistake regardless of the type of the device. For MDI users, poor timing described earlier is another common and serious mistake (11).

2 c) Significance of the Study

Asthma is one of the most common diseases in children in the world at large and in Ethiopia. But, little is known about the current situation regarding the appropriate use of inhalers by children in Ethiopia.

Children are more prone to use inhalation devices incorrectly if they are not monitored closely to use correctly. Pressurized MDI with and without a spacer were more prone to errors compared with DPIs, children prescribed a new device were more prone to usage errors. Many asthmatic children use their inhaler devices too poorly to result in reliable drug delivery, even after inhalation instruction.

Comprehensive inhalation instruction and repeated check-up are needed to assure reliable inhalation technique.

This study will assess the inhalation technique in children and it helps to give clue for the inhalation technique. And for the other researchers to study the problems of inhalation technique in children. In addition, it will initiate Gondar University Hospital as well as the country as a whole to give priority attention of adequate use of asthma inhalation medications.

3 Methods and Materials a) Study Area and Period

The study was conducted in Gondar University Teaching Hospital in pediatrics ward and pediatrics chronic illness outpatient department, Amhara region, Northwest Ethiopia which is 738 km from Addis Ababa.

The study was conducted from October 15 to May 20, 2013.

4 b) Study Design

A cross-sectional study was conducted on adequate use of asthma inhalation medication in children in Gondar University Teaching Hospital.

5 c) Population

6 i. Source of Population

All asthmatic children attending Gondar University Teaching Hospital.

7 ii. Study Population

All asthmatic children aged 0-14 years who had been prescribed inhalation medication attending Gondar University Teaching Hospital.

8 ? Inclusion Criteria

? Patients who started asthma inhalational medication ? Patients whose age is 0-14 years ?

9 e) Sampling Technique and Sample Size

Convenience sampling technique was used to select 61 asthmatic children from out of the total 70 asthmatic children who were expected at the pediatric department of university of Gondar teaching hospital.

10 f) Data Collection Procedure

Data was collected by interview guide composed of closed and open ended questions and a questionnaire was prepared to gather the necessary information from respondents. Data was collected by a data collector (health professional).

11 g) Data Analysis

All data collected by questionnaire was checked for the completeness and fulfillment daily. The data was processed by SPSS and analysis was done using descriptive and analytical method (binary logistic regression), the result was presented by tables and the necessary conclusion was made.

12 h) Ethical Considerations

Before starting to collect data for the study we obtained formal letter from Gondar University Research Office, permission letter from school of pharmacy, department of clinical pharmacy and willingness from pediatrics department. Representation sample was taken and kept free from any bias. Confidentiality, neutrality, accountability and academic honesty was maintained throughout the study.

13 i) Dissemination Plan

The final report of this study will be given to the concerned bodies (School of Pharmacy, pediatrics department, CEO of Gondar University Teaching Hospital, regional health bureau, etc) through seminar presentation, provision of hard copy, and other means.

14 j) Operational Definitions

Metered dose inhaler -is a device that delivers a specific amount of medication to the lungs, in the form of a short burst aerosolized medicine that is inhaled by a patient.

Dry Powder Inhalers -are inhalers that deliver medication in a dry powder form.

Spacer -is an add-on device used to increase the ease of administering aerosolized medication from a MDI. In this study called 'traditional plastic bottle.' Mask -is a device used to deliver medications which is attached to a spacer that goes over the child's mouth and nose. Intermittent -is the mildest form of asthma which occurs sporadically. Example: symptoms .

Pediatrics department-is part of the University of Gondar teaching hospital which includes the pediatric outpatient department and pediatric wards.

Persistent -another type of asthma which classified in to three and occurs repeatedly.

a) Mild persistent-symptoms occur $>$ 2 days per week. b) Moderate persistent-symptoms occur daily. c) Sever persistent-symptoms occur throughout the day.

Triggers -are factors those set-off/worsen asthma symptoms.

Breathing rate -a speed at which the children breathe in through the spacer.

a) Fast-breathing within $<$ 2 sec. b) Normal-breathing between 2-5 sec. c) Slow-breathing $>$ 5 sec.

IV.

15 Results

Of 61 asthmatic children who took inhalational medications, 35 (57.4%) males and 26 (42.6%) females were included in the study with the mean age of 4.67 3.69 years. Among 61 asthmatic children 44 (72.1%) were preschool children. Thirty two (52.5%) asthmatic children live in a family member of 1-5, 28 (45.9%) live in a family member of 5-10, and only 1 (1.6%) lives in a family member of > 10. Nineteen (31.1%) asthmatic children had a family history of asthma (Table 1).

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Volume XIV Issue II Version I Of 61 asthmatic children 57 (93.4%) got instructions from GPs, 56 (91.8%) assessed the remaining dose by spraying into the air, 46 (75.4%) inhalation technique was checked during follow up appointment, 45 (73.8%) of asthmatic children inhaler use was decided by their parents. Most (51 (83.6%)) asthmatic children and their parents did not read leaflet (Table 3). Of 61 asthmatic children 12 (19.7%) were less than 1 year. Among these 4 (33.3%) were shaking before use and 8 (66.7%) were not shaking before use. Of 61 asthmatic children 8 (13.1%) were age 10-14 years, among these 7 (87.5%) were shaking before use and 1(12.5%) were not shaking before use. Other independent variables did not have statistically significant association with dependent variables. The likelihood of shaking inhalational medications before use was 14 times more in 10-14 years of age than that of <1 year age (Table 4). compare with a study in Thailand asthmatic children also shows that slow breathing after activation of MDI was the major problem (40.5%), which is the same problem but higher in our study (13).Year 2014 (B)

The device used to take the medication was plastic bottle which is traditional (not used by other countries). This makes the children not to improve within short period of time. Because the dose was not taken fully as a result of the plastic bottle not fit well with the face in addition to their incorrect technique. So, the modern device which is used by other countries must replace this plastic bottle so as to get the correct prescribed full dose and improved within short period of time. Children with the same severity of disease and take the same dose might not get relief from symptoms at the same time, due to the difference of device used.

Cleaning the plastic bottle was very important but in this study, most (44 (72.1%)) were not cleaning it, even they did not know the plastic bottle is to be cleaned. Actually there were children who know how to clean: some 10 (16.4%) children clean the plastic bottles by soft which was incorrect and the other 7 (11.5%) have changed the plastic bottle totally so as to get clean plastic bottle. But a study in Dutch children, the method of cleaning the inhaler was soaping inhaler, dry in air which is the correct method of cleaning (49%), but 10% were not cleaning at all (12).

Shaking before use is mandatory to take the medication but there were significant numbers of asthmatic children 23 (37.7%) who did not shake before use due to forgetting and not aware the importance of shaking. This mistake also was frequently made by other countries like Dutch children (20%) (4).

Knowing the correct route of taking the inhalational medication is very crucial for asthmatic children to get the required therapeutic effect of the drug but there were children 2 (3.3%) who took the medication by nose which is not effective. Taking the inhalational medication by mouth is the appropriate route. If the children whose age is < 5 years, they can use both nose and mouth.

Decision concerning with the inhaler use, the involvement of parents with clear and simple instructions were important when and how to use because most 43 (70%) asthmatic children were less than 5 years of age.

In this study 56 (91.8%) of participants were assessing the remaining doses by spraying into the air but the other 5 (8.2%) did not know how to assess the remaining dose. Spraying into the air is incorrect method of assessing remaining dose, but spraying into the dark background is the correct method of assessing remaining dose. A study in Dutch children the method of assessing the remaining doses were spraying against dark background (9%), if inhaler floats in water, it is empty (4%), counting the remaining doses using agenda (7%) and looking on counter (7%) which were correct method of assessing and the others spraying in the air (28%), feeling inhaler weight while shaking (20%), listening to inhaler while shaking (9%), not assessing at all (14%) and if inhaler sink in water, it is empty (2%) were incorrect methods (6). There is significant association between age and shaking before use (p= 0.032). This shows that the age group of 10-14 years had good practice of shaking before use as compared to <1 years of age. This might be because of the age groups of 10-14 years were matured enough to accept the instructions told by health professionals and parents were forgetting the instructions told by health professionals because they were responsible for many activities in the house.

17 VI.

18 Limitations of the Study ? This Study had Potential Limitations

? Absence of asthmatic children during their follow up appointment which was not included during our data collection period. So, we did not include all patients. ? Some parents were not voluntary to respond for our questionnaire ? As the study was cross-sectional interview based, there might be recall bias in the study subjects side.

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20 Conclusion

There were significant mistakes/errors related to inhaler use that are easy to avoid. These mistakes were due to different factors like the device used, lack of giving appropriate instructions and parents give too much responsibility to the child for monitoring and treating their asthma. These lead to inadequate use of inhalational medications. Selecting the right inhalational device in University of Gondar Teaching Hospital, pediatric department is crucial because their technique was incorrect, they would not get the benefit from the drug. This must be checked by the doctors, nurses or pharmacists.

21 VIII.

22 Recommendations ? The inhalation device used in Gondar University

Teaching Hospital should be modernized, i.e. spacer with/ without mask. ? The device also should be based on age in order to fit with the face. ? Parents should be involved during the use of inhaler devices with clear and simple instructions by health professionals. ? Teach patients and their parents when and how to use asthma medications and observe the patients inhaler technique regularly. ? Provide simple verbal and written instructions and information on treatment for children and their parents and check their understandings. ? If there is misunderstandings and bad experience, clarify for them. [1] [2] [3]

Figure 1:

Figure 2:

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[3] Assessment of Adequate use of Asthma in halational Medication Administration in Children in GondarUniversity Teaching Hospital, Northwest Ethiopia

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		Frequency (%)
Age	< 1 year	12 (19.7%)
	1-5 years	31 (50.8%)
	5-10 years	10 (16.4%)
	10-14 years	8 (13.1%)
Sex	Male	35 (57.4%)
	Female	26 (42.6%)
Religion	Orthodox	48 (78.7%)
	Muslim	11 (18%)
	Protestant	2 (3.3%)
Occupation	Student	17 (27.9%)
	Preschool	44 (72.1%)
No of family in a house	1-5	32 (52.5%)
	5-10	28 (45.9%)
	>10	1 (1.6%)
Family history of Asthma	Yes	19 (31.1%
	No	42 (68.9%)
Shake before use		Frequency (%)
	Yes	38 (62.3%)
	No	23(37.7%)
Mask placed	Mouth	18 (29.5%)
	Nose	2 (3.3%)
	Both	41 (67.2%)
Mask fit well with face	Yes	41 (67.2%)
	No	20 (32.8%)
Dose at a time	2-5 puff	32 (52.5%)
	6-9 puff	29 (47.5%)
Rate of breathing during inhalation	Fast	2 (3.3%)
	Normal	19 (31.1%)
	Slow	40 (65.6%)
Pattern of breathing during multiple dosing	Bring all doses in spacer and start breathe	3 (4.9%)
	Bring one dose in the spacer and start breathe, then bring the other	58 (95.1%)

Figure 3: Table 1 :

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Rinse the mouth after	Yes	8 (13.1%)
inhaling	No	53 (86.9%)
Cleaning the plastic bottle	Not clean	44 (72.1%)
	By soft	10 (16.4%)
	Changing	7 (11.5%)

Figure 4: Table 2 :

3

Gives instructions

Figure 5: Table 3 :

4

P-value= 0.032; *-reference

Figure 6: Table 4 :

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.2 Discussion

The aim of the study was to summarize the most common problems experienced by various age groups of asthmatic children in using their inhalers correctly and to assess the knowledge of asthmatic children and their parents towards their inhalation technique.

Inhaler therapy is very important if we use appropriately. A variety of mistakes concerning therapy adherence, the inhalation technique and mistakes in the handling of devices were made by Gondar University Teaching Hospital asthmatic children. When we compared with the other countries like Dutch children, the mistakes were different. The most significant mistakes in this hospital during the use of inhalation were: not rinsing the mouth after inhaling (86.9%), not cleaning the plastic bottle (72.1%), slow rate of breathing through the inhaler (65.6%), not shaking before use (37.7%) but in Dutch children "when I need two doses, I can activate the inhaler (MDI) twice before starting to inhale through the spacer (43%) and not shaking before use (20%) were the most frequently noticed mistakes (12).

The most frequently noticed inhalational problems by various age groups of asthmatic children: slow rate of breathe through the inhaler was the most frequent problem in our study (65.6%). When we IX.

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