A SHORT CLINICAL STUDY TO EXPLORE THE REASONS FOR FAILURE OF DRUG TREATMENT IN CHRONIC ASTHMATICS WITH REFERENCE TO DRUG DELIVERY SYSTEMS

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ABSTRACT

Introduction: Asthma is one of the most common chronic respiratory illnesses in the community. Easy and the common method to deliver the antiasthmatic drugs are topical drug delivery devices. Even though many patients were using the devices for quiet long time at regular intervals still, considerable number of patient are not able to overcome the breathing difficulty. Material and Methods: A prospective interactive observational clinical questionnaire based study was conducted among chronic asthmatics of 50 years and above, using validated asthma control test (ACT) questionnaire at Department of Pulmonology, PSG hospitals, Coimbatore, South India after the IHEC approval of SGIMSR. Results: Among 100 participants 60 were male and 40 were female. 56% had problem for more than 5 years. 94% were using both topical and oral route. Among the topical route 70% were using devices whenever needed. 82% were using topical route mode for more than 1 year. 68% felt inhalational is the comfortable route. Among the total topical users 37% were not able to take short interval between two breaths and 58 % had lack of coordination while using devices. Discussion: This study had expressed the reason for failure of therapy as lack of coordination while using inhaler and irregular use. Conclusion: During regular follow-up, if the patients are checked by the physician for therapeutic failure or worsening symptoms, will positively shift their conduct to adhere prescription in turn will motivate the patients to use the devices regularly and prescription will become cost effective. KEYWORDS: Topical delivery devices, chronic asthma, antiasthmatic drug.

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INTRODUCTION

Asthma is recognized as the major public health problem affecting majority of the population worldwide. Global rates of asthmatic patients has increased significantly between 1960s and 2008.\(^1,2\) It is common in developed than developing countries.\(^3\) Many factors are attributed with provoking the incidence of asthma. Allergens, upper respiratory tract infection, exposure to second hand smoke are the risk factors linked with development of asthma.

Moreover, many other diseases like COPD (chronic obstructive pulmonary disease), congestive heart failure in adults and sinusitis, allergic rhinitis in children are misdiagnosed as asthma being these problems carry similar symptoms with asthma.

Asthma in elderly above 65 years of age is usually unreported, reason being elderly presumes that their symptoms are due to ageing or to other illnesses and often ignore it. This will eventually lead to worsening of their condition.

Several therapeutic treatments are available to aid asthmatic patients. The medications include corticosteroids, beta2 agonists and mast cell stabilizers. And these medications are provided via drug delivery devices like metered-dose inhalers (MDIs), Spacers and nebulizers.

The usage of the drug delivery devices has several shortcomings which affect the effectiveness of the therapy. Eventually the patient is not benefited due to lack of awareness of usage, the techniques of operating the device and also the methods of cleaning it, thus resulting in failure of drug treatment. From now, this issue should be further analyzed and corrected for the welfare of the elderly asthmatics.

REVIEW OF LITERATURE

Asthma

Asthma is a chronic inflammatory disease of the airways. Airways swell up and restrict the airflow into and out of the lungs, causing difficulty in breathing. A study conducted by the Indian Council of Medical Research (ICMR) on children of Kamrup (Metro) district revealed that out of around 6,000 children diagnosed with respiratory diseases, 4-13 % are found to be suffering from asthma.\(^4\)

The incidence of asthma is rampant in South Asia. As per National Family Health Survey of India, 2,468 persons per 100,000 population are reported to be suffering from asthma, which
is considerably higher in rural areas (2468 per 100,000) than in urban population (1966 per 100,000).[5]

The elderly are susceptible to asthma as their respiratory system is prone to several age-related anatomical, immunological and physiological changes. The lung matures only by the age of 20-25 years. Ageing in turn causes progressive decline in lung function. The respiratory muscle strength declines with age thus disrupting the airway clearance. And also the airway receptors respond less likely to drugs in comparison to the young. Furthermore, there is disturbance in gaseous exchange due to increase in alveolar dead space.[6]

The onset of asthma begins usually in childhood and is more prevalent among the children than the adults, especially the boys. However the elderly are also prone to develop asthma as well. There are changes in body tissues, cells, bones and muscles secondary to asthma. The bones become thinner changing its shape and shape of the ribcage as well. Thus expansion and contraction of the ribcage is limited during breathing. The immune system of the body is also weakened and hence body is unfit to fight off lung infections and other diseases.[7,8]

The lung function worsens as a result of risk factors like allergens, environmental factors (irritants) and infections. By inhaling certain substances like pollen from plants, dust mites which have enzymes containing an allergen will trigger the immune system to overreact to exposure to allergen. Direct irritants to the lungs like indoor chemicals, air pollution and respiratory and bacterial infections play important role in triggering asthma.[9]

Pulmonary function tests are conducted to assess the severity, progress and response to treatment for respiratory diseases. The tests are classified according to their respective purposes. For instance, there are ventilation function tests, tests of diffusion and tests of ultimate purpose of respiration.

A ventilation function test includes measurement of various lung volumes and capacities, dead space, compliance and airway resistance. Spirometer is an instrument which is used to measure the amount of air inhaled and exhaled from the lungs. The values recorded are vital capacity (VC), Peak expiratory flow rate (PEFR) and Forced expiratory volume (FEV1). With these values the lung function is evaluated in people with obstructive or restrictive lung diseases.[10]
Chronic asthma is a condition that occurs in patients where the asthma has become persistent and there is chronic airflow obstruction despite anti-asthmatic therapy. Smoking and environmental factors play a major role for this condition. The patients face recurrent episodes of breathlessness, sudden tightness of the chest and wheezing sounds. The treatment for chronic asthmatics differs from age to age.

Apart from chronic asthma there are numerous other chronic respiratory diseases in India that includes Tuberculosis, Pneumonia, and COPD etc. Smoking which increases the incidence of clinical tuberculosis, has been the cause of half the male tuberculosis deaths in India, and a quarter of all male deaths in middle age.\textsuperscript{[11]} The severity of asthma is also found to be increased by air pollution, high ozone levels, and psychological stress.

A wide range of treatment options are available in treating respiratory disorders. Emphysema, a chronic lung disease, is treated by inhaled bronchodilators helping in relaxing and opening up of the airways. They may be either short acting drugs (Oxitropium, Ipratropium) or long-acting drugs (Tiotropium).\textsuperscript{[12]} In the case of pneumonia the treatment is ideally based on the causative microorganism and duration of the treatment varies according to the severity of the condition.\textsuperscript{[13]}

Therapeutically treatment of chronic asthma includes anti-inflammatory drugs like inhaled steroids which prevent asthmatic attacks and works by reducing the swelling and mucus production in airways. Inhaled steroids are available in three forms-metered-dose inhalers, spacers and nebulizers.

A combination of drugs or medications is provided for better control and is of convenience to the elderly. The combination medication includes long-acting bronchodilators (LABA) and an inhaled corticosteroid. This facilitates the elderly to breathe easily as the bronchodilator works by widening the airways. Moreover the inhaled steroid reduces and prevents inflammation of the airways.

An example of combination drug would be Budesonide and formoterol for elderly.\textsuperscript{[14]} Along with the inhaled corticosteroids, a leukotriene modifier like Montelukast is given additionally. In elderly patients, the simpler route of administration of leukotriene modifiers, compared with inhaled agents could represent a more effective strategy in improving the outcomes of asthma therapy.\textsuperscript{[15]}
With reference to the drug delivery devices, nebulizer is a machine that changes the medication from liquid to mist form which is inhaled by the patient. The patient breathes through a facemask which is of two types one for the children and other one for the adults. Inhalers are hand held devices which is also of two-types, Metered-dose inhalers (MDI) and Dry powder inhalers (DPI). These inhalers deliver the medication directly into the airways promptly if it is properly utilized.

The advantages of these drug-delivery devices are faster onset of pharmacological actions, since the drug is being delivered to the site needing the therapeutic effect and a lower systemic bioavailability which decreases potential adverse effects.[16]

However though there are several benefits in the drug-delivery systems, these have several shortcomings which are to be modified and corrected for effectiveness to the elderly. The drug-delivery systems still do bring about failure in the treatment of asthma resulting in chronic asthmatics.

AIMS AND OBJECTIVES
1) To find out the benefits of common drug delivery devices used by chronic asthmatic patients.
2) Reasons for exploring the persistence of asthma even though there is strict patient compliance.

MATERIALS AND METHODOLOGY
The Information on treatment modality & drug delivery devices were collected from the patients attending Pulmonology Department, PSG Hospitals via a validated questionnaire. The data from the questionnaire was evaluated and results were obtained.

IHEC approval: Obtained from Institutional Human Ethics Committee, PSGIMSR.

Mode of study: A prospective interactive observational clinical questionnaire based study using validated asthma control test (ACT) questionnaire.
OBSERVATIONS AND RESULTS

1) Age group

![Age group chart]

2) Sex

![Gender chart]

3) Duration of breathing problems

![Duration chart]
4) Frequency of breathing problems

- Daily: 30%
- Whenever there is breathing problems: 70%

5) Method of medications taken

- Oral: 94%
- Inhalers: 4%
- Both: 2%

6) Frequency of usage of drug delivery devices

- Inhaler: 28%
- Rotahaler: 0%
- Spacer: 36%
- Nebulizer: 14%
- Any two: 22%
7) Duration of usage of drug delivery devices

8) Self-support to aid the treatment

9) Familiarity with medicines
10) Different routes of administrations of medications

![Bar chart showing different routes of administration]

- Oral: 40%
- Inhalational: 20%
- IV injections: 30%

Routes of administration (TABLE 6)

11) Comfortable route of administrations of medications

![Pie chart showing comfortable routes]

- Oral: 68%
- Inhalational: 6%
- IV injections: 4%
- Both: 22%

Comfortable route (Chart 5)

12) Frequency of usage of drug delivery device

![Bar chart showing frequency of usage]

- Daily: 80%
- Fixed day: 10%
- Wheneve there is breathing problems: 0%

Frequency of usage of device (TABLE 7)
13) Frequency of visiting doctors

![Frequency of visiting doctors](chart)

14) Usage of oxygen at home

![Oxygen usage at home](chart)

15) Frequency of buying medicines

![Frequency of buying medicine](chart)
16) Expenses spent

![Expenses spent chart](chart7)

17) Coordination with the drug delivery device

![Coordination with device chart](chart8)

18) Percentage of people who took short intervals of breath holding between each puff

![Short intervals between each puff chart](chart9)
19) Frequency of cleaning spacers

![Frequency of cleaning spacers](chart)

- Monthly: 4%
- 3 months once: 0%
- Daily: 96%
- Never: 0%

20) Method of cleaning spacers

![Method of cleaning spacers](chart)

- Running water: 69%
- Leave under sunlight: 19%
- With cloth: 12%

21) Frequency of cleaning inhalers

![Frequency of cleaning inhalers](chart)

- Daily: 30
- Whenever required: 50
- For every dose: 20
22) Various situations for utilization of device

![Situation for urgent usage of device (Chart 12)](image)

- During sleeping: 4%
- During walking: 2%
- Climbing up: 14%
- Stressful time: 16%
- Any two: 64%

21) Emotional support from family

![Emotional support from family (Chart 13)](image)

- Yes: 90%
- No: 10%

23) Expenditure

![Expense management (TABLE 11)](image)

- Self: 0
- Family: 100
- Sports: 0
- Government hospitals: 0
DISCUSSION

Asthma is a respiratory disease causing repeated episodes of wheezing, breathlessness, chest tightness, and nighttime or early morning cough.

It has become one of the commonest respiratory conditions that elderly face. Its prevalence as well as the intensity of the asthmatic attacks has increased overtime among elderly. Several drug delivery devices have been prescribed to aid the treatment of asthma. Nevertheless the worsening of the condition as well as the persistence of periodic asthmatic attacks among elderly has brought into question, whether there are faults in the usage of the drug delivery devices. Hence a asthma control test (ACT) questionnaire based validated questionnaire was prepared and the patient’s responses were noted. According to the results obtained from (TABLE 3), out of 50 patients were of age group 50-90 years and 60% were males & 40% were females. In the study group 56% of the patients had breathing problems for more than 5 years that indicated the severity of the condition. 70% of the study patients experienced breathing problems regularly while 30% experienced at different times (CHART 1). Among them 50% of participants were using inhalers and 45% were using any two inhalational devices (Table 4) also 82% were using the inhalational devices for more than a year (Table 5), of which 70% were using devices daily (Table 7) with 68% of patients had comfort on inhalational route of administration (Chart 5). And also 31% of people were unable to take short interval of breath holding between each puff (Chart 9). 70% of patients were not on other supports like yoga, breathing exercises (Chart 3) and only 10% were aware about their medications (Chart 4). 76% patients were buying medicines at a time and 24% were getting it on weekly basis (Table 9) and spending 500-1500 rupees per prescription (chart 7). Thus, this study is aimed to cross check the ability of patients to follow the steps related to the Inhaler use, and found that 58% were unable to practice the coordinated movements to hold the breath for activation of the canister.

The purpose of the study was to evaluate the reasons for failure of drug treatment and the persistence of asthma above 50 years of age. In this study majority of patients were visiting hospitals at regular interval for review and following prescription properly but 58% were not able to use devices as per the expected way due to either lack of coordination in few steps, or not able to take short intervals of breath holding between each puff when inhaler is used by them. During each review, when this particular problems if are reviewed by the consultants
might help the patient’s moral support to adhere to medicines and also helps in reducing the unnecessary change in prescriptions.

CONCLUSION
During regular follow-up, if the patients are personally cross checked by the physician if there is failure of therapy or lack of improvement in clinical symptoms, will positively shift their behavior to adhere prescription and also patients will be motivated to use the devices regularly and prescription will become cost effective.

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REFERENCES
3. GINA guidelines 2011.
10. Indu Khurana-respiration(applied aspects)chapter, pulmonary function tests pg 365.