

## Acute Asthma in Young Adults in Out patient Department: Bronchodilator (Salbutamol) response by Pressurized Metered Dose Inhaler (pMDI) with Spacer and Dry Powder Inhaler (DPI): Efficacy assessment

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### Abstract:

**Background:** Asthma is a chronic inflammatory disease of the airway with relapse and remission. There are different forms or variants of asthma eg: Intermittent Asthma, Persistent Asthma. Loss of control of any form or variant of asthma is termed as Acute exacerbation: which may cause mild to life threatening attack. Salbutamol inhalation is the key to control the acute attack. With its own advantages and disadvantages different delivery systems have been developed for asthma medications. Efficacy assessment compared between pMDI with Spacer and DPI(Aerolizer) about bronchodilator response in mild to moderate acute exacerbation of Asthma in young patients(19 years to 40 years) at out patient basis. Patients with severe acute exacerbation were excluded.

**Methods:** This observational study was done at outpatient basis in Brahmanbaria Medical College Hospital, Concept Hospital, Feni & National Hospital, Dagonbhuiyan, Feni, Bangladesh and the sample was 100 Acute Asthma patients over a period of six months from January 2017 to July 2017. The patients were selected by pre-diagnosed Asthma patients as Acute exacerbation of Asthma by typical symptoms eg: Mild exacerbation: patient was dyspnoeic but can complete sentences and Moderate exacerbation; patient was more dyspnoeic and can,t complete a sentence in one breath. Initial peak expiratory flow rate (PEFR) was recorded. Randomly distributed two groups of equal number of patients received 500 micro-gm of salbutamol either by MDI with spacer and DPI (Aerolizer).Subsequent Subjective assessment were done by patient,s clinical status and objective follow-up were done by peak flow meter to record PEFR.

**Results:** The subjective and objective improvement were observed with pMDI with spacer and DPI evident by symptoms and PEFR.

**Conclusion:** Dry powder inhaler is better compliant in younger patient as it is effort dependent with greater Peak Inspiratory Flow Rate (PIFR) usually 60L/min or higher, measured by In-Check DIAL. However this study showed that in acute Asthma where there is loss of control equal amount of drug delivered by MDI with spacer showed better bronchodilator response.

**Key words:** Acute exacerbation of Asthma, pMDI. Spacer. DPI.Aerolizer. PEFR

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### I. Introduction

Asthma is a respiratory disease with relapse and remission, Chronic inflammatory in nature causing hyper-responsiveness of the airways to certain stimuli resulting in at least partially reversible, recurrent, variable airflow limitations presenting as cough, wheeze, chest tightness and breathlessness. Current estimate suggests that 300 million people worldwide suffer from asthma and additional 100 million may be diagnosed with asthma by 2025.<sup>[1]</sup>

Inhalation of an allergen in a sensitized atopic asthmatic patient result in a two phase broncho-constrictor response. Early reaction (Type-1): Preformed mediators release: Inhaled allergen rapidly interacts

with mucosal mast cells via an IgE dependent mechanism, resulting in the release of mediators such as histamine & the Cysteinyl leukotriens with resulting bronchoconstriction. Late reaction (Type-2): Inflammatory cell recruitment & activation: In persistent asthma a chronic and complex inflammatory response ensues. Characterised by an influx of numerous inflammatory cells, the transformation & participation of airway structural cells and the secretion of an array of cytokines, chemokines & growth factors. The cellular and structural components to the asthmatic inflammatory response include Mast Cell: Eosinophil: T Lymphocyte: Neutrophil: Macrophage, Epithelium:, Airway Smooth muscle: Endothelium: Neuronal Dysfunction. Pathophysiological features of asthma includes Airflow limitation: Airway hyper-reactivity and Airway inflammation:

Clinically asthma is classified into **Intermittent asthma**: Where there is Two or < 2 nocturnal symptoms in a month. Between the episodes, patient is symptom free, PFT is normal sub-basement fibrosis yet not developed.

**Persistent asthma**: Mild persistent asthma: >2 nocturnal attack per month, baseline (during symptom free state) PEFr or FEV1 is usually <80% to <65% of predicted value.

Moderate persistent asthma: Usually patients have almost daily attack of dyspnoea & base line PEFr or FEV1 is <65% to <50% of predicted value. Severe persistent asthma: Usually patient have dyspnoea to some extent continuously for 6 months or more & baseline PEFr or FEV1 is <50% of predicted value.

**Special Variants**: There are 5 special variants of asthma:

- a. Seasonal asthma;
- b. Exercise induced asthma;
- c. Drug induced asthma;
- d. Cough variant asthma;
- e. Presents with chronic cough and Occupational asthma;

**Acute exacerbation**: means Loss of control of any form or variant of asthma which may cause mild to life threatening attack. It has three variants: Mild: patient is dyspnoeic but can complete sentences. Moderate: patient is more dyspnoeic and can't complete a sentence in one breath. Severe (Severe acute asthma: Status asthmaticus): Patient is severely dyspnoeic, talks in words and may be restless even unconscious.<sup>[2]</sup>

Making a diagnosis of asthma includes Compatible clinical history plus either /or FEV1 >15% (and 200ml) increase following administration of a bronchodilator/trial

\*>20% diurnal variation on >3days in a week for 2 weeks on PEF diary. FEV1- > 15% decrease after 6 minutes of exercise. The goals of asthma management are to

achieve and maintain control of symptoms, prevent asthma exacerbation, maintain pulmonary function as close to normal as possible, avoid adverse effects from asthma medication, prevent development of irreversible airflow limitation and Prevent asthma mortality. Principles of management: Patient education: Avoidance of aggravating factors: Medication: A stepwise approach to the management of asthma. Medications are reliever- eg: Short acting B2 agonist (SABAs), Long acting B2 agonist (LABA), Anticholinergic eg: Ipratropium: Controller medications are inhaled corticosteroid eg: Beclomethasone dipropionate, Budesonide, Fluticasone & Ciclesonide. Leukotrien eg: receptor antagonists: Montelukast, Zafirlukast, LABA & sustained release theophylline, Cromones: cromoglycate & Nedocromil.

Although there are many routes of drug delivery including oral, Injectable & Inhalation. Inhaled medications are the main therapy for bronchial asthma because medications are directly delivered into the airways, which produce a high concentration with significantly less risk of systemic adverse effects. Among the inhaler devices available are pressurized metered dose inhaler (PMDI) with or without Spacer, Dry powder inhaler (DPI) which include Aerolizer, Diskus, Handihaler, Rotahaler etc.<sup>[3,4]</sup>



Figure 1.1: Spacer



Spacer with MDI



Figure 1.3: DPI (Aerolizer)

## II. Methodology

**Methods and Materials:** A mixed method was applied for the study. A sample survey through survey questionnaire and interview and observation was done on 100 Acute Asthma patients over a period of six months from January 2017 to July 2017.

**Sampling technique:** Purposive sampling.

**Study Area:** This observational study along with survey was done at outpatient basis in Brahmanbaria Medical College Hospital, Concept Hospital, Feni & National Hospital, Dagonbhuiyan, Feni, Bangladesh.

**Inclusion Criteria:** The patients were selected by pre-diagnosed Asthma patients as Acute exacerbation of Asthma by typical symptoms eg: Mild exacerbation: patient was dyspnoeic but can complete sentences and Moderate exacerbation; patient was more dyspnoeic and can't complete a sentence in one breath. Initial peak expiratory flow rate (PEFR) was recorded. Randomly distributed two groups of equal number of patients received 500 micro-gm of salbutamol either by MDI with spacer and DPI (Aerolizer). Subsequent Subjective assessment were done by patient,s clinical status and objective follow-up were done by peak flow meter to record PEFR.

### III. Results

#### Profile of the Asthma Patients:

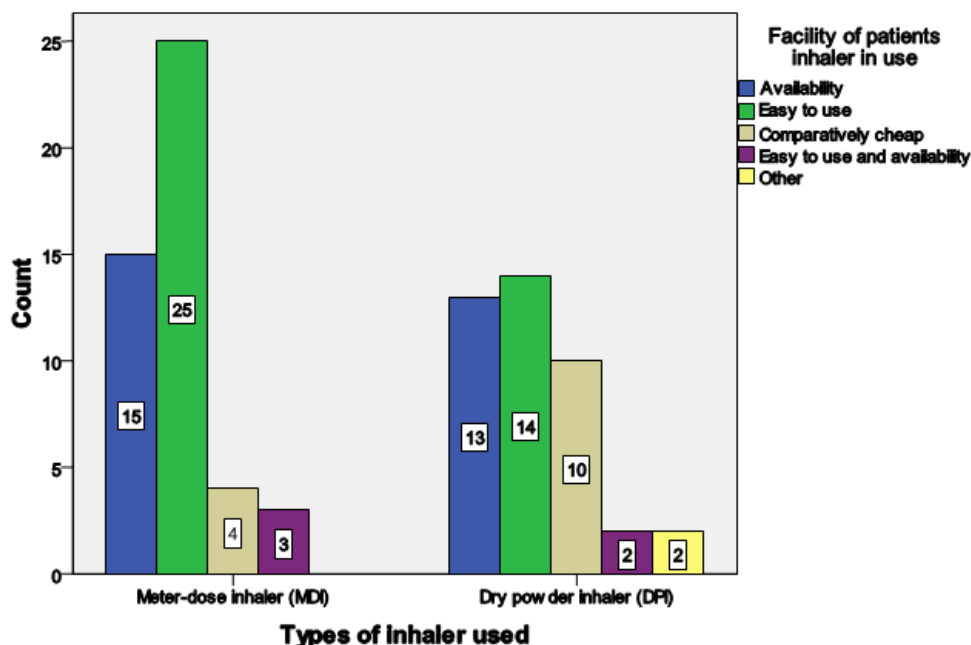
**Table 2:** Age group of the Acute Asthma patient

Age group	Frequency	Percent	Valid Percent	Cumulative Percent
19-30	51	51.0	51.0	51.0
31-40	49	49.0	49.0	100.0
Total	100	100.0	100.0	

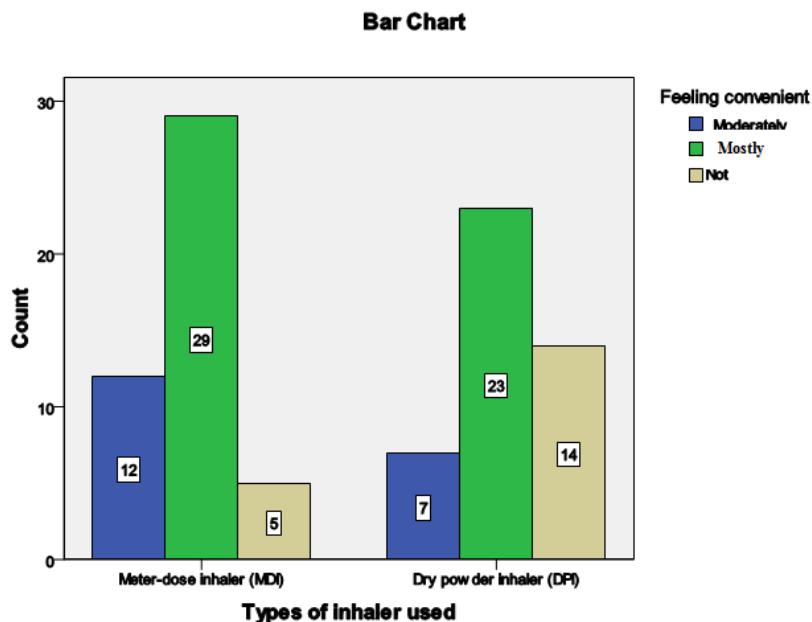
**Table 2:** Sex of the Acute Asthma patient

Sex	Number of Patient (percentage)
Male	59(59%)
Female	41(41%)

#### Bar Chart



**Figure 1:** Facility of patients inhaler in use



**Figure 2: Status of feeling convenient**

The subjective and objective improvement was observed with pMDI with spacer as evident by symptoms and PEFr.

#### IV. Discussion

Acute asthma is characterized by a progressive increase in shortness of breath, cough, wheezing or chest tightness, and by a decrease in expiratory airflow that can be quantified by measurements of pulmonary function such as the peak expiratory flow rate (PEFR) and FEV<sub>1</sub>.<sup>[5]</sup>

Acute asthma is a common medical emergency faced by emergency department (ED) and intensive care specialists. In the United States, asthma represents the 11th most frequent ED diagnosis nationwide, and adolescents and young adults are the most likely age groups to visit the ED for treatment. Women visit the ED and are hospitalized for acute asthma twice as often as men. Previous data suggested that 40% of these hospitalizations occur during the premenstrual phase of the cycle. Men are less likely than women to report severe asthma symptoms and activity limitations in the presence of airway obstruction. Data from Australia, Canada, and Spain reported that acute asthma accounted for 1 to 12% of all adult ED visits.<sup>[6,7]</sup> Of the 1.5 million ED visits by asthma patients in 1995 in United States, 20 to 30% of patients required hospital admission, rates of hospital admission for female patients and blacks are consistently higher than for male patients and whites. However, in the past decade there has been a decline in the number of patients with acute severe asthma requiring ICU admission, and a trend toward less advanced presentations with reduced level of respiratory acidosis and decreased ICU length of stay. In one large tertiary care hospital, only 4% of asthma admissions required ICU care over a 10-year period. In another report, 7% of adult acute asthma patients who presented to EDs in France are transferred to an ICU. Probably, most hospitalizations, including those requiring ICU care, are preventable." Developed economies might expect 1 to 2% of total health-care expenditures to be spent on asthma. The US studies estimated that the total burden of asthma is approximately \$6 billion per year.<sup>[8]</sup> Direct costs (providing health care to asthmatics) rather than indirect costs (missed work, additional child care, etc.) represented the greater part (almost 90%) of the total societal cost. Together, hospitalizations and ED visits represent the single greatest cost category, accounting for almost 50% of the total cost overall. The average annual cost per patient who had an attack is \$600, compared with \$170 for those who did not, an increase of > 3.5 times.<sup>[9]</sup>

Only approximately 20% of asthmatics have ever been admitted to an ED or hospital, yet these patients account for > 80% of total direct costs ("high-cost patients"). The estimated annual per patient cost for those high-cost patients is \$2,500, in contrast with \$140 for the rest. These estimations indicate that hospitalization and ED visits account for the largest proportion of costs, and represent the area with the principal potential for savings.

#### V. Conclusion

We know that usually DPI is better compliant in younger patient as it is effort dependent with greater Peak Inspiratory Flow Rate (PIFR) usually 60L/min or higher, measured by In-Check DIAL. However this study

showed that in acute Asthma where there is loss of control equal amount of drug delivered by MDI with spacer showed better bronchodilator response.

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