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Research Article

Clinical study of bronchial asthma in children aged 5 to 12 years with special reference to peak expiratory flow rate

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ABSTRACT

Background: Asthma is one of the most common chronic diseases worldwide imposing a substantial social burden on both children and adults. Over the last 20 years its prevalence has considerably increased, especially among children. The aim of present study is to study the clinical features of bronchial asthma and to assess objective response of PEFR to bronchodilator therapy.
Methods: After taking detailed history, clinical examination, the PEFR was recorded in fifty symptomatic bronchial asthma children between 5-12 years of age group before and after salbutamol nebulization. They were compared with PEFR values of normal children from same population in same age group, height range, weight range and sex.
Results: Among Fifty cases studied, maximum number (44%) of cases of asthma was found in the age group of 11-12 years with male: female ratio 1.77:1. Cough and wheeze were predominant symptom and was present in all cases (100%). Cold air in 24 (48%) cases, URTI in 15 (30%) cases, dust in 8 (16%) cases and cold food in 3 (6%) cases were found to be important precipitating factors. There was significant reduction in PEFR (L/min) in study group as compared with control group. The percentage of improvement in PEFR was 21.3% after bronchodilator therapy which is statistically significant (P<.000).
Conclusions: Significant improvement in PEFR following bronchodilator therapy indicates its usefulness in monitoring the response to treatment of asthma and however serial recording of PEFR is recommended for better management and control of asthma in childhood.

Keywords: Bronchial asthma, PEFR, Bronchodilator

INTRODUCTION

Asthma is one of the most common chronic diseases world wide imposing a substantial social burden on both children and adults.[1] Asthma occurs in all countries regardless of the level of development but varies greatly between populations, even with countries. There is evidence that over the last 20 years its prevalence has considerably increased, especially among children.[1]

The prevalence of asthma symptoms in children varies from 0 to 30 percent in different population. Worldwide childhood asthma appears to be increasing in prevalence, despite considerable improvement in management of asthma.[2]

In India prevalence of asthma has been found to be around 6% in majority of survey. However it has been reported to vary from 2-17% in different study population.[3]

Disease can start at any age, but in majority it starts before 10 years of age. Although many patients have mild disease, any person with asthma can develop a severe exacerbation.[3]

Childhood asthma is responsible for significant proportion of school days lost. A wide range of different methods to assess the level of airflow limitation exists. But two methods have found wide spread acceptance for use in patients over 5 years of age. These are the measurement of forced expiratory volume in 1 sec (FEV_1) and its accompanying forced vital capacity and the measurement of peak expiratory flow.[4]

Pulmonary function testing is an important tool in the diagnosis and management of Asthma, especially pulmonary function tests provide an objective and reproducible method to evaluate the disease and follow the response to therapy.

In particular, PEFR measurement has gained worldwide acceptability as a method of recognition, assessment of severity and planning of therapy.[4]

PEFR measurement has been suggested by all international guidelines as an important tool in asthma management4.The PEFR can be measured using "standard Wright peak flow meter". As the "Miniature Wright peak flow meter correlates well with standard Wright peak flow meter, it is being used widely in clinical practice.[5,6]

It is simple to use the equipment and portable. With proper instruction the results can be used to monitor improvement, intervene early worsening and measure response to therapy.[4-6]

METHODS

Objectives of the study

1. To study the clinical features of bronchial asthma.
2. To study the PEFR in patients with acute exacerbation of bronchial asthma and to assess objective response of PEFR to bronchodilator therapy.

Source of data

A group of 50 children with symptomatic bronchial asthma attending the OPD or admitted to pediatric wards, in tertiary care hospital fulfilling the inclusion criteria.

Inclusion Criteria

The children between age group of 5 to 12 years with exacerbation of asthma.

Exclusion Criteria

The patient with history of contact with T.B. or past history of having been treated for the same disease.

The patient with history of heart failure, abnormal chest radiography findings apart from hyper-inflated chest.

Children with life threatening asthma as defined by British guidelines on management of asthma.

The patient with history of systemic disease influencing respiratory system.

The patient with history of major respiratory disease or thoracic surgery in the past is excluded from study.

Control group was selected from children attending OPD of Hospital for minor ailments and without any systemic diseases. Their height, weight and age; detailed history, clinical examination and PEFR recording were done.

Methods of Collection of data

Data was collected by using pre-tested proforma meeting the objectives of the study. The purpose and technique of the study was carefully explained to the subjects and informed consent was taken. About 50 cases under each group were selected. Detailed clinical history, thorough clinical examination was taken. Relevant investigations were done. Instrument used measure PEFR was “The miniature Wright's peak flow meter”.

Techniques of performing PEFR

The patients were selected according to the criteria laid down earlier. The purpose and technique of the study was carefully explained to the subjects and informed consent was taken.

PEFR was measured before giving nebulization with salbutamol. Post bronchodilator PEFR was recorded 10 min after nebulization with 0.5% solution of salbutamol. The patients were advised to take maximum inspiration and then to exhale forcibly into the flow meter with nose closed after satisfactory trial blows and then recordings were taken. Care was also taken to maintain airtight seal between lips and mouth piece of the instrument. For analysis the maximum of 3 recordings was taken.

RESULTS

Fifty children in the age group between 5-12 years with symptomatic bronchial asthma visiting OPD or admitted to hospital were randomly selected for the study. Age and sex matched control group of 50 was taken from the same population as the lung function tests are affected by certain variables like age, sex, stature and environmental condition.

A non significant association was observed between age groups and study and control groups.

The study group was divided into 4 groups based on age and maximum number (44%) of cases of asthma was found in the age group of 11-12 years.

In our study group there were 32 male and 17 female children with male to female ratio of 1.77:1 which was same as that of control group.

There was equal distribution of study cases and control based on both age and sex. There was no significant difference between the mean age, mean weight and mean height in study group and control group.

In the study group 40 (80%) cases were from urban area and 10 (20%) cases from rural area. Contingency coefficient revealed a non-significant association between groups and area. However we find significantly more number of patients from urban area.

Table 1: Age-wise distribution of study and control group (n=50).

Age Group	Study group	Control group	Total
I (5 -6 years)	8	(16%)	8
II (7- 8 years)	10	(20%)	9
III (9-10 years)	10	(20%)	10
IV (11-12 years)	22	(44%)	23
Total	50	(100%)	50

CC=.027, P<.997(NS), CC = Contingency Coefficient

Table 2: Symptoms in study group.

Symptoms	Number	Percentage
cough	50	100
wheeze	50	100
fever	06	12
Chest retraction	22	44
Nocturnal cough	10	20

In the study group cough and wheeze was present in all cases (100%). chest retraction was present in 22 (44%) cases. Fever was present in 6 (12%) cases. Nocturnal cough was present in 10 (22%) cases. The mean respiratory rate is significantly higher in study group as compared to control group.

In this study Cold air was the most frequent precipitating factor for asthma in 24 (48%) cases followed by URTI in 15 (30%) cases, dust in 8 (16%) cases and cold food in 3 (6%) cases.

Family history of asthma was present in 20 (40%) cases. History of food allergy was present in 16 (32%) cases. AEC>400/mm3 was present in 16 (32%) cases. Abnormal Chest X ray (hyperinflated lung fields) was found in 10 (20%) cases.

Table 3: Number of cases having precipitating factors in study group.

Precipitating factors	Numbers	percentage
Cold air	24	48
URTI	15	30
Cold food	03	06
Dust	08	16
Total	50	100

There was significant reduction in PEFR in all the age groups of the study group as compared to the control group.

The increase in mean PEFR after bronchodilator therapy was statistically highly significant (P < .000). The total percentage of increase in mean PEFR was 21.5% in males and 21% in female children which was statistically significant.

The increase in mean PEFR readings in relation to height after nebulization was in the range of 95.83±17.17 and 120±17.19 (25.22% improvement) in 100-125cm and 143.84±27.14 to 171±28.17 (18.88%) in 125-150cm which was statistically significant.

DICUSSION

Fifty Children with Symptomatic bronchial asthma, between age group of 5 and 12 years were selected by using simple random sampling technique and peak expiratory flow rate was measured before and after bronchodilator therapy with the help of mini Wright peak flow meter.

The study group was divided into 4 groups based on age. Age and sex matched control group with normal health status was taken from the same population. It is known that peak expiratory flow rate varies with age, sex, height and weight. Therefore important consideration in study of PEFR was to ensure matching of these variables between study group and control group.

In the present study, 22 (44%)cases were found in the age group of 11 to 12 years, 32 (64%) cases were male; with a male to female ratio of 1.77:1 and this was comparable to studies as shown in the table 6.

This in concordance with findings of surveys of asthma in western countries. Several studies have shown that asthma is more common and more severe in boys than in girls. Wayne J et al, Juan C Celedon, Lee YL et al and Meenu Singh, studies have reported a

higher incidence of asthma in boys compared to girls.[7-10]

Results in this study show that in the both groups (study group and control group), sex, height, weight and age were nearly equally distributed among cases and controls with nearly equal mean SD. Since cases and controls were sampled from the same population, they have same socioeconomic background. Thus this ensures adequate matching for comparability between cases and controls.

In present study 40 (80%) children were from urban area and 10 (20%) children were from rural area. This shows that in our study there is urban predominance. This is in concordance with Andrew et al[11] study, who reported all children in urban area are at increased risk for asthma. The high incidence of asthma in urban populations compared with a significantly lower incidence in rural populations suggests that environmental risk factors have key role.[12]

Table 4: Mean PEFR (l/mm) ± SD in study group before nebulization and control group (n=50).

Age group	Study group		Total	Control group		Total
	Male Mean±SD	Female Mean±SD	Mean±SD	Male Mean±SD	Female Mean±SD	Mean±SD
1(5-6)	76.66±15.27	92.00±13.03	86.2 ± 15.0	120 ± 17.3	112 ± 8.3	115 ±
11(7-8)	91.42±15.73	96.66±15.27	93.0 ± 14.9	158 ± 16.7	155 ± 7.0	157.7 ± 14.8
111(9-10)	122.50±28.1	130.0±28.28	124.0 ± 26.7	198 ± 44.3	200 ± 20	199 ± 37.2
IV(11-12)	143.57±31.77	146.25±11.8	144.5 ± 25.9	228 ± 21.3	218 ± 18.8	225.2 ± 20.6

Fgroup=116.658; P< 0.000 Fsex=0.015; P<0.815, Fage=55.292; P<0.000

Table 5: Comparison of mean PEFR (l/mm) ± SD before and after bronchodilator therapy in study group (n=50).

Age Group	Prebronchodilator	Post bronchodilator therapy
I (5-6)	86.2 ± 15.05	108.7 ± 16.42
II (7-8)	93.0 ± 14.94	120.0 ± 14.14
III (9-10)	120.0 ± 14.94	151.0 ± 26.85
IV (11-12)	144.5 ± 25.95	170.4 ± 29.83
Total	120.8 ± 33.18	146.6 ± 35.02

P < 0.000

Chakvarthy et a1 studied prevalence of asthma in urban and rural children in Tamilnadu and found that 22% of urban and 9% of rural children (6-12 yrs of age) reported breathing difficulty at any time in the past and concluded that the prevalence of asthma, breathing difficulty and nocturnal cough was significantly higher among urban children in the age group of 6-12yrs.[13] Paramesh also reported asthma prevalence among children is predominantly seen in urban (16.6%) compared to rural (5.7%).[14]

The clinical course of asthma encompasses acute exacerbation of cough, wheeze and chest retraction. In this study, all children had cough and wheeze (100%) as the predominant symptoms and chest retraction was present in 22 children (44%).

In present study the mean respiratory rate in 4 groups was 62.25, 56.2, 47.6 and 38.3 per minute as compared to 18.5, 18, 17.4 and 17.5 per min in control group respectively.

This shows that during the attack, there is increased work of breathing and respiratory rate increases to maintain normal $pa0_2$ and Pco2 in blood (P < .000). Hence statistically significant

In present study, cold air was the most frequent precipitating factors for asthma constituting 48%, followed by URI (30%), dust(16%) and cold food (06%).

With various studies conducted, 24.54% incidence of acute exacerbation of asthma was with concurrent viral acute respiratory infections. Roldaan and Mansural performed a prospective study of 32 older children with atopic asthma and 54% of them had acute respiratory infection at the time of attacks.[15]

Ratageri et al studied precipitating factors for mild and severe asthma.[16] They found, cold air in 61.7%, URI in 50%, smoker in 30%, dust in 46.6%, cold food in 63.3% of cases were precipitating factors associated with mild asthma and cold air in 83.3%, URI in 70%, smoke in 56.6%, dust in 46.6%, cold food in 8.3% with severe asthma.

Tomac et al studied prevalence and risk factors for childhood asthma and concluded that family history of allergy, symptoms or diagnosis of allergic rhinitis and bronchitis and male gender were found to be significant predictors for asthma symptoms.[17]

Asthma is an atopic disease, some studies have showed strong genetic component in atopic disease including asthma. In this study, family history of Asthma was present in 20 (40%) children. Benera et al studied, Genetic and environmental factors associated with asthma in school children and concluded that, the family history of asthma contributed more to childhood asthma than indoor and outdoor environmental factors.[18]

Wayne J et al reported family history in 40% patients with asthma. Blair found that 73% of those asthmatics having a first-degree relative with an atopic condition had chronic recurrent asthma at follow up.[19] Celdon JC et al studied, Risk factors for childhood asthma in Cost Rica and concluded that low parental education ,parental history of asthma are risk factor for asthma.

Table 6: Male : female ratio in comparison to other studies.

Present study	Wayne j et al	Juan C Celedon	Lee YL et al	Menu singh
1.77: 1	2:1	1.2:1	1.45:1	1.75:1

In this study we found that grandparents were the predominant category affected among family members and food allergy was found in 2 (4%) cases. Penerd-Mornad C et a1 studied prevalence of food allergy and its relationship to asthma and allergic rhinitis in school children and found that about 2.1% of children reported symptoms of food allergy.[20]

Since Asthma is an atopic disease, it is usually associated with an increase in eosinophil count. Ulrik CS showed that increased eosinophil count was associated with asthma.[21] In present study absolute eosinophil count (AEC) > 400 cells/mm^3 was present in 16 children (32%).

The PEFR was studied in 4 groups based on age. The mean PEFR with SD before giving bronchodilator was 120.8 ± 28.8 1/min and after bronchodilator was 146.6±35.0 1/min. Applying paired 't' test mean value of PEFR before and after bronchodilator therapy in study group was highly significant (P < 0.000).

The mean PEFR in study group was compared with mean PEFR in control group in all 4 groups. There was significant reduction in PEFR (l/min) in study group as compared with control group.

The percentage of improvement was 21.3% after bronchodilator therapy (statistically significant P <0.000). Statistical analysis shows significant reduction of PEFR in asthmatic patients. Applying paired T test the mean value of PEFR before and after bronchodilator therapy in study group was highly significant (P <0.000).

Even after bronchodilator therapy, the mean PEFR in study group though significantly higher than pre bronchodilator, values were significantly lower than mean PEFR of control group irrespective of age, sex and height. This suggests the though there was improvement with bronchodilator therapy some airway obstruction persisted. The PEFR in study group was compared with PEFR in control group in relation to height also. There was significant improvement after bronchodilator therapy.

Table 7: Family history of asthma, compared to other studies.

Present study	Waynej et al	Jaun C. Celdon	Ratageri et a1
40%	40%	38.3%	40%

Gary Mueller and Eigen studied pulmonary function test in asthma and found 12% improvement in PEFR after bronchodilator therapy.[22]

John et al studied pulmonary function test in infants and children and stated that PEFR measurement in asthma can be used to monitor improvement, intercept early worsening and measure response to therapy.[23]

Slieker MG et a1 studied 271 children with asthma. PEFR measurement was performed in children with asthma who attended the hospital for a routine pulmonary evaluation.[24] and noticed 20% improvement in PEFR after bronchodilator therapy and concluded that PEF testing has the properties to be a good screening test to exclude airway obstruction and bronchodilator response but is of less clinical value as a diagnostic test.

Brand PL et a1 studied , Peak flow variation in childhood asthma and concluded that peak expiratory flow variation in children with stable, moderately severe asthma is significantly, but weakly, related to symptoms and airway hyperresposiveness.[25]

The significant improvement in PEFR after bronchodilator therapy as compared to pre bronchodilator observed in this study indicated that PEFR could be employed to estimate the extent of bronchial patency. However, serial measurements might be more useful. This suggests that PEFR could be useful in assessing response to various treatment modalities of asthma.

CONCLUSION

Cough, wheeze are the predominant symptom and cold air, URTI are most frequent precipitating factors in children with Asthma. Significant improvement in PEFR following bronchodilator therapy indicates its usefulness in monitoring the response to treatment of asthma and however serial recording of PEFR is recommended for better management and control of asthma in childhood and further studies are needed to establish causal

relationship between various precipitating factors and asthma.

Thus simple test like PEFR can be utilized in the office management of bronchial asthma which increases the effectiveness of long term management. Hence the use of this test should be encouraged in routine pediatric practice.

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