

# Clinico Etiological Evaluation of Asthma with Special Reference to Pulmonary Function Test

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## Abstract

**Objective:** 1) To Study incidence and analyse demographic profile of Asthma. 2) To Analyse role of Pulmonary Function Test in diagnosis and control of Asthma and observe role of serial monitoring of pulmonary function tests in relation to effect of preventive drug regimen. **Design:** This Prospective Observational type of study was conducted at the Paediatric Department of Civil hospital, Ahmedabad on Patients Diagnosed with Asthma from 15/07/2022. **Subjects/Patients:** Patients aged between 1 to 12 years were included. **Methods:** Statistical analysis used: chi square test, p value. **Results:** In present study, 89.5% had onset of asthma symptoms between 1 to 5 year of age, 2.01% had symptoms onset <1 year of age and 8.4% had onset >5 year of age. Pulmonary function test is not much affected in well controlled disease but in persistent variety there are restrictive changes in pulmonary function test in form of decrease in % of FEV1 predicted. **Conclusion:** In Pulmonary function testing value of FEV1 and FVC: FEV1 correlate with severity of Asthma which suggests that spirometry not only helps in diagnosis but also helps in assessing the severity which has the key role in the successful management.

**Keywords:** Asthma, Pulmonary Function test.

## Introduction

Asthma is one of the commonest chronic inflammatory disorders of the airways characterized by an obstruction of airflow, which may be completely or partially reversed with or without specific therapy<sup>[1-3]</sup>.

Acute attack of asthma is most common medical emergency in children. In assessment of acute attack, in children it is difficult to decide on initial assessment whether outpatient therapy is adequate or hospitalization is indicated. Main methods used to evaluate severity of acute asthma are clinical parameters, SPO<sub>2</sub> and PEFR. The most accurate method to measure severity is spirometry / PEFR. This study was performed to study demographic profile of asthma and role of serial monitoring of pulmonary function test.

## Methods

**Study Design:** Prospective Observational type.

**Study Period:** Patients Diagnosed with Asthma from 15/07/2022.

**Study Site:** This study was conducted in the Paediatric Department of Civil hospital, Ahmedabad.

## Patient Selection

## Inclusion Criteria

1. Age of patients between 1 year to 12 years.
2. All patients with wheeze on presentation diagnosed as having Asthma.

## Exclusion Criteria

1. Age of patients more than 12 year and less than 1 year.
2. Patients of Acute Bronchitis due to other cause like
  - Foreign bodies
  - Congenital anomalies of larynx, trachea or Bronchus.
  - Gastro oesophageal reflux disease.
  - Cystic Fibrosis and other Mucociliary Defect.
  - Bronchiolitis.
  - Congenital Heart Disease.
3. Patients not willing to take part in this study.

This prospective observational study was conducted in paediatric department of civil hospital Ahmedabad, Patient's personal data, clinical and laboratorial information was recorded based on pre-structured, pre-standard proforma, together with results of the physical examination.

## Results

The present study was done at department of paediatrics of tertiary care hospital from 15/07/2022 over a period of one and half year.

During study period total 10540 patients got admitted in hospital out of 162 patients got admitted due to acute exacerbation of Asthma. In this study, out of 248 patients, the highest number of patients belonged to 6-10 years of age group contributing total 72.4%, with mean age of 7.3 years. out of 248 patients, pulmonary function test was done in 203 patients. Out of 203 patients only 2 (1%) patients had severe obstruction, whereas in 95(46.8%) patients had moderate obstruction and in 106 (52.2%) patients mild obstruction seen. The mean FEV1 values were  $85.60 \pm 6.79$  for mild intermittent asthma,

$83.12 \pm 3.46$  for mild persistent and  $70.60 \pm 6.50$  percent for moderate persistent. We found positive correlation between severity of Asthma and values of FEV1 ( $p < 0.001$ ). In the present study, 54.2% children showed FEV1: FVC ration more than 80% whereas 42.9% had between 75-80% and 3% had  $< 75\%$ . The mean values were  $85.18 \pm 2.97$  for mild intermittent,  $84.88 \pm 2.96$  for mild persistent and  $77.21 \pm 2.85$  for moderate persistent. In present study, out of 203 patients in whom pulmonary function test was done, 71 patients regularly followed and repeat spirometry done. In mild persistent mean values for FEV1 improved from  $82.43 \pm 2.07$  to  $87.43 \pm 1.62$ , from  $71.62 \pm 7.52$  to  $82.71 \pm 3.81$  in moderate persistent, and this is statistically highly significant.

**Table 1: Proportion of Asthma in Present Study.**

Total number of patients hospitalized during study period	No of patients hospitalized with acute exacerbation of bronchial asthma
10540	162

**Table 2: Distribution of age group according to severity in present study.**

Age (years)	1 to 5 years (n=45)	6 to 10 years (n=181)	11 to 12 years (n=22)
Mild intermittent (n=82)	18 (40%)	57 (31.5%)	7 (31.8%)
Mild persistent (n=25)	6 (13.3%)	15 (8.3%)	4 (18.2%)
Moderate persistent (n=141)	21 (46.7%)	109 (60.2%)	11 (50%)
$X^2 = 4.64, p = 0.32$			

**Table 3: Comparison of Distribution of age group in various studies.**

Age	No of patients(n=248)	Percentage (%)	Krishna Prashad <i>Et al.</i> <sup>(24)</sup> (n=100)	Daljit Singh <i>et al.</i> <sup>(25)</sup> (n=58)	Mean age
1-5 years	45	18.8%	36%	22.4%	7.3 $\pm$ 2.3
6-10 years	181	72.4%	56%	56.9%	
11-12 years	22	8.8%	8%	20.7%	

**Table 4: Association between gender and severity of asthma**

Gender	Female(n=77)	Male(n=171)	Percentage (%) (n=248) M:F ratio	Trivedi PP <i>et al.</i> <sup>(28)</sup> (n=109)
Mild intermittent (n=82)	30 (39.0%)	52 (30.4%)	2.2:1	2.6:1
Mild persistent (n=25)	6 (7.8%)	19 (11.1%)		
Moderate persistent (n=141)	41 (53.2%)	100 (58.5%)		
$X^2$ & p value	$X^2 = 2.01, p = 0.36$			

**Table 5: Pulmonary Function Test in Asthmatic Patients**

% OF FEV1 Of Predicted	No of patients(n=203)	Percentage	Charul Mehta <i>et al.</i> <sup>(45)</sup> (n=91)
Mild or No obstruction FEV1 $> 80\%$	106	52.2%	79.2%
Moderate Obstruction FEV1 $> 60\%$ TO $< 80\%$	95	46.8%	19.7%
Severe Obstruction $< 60\%$	2	1.0%	1.1%

• FEV1: Forced expiratory volume in 1 minute

**Table 6: FEV1: FVC Ratio in Patient with Asthma**

FEV1: FVC Ratio	No of patients(n=203)	Percentage (%)	Charul Mehta <i>et al.</i> <sup>(45)</sup> (n=91)
$> 80\%$	110	54.2%	79.2%
75-80%	87	42.9%	19.7%
$< 75\%$	6	3.0%	1.1%

• FEV1: Forced expiratory volume in 1 minute

• FVC: Forced vital capacity

**Table 7: Effect of Bronchodilator on FEV1 at 6 months follow up**

	At the time of Diagnosis	After 6 months	p value
Mild intermittent (n=22)	$84.86 \pm 2.01$	$93.55 \pm 1.53$	0.965
Mild persistent (n=7)	$82.43 \pm 2.07$	$87.43 \pm 1.62$	0.009
Moderate persistent (n=42)	$71.62 \pm 5.11$	$82.71 \pm 3.81$	$< 0.001$
Total (n=71)	$76.79 \pm 7.52$	$86.54 \pm 5.81$	$< 0.001$

• FEV1: Forced expiratory volume in 1 minute

## Discussion

In this study, out of 250 patients, the highest number of patients belonged to 6-10 years of age group contributing total 72.4%, with mean age of 7.3 years.

Higher prevalence of Asthma in school going children was also noted in the studies done by Krishna Prasad *et al.*<sup>[6]</sup> (56%) and Daljit Singh *et al.*<sup>[7]</sup> (56.9%). The Higher prevalence of Asthma in school going children in the present study may be due to increased exposure to triggers like air pollutants and respiratory infections in the school. In our study 33% patients had mild intermittent Asthma, 10.08% had mild persistent Asthma and 56.85% had moderate persistent Asthma. This finding is similar to a hospital based descriptive study conducted by A. Krishna Prasad *et al.*<sup>[6]</sup>, who had observed 34% as moderate persistent, 26% as intermittent Asthma and 13% suffering from severe Asthma. In study done by Patil PM *et al.*<sup>[8]</sup> 34% had mild intermittent, 37% had mild persistent and 23% had moderate persistent asthma, while only 6% had severe persistent Asthma. In Gupta *et al.*<sup>[9]</sup> prevalence of Asthma was more in age group of 10-15 years.

In present study, it was found that Asthma was more prevalent in males than female, (68.9% vs 31.04%) which is statistically not significant ( $p=0.36$ ), indicating that increased prevalence of asthma in males was just a chance observation. In studies done by Chandra *et al.*<sup>[10]</sup> and Sharma *et al.*<sup>[11]</sup> slight male preponderance was observed, M:F ratio was 1.46:1 and 1.8:1 respectively. In study done by Bhalla *et al.*<sup>[12]</sup> (M: F =2.27:1), Trivedi PP *et al.*<sup>[13]</sup> (M: F=2.6:1), Daljit Singh *et al.*<sup>[14]</sup> (M: F=1.2:1) similar finding was noted. This shows that the male gender is at increased risk for Asthma and this is probably related to narrower airways, and increased airway tone which predispose them to enhanced airflow limitation in response to various stimuli. This difference disappears after the age of 10 years when airway diameter/length ratio is same in both sexes, because of change in thoracic size that occurs in males but not in females.

In present study out of total 248 patients 89.5% of patients had onset of Asthma symptoms between age of 1-5 years of age, while 2.01% had onset <1 year and 8.4% had after 5 year of age, this observation is statistically highly significant ( $p=0.01$ ) suggesting that early onset of Asthma had higher chance to get convert in more severe form. In H. Paramesh <sup>[15]</sup> study majority of children (51.4%) had onset of symptom before preschool age. Various factors are associated with onset of childhood Asthma like maternal risk factors during pregnancy, low birth weight, preterm birth, and environmental risk factor like exposure to air pollutants, dust, cold dry air etc.

In present study, out of 248 patients, pulmonary function test was done in 203 patients. Out of 203 patients only 2 (1%) patients had severe obstruction, whereas in 95(46.8%) patients had moderate obstruction and in 106 (52.2%) patients mild obstruction seen. In Study done by Charul Mehta *et al.*<sup>[16]</sup> similar observation was seen. The mean FEV1 values were  $85.60 \pm 6.79$  for mild intermittent asthma,  $83.12 \pm 3.46$  for mild persistent and  $70.60 \pm 6.50$  percent. We found positive correlation between severity of Asthma and values of FEV1 ( $p<0.001$ ). In various study done on adult asthmatic patients shown that there was significant decrease in FEV1 value, which might be due to as age increases prolonged inflammation leads to injuries and repair including regeneration and replacement by connective tissue. This leads to significant decrease in lung function.

In the present study, 54.2% children showed FEV1: FVC ration more than 80% whereas 42.9% had between 75-80% and 3% had <75%. The mean values were  $85.18 \pm 2.97$  for mild intermittent,  $84.88 \pm 2.96$  for mild persistent and  $77.21 \pm 2.85$  for moderate

persistent. In study done by Charul Mehta *et al.*<sup>[16]</sup> 79.2% had ratio >80%, 19.7% had 75-80%, and 1.1% had ratio >75%. Shrivastava A *et al.*<sup>[17]</sup> studied PFTs in children with respiratory disorders and in normal children. He found that FVC was normal in Asthmatic children, decreased in restrictive diseases as in pneumonia and empyema. FVC remains normal in mild and moderate obstruction. It may be decreased in severe obstruction and in restrictive lung diseases as FVC represents lung parenchyma and asthma is disease of airways so in asthma FVC remains normal except in severe Asthma where FVC may be decreased due to worsening of air trapping <sup>[18,19]</sup>. In present study, out of 203 patients in whom pulmonary function test was done, 71 patients regularly followed and repeat spirometry done. In mild persistent mean values improved from  $82.43 \pm 2.07$  to  $87.43 \pm 1.62$ , from  $71.62 \pm 7.52$  to  $82.71 \pm 3.81$  in moderate persistent, and this is statistically highly significant. This observation suggests that after proper treatment airflow limitation is reversible in asthmatic patients and control symptoms.

Smaller sample size and restriction of age group to up 12 year are limitations of present study. Larger sample size required to draw a definitive conclusion, and long term follow up of pulmonary function test is also not included in present study.

In present study, out of total 248 patients 242 (97.5%) patients were successfully discharged while 6 (2.4%) patients had taken DAMA due to social reason. This high discharge rate suggest that timely intervention can improve disease outcome in asthmatic children.

## In conclusion

In Pulmonary function testing value of FEV1 and FVC: FEV1 correlate with severity of Asthma which suggests that spirometry not only helps in diagnosis but also helps in assessing the severity which has the key role in the successful management.

## List of Abbreviations Used

FEV1: Forced expiratory volume in 1 minute  
FVC: Forced vital capacity  
SABA: Shorter acting b2 agonist  
LABA: Longer acting b2 agonist  
ICS: Inhaled corticosteroids  
LTRA: Leukotriene receptor agonist  
MDI: Metered-dose inhaler

## Declarations

## Ethical Approval and consent to Participate

Yes

## Consent for Publication

NA

## Availability of Supporting Data

Yes

## Competing interest

No

## Funding/ financial support

No

## Authors contribution

	Contributor 1	Contributor 2	Contributor 3
Concepts	✓	✓	✓
Design	✓	✓	✓
Definition of intellectual content	✓	✓	✓
Literature search	✓	✓	✓
Clinical studies	✓	✓	✓
Experimental studies	✓	✓	✓
Data acquisition	✓	✓	✓
Data analysis	✓	✓	✓
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Manuscript review	✓	✓	✓
Guarantor	✓	✓	✓

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