Indian J Physiol Pharmacol 2018; 62(2) : 174–181

Original Article

Correlation of Age with Lung Parameters in Asthmatic Patients with Positive Parental History

S. Subashini[1], Rashmi Ramanathan[2]*, Mohan Jayapal[2], Manishankar Subramaniyam[2], Jyothi Sivalingiah[2] and Rajeswari[3]

Department of Physiology[1], Community Medicine[3]
Karpagam Faculty of Medical Sciences and Research,
Othakalmandapam, Coimbatore

Department of Physiology[2]
Coimbatore Medical College, Coimbatore

Abstract

Patients with positive family history of asthma among their first degree relatives have increased risk by 3–6 times. Pulmonary functions were assessed using computerised spirometer RMS Helios 702 in asthmatics aged 20 to 40 years with positive parental history. They were classified based on GINA (Global Initiative for Asthma) 2017 guidelines into controlled, partly controlled and uncontrolled group and subdivided into 20-30 yrs and 31-40 yrs. In this study patients belonging to 20-30 years in uncontrolled group show positive correlation between age and FEV_1/FEC ratio whereas negative correlation noted in controlled and partly controlled groups. Positive and significant ($P<0.05$) correlation was found between age and Peak expiratory Flow Rate (PEFR) in controlled and uncontrolled groups among 20-30 years. The uncontrolled group with mild symptoms progress to severe forms within a short period of time due to genetic susceptibility. Therefore earlier the onset of illness, more profound is their impact on pulmonary function.

Introduction

Bronchial asthma has grown to be one of the major chronic health problem worldwide affecting 300 million. The global prevalence ranges from 1%-18%. It affects all age groups with rising treatment costs and burden to the community. Risk factors are genetic predisposition, environmental factors like allergens, pollution, infections, active and passive smoking, temperature variation, pet hair, perfume, over exertion and stress or anxiety.

Release of acetylcholine from parasympathetic nerves activates post junctional muscarinic receptors present on airway smooth muscle, sub mucosal glands and causes bronchoconstriction and mucus secretion (1). John Floyer defined asthma as “laborious respiration with lifting of the shoulders and wheezing with intermittent episodes” and that the treatment needs rescue and controller therapy (2). Symptoms are

***Corresponding author :**

Dr. Rashmi Ramanathan. New No.: 163 NSR Road, Saibaba Colony, Coimbatore – 11, Tamilnadu, India; Mobile: 9486127040; Email: rashmikumar82@gmail.com

(Received on January 1, 2018)

shortness of breath, coughing and wheezing. Asthma has no set pattern. It can flare up from time to time and then not appear for longer periods. Bateman ED et al. asserts that "it is reasonable to expect that in most patients with asthma, control of the disease can be achieved and maintained" and recommends a change in approach to asthma management (3).

Computerized spirometry is a physiological test that measures how an individual inhales or exhales volume of air as a function of time. The primary signal measured in spirometry may be volume or flow (4). The most common measurements are FVC and FEV_1. FEV_1 is the forced expiratory volume in first second i.e, volume of forced vital capacity expired in 1st second of exhalation (83%). FVC is the volume of air that is expelled into the spirometer following a maximum inhalation effort. An obstructive pattern affects the rate at which air can be expelled from the lungs with normal FVC, reduction in FEV_1 and low FEV_1/FVC ratio. Reversibility of FEV_1 by more than 400 ml or 20% suggests a diagnosis of asthma. Asthma management decisions based on symptom control appear to have greater practical utility in a primary care setting (5). GINA (Global Initiative for Asthma) guidelines provides a comprehensive and integrated approach for categorizing and treating asthma patients. Halbert RJ et al. suggested that measuring asthma control is the first step to effective patient management (6).

Bill Cookson et al. found that any one of brothers and sisters affected by allergy-type illnesses had inherited the relevant gene, situated on maternal chromosome 11 (7). Burke W et al. in his study emphasised family history as a predictor of asthma risk (8). Recent researches have suggested that the risk of allergies in young children is much greater when the mother is allergic than the father. This is due to the influence of maternal antibodies on the immunity of offspring.

Fernando martinez in his study showed that the development of asthma is determined by complex interactions between genetic and environmental factors. Breast milk contains antibodies and dietary substances (9) which alters infant's immunity and reduces the risk of developing allergies in adult life. There are studies which say, influence of heredity on the risk of developing asthma declined over age (10). Earlier the onset of illness, more marked the pulmonary function parameters deterioration. Hence this study was undertaken to assess the impact of age on onset and severity of asthma leading to deterioration of lung parameters in patients with positive parental history.

Materials and Methods

This cross sectional study was conducted in the physiology clinical laboratory. Asthmatics with positive parental history between the age group 20-40 years of both sex were taken as subjects after informed consent. Smoking history, drug history, disease duration, respiratory symptoms, remissions and exacerbation, hospital admissions, education level were elicited. Pulmonary parameters were obtained using computerised spirometer RMS Helios 702.

Inclusion criteria

1. Confirmed cases of asthma as per GINA guidelines
2. Both males and females
3. Age group 20-40 years attending outpatient department.

Exclusion Criteria includes patients with pneumonia, diabetes mellitus, pregnancy, hypertension, tuberculosis, taking drugs like anti-epileptics, sympathomimetics.

Prior to Pulmonary function tests, the patient should avoid :

– Smoking for 24 hours.

– Vigorous exercise for at least 30 minutes.

– Wearing any tight clothing.

– Eating a large meal for at least 2 hours.

– Taking short-acting bronchodilators for 2 hours.

– Taking long-acting beta-2-agonist inhalers for 12 hours and theophylline-based drugs for 24 hours as per Association of Respiratory Technicians and Physiologists-ARTP and British Thoracic Society (11).

Procedure

The patient was allowed to sit and relax for 5-10 min. The patient was instructed to take the maximal breath, close the nostrils with nose clips and exhale through mouthpiece for at least 6 seconds followed by deep inspiration. Three breathing maneuvers were recorded during the procedure and the highest of three trials is used for evaluation of breathing. After investigation, 25 patients were enrolled in each of the three groups (controlled, partly controlled and uncontrolled) based on FEV_1 and clinical symptoms.

Statistical analysis

Data was recorded and analysed using SPSS Version 22.0. The statistical significance was set at P£0.05. The correlation of age with FEV_1/FVC and PEFR were calculated using Pearson product moment correlation analysis. When r³0.75 it is interpreted as strong relationship, when 0.50£r£0.74 interpreted as moderate relationship and when r£0.49 interpreted as weak relationship.

Results

TABLE I: Comparing Age, BMI & FEV1/FVC in the three asthmatic groups.

Asthmatics	*Controlled (n=25)*		*Partly controlled (n=25)*		*Uncontrolled (n=25)*	
	20-30 yrs	*31-40 yrs*	*20-30 yrs*	*31-40 yrs*	*20-30 yrs*	*31-40 yrs*
Mean agein years	24.3±3.020	35.2±3.004	24.92±3.28	34.77±2.919	25±2.631	35.818±3.572
Mean BMI Kg/m^2	22.4±2.8	25.84±3.2	25.64±3.6	26.92±2.8	24.8±3.8	27.2±4.2
FEV1 (L)	2.63±0.188	2.89±0.325	1.469±0.406	1.718±0.363	1.206±0.312	1.391±0.402
FVC (L)	3.178±0.43	3.618±0.452	2.225±0.631	2.759±0.660	2.98±0.659	3.018±0.821
FEV1/FVC (%)	80.07±1.502	80.14±2.82	66.577±6.01	63.607±2.894	40.819±5.61	46.018±2.868
PEFR/Sec	4.67±0.098	5.01±0.15	3.72±0.19	3.97±0.20	2.585±0.28	2.91±0.23

TABLE II: Correlation of Age with FEV1/FVC ratio in different asthmatic groups.

	Asthmatics	*Age group*	*95% CI of 'r'*	*'r' value*	*'p' value*
1.	Controlled group	20-30 yrs	–57.75 to –53.78	0.406	0.244
		31-40 yrs	–46.903 to –42.98	0.260	0.349
2.	Partly controlled group	20-30 yrs	–46.33 to –36.989	–0.182	0.571
		31-40 yrs	–32.146 to –25.53	–0.773	0.002*
3.	Uncontrolled group	20-30 yrs	–18.742 to –12.90	0.434	0.121
		31-40 yrs	–13.158 to –7.24	0.078	0.819

CI = Confidence interval, r = Correlation coefficient, NS = Not significant. *-Significant

TABLE III: Correlation of Age with PEFR in different asthmatic groups.

	Asthmatics	*Age group*	*95% CI of 'r'*	*'r' value*	*'p' value*
1.	Controlled group	20-30 yrs	17.531 to 21.74	0.842	0.002**
		31-40 yrs	28.504 to 31.87	–0.221	0.430
2.	Partly controlled group	20-30 yrs	19.11 to 23.28	0.086	0.792
		31-40 yrs	28.99 to 32.61	–0.343	0.251
3.	Uncontrolled group	20-30 yrs	20.98 to 23.84	0.600	0.02*
		31-40 yrs	30.56 to 35.256	0.368	0.265

CI = Confidence interval, r = Correlation coefficient, NS = Not significant. *-Significant

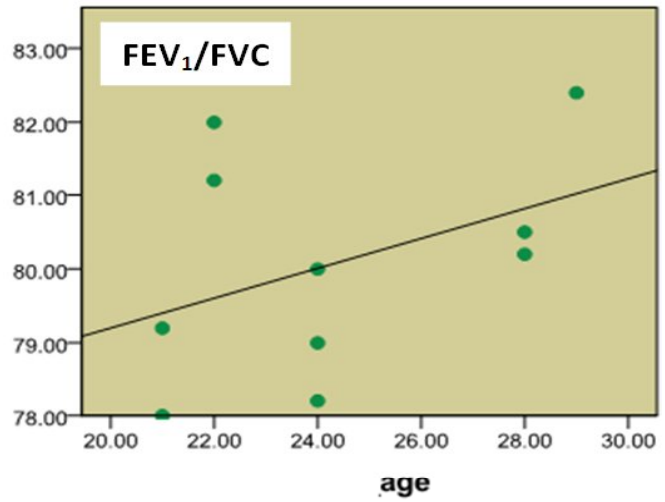

Fig. 1 : Correlation of age and FEV_1/FVC ratio in Controlled group in 20–30 years.

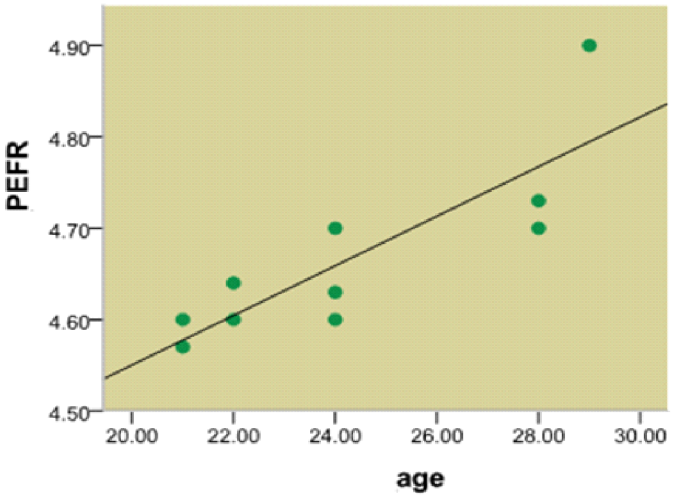

Fig. 2 : Correlation of age and PEFR ratio in Controlled group in 20–30 years.

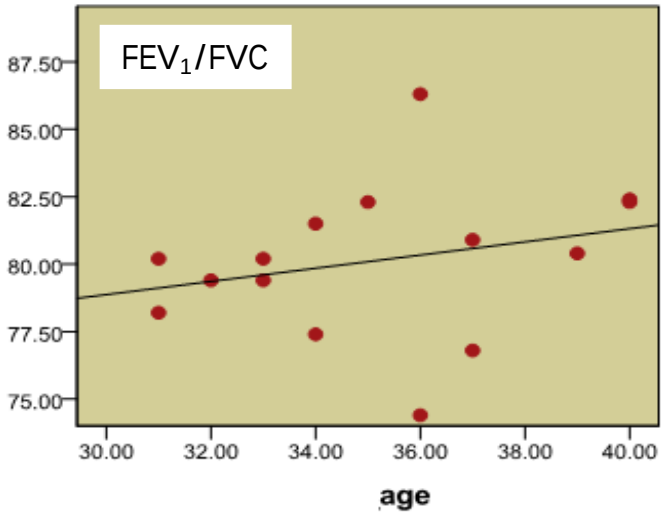

Fig. 3 : Correlation of age and FEV_1/FVC ratio in Controlled group in 31–40 years.

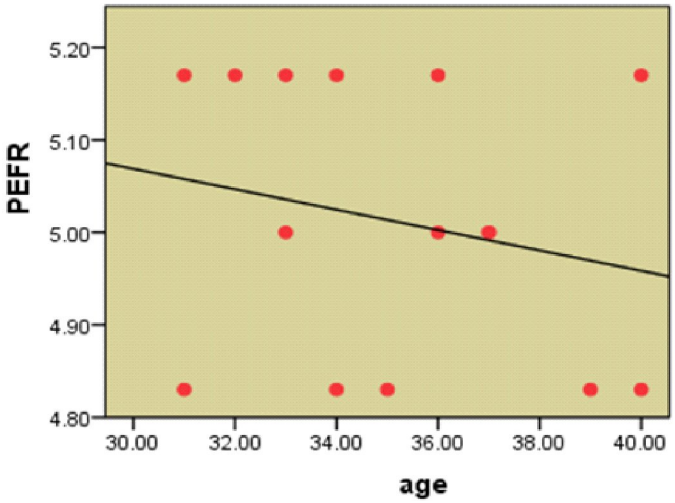

Fig. 4 : Correlation of age and PEFR ratio in Controlled group in 31–40 years.

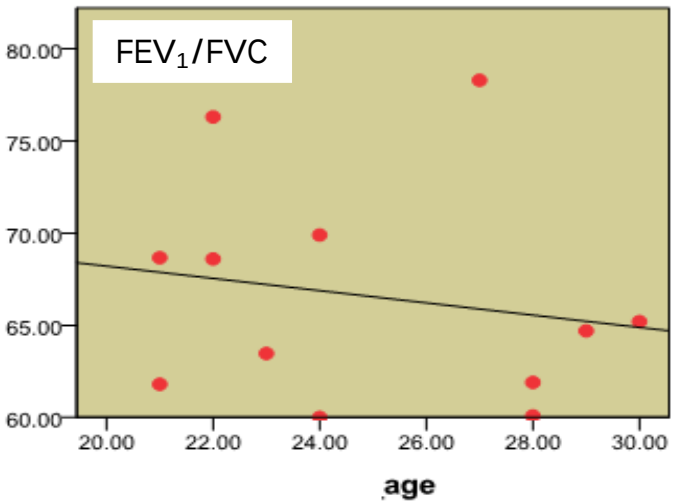

Fig. 5 : Correlation of age and FEV_1/FVC ratio in Partly Controlled group in 20–30 years.

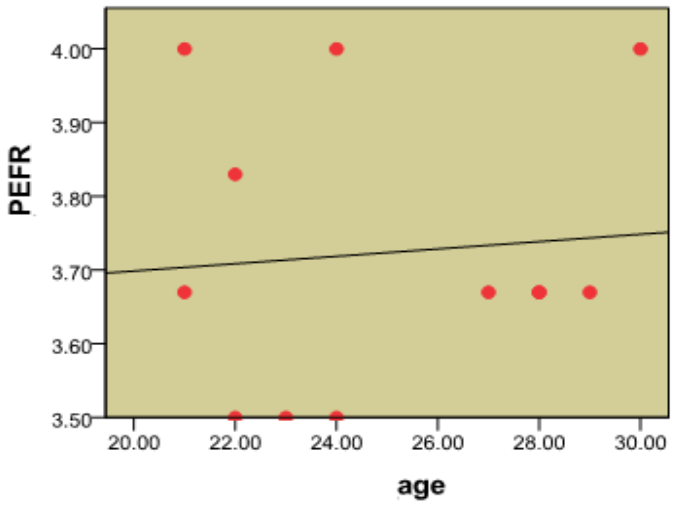

Fig. 6 : Correlation of age and PEFR ratio in Partly Controlled group in 20–30 years.

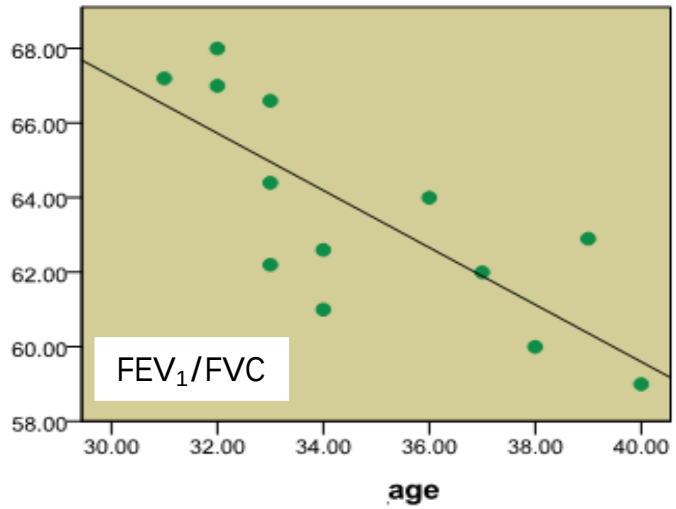

Fig. 7 : Correlation of age and FEV_1/FVC ratio in Partly Controlled group in 31–40 years.

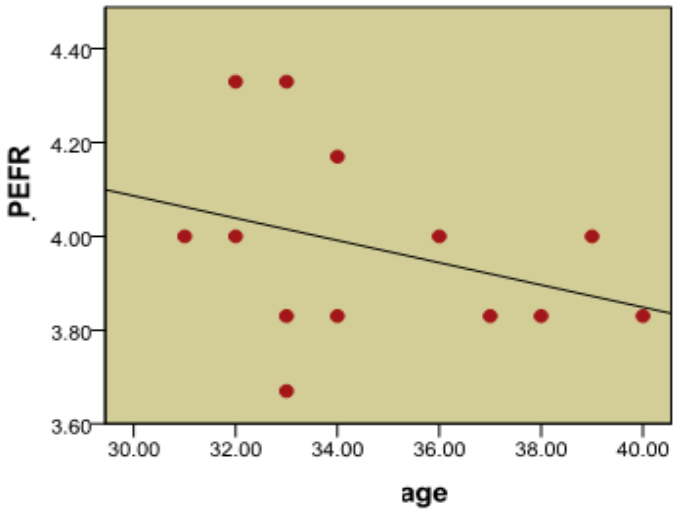

Fig. 8 : Correlation of age and PEFR ratio in Partly Controlled group in 31–40 years.

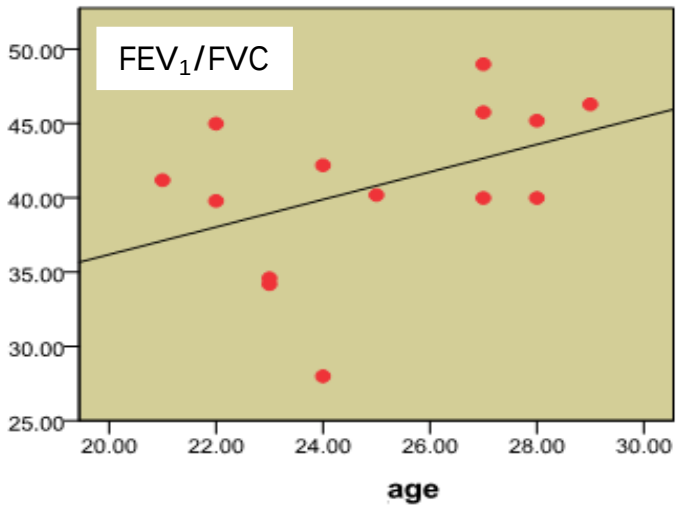

Fig. 9 : Correlation of age and FEV_1/FVC ratio in Uncontrolled group in 20–30 years.

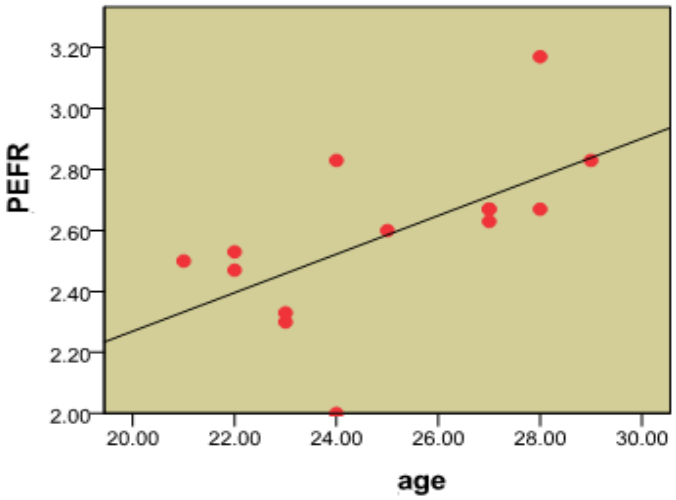

Fig. 10 : Correlation of age and PEFR ratio in Uncontrolled group in 20–30 years.

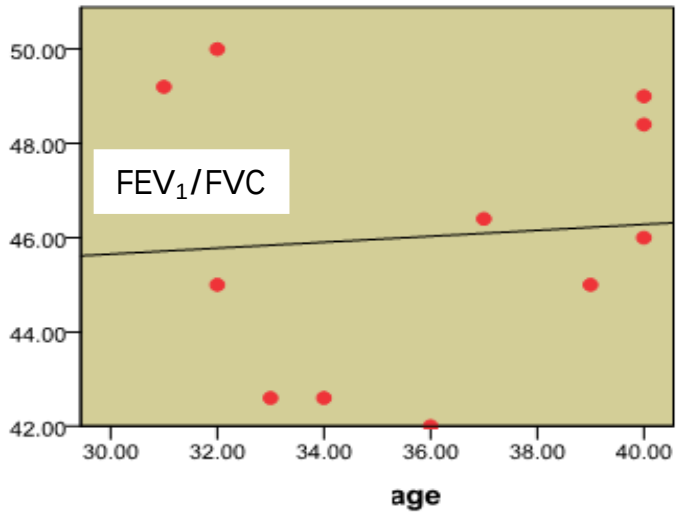

Fig. 11 : Correlation of age and FEV_1/FVC ratio in Uncontrolled group in 31–40 years.

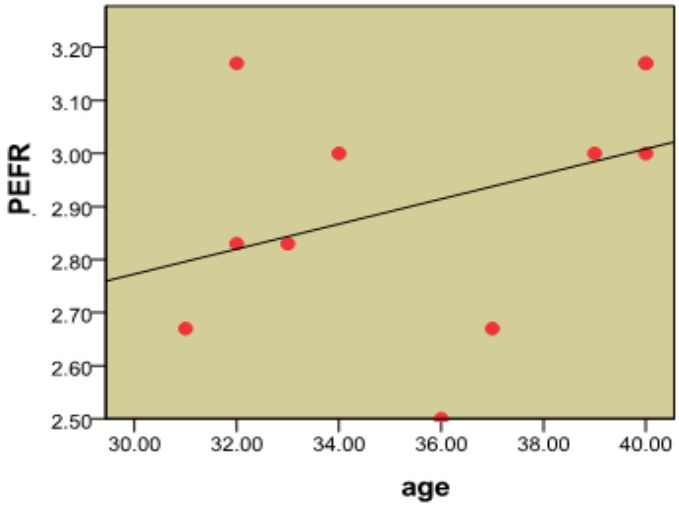

Fig. 12 : Correlation of age and PEFR ratio in Uncontrolled group in 31–40 years.

Discussion

Modern clinical practice has revolutionized to identify and remove the exciting causes of asthma to alleviate the bronchospasm during the paroxysm and to treat complications and sequelae by following strategic GINA guidelines to optimize diagnosis and management (12).

In controlled group population, FEV_1 is near normal but they presented with one or two episodes of day time asthmatic attacks per week. FEV_1 was lowered in partly controlled along with few limitations of activity and nocturnal symptoms. In the uncontrolled group, FEV_1 is significantly lowered along with exacerbations any time in a week, limitation of activity and nocturnal symptoms. FEV_1 and symptoms were reversible with bronchodilator therapy.

Decrease in the rate of maximal expiratory air flow due to the increased resistance and a reduction in forced vital capacity (FVC) correlate with the level of hyperinflation of the lungs as these patients breathe at such high lung volumes near the top of the pressure-volume curve, where lung compliance greatly decreases.

In our study asthmatics with positive family history was included to evaluate the impact of age of disease onset on lung parameters. A statistically significant association of bronchial asthma with family history of asthma was observed (13). Most patients with positive family history presenting with mild symptoms progress to severe forms early in their life within a short period of time than others due to genetic susceptibility.

In case of Asthmatics, FEV_1 Value and FEV_1/FVC ratio decreases in the descending frequency among controlled, partly controlled and uncontrolled groups respectively. In this study, Controlled group asthmatics in the age group of 20-30 years have mean FEV_1, mean FEV_1/ FVC and mean PEFR less than those in the age group of 31-40 years. Also, partly controlled group asthmatics in the age group of 20-30 years have mean FEV_1, mean FEV_1/ FVC and mean PEFR less than that in the age group of 31-40 years. The patients in uncontrolled group in the age group of 20-30 years have mean FEV_1, mean FEV_1/ FVC and mean PEFR less than that in the age group of 31-40 years.

One may expect the pulmonary function to deteriorate with age. It was noted in our study that asthmatic patients with positive family history and early onset of symptoms had decreased lung function parameters. This is in accordance with London et al. who found that early onset persistent asthma with reduced pulmonary function was strongly associated with parental history (14).

Among the controlled asthmatics in the age group of 20-30 years and 31-40 years, positive correlation ($r=0.406$, $r=0.260$ respectively) which is less significant ($p>0.05$) was noted between age and FEV_1/FVC ratio. In partly controlled asthmatics of 20-30 years negative correlation ($r=-0.182$) which is less significant ($P>0.05$) was found between age and FEV_1/FVC ratio whereas in the 31-40 years group, negative correlation ($r=-0.773$) which is significant ($p<0.05$) was observed. In Uncontrolled asthmatics of 20-30 yrs and 31-40 age groups, positive correlation ($r=0.34$, $r=0.078$ respectively) which is less significant ($P>0.05$) was found between age and FEV_1/FVC ratio. The results were similar with the study evidence of Stephaine J & W James et al. that parental and siblings history of asthma and allergy were generally more strongly associated with early onset persistent asthma compared with early transient or late onset asthma (15).

PEFR is the sensitive index to respiratory muscles strength and reflects mainly the calibre of the bronchi and larger bronchioles. Usually PEFR declines with age but in our study mean PEFR is more in 31-40 years and less in 20-30 years. The inverse relationship between familial asthma risk and people's age at onset may reflect a stronger genetic component (16).

Positive and Significant ($P<0.05$) correlation was found between age and PEFR in controlled and uncontrolled asthmatic groups in the 20-30yrs age group and positive insignificant correlation exists

between them in partly controlled group. Higgins and Keller et al. found that a statistically significant correlation exist between ventilatory function in children and their parents (17). Negative and insignificant (P>0.05) correlation was found between age and PEFR in controlled and partly controlled asthmatic groups in the 31-40 yrs age group.

Leeder in his study emphasise that, the earlier the onset of the illness, the more marked was its effect on ventilator function (18). Our study also confirms the positive association between family history of asthma and the earlier onset of symptoms.

Conclusion

Identifying positive parental history of asthma provide a basis for targeted prevention efforts and aimed at reducing exposure to environmental risk factors. Unless prevented, asthma attacks can interrupt everyday activities causing a significant impact on the quality of life. Asthma flare-ups are stressful and require hospitalizations. Patients with positive family history presenting with mild symptoms progress to severe forms early in their life within a short period of time due to their genetic predisposition. The early onset of symptoms was associated with decreased lung function parameters in asthmatic patients with positive parental history.

Prevention is better than cure. Since genetic susceptibility is a non modifiable factor, we conclude by emphasising that the avoidance of triggering and exacerbating factors like allergens, pollutants and passive smoking in genetically susceptible persons reduce the exacerbation of asthma and minimize the use of unnecessary drugs.

Acknowledgements

The authors acknowledge the encouragement and support of Dean Dr. T.P. Kalaniti, Dr. T. Arun Kumar and other staff at the Department of Physiology for their assistance.

Source of funding :

Self

Conflict of interest :

None

References

1. Coulson FR, Fryer AD et al. Muscarinic acetylcholine receptors and airway diseases. *Pharmacol Ther* 2003; 98: 59–69
2. Floyer JS. A treatise of the asthma, divided into four parts. London: Printed for Richard Wilkin at St. Paul's Churchyard, 1698.
3. Bateman ED, Hurd SS, Barnes PJ, et al. Global strategy for asthma management and prevention: GINA executive summary. *Europ Respi J* 2008 Jan; 31(1): 143–178.
4. MR Miller, J Hankinson et al. Standardisation of spirometry. *Europ Respi J* 2005; 26: 319–338.
5. Barbara P Yawn[a]. Asthma management: are GINA guidelines appropriate for daily clinical practice? *Pri Care Respi J* Vol. 14(6): December 2005; 294–302.
6. Halbert RJ, Tinkelman DG, Globe DR, Lin SL: Measuring asthma control is the first step to patient management: a literature review. *Journal Asthma* 2009; 46: 659–664.
7. Liz hunt et al. Asthma gene 'only active if inherited from mother'. The independent news paper article. August 15. 1992.
8. Burke W, Fesinmeyer M et al. Family history as a predictor of asthma risk. *Ameri J Preven Med* 2003 Feb; 24(2): 160–169.
9. Fernando martinez et al. CD14, Endotoxin, and Asthma Risk. *Ameri Thora Soci* 2007 July; 4(3): 221–225.
10. Elina MS Paaso et al. The Importance of family history during first 27 years of life. *AJRCCM Issues*. Sep. 01: 2013; Vol 188(5).
11. Global Initiative for Asthma (GINA), National Heart, Lung and Blood Institute (NHLBI) Global strategy for asthma management and prevention. Bethesda (MD): Global Initiative for Asthma (GINA), National Heart, Lung and Blood Institute (NHLBI); 2006. p. 339. Available from: www.ginasthma.com.
12. Vinh Nhu Nguyen et al. Asthma Control Test (ACT) as an alternative tool to Global Initiative for Asthma (GINA) guideline criteria for assessing asthma control in Vietnamese outpatients. *Pri Care Respi J* March 2012; 2(1): 85–89.
13. Aminesh Jain. et al. Prevalence of bronchial asthma in rural Indian children: a cross sectional study from south India. *Ind J of Pediat* 2010; 77(1): 31–35.
14. London SJ, James-Guderman W, Avol E, Rappaport EB, Peters JM. Family history and the risk of early-onset persistent, early-onset transient, and late-onset asthma. *Epidemiology* 2001; 12: 577–583.

15. Stephaine J & W JAMES et al. Family history and the risk of early onset transient and late onset asthma HHS public access. *Epidemiology* 2001 Sept.; 12(5): 577–583.
16. Tiebin Liu et al. Office of Public Health Genomics. The association between family history of asthma and the prevalence of asthma among US adults: National Health and Nutrition Examination Survey, 1999–2004.
17. Higgins M, Keller J. Familial occurrence of chronic respiratory disease and familial resemblance in ventilatory capacity. *J Chron Dis* 1975; 28: 239.
18. R Leeder, RT Corkhill. Influence of personal and family factors on ventilatory function of children. *Brit J Prev Soc Med* 1976; 30: 219–224.