Biomedicine: 1992; 12(2) 59 - 62.

MAXIMAL EXPIRATORY FLOW RATES IN TROPICAL EOSINOPHILIA

Kuppu Rao KV, Vijayan VK, Venkatesan P and Sankaran K

Cardio-Pulmonary Medicine Unit
TB Research Centre
Indian Council of Medical Research
Madras 600 031, India.

Abstract

Maximal expiratory flow rates such as Peak Expiratory Flow Rate (PEFR), rates at 25%, 50% and 75% of forced vital capacity (VE 25%, VE 50% and VE 75%) were studied in twenty untreated tropical eosinophilia (TE) patients. All measurements were significantly lower in patients with TE compared to their mean predicted values. These data suggest that inflammation of airways is an important mechanism of pathophysiology of tropical eosinophilia.

Introduction

The pulmonary manifestations of tropical eosinophilia (TE) are characterized by cough, dyspnoea, nocturnal wheezing and diffuse reticula-nodular infiltrates on chest X-rays (Udwadia, 1964). Pulmonary function studies (Vijayan et al., 1991; Nesarajiah, 1972; Ray, 1974) had shown restrictive and obstructive ventilatory defects. Histopathological studies had revealed (Udwadia, 1967) dense accumulation of eosinophils in interstitial tissue. A striking eosinophilic alveolitis with marked elevation in both the proportion and concentration of eosinophils in the recovered fluid has also been described by bronchoalveolar lavage studies (Pinkston et al., 1987). The lung function abnormalities in TE could, therefore, be due to the abnormally accumulated inflammatory cells in the lung. The maximal expiratory flow rates during forced vital capacity manoeuvre had been shown to reflect histopathological changes in lungs (Cosio et al., 1978). Thus, in conformity with these findings, we had previously shown that there was a correlation between lung function changes and lower respiratory tract inflammation (Vijayan et al., 1991). However, there are no reported studies of maximal expiratory flow rates in untreated Tropical Eosinophilia patients. Therefore, we undertook a study to evaluate changes in maximal expiratory flow rates and their relationship with peripheral blood eosinophilia.

Materials and Methods

Twenty male patients with symptoms of one week to six months duration and fulfilling the diagnostic criteria (Neva et al., 1978) of residence in the endemic area of Madras city, respiratory symptoms such as cough, dyspnoea and nocturnal wheezing, chest X-ray infiltrates, peripheral blood eosinophilia of more than 2000 cells per cubic millimeters, high serum titres of antifilarial IgG and a response to diethylcarbamazine therapy were included in the study. Clinical evaluation of each patient included detailed history, physical examination, chest x-ray, blood and stool examinations

for the presence of other parasites and IgG filarial antibody determinations.

Maximal flow volume spirogram tests were carried out using Transfer Test Model C (P.K. Morgan P. Ltd. Chatham UK). This instrument is provided with Data Dee Computer and X-Y recorder for electronic memory and recording flow volume loops. The instrument has a resolution of 0.05 litre in measuring lung volume and 0.1 litre per second in measuring flow rates.

The results are printed out after correction to body temperature and pressure saturated with water vapour (BTPS). Best of three well attempted efforts is utilised for analysis of Forced Vital Capacity (FVC) and Forced Expiratory Volume in one second. The highest value of peak expiratory flow (PEFR) in any of the attempts, and values of flow rates at 25% (VE25), 50% (VE50); 75% (VE75) of vital capacity obtained from the attempt in which the sum of FVC and FEV1 was highest, were used for further statistical analysis (American Thoracic Society Workshop Report, 1979). The predicted values of maximal expiratory flow rates for this study were obtained from the regression equations established in our laboratory (Vijayan et al., in press). Total and differential leucocyte counts were utilised to obtain blood eosinophils. Data were analysed by the students t-test.

Results

Of the twenty male patients, nine were smokers and remaining 11 were non-smokers: The mean age was 22.7±5 (SD) years (range 18 - 40 years). Mean height was 163.1±6.5 (SD) centimeters and mean weight was 46.7±8.0(SD) kilogrammes.

Since there was no significant difference in mean values of maximal expiratory flow measurements between smokers and non- smokers, the data were amalgamated. Spirometric lung volumes are shown in Table 1. The maximal expiratory flow rates, viz, PEFR VE 25%, VE50% and VE75% are as given in Table 2.

Table 1: Spirometric Lung Volumes

Parameter	Mean ± SD	% Predicted
FVC(L)	2.56 ± 0.67	78.6
FEV1(L)	2.09 ± 0.58	70.0
FEV1/FVC%	81.1 ± 9.8	89.1

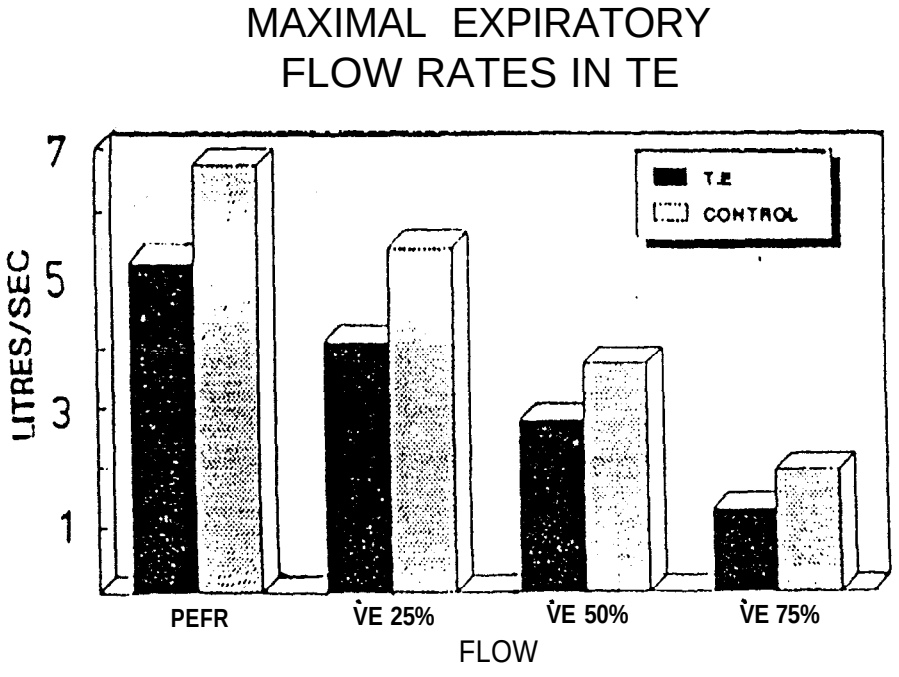
Table 2 Maximal Expiratory Flow Rates in TE

Parameter	Observed (Mean ± SD)	Predicted (Mean ± SD)	% Predicted
PEFR (L/S)	5.25 ± 1.71 **	6.74 ± 0.68	77.7
$\dot{V}E$ 25%(L/S)	4.08 ± 1.66*	5.44 ± 0.62	75.0
$\dot{V}E$ 50%(L/S)	2.77 ± 1.02 **	3.72 ± 0.42	74.5
$\dot{V}E$ 75%(L/S)	1.28 ± 0.90*	1.92 ± 0.32	66.8

* P<0.01 ** P<.001

PEFR (5.25±1.71 L/S VS 6.74±0.68 L/S P < 0.001); VE25% (4.08±1.66 L/S VS 5.44±0.62 L/S P< 0.01); VE50% (2.77± 1.02 L/S VS 3.72 ±0.42 L/S P < 0.001) and VE 75% (1.28±0.90 L/S VS 1.92±0.32 L/S P< 0.01) were significantly lower in patients compared to their mean predicted values (Fig.1). PEFR was less than 70% predicted in 6 patients, VE 25%, VE 50% and VE 75% were less than 70% predicted in 8, 8 and 12 patients respectively.

On further analysis it was found that there was no correlation between any of the expiratory flow rates and peripheral blood eosinophilia.



Discussion

The predominant pulmonary function abnormality in untreated TE had been shown to be a reduction in single breath transfer factor (Vijayan et al., 1988) and a proportion of patients had obstructive ventilatory defects as well (Vijayan et al., 1991). The observation of significantly reduced expiratory flow rates in our study subjects suggests the involvement of airways in the inflammatory process in addition to parenchymal inflammation. The lower respiratory tract inflammation in untreated TE had been shown to be due to an intense macrophage-eosinophilic alveolitis (Vijayan et al., 1991). We had also shown that inflammatory cells especially macrophages recovered from lower respiratory tract had negative correlation with pulmonoary function tests such as FVC and FEV1 (Vijayan et al., 1991). Therefore, signficant reductions in expiratory flow rates in this study may suggest that inflammation of airway may also play an important role in pathophysiology of the disease.

Activated eosinophils had been shown to be capable of injuring airways and parenchymal cells (Barnes et al., 1987; Davis et al., 1984; Frigas et al., 1980). Eventhough there was no correlation of peripheral blood eosinophils with flow rates in this study, the abnormally acumulated lung eosinophils may cause injury to airway epithelium; as it had been shown that eosinophilic cationic protein and major basic protein released from activated eosinophils are capable of injuring airway epithelium in subjects with bronchial asthma and Adult Respiratory Distress Syndrome (Hallgren et al., 1987; Laitenen et al., 1985). Inflammatory cells recovered from lower respiratory tract have been shown to be capable of releasing various inflammatory mediators such as Platelet Activating Factor (PAF), leukotrines, histamine and prostaglandins (Barnes et al., 1987). We had shown previously that the eosinophils recovered from the lower respiratory tract of patients with untreated TE are activated (Pinkston et al., 1987) and thus capable of releasing toxic mediators. It had also been shown

that there was airway hyperreactivity in TE (Chhabra et al., 1988) and the mechanism of this hyperresponsiveness in TE may be due to the toxic mediators especially PAF produced by these inflammatory cells (Barnes et al., 1987; Lee et al., 1984).

The finding of significantly reduced expiratory flow rates in this study, therefore suggests that inflammation of airways is also an important mechanism in the pathophysiology of TE, in addition to parenchymal inflammation (Vijayan et al., 1991).

References

1. Udwadia FE and Joshi VV. A study of Tropical Eosinophilia. Thorax 1964; 19:548-554.
2. Vijayan VK, Kuppu Rao KV, Sankaran K, Venkatesan P and Prabhakar R. Tropical Eosinophilia; Clinical and physiological resp onse to diethylcarbamazine. Respiratory Medicine, 1991, 85:17-20.
3. Nesarajah MS, Pulmonary function in Tropical eosinophilia Thorax, 1972, 27:185-187.
4. Ray D, Lung function in Tropical eosinophilia. Ind J Chest Dis., 1974; 16:368-373.
5. Udwadia FE, Tropical eosinophilia : a correlation of clinical, histopathologic and lung function studies, Dis Chest 1967, 52:531-538.
6. Pinkston P, Vijayan VK, Nutman TB et al., Acute tropical pulmonary eosinophilia : Characterisation of lower respiratory tract inflammation and its response to treatment, J Clin Invest 1987; 80:216-25.
7. Cosio M, Gheezzo M, Hogg JC, Cobin R, Loveland M, Dosman J, The relation between structural changes in small airways and pulmonary function tests, N Engl J Med, 1978; 298:1277-1281.
8. Vijayan VK, Sankaran K, Venkatesan P, Kuppu Rao KV, Correlation of lower respiratory tract inflammation with changes in lung function and chest roentgenogams in patients with tropical pulmonary eosinophilia, Singapore Medical Journal 1391; 32:122-125.
9. Neva FA and Ottesan EA, Tropical (Filarial) Eosinophilia, N Engl J Med, 1978; 298:1129-1131.
10. American Thoracic Society : Snowbird workshop on standardisation of spirometry, Am Rev Respir Dis 1979; 193:831-838.
11. Vijayan VK, Kuppu Rao KV, Venkatesan P, Sankaran K and Prabhakar R, Reference values and prediction equations for maximal expiratory flow rates in non-smoking normal subjects in Madras (in press)
12. Vijayan VK, Kuppu Rao KV, Sankaran K, Venkatesan P, Prabhakara R, Diffusing capacity in acute untreated Tropical Eosinophilia, Ind J Chest Dis and All Sci 1988; 30:71-77.
13. Vijayan VK, Sankaran K, Venkatesan P and Prabhakara R, Effect of Diethylcarbamazine on alveolitis of tropical eosinophilia, Respiration 1991; 58:255-259.
14. Barnes NC, Costello JF, Airway hyperresponsivness and inflammation, Br Med Bull 1987; 43(2):445-459.
15. Davis WB, Fells GA, Sun X, Gadek JE, Venet A, Crystal RG, Eosinophil mediated injury to lung parenchymal cells and interstitial matrix, J Clin Invest 1984; 74:249-278.
16. Frigas E, Loegering DA, Gleich GI, Cytotoxic effects of guinea pig eosinophil major basic protein on tracheal epithelium, Lab Invest 1980; 42:35-43.
17. Hallgren R, Samulsson T, Vengc P, Modig J, Eosinophil activation in lung is relate, to lung damage in adult respiratory distress syndrome, Am Rev Respir Dis 1987; 135:639-642.
18. Laitenen LA, Heino M., Laitenen A, Kava T, Hachtcla T, Damage of airway epithelum and bronchial reactivity in patients with asthma, Am Rev Respir Dis 1985; 313:599-606.
19. Chhabra SK, Gaur, Airway hyperreactivity in tropical pulmonary eosinophilia, Chest 1988; 93:1105-1106.
20. Lee TC, Lenihan DJ, Malone D, Roddy LL, Wasserman SI, Increased biosynthesis of pla telet activating factor in activated human eosinophils, J Biol Chem 1984; 259:5526-5530.