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Short Communication

Study of oxidative stress in relation with antioxidant status in chronic bronchitis

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Lipid peroxide plays an important role in inflammatory lung diseases. Increased epithelial permeability produced by cigarette smoke is likely to be mediated through depletion of the Total Antioxidant Capacity. Oxidative stress has been recognized as a central feature of smoke induced chronic bronchitis. Imbalance between oxidants and Total Anioxidant Capacity is also an established fact in these patients. 60 patients with chronic bronchitis were included in the study. Their base line clinical examination, malondialdehyde (MDA), nitric oxide, alpha tochopherol and Total Antioxidant Capacity were measured. 100 healthy non-smokers' served as controls. The mean malondialdehyde levels and nitric oxide in the patients at base line were higher than controls ($p<0.001$). Plasma alpha-tocopherol and total antioxidant capacity were lower ($p<0.001$) in the patients compared to controls. The present study shows that initially the plasma lipid peroxide (MDA) levels were high and antioxidants (alpha-tocopherol, total antioxidant capacity) were low in patients with chronic bronchitis. Our results suggest the presence of oxidative stress and decrease in total antioxidant capacity in chronic bronchitis.

Key words: Malondialdehyde, alpha-tocopherol, total antioxidant capacity, chronic bronchitis.

INTRODUCTION

Lung is the organ which is constantly exposed to many atmospheric pollutants such as cigarette smoke, ozone and nitrogen dioxide and is also at risk from oxidant injury by inhalation (Irfan and William, 1999). Inhaled ozone induces toxic processes that impair lung function. Lipid peroxide plays an important role in inflammatory lung diseases. Increased epithelial permeability produced by cigarette smoke is likely to be mediated though depletion Total Antioxidant Capacity (Rahman and Adcock, 2006). Oxidant-antioxidant balance is essential for the normal lung function. Both an increased oxidants and or decreased antioxidants may reverse the physiologic oxidant-antioxidants balance in favors of oxidants leading to lung injury.

Chronic bronchitis is defined clinically that it is present in any patient who has persistent cough with sputum production for at least two consecutive years in the absence of any other identifiable cause. In simple chronic bronchitis, patients have a productive cough but no physiologic evidence of airflow obstruction. Some individual may demonstrate hyperactive airways with intermittent bronchospasm and wheezing. This condition is called chronic asthmatic bronchitis while some patients, especially heavy smokers, develop chronic airflow obstruction usually with evidence of associated emphysema and are classified as obstructive chronic bronchitis.

The earliest feature of chronic bronchitis is hyper secretion of mucus in the large airways associated with hypertrophy of the sub-mucosal glands in the trachea and bronchi. As chronic bronchitis persist there is also marked increase in goblet cells of small airways – small bronchi and bronchioles – leading to excessive mucus production that contributes to airway obstruction (Thurbleck, 1991).

Now a day's attempts towards oxidative stress status are continuing. The study of antioxidant capacity in lung

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Table 1. Illustrate the the levels of MDA, NO•, Vitamin E and TAC in the healthy controls and chronic bronchitis patients.

Test	Healthy controls (n=100)	Chronic bronchitis patients (n=60)
Sr. MDA (µmol/L)	1.66±0.289	4.61±2.7*
Sr. No•(µmol/L)	33.15±6.13	33.58±12*
Sr. Vit E (mg/dl)	0.927±0.12	0.32±0.09*
Sr.TAC (µmol/L)	1253.12±170.22	354.43±88.*

n = Number of cases; all values are expressed in mean ± SD; * = significant when compared with control group.

disease patients opens a promising field in prevention of oxidative stress related complications in these patients.

Aims and objectives

1. To explore the existence of possible peroxidative damage in lung disease patients by estimating the level of serum malondialdehyde as an index of lipid peroxide.
2. To estimate nitric oxide as a marker of oxidative stress.
3. To study possible alteration in Total antioxidant Status in lung disease patients by estimating the total antioxidant capacity.
4. To study non enzymatic antioxidant vitamin E.

MATERIALS AND METHODS

The present study was conducted in the department of Biochemistry Dr. Vikhe Patil Medical College and Hospital Ahmednagar. This study included 60 clinically stable COPD Patients in the age group of 35 to 60 years, 100 healthy controls who were diagnosed by physicians on the basis of detailed clinical history, clinical examination and relevant biochemical examinations.

Hypertensions, malignancy, overt cardiac failure recent surgery, severe endocrine, hepatic or renal diseases and lung disorders other than COPD were excluded from the present study.

Informed consent was obtained from each patient in the study. The study was cleared by institutional ethics committee. 10 ml blood was collected from each patient. Serum was separated by centrifugation at 3000 rpm for 10 min at room temperature. Following parameters were carried out on the samples on the same day of collection.

1. The level of serum total lipid peroxide in terms of Malondiadehyde (MDA) was determined by Kei Satoh method (1998).
2. Serum Nitric oxide ($NO^{\cdot}$) as nitrite was estimated by Najwa Cortas and Nabil Wakid method (1990).
3. Serum Vitamin 'E' (α – Tocopherol) was estimated by the method of Baker and Frank (1968).
4. Total antioxidant capacity in plasma (TAC) was assayed by FRAP analysis (Iris and Strain, 1996).

RESULTS AND OBSERVATIONS

Statistical analysis

Analysis was carried out using students unpaired' test. Probability values < 0.05 were considered as significant. Also data were expressed in mean ± SD form**.**

DISCUSSION

Table 1 shows significant high levels (p< 0.001) of oxidants serum lipid peroxide (MDA) and serum nitric oxide (NO•) were observed as compared to healthy controls. The mean plasma levels of vitamin E (P<0.001) and total antioxidant capacity (TAC) was lower than controls.

Lung cells, in particular alveolar epithelial type II cells, are susceptible to the injurious effects of oxidants. Lungs are continuously exposed to oxidants, either generated endogenously by metabolic reactions or exogenously, such as air pollutants or cigarette smoke and since cigarette smoking, another environmental hazard, also delivers oxidants and free radicals to the lungs. Cigarette smoke contains many oxidants and free radicals, both in the gas and the tar phase and causes sequestration of neutrophils into the pulmonary microcirculation and accumulation of macrophages in respiratory bronchioles. Once recruited, these cells become activated and generate ROS. ROS, which may also be released by lung epithelial cells, may also stimulate inflammatory cells directly, thereby amplifying lung inflammatory and oxidant events. There by increases the MDA significantly in chronic bronchitis patients (Paul and Irfan, 2006).

In the respiratory tract, $NO^{\cdot}$ is generated enzymatically by all three distinct isoforms of $NO^{\cdot}$ synthase that is, NOS-1, NOS-2 and NOS-3. Of these three forms, NOS-2 activity is primarily regulated transcriptionally and is commonly induced by bacterial products and pro-inflammatory cytokines. Inflammatory diseases of the respiratory tract such as chronic bronchitis is commonly characterized by an increased expression of NOS-2 within respiratory epithelial and inflammatory immune cells, and markedly elevated local production of $NO^{\cdot}$ in the patients with lung diseases (Chambers and Tunncliffe, 1998).

Vitamin E is the most important lipophilic antioxidant in humans in this study we observed the reduced vitamin E level in lung disease patients could be due partly to its overconsumption as an antioxidant subsequent to

increased production of free radicals by cigarette smoke and inflammatory reaction.

The total anti-oxidative potential of the plasma reflects the ability of an individual to resist the oxidative stress. Ferric reducing ability of plasma (FRAP) evaluates plasma total antioxidant capacity due to known and unknown antioxidants in the plasma (Aysen et al., 2004). Therefore in the present study significant reduction observed in total ferric reducing ability of plasma may be due to increased free radical activity either because of inflammation or complications that results in imbalance between antioxidant capacity and peroxidant affecting lung function. Extensively amplified oxidant burden and declined individual antioxidant levels might be responsible for the observed significant fall in total antioxidant capacity of patients with lung disease.

Conclusion

Thus evaluating oxidative stress in lung disease patients by measuring lipid peroxidation and antioxidant status can lead to better understanding of free radical mediated damage in chronic bronchitis patients**.** An inequity between oxidative stress and antioxidative capacity has been proposed to play an important role in the development and progression of chronic bronchitis and it is related to the severity of disease.

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