Original Article ISSN (O):2395-2822; ISSN (P):2395-2814

Assessment of Correlation of hs-CRP, Exhaled Nitric Oxide and Atopic Status in Non-Obese and Obese Bronchial Asthma Patients

M. Gangadhara Reddy[1]

[1]Associate Professor, Department of TB and Chest, Sree Balaji Medical College, Chennai, Tamil Nadu, India.

ABSTRACT

Background: To assess correlation of hs-CRP, exhaled nitric oxide and atopic status in non-obese and obese bronchial asthma patients. **Methods:** One hundred twenty asthmatic patients age ranged 18- 60 years of both genders were divided into 2 equal groups as group 1 having non- obese asthmatic patients and group 2 having obese asthmatic patients. Complete pulmonary function test with diffusion capacity, measurements of FENO level, hs-CRP, skin prick test (SPT), forced vital capacity (FVC), forced expiratory volume in the first second (FEV1), vital capacity, residual volume and total lung capacity, hs-CRP levels and exhaled nitric oxide was assessed. **Results:** Mean age was 29.2 years in group 1 and 34.2 years in group 2, weight was 59.4 kg in group 1 and 82.4 kg in group 2, height was 162.8cm in group 1 and 159.2 cm in group 2, BMI was 23.5 kg/m2 in group 1 and 33.4 kg/m2in group 2, hs- CRP level was 15.6 mg/L in group 1 and 21.3 mg/L in group 2 and FENO level was 38.4 ppb in group 1 and 30.5 ppb in group 2. A significant difference was observed (P< 0.05). FVC (%) was 91.5 in group 1 and 85.2 in group 2, FEV1 (%) was 78.4 and 72.0, FEV1/ FVC was 74.8 and 72.1, PEFR 25-75(%) was 87.4 and 83.1, FEF 25-75(%) was 57.8 and 53.2, FRC (%) was 112.8 and 87.4, SVC (%) was 91.5 and 86.2, IC (%) was 89.2 and 96.5, ERV (%) was 97.1 and 70.3, RV (%) was 121.8 and 102.5 and DLCO (%) was 108.2 and 98.4 in group 1 and 2 respectively. A significant difference was observed (P< 0.05). **Conclusion:** Obese patients with asthma exhibited higher hs-CRP level. There was no significant difference for non-invasive inflammatory marker (FENO) and skin prick test to common aeroallergens and food allergens between both groups.

Keywords: Asthma, Obese, vital capacity, CRP.

INTRODUCTION

Asthma, one of the most common chronic diseases all over the world, currently affects 300 million people. It is defined as a chronic inflammation of airways characterized by increased responsiveness of trachea and bronchial tree to a variety of stimuli.[1] Asthma results from a state of persistent sub-acute inflammation of the airways.[2] The main pathogenesis of asthma is infiltration of such inflammatory cells as eosinophils, basophils, and CD4 + lymphocytes. C-reactive protein (CRP) is a well-known inflammatory marker synthesized by hepatocytes. This marker increases in systemic inflammations such as diabetes, cardiovascular diseases, collagen vascular diseases, malignancies, and also obesity.[3]

Obesity even in the absence of intrinsic lung disease causes physiological impairment in lung functions due to mass loading of the respiratory system. Obesity is a well-established risk factor for diabetes mellitus, hypertension, sleep apnoea, stroke, cardiovascular disease, arthritis, and many other diseases. Inflammatory markers like C-reactive protein (CRP) levels and fraction of exhaled nitric oxide (FENO) levels are actively and independently linked with the respiratory impairment and more frequently hyper-responsiveness.[4] These markers suggest that both respiratory impairment and bronchial hyper-responsiveness are associated with a systemic inflammatory process in patients with bronchial asthma. Obesity aggravates inflammation in bronchial asthma leading to increased severity of asthma and decreased hyper-responsiveness to the treatment, thus, leading to an increase in morbidity and mortality in obese asthmatics compared to non-obese asthmatics.[5]

Recent population-based studies showed a correlation between increased levels of serum high sensitivity-CRP (hs-CRP) with a high frequency of airway hyper-responsiveness and low forced expiratory volume in one second (FEV1) among subjects without heart disease. Both interleukins 1 and 6 adjust high-sensitivity CRP (Hs/CRP) and contribute in airway inflammatory response.[6] Higher Hs/CRP levels are associated with impaired lung function and respiratory hyper responsiveness. In asthma as API, there is a fast CRP synthesis that act as a universal forager molecule as well as aids in processes of opsonization, phagosis and cell toxicity.[7] Considering this, the present study aimed at evaluating correlation of hs-CRP, exhaled nitric oxide and atopic status in non-obese and obese bronchial asthma patients.

Name & Address of Corresponding Author
Dr. M. Gangadhara Reddy
Associate Professor,
Department of TB and Chest,
Sree Balaji Medical College,
Chennai, Tamil Nadu, India.

MATERIALS AND METHODS

We enrolled one hundred twenty asthmatic patients age ranged 18- 60 years of both genders. Selected

patients were informed and their written consent was obtained before commencing the study. Approval for the study was taken from institutional ethical clearance committee.

Demographic profile of all patients was recorded. Randomization was done into 2 equal groups as group 1 having non- obese asthmatic patients and group 2 having obese asthmatic patients. Weight (Kg) and height (cm) of all selected patients was performed. BMI was calculated as weight/height2 (kg/m2). BMI less than 25 denoted normal and above 30 as obese. Complete pulmonary function test with diffusion capacity, measurements of FENO level, hs-CRP, skin prick test (SPT) were done. Pulmonary function test comprised of lung volumes such as forced vital capacity (FVC), forced expiratory volume in the first second (FEV1), vital capacity, residual volume and total lung capacity were measured as per the guidelines. The diffusion capacity of the lungs was analysed by using single breath method (SBDLCO).

The hs-CRP levels were quantitatively measured by enzyme-linked immunosorbent assay (ELISA) using the ACCUBIND automated (URIT-660) analyzer. The assessment of exhaled nitric oxide was performed using breath exhaled NO analysis (online method) on breath analyser CLD 88SP (M3014) chemiluminescence (NIOX) analyser. Results of the present study after recording all relevant data were subjected for statistical inferences using chi- square test. The level of significance was significant if p value is below 0.05 and highly significant if it is less than 0.01.

RESULTS

Table 1: Distribution of patients

Parameters	Group 1	Group 2	P value
Age (years)	29.2	34.2	<0.05
Weight (Kg)	59.4	82.4	<0.05
Height (cm)	162.8	159.2	<0.05
BMI (kg/m^2)	23.5	33.4	<0.05
hs-CRP (mg/L)	15.6	21.3	<0.05
FENO (ppb)	38.4	30.5	>0.05

Table 2: Pulmonary function tests in both groups

Parameters	Group 1	Group 2	P value
FVC (%)	91.5	85.2	>0.05
FEV1 (%)	78.4	72.0	>0.05
FEV1/ FVC	74.8	72.1	<0.05
PEFR 25-75(%)	87.4	83.1	<0.05
FEF 25-75(%)	57.8	53.2	<0.05
FRC (%)	112.8	87.4	<0.05
SVC (%)	91.5	86.2	<0.05
IC (%)	89.2	96.5	<0.05
ERV (%)	97.1	70.3	<0.05
RV (%)	121.8	102.5	<0.05
DLCO (%)	108.2	98.4	<0.05

Mean age was 29.2 years in group 1 and 34.2 years in group 2, weight was 59.4 kg in group 1 and 82.4 kg in group 2, height was 162.8cm in group 1 and 159.2 cm in group 2, BMI was 23.5 kg/m2 in group 1 and 33.4 kg/m2in group 2, hs- CRP level was 15.6 mg/L in group 1 and 21.3 mg/L in group 2 and FENO level was 38.4 ppb in group 1 and 30.5 ppb in group 2. A significant difference was observed (P< 0.05) [Table 1].

FVC (%) was 91.5 in group 1 and 85.2 in group 2, FEV1 (%) was 78.4 and 72.0, FEV1/ FVC was 74.8 and 72.1, PEFR 25-75(%) was 87.4 and 83.1, FEF 25-75(%) was 57.8 and 53.2, FRC (%) was 112.8 and 87.4, SVC (%) was 91.5 and 86.2, IC (%) was 89.2 and 96.5, ERV (%) was 97.1 and 70.3, RV (%) was 121.8 and 102.5 and DLCO (%) was 108.2 and 98.4 in group 1 and 2 respectively. A significant difference was observed (P< 0.05) [Table 2, Figure 1].

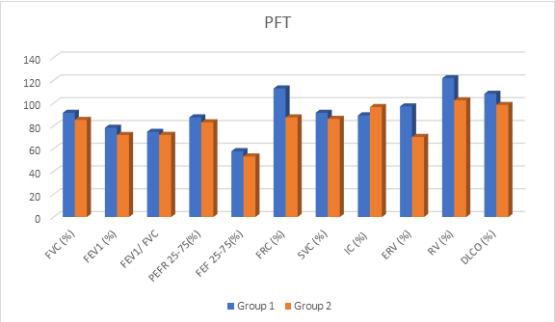

Figure 1: Pulmonary function tests in both groups

DISCUSSION

Bronchial asthma (BA) is a chronic airway inflammatory illness affecting over 315 million individuals globally, initiating a major cause for illness and significant burden on communities. It still continues to be under-diagnosed and under-treated.[8] Ongoing inflamed airways passages in asthma subsidizes to frail control. C-reactive protein (CRP) is a finely delicate, nonspecific biomarker of acute-phase inflammation (API) and injured cells. Likewise, CRP is raised up during early stages of inflammatory response of chronic obstructive pulmonary disease (COPD) and bronchial asthma (BA) mutually.[9] The fraction exhaled nitric oxide (FeNo) test has played attention as it is feasible, delivers an immediate result, non-invasive, besides it is reproducible marker of airway inflammation. Numerous researches have been directed to authenticate the opportunity of using the FeNo test in BA and respiratory function tests for the management of asthma. There are main progresses in FeNo and its association to inflammatory airways states; still, its aptitude to estimate course of BA leftovers uncertain.[10] The present study aimed at

evaluating correlation of hs-CRP, exhaled nitric oxide and atopic status in non-obese and obese bronchial asthma patients.

We enrolled one hundred twenty asthmatic patients age ranged 18- 60 years of both genders. Of which, 50 were female and 70 were males. Group 1 had non- obese asthmatic patients and group 2 had obese asthmatic patients. Halvani et al,[11] compares and evaluated the correlation between CRP level and sputum eosinophilia in asthmatic and control subjects. A total of 61 patients suffering from mild-to-moderate asthma participated in this study. They were divided into two groups based on whether they used inhaled steroid or not. Thirty-seven healthy subjects were selected and their blood samples were taken. Thirty asthmatic patients in user group (14 females/16 males) with the mean age of 39.4±9.37 years, 31 asthmatic patients in non-user group (13 females/18 males) with the mean age of 35.5±8.87 years, and 37 healthy controls (17 females/20 males) were included in our study. The mean serum concentration of CRP was 2.6 μg/mL, 3.32 μg/mL, and 1.16 μg/mL in user, non-user, and control groups, respectively. Compared to healthy controls, serum concentrations of high sensitivity-CRP (hs-CRP) significantly increased in the non-user group (P=0.0001), and user group as well. (P=0.016). The number of sputum eosinophils and peripheral blood eosinophils significantly increased in the non-users compared to the healthy controls (P=0.0001, P=0.003, respectively). In the non-user group, serum hs-CRP levels correlated negatively with FEV1 and positively with numbers of sputum eosinophils, which was not statistically significant. Atopy status, age, and sex did not affect hs-CRP levels in both asthmatic groups.

Our study revealed mean age was 29.2 years in group 1 and 34.2 years in group 2, weight was 59.4 kg in group 1 and 82.4 kg in group 2, height was 162.8cm in group 1 and 159.2 cm in group 2, BMI was 23.5 kg/m2 in group 1 and 33.4 kg/m2in group 2. Buyukozturk et al,[12] noted that although CRP level was higher in allergic rhinitis and asthma, mean CRP and fibrinogen level was not significantly higher than in healthy population. However, serum amyloid A level was significantly higher than in controls.

Our results showed that hs- CRP level was 15.6 mg/L in group 1 and 21.3 mg/L in group 2 and FENO level was 38.4 ppb in group 1 and 30.5 ppb in group 2. Takemura et al,[13] showed that serum CRP level of non-user asthmatic patients was significantly higher than in controls. Although serum CRP level among user patients was more than in control group, this was not statistically significant.

We observed FVC (%) was 91.5 in group 1 and 85.2 in group 2, FEV1 (%) was 78.4 and 72.0, FEV1/FVC was 74.8 and 72.1, PEFR 25-75(%) was 87.4 and 83.1, FEF 25-75(%) was 57.8 and 53.2, FRC (%) was 112.8 and 87.4, SVC (%) was 91.5 and 86.2. Sin et al,[14] studied the effect of steroid inhaler on systemic inflammatory markers in mild-to-moderate chronic obstructive pulmonary disease cases. They found that following discontinuation of inhaler fluticasone, serum CRP level increased and vice versa. It seems that steroid inhalation decreases systemic inflammatory markers in asthma too, which should be studied more in cohort investigations. It should be noted that according to our findings, mean levels of sputum eosinophils in asthma group were significantly higher than upper limit of normal population in both user and non-user groups.

It was seen that IC (%) was 89.2 and 96.5, ERV (%) was 97.1 and 70.3, RV (%) was 121.8 and 102.5 and DLCO (%) was 108.2 and 98.4 in group 1 and 2 respectively. The mechanisms include the possibility that abdominal fat deposition leads to re-distribution of blood to the thoracic compartment that reduces VC. In obese patients, the diaphragm is in the upper position, which results in a low FRC. Such modification in resting end-expiratory lung volume may result in a massive change in airway resistance related to an increase in transmural pressure across the bronchial.[15]

CONCLUSION

The result of the present study showed that obese patients with asthma exhibited higher hs-CRP level. There was no significant difference for non-invasive inflammatory marker (FENO) and skin prick test to common aeroallergens and food allergens between both groups.

REFERENCES

1. Jones RL, Nzekwu MM. The effects of body mass index on lung volumes. Chest 2006;130:827–33.
2. National Task Force on the Prevention and Treatment of Obesity. Overweight, obesity, and health risk. Arch Intern Med 2000;160:898–904.
3. Must A, Spadano J, Coakley EH, Field AE, Colditz G, DietzWH.The disease burden associated with overweight and obesity. JAMA 1999;282:1523–9.
4. Golden MP, Swern A, Bird SS, Hustad CM, Grant E, Edelman JM. Influence of body mass index on the response of asthma controller agents. Eur Respir J 2006;27:495–503.
5. Weisberg SP, McCann D, Desai M, Rosenbaum M, Leibel RL, Ferrante AW Jr. Obesity is associated macrophage accumulation in adipose tissue. J Clin Invest 2003;112:1796–30.
6. Xu H, Barnes GT, Yang Q, Tan G Yang D, Chou CJ, et al. Chronic inflammation in fat plays a crucial role in the development of obesity-related insulin resistant. J Clin Invest 2003;112:821–30.

7. Shawn D, Aaron, Katherine L, Louis-philippe B, Andrew MR, Hernandez P, Catherine L, Stephen K. Over diagnosis of asthma in obese and non-obese adults. Canadian Med Assoc J 2008;179:1121–31.
8. Watson RA, Pride NB. Postural changes in lung volumes and respiratory resistance in subjects with obesity. J Appl Physiol 2005;98:512–7.
9. Little S. Impact of obesity on respiratory function. Respirology 2011;17:43–49. 21. Shinde PU, Irani FB, Heena K. The effect of body mass index on dynamic lung volumes. Int J Health Sc R 2014;4:42–46.
10. Fredberg JJ. Airway smooth muscle in asthma: flirting with disaster. Eur Respir J 1998;12:1252–6.
11. Halvani A, Tahghighi F, Nadooshan HH. Evaluation of correlation between airway and serum inflammatory markers in asthmatic patients. Lung India: Official Organ of Indian Chest Society. 2012 Apr;29(2):143.
12. Buyukozturk S, Gelincik AA, Genc S, Koçak H, Oneriyidogan Y, Erden S, et al. Acute phase reactants in allergic airway disease. Tohoku J Exp Med. 2004;204:209–13.
13. Takemura A, Matsumoto H, Niimi A, Ueda T, Matsuoka H, Yamaguchi M, et al. High sensitivity C-reactive protein in asthma. Eur Respir J. 2006;27:908–12.
14. Sin DD, Lacy P, York E, Man SF. Effects of fluticasone on systemic markers of inflammation in chronic obstructive pulmonary disease. Am J Respir Crit Care Med. 2004;170:760–5.
15. Monadi, M., et al., Serum C-reactive protein in asthma and its ability in predicting asthma control, a case-control study. Caspian journal of internal medicine, 2016. 7(1): 37-42.

How to cite this article: Reddy MG. Assessment of Correlation of hs-CRP, Exhaled Nitric Oxide and Atopic Status in Non-Obese and Obese Bronchial Asthma Patients. Ann. Int. Med. Den. Res. 2016;2(2):186-189.

Source of Support: Nil, **Conflict of Interest:** None declared