Int J Hum Genet, 3(1): 65-67 (2003)
PRINT: ISSN 0972-3757 ONLINE: 2456-6360
DOI: 10.31901/24566330.2003/03.01.12

Serum Adenosine Deaminase Activity in Myocardial Infarction

A. Jyothy[1], H. Surekha Rani [2], V. Dayasagar Rao[2] and P.P. Reddy[1]

1. Department of Cell Biology, Institute of Genetics, Hyderabad, Andhra Pradesh, India
2. Department of Cardiology, Durgabai Deshmukh Hospital & Research Centre, Hyderabad, Andhra Pradesh, India

KEY WORDS Adenosine deaminase; myocardial infarction; cell-mediated immunity; Immuno enzyme marker.

ABSTRACT The presence of immunological component in the progression of atherosclerotic lesions of coronary heart disease has been suggested in the earlier studies. The present study is one such attempt to estimate the level of adenosine deaminase (ADA) activity,an accepted non-specific marker of T lymphocyte activation in patients with Myocardial Infarction(MI) and establish it as a marker of cell mediated immunity in these patients. 50 cases presenting MI and 50 age and sex matched healthy controls were included in the study. Serum ADA activity was measured spectrophotometrically at 630nm. The mean ADA levels were 44.07±12.46 in patients and 20.71±5.63 in controls. The difference in the values between the two groups was found to be highly significant ($p< 0.01$). The observations of the present study provide evidence for T lymphocyte activation and proliferation in MI patients and suggest ADA as one of the marker to elucidate the pathogenesis of MI.

INTRODUCTION

Myocardial Infarction (MI) continues to be a major public health problem in the industrialised world. It forms the major cause of mortality in the middle age and elderly population. Majority of the MI's result from coronary atherosclerosis. The etiology and the underlying mechanism leading to atherosclerotic coronary artery is still to be completely understood although a number of risk factors have been identified (Braunwald 1996) .

In Myocardial Infarction there is ischemic necrosis of a variable amount of myocardial tissue as a result of an abrupt acute decrease in coronary flow or an equivalent abrupt increase in myocardial demand for oxygen, which cannot be supplied by an obstructed coronary artery. Coronary flow may be impaired by a thrombus in one of the coronary arteries or hemorrhage within or beneath an atherosclerotic plaque (Chesebro et al.1998).

The atherosclerotic lesions harbour macrophages and activated T cells, which secrete cytokines. This inflammatory response results in plaque rupture and thrombosis causing stroke or myocardial infarction. Thus the Thrombi that form on atherosclerotic lesions in coronaries are responsible for myocardial infarction and progression of athero-sclerosis.(Kovanan 1998).

The role of immunological mechanisms in the progression of atherosclerosis and its thrombotic complications has been an active area of research during the last two decades. The presence of both lymphocytes and macrophages in human atheroma suggests the contribution of immununological process in the pathogenesis of atherosclerotic lesions (Kovanan 1998).

Adenosine deaminase (E.C. 3.5.4.4) (ADA) an enzyme involved in metabolism of purine through the salvage pathway, catalyzes the irreversible hydrolytic cleavage of (deoxy) adenosine to (deoxy) inosine and ammonia (Adams et al.1976). It is widely distributed in human tissues and shows highest activity in lymphoid tissues and it is necessary for the proliferation, maturation and function of lymphocytes, specifically for T lymphocytes. It's activity increases during antigenic and mitogenic responses of lymphocytes, therefore it is considered as an important immunoenzyme marker for assessing cell mediated immunity in diseases characterized by T lymphocyte proliferation and maturation. (Kose et al.2001). Hence the present study was undertaken to assess cell mediated immunity by estimating the levels of ADA in MI patients when compared to controls.

MATERIAL AND METHODS

The study population consisted of 50 patients (age range 35-65 years) with

Corresponding Author: Dr. A. Jyothy, Associate Professor and Head, Department of Cell Biology, Institute of Genetics & Hospital for Genetic Diseases, Osmania University, Begumpet, Hyderabad 500 016, Andhra Pradesh, India
Phone (off): 040-3403681
E-Mail: Jyothycell@rediffmail.com

angiographically documented MI, admitted at Durgabai Deshmukh the cardiology unit of Hospital & Research Centre, Hyderabad and the control group consisted of 50, age and sex matched healthy individuals with no known history of any disease.

All the patients were examined clinically and information pertaining to age, sex, habits and health status was recorded in special case proforma.

ADA Estimation

For ADA estimation 2ml of blood sample was collected into the serum separation tubes from both control and patients. The blood samples were centrifuged at 3000 rpm for 10 minutes and the serum was assayed immediately for ADA activity as described by Guisti and Galanti (1984), based on the Bertholet reaction, that is, the formation of colored indophenol complexes from ammonia liberated from adenosine and quantitated spectrophotometrically.

50 µl of serum was incubated for 1 hour at 37°C in 1 ml of adenosine solution (20 mmol/l) buffered with phosphate (50 mmol/l), pH 6.5. For determination of ammonia, 3 ml of phenol nitroprusside and 3 ml of alkaline hypochlorite were added. Ammonium sulphate solution served as standard. The absorbance was measured at 630 nm in a Shimadzu UV-240 spectrophotometer. The activity of ADA is expressed in units/liter. Statistical analysis was carried out by Student *t* test.

RESULTS

Mean ADA levels estimated in patients with MI and controls are presented in table 1. The mean ± SD of ADA levels in serum of MI patients was 44.07 ± 12.46 and that of controls was found to be 20.71 ± 5.63. The difference in the mean values was statistically significant at 0.01.

Table 1: Serum ADA levels (µ/l) in MI patients compared with healthy controls.

Study Groups	*Number of Cases*	*Serum ADA (µ/l) Mean ± SD*	*Serum ADA (µ/l) Range*
MI patients	50	44.07 ± 12.46	20.5-93
Healthy controls	50	20.71 ± 5.63	15-25

P<0.01, significant

DISCUSSION

Characterization of human atheromata has determined that T cells localize to lesions early during pathogenesis. Activated macrophages, T lymphocytes and mast cells were found in the atherosclerotic arterial wall and thus the thrombotic component of the disease is attributed by immunologic processes of the cellular and humoral type (Libby 2000). Th1 cells are the predominant lymphocytes found in atherosclerortic lesions. The role of Th1cells in cell mediated immunity has been well characterized. T-cell activation results in the secretion of cytokines, including interferon γ, tumor necrosis factor α and β that amplify the inflammatory response (Song et al.2001). More over, these cells secrete IFN-γ a potent proinflamatory cytokine that induces the expression of major histocompatibility complex (MHC) class II and activation of macrophages (Bach et al.1997).

It is well established that the ADA levels reflect the activity of stimulated T-lymphocytes and its levels are raised whenever cell mediated immunity is stimulated. It's activity has been shown to be increased in diseases characterized by T lymphocyte proliferation and activation. Therefore it has been considered as a non-specific marker for T cell activation (Hovi et al. 1976). Hence, ADA levels have been estimated in the MI patients to assess the cell mediated immune response.

The results of the present study showed highly significant mean levels of ADA in MI patients when compared to controls. The elevated levels of ADA indicate the involvement of cell mediated immune responses in the pathogenesis of Myocardial infarction.

Earlier studies have also shown elevated levels of serum ADA in a number of other diseases where CMI is stimulated like Behcet's Disease (Kose et al. 2001) typhoid (Ungerer et al. 1996), Tuberculosis (Sharma et al. 2001), acute nephrotic syndrome (Mishra et al. 1997) and cancers (Erogly et al. 2000). A hereditary deficiency of ADA has been reported in children suffering from severe combined immunodeficiency (SCID) associated with defective cellular and humoral immunity (Hirschorn et al. 1978).

The present study is in agreement with the other reports, suggesting the role of ADA as an

important immunoenzyme marker in assessing the cell mediated immune response.

Our results suggests that estimation of ADA activity in myocardial infarction is important and may play a vital role in assessing the activation of T lymphocytes in the pathogenesis of MI.

REFERENCES

Adams A, Harkens RA 1976. Adenodine deaminase activity in thymus and other human tissues. *Clin Exp Immunol,* **26:** 647-649.

Bach EA, Aguet M, Schreiber RD 1997. The IFN gamma receptor: A paradigm for cytokine receptor signalling. *Annu Rev Immunol,* **15:** 563-591.

Braunwald E 1996. Acute MI -the value of being prepared. *N Engl J Med,* **334:** 51.

Chesebro JH, Rauch U, Fuster V, Badimon JJ 1997. Pathogenesis of thrombosis in coronary artery disease. *Haemostasis,* **27:** 12-18.

Erogly A, Canbolat O, Demirci S, Kocaoglu, H, Eryavuz Y, Akgul H 2000. Activities of adenosine deaminase and 5'-nucleotidase in cancerous and noncancerous human colorectal tissues. *Med Oncol,* **17:** 319-24.

Guisti G, Galanti B 1984. Adenosine deaminase: In: *Methods of Enzymatic Analysis.* H.U.Bergmeyer.1-3rd Edn., Verlag Chemie, Weinheim. New York: Academic Press, pp. 315-323.

Hirschhorn R, Martiniuk F, Rosen FS 1978. Adenosine deaminase activity in normal tissues and tissues from a child with severe combined immuno-deficiency and adenosine deaminase deficiency. *Clin Immunol Immunopathol,* **9:** 287-292.

Hovi T, Symth JE, Allison AC, Williams SC 1976. Role of adenosine deaminase in lymphocyte proliferation. *Clin Exp Immunol,* **23:** 395.

Kose K, Yazici C, Asciglu O 2001. The Evaluation of lipid peroxidation and adenosine deaminase activity in patients with Behcet's disease. *Clin Biochem,* **34:** 125-129.

Kovanan PT 1998. Predication of myocardial infarction in Dyslipidaemic men by elevated levels of immunoglobulin classes A, E, and G, but not M. *Arch Intern Med,* **158:** 1434-1438.

Libby P 2000. Changing concepts of Atherogenesis. *J Intern Med,* **247:** 349-358.

Mishra OP, Rajiv G, Ali Z, Usha 1997. Adenosine deaminase activity in nephrotic syndrome. *J Trop Pediatr,* **43:** 33-37.

Sharma SK, Suresh V, Mohan A, Kaur P, Saha P, Kumar A, Pande, JN 2001. A prospective study of sensitivity and specificity of adenosine deaminase estimation in the diagnosis of tuberculosis pleural effusion. Indian. *J Chest Dis Allied Sci,* **43:** 149-155.

Song Li, Leung C, Schindler C 2001. Lymphocytes are important in early atherosclerosis. *J Clin Invest,* **108:** 251-259.

Ungerer JP, Burger HM, Bissbort SH, Vermaak WJ 1996. Adenosine deaminase isoenzymes in typhoid fever. *Eur J Clin Microbiol Infect Dis,* **15:** 510-512.