

# Role of Adenosine Deaminase in Common Chronic ENT Infections

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## ABSTRACT

**Introduction:** Adenosine Deaminase (ADA) has been suggested to be an important enzyme which is associated with the cell mediated immunity. But its clinical significance in ENT infections needs to be correlated.

**Aim:** To evaluate the role of serum adenosine deaminase level estimation in common chronic ENT infections.

**Materials and Methods:** This was a prospective randomized study. The subjects were divided into 4 groups. Group A consisted of 25 normal healthy individuals who served as the controls. Group B consisted of 25 patients, who were clinically diagnosed as chronic tonsillitis. Group C consisted

of 25 patients, clinically diagnosed as chronic rhinosinusitis and Group D consisted of 25 patients, clinically diagnosed as chronic otitis media of mucosal type. The serum levels of ADA were estimated in all the subjects.

**Results:** The level of serum ADA was found to be elevated in common chronic ENT infections (Group B,C and D), when compared to control group(Group A) and  $p < 0.05$ , which is statistically significant.

**Conclusion:** From the present study, it can be concluded that serum ADA level can be considered as one of the essential diagnostic tool in diagnosing common chronic ENT infections.

**Keywords:** Chronic tonsillitis, Chronic rhinosinusitis, Chronic otitis media, Adenosine deaminase

## INTRODUCTION

Even though there are many chronic ENT infections, but chronic tonsillitis, chronic rhinosinusitis and chronic otitis media constitutes major part of the disease commonly seen by the otorhinolaryngologists in their clinical practice. Chronic tonsillitis is a condition which is most commonly seen in younger age group. The natural course of the disease affects the quality of life and seeks immediate medical attention. Chronic rhinosinusitis is a persistent inflammation of the mucosa of the nose and paranasal sinus, seen in both children and adults.

Chronic otitis media is a chronic inflammation of the middle ear cleft, resulting in permanent perforation and recurrent otorrhoea with reduced hearing [1]. In developing countries, the incidence is quiet high among low socio-economic groups may be because of overcrowding, poor personal hygiene, inadequate health care and recurrent episodes of upper respiratory tract infection [2]. The common route of spread of infection into the middle ear cavity is through the eustachian tube [3] and the causative infection may be in the adenoids, paranasal sinus, nose or in the oropharynx [4].

In purine metabolism the deamination of adenosine to inosine and ammonia, Adenosine Deaminase (ADA) enzyme plays a key role [5,6]. If there is obstruction to a normal pathway of enzyme secretion or excretion or if there is a change in the cell permeability, the normal study state of the passage of the enzyme from cells to extracellular fluid will be altered [7].

There are two isoforms of ADA: ADA 1 and ADA 2. The lymphocytes and macrophages contains ADA 1, it is not present only in the cytosol and nucleus but also as the ecto-form on the cell membrane. ADA 2 was first identified in human spleen and it is predominantly present in human plasma. The increased rate of cell damage rather than the total extent of cell damage is determined by the rise in serum adenosine deaminase level. The serum enzyme concentration represents a balance between leakage of enzyme from the damaged cells and loss of enzyme from the plasma into extracellular fluid to excretion or catabolism. If the serum enzyme increases, it reflects an increase in the rate of cell damage and not the complete extent of cell damage [8,9]. This study was conducted as there is no specific investigation

to support the diagnosis of chronicity pertaining to the common chronic ENT infections.

## MATERIALS AND METHODS

This study was conducted in the Department of Otorhinolaryngology- Head and Neck Surgery. Those patients who were diagnosed to have chronic ENT infections, attending ENT outpatient department in Chigateri district hospital and Bapuji hospital attached to JJM Medical College, Davangere from November 2014 to August 2015 were enrolled for the study. Informed consent from all the patients and the ethical committee clearance was taken to conduct the study. The patients were divided into 4 groups. Group A (control group) consisted of 25 patients. Group B consists of patients clinically diagnosed as chronic tonsillitis. Group C consisted of 25 patients, clinically diagnosed as chronic rhinosinusitis, and Group D consisted of 25 patients clinically diagnosed as chronic otitis media (mucosal type). Blood samples were collected through venepuncture taking aseptic measures. Serum was separated into clean, dry sterile vials, stored at  $-10^{\circ}\text{C}$  and ADA activity was assayed within a week. The samples were centrifuged at 3000rpm for 10 minutes and the supernatant was used for assay. The assay mixture containing 0.1Mm adenosine, 15 Mm potassium phosphate buffer (pH 7.4), 1.25% glycerol and 0.05ml of serum were used to measure the serum ADA activity spectrophotometrically at 265nm. The concentration of adenosine is directly proportional to the optical density of adenosine solution. Hence, the disappearance of adenosine is taken as an index of ADA activity and is followed by the rate of decrease in optical density at 265nm [10]. The ADA enzyme activity is expressed in IU/L and one unit of ADA represents the deamination of one micromole of adenosine per minute at  $37^{\circ}\text{C}$ . To avoid the technical error, all the reagents used to measure the ADA level were prepared with double distilled water to avoid the interference of the ammonia content in the tap water.

## STATISTICAL ANALYSIS

The results were represented as tables. The mean and the standard deviation of ADA in the different groups were analysed. The independent sample t-test and the p-values were then assessed. The p-value of  $< 0.05$  was considered as significant.

## RESULTS

A total of 100 patients were included in the study. These patients were selected randomly and consisted of all age groups and both sexes.

Groups	Serum ADA Level	
	Mean	Std Deviation
GROUP A	18.52	5.84
GROUP B	68.72	30.38
GROUP C	62.08	20.05
GROUP D	54.72	25.20

**[Table/Fig-1]:** Mean ADA Level In Different Groups.

Comparison	t-Value	p-Value
GROUP A VS GROUP B	8.11	p<0.000
GROUP A VS GROUP C	10.23	p<0.000
GROUP A VS GROUP D	6.99	p<0.000

**[Table/Fig-2]:** Comparison of Serum ADA Level in Different Groups with Control Group.

The mean values for serum ADA are significantly higher in Group B, C and D when compared to Group A as shown in [Table/Fig-1]. The t-value in Group A, Group B, Group C are 8.11, 10.23 and 6.99 respectively when compared to Group A [Table/Fig-2]. The p-value <0.05 in study groups in comparison with the control group, which is statistically significant.

## DISCUSSION

Many chronic infections related to ear, nose and throat are encountered by the otorhinolaryngologists in the current day practise. Eventhough, there are many chronic ENT infections, chronic tonsillitis, chronic rhinosinusitis and chronic otitis media constitutes the most of the patients examined by the ENT surgeons as outpatient as well as in-patient basis, the difficulties and the challenging task faced by them in diagnosing and treating those conditions. The serum ADA level increases in different diseases and it is considered as one of the marker for cell mediated immunity [11, 12]. ADA irreversibly deaminates adenosine, converting it to the related nucleoside inosine by the substitution of the amino group for a hydroxyl group. The enzyme purine nucleoside phosphorylase deribosylates inosine and converting it to hypoxanthine. The increased level of ADA under antigenic stimulation shows the importance of this enzyme in rapid proliferation of cells to prevent the accumulation of toxic metabolites [12].

In this present study, the serum ADA level was found to be significantly raised in Group B (chronic tonsillitis), Group C (chronic rhinosinusitis) and Group D (chronic otitis media of mucosal type) when compared to the Group A (control group). This is due to the chronic inflammation results in the release of lymphocytes. Several roles have been served by these lymphocytes after entering the inflamed tissue. Most notable, was the 'T' cells that activate macrophages. Dealing with different pathogens by phagocytosis requires the activity of ADA enzyme.

OP Mishra et al., in his study stated that lymphocyte proliferation and differentiation requires adenosine deaminase (ADA) [13]. 'T' lymphocytes detects this enzyme. Hence, in chronic inflammatory conditions there might be increased in serum ADA level.

Nagpal R et al., in his study, found that the level of ADA in acute tonsillitis decreases [14]. It was summarized that in the acute stage, tonsil instead of acting as a protective barrier, appear to become a source for the breakdown of immunological mechanism and neutrophils play a vital role in acute inflammation, and no role for cell mediated immunity. In the present day scenario, various studies are undertaken to find the diagnostic value of ADA level in various diseases such as tuberculosis in pleural, pericardial and peritoneal fluids by Mathur et al., Typhoid fever and other febrile illness by Sameera et al., and to predict glycaemic status in Type 2 Diabetes mellitus by Nisha Subhashchandra et al., [15-17]. Regarding the role of serum adenosine deaminase level in chronic ENT infections, as a diagnostic tool, no studies have been conducted yet.

## CONCLUSION

We conclude that estimation of adenosine deaminase level can be considered as one of the essential diagnostic tool in case of chronic tonsillitis, chronic rhinosinusitis and chronic otitis media of mucosal variety. However further studies are required with a large sample size.

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