EVALUATION OF THE RELATIONSHIP BETWEEN PERIODONTAL DISEASE AND GENERAL HEALTH STATUS IN CHRONIC PERIODONTITIS PATIENTS USING SERUM ALBUMIN CONCENTRATION

Sandeep K. Pimpale[1],Vishal N. Parmar[2] ,Mala Dixit Baburaj[3]
1.Assistant Professor,Department Of Periodontics,Nair Hospital Dental College, Mumbai
2.Assistant Professor,Department Of Periodontics,Nair Hospital Dental College,Mumbai
3.Professor & Head Of Department,Department Of Periodontics,Nair Hospital Dental College, Mumbai

ABSTRACT:

AIM: The study aimed at investigating the correlation between periodontal disease and serum albumin concentration in chronic periodontitis patients.

MATERIALS AND METHODS: 400 subjects divided into two age groups between 25 to 35 and 35 to 45 years (200 in each group, comprising 100 healthy and 100 chronic periodontitis patients). Serum albumin level was detected by using automated machine. Level of serum albumin was compared between the patients affected with chronic generalized periodontitis & healthy individuals.

RESULT: Statistical analysis using Student's unpaired t-test was employed to compare the difference between the two means. In both age groups, the difference in healthy and chronic periodontitis patients in terms of serum albumin level was found to be statistically significant ($p < 0.05$).

CONCLUSION: The results suggest that serum albumin concentration is an important risk indicator in chronic periodontitis.

Key words: Chronic periodontitis, Serum albumin concentration, General health status.

INTRODUCTION:

Periodontal infection has been implicated as a risk factor for systemic diseases such as coronary heart disease and diabetes. [1,2] It has been suggested that impaired dentition status such as tooth loss owing to periodontal infection may affect individuals by causing dietary restrictions via difficulty in chewing; possibly compromising their nutritional status and well-being. Serum albumin levels might be a practical marker of the general health status as they describe the severity of an underlying disease. [3]

According to Herrmann et al. (1992), many conditions, such as inflammatory states, liver diseases and renal diseases, have been indicated to reduce serum albumin levels. [4] Moreover, malnutrition

also may be monitored by means of the serum albumin concentration. [5]

Serum albumin levels remain virtually unchanged even in the presence of protein calorie malnutrition in otherwise healthy individuals until near terminal starvation. Hence, serum albumin concentration could be a criterion, which indicate the general health. [6]

Yoshihara et al. (2003) have recently reported that the number of untreated teeth was a significant factor associated with serum albumin concentration in elderly. Therefore, it is suggestive that oral disease burden might be monitored by the levels of serum albumin. However, few studies have been performed or reported on the relationship between periodontal disease status and serum albumin concentration. [7]

MATERIAL AND METHODS:

STUDY DESIGN:

Aims:

This study aims at investigating whether periodontal condition can influence the serum albumin concentration in chronic periodontitis patients.

Armamentarium: Diagnostic instruments include mouth mirror, UNC-15 periodontal probe, tweezers and sterile hand gloves. Sterile needles and syringes were used to collect blood for investigation purpose. Vacutainer (EDTA bulb) were used to carry blood samples from the Haematology department to the Biochemistry department.

Patients for this study were selected from the out patient Department of Periodontics, Nair Hospital Dental College, whose written informed consent was taken prior to the study.

Clinical Protocol:

Inclusion criteria:

A total number of 400 patients were selected using the following selection criteria:

1. Healthy patients.
2. Patients affected with chronic generalized periodontitis showing probing pocket depths $\geq$ 5 mm.

Exclusion criteria:

1. Patients who were smokers.
2. Patients who had systemic diseases, e.g., Diabetes, Hypertension, Epilepsy.

Experiment Design:

Patients were selected using above criteria. They were subjected to detailed case history, examination and counselling.

- ❑ 5 ml of blood was collected using 22 gauge needles in bulbs containing EDTA.
- ❑ Serum albumin level was detected by using automated machine in Biochemistry department of Nair hospital & medical college.
- ❑ Levels of Serum albumin were detected in 400 subjects who were divided into two age groups between 25 to 35 and 35 to 45 years (i.e. 200 in each group).
- ❑ Level of serum albumin was compared between the patient affected with chronic generalized

periodontitis & healthy individuals selected from out patient department of periodontics, Nair Hospital Dental College.

RESULTS:

Statistical analysis using Student's unpaired t-test was employed to compare the difference between two means.

See Table 1 and Table 2

Patients with chronic generalized periodontitis showed significant relationship with serum albumin concentration at $p < 0.05$. After comparing the means of control & test group, the p value findings were found to be significant.

DISCUSSION:

Proteins are building blocks of human body. Among all the proteins, albumin is one of the essential proteins required for many functions of the body. Albumin is the major constituent of plasma proteins. Albumin is exclusively synthesized by the liver. Albumin is synthesized in the liver as pre proalbumin, which has an N-terminal peptide that is removed before the nascent protein is released from the rough endoplasmic reticulum. The product, pro-albumin, is in turn cleaved in the Golgi vesicles to produce the secreted albumin. Liver produces about 12gms of albumin per day which represents 25 % of total hepatic protein synthesis. [8]

The normal reference range for albumin concentrations in blood is 3.4 to 5.4 g/dl. It has a serum half-life of approximately 20 days and a molecular mass of 67 kDa.

Functions of albumin include [8]

- Maintains oncotic pressure

- Transports thyroid hormones

- Transports other hormones, in particular, ones that are fat-soluble

- Transports fatty acids ("free" fatty acids) to the liver

- Transports unconjugated bilirubin

- Transports many drugs (serum albumin levels can affect the half life of drugs)

- Competitively binds calcium ions (Ca^{2+})

- Buffering functions - Among the plasma proteins, albumin has the maximum buffering capacity

- Serum albumin, as a negative acute-phase protein, is down-regulated in inflammatory states. As such, it is not a valid marker of nutritional status; rather, it is a marker in inflammatory states

- Prevents photo degradation of folic acid

Periodontitis is defined as an inflammatory disease of the supporting tissue of teeth caused by specific microorganisms or groups of specific microorganisms, resulting in progressive destruction of the periodontal ligament

and alveolar bone with pocket formation, recession or both. [9]

Periodontitis results in the formation of many inflammatory mediators like C-reactive proteins. Also this will stimulate antibody formation like IgG. A significant association between serum albumin concentration and IgG has also been reported. [10] C-reactive protein may be used to identify the presence of inflammation in individuals with a lower serum albumin concentration. [11] Because of increased synthesis of inflammatory mediators & C-reactive protein levels by the liver in diseased conditions, the albumin levels are decreased in the serum.

In 1964, Scherp reviewed the available literature on epidemiology of periodontal diseases and concluded that

1. Periodontal diseases appear to be major, global public health problem affecting the majority of the adult population after the age of 35-40 years.

2. The disease starts as gingivitis in youth, which if left untreated, leads to progressive destructive periodontitis.

3. More than 90% of the variance of the periodontal diseases and its severity in the population can be explained by age and oral hygiene. [12]

In 2004 Susin et al. in Brazil did a prevalence study of periodontitis in adult population aged 30 – 60 years old. He demonstrated that moderate attachment loss (≥5mm) and advanced attachment loss (≥7mm) occurred in 70 – 52 % of the subjects. It affected an average of 36% and 16% of their teeth, respectively. Patients above 30 years of age had a threefold increase risk for moderate and 7.4 fold increase risk for advanced attachment loss. [13]

In aged individuals, perhaps it would seem that the impaired dentition status will merge with the possibility of compromised systemic health status in reflecting the values of serum albumin concentration. Though this is a possibility, it becomes difficult to infer whether serum albumin concentrations are affected by inflammatory component of chronic periodontitis or the compromised nutritional status, owing to the general health status of the individual.

In our clinical trial, the possibility of general health/nutritional status in any way affecting the serum albumin concentrations was somewhat eliminated in the control and test age group of 25 to 35 and 35 to 45 years, as the subjects included in our clinical trial were physically fit without any systemic diseases. Thus, it would seem appropriate to infer that the lower serum albumin concentrations (4.0 g/dl) were solely affected by the inflammatory component of chronic periodontitis. The age groups selected for this clinical trial were appropriate as we know maximum patients affected with advanced periodontitis fall in the age of above 30 years. So, assuming the possibility of

significantly decreased serum albumin levels will be seen in 30 years above age group patients compared to 30 years below age group [13], two age groups of 25 to 35 and 35 to 45 years were selected.

Our results are similar to those reported by Yoshihara *et al.* and substantiate the association between oral health status, in particular periodontal disease and serum albumin concentrations.[7]

Corti *et al.* have reported graded increase in mortality rate with decreasing albumin levels. Thus there could be a connection of serum albumin level and mortality rate. [14] However, it seems more evident that serum albumin levels below 4 g/dl have higher mortality rate. Shibata *et al.* reported the periodontal disease status has a substantial influence not only on the subject's serum albumin levels but also on general health aspects. [15]

In a longitudinal study by Iwasaki *et al.*, a significant association was found between the periodontal disease and serum albumin levels over 4 years. [16]

The mean serum albumin levels in our clinical trial in chronic periodontitis

patients were 4.6 g/dl in the 25 – 35 years age group and 4.0 g/dl in the 35 - 45 years age group. Although in test age group evaluated there is no significance in mortality rate of the patients, these findings would lead us to assume that there is a significant relationship between serum albumin levels & chronic periodontitis. The age group of the sample selected in our clinical trial is much lesser than the age group of sample selected in the earlier study discussed where the mortality was high. This is the reason for which the age group for our clinical trial was selected in order to eliminate any other systemic possibilities affecting the serum albumin concentration in the older age group.

CONCLUSION:

In chronic periodontitis there is increased synthesis of inflammatory mediators & C-reactive protein levels similar to that seen in diseased conditions. The serum albumin levels in chronic periodontitis patients had decreased in comparison with healthy individuals of the same age group. Thus, serum albumin concentration could be a significant risk indicator for patients with chronic periodontitis.

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TABLES:

Table no. 1

	Control (25-35 yrs age grp)	Test (25-35 yrs age grp)	Control (35-45 yrs age grp)	Test (35-45 yrs age grp)
Mean value	4.80 gm/dl	4.60 gm/dl	4.80 gm/dl	4.00 gm/dl
Standard deviation	0.48	0.46	0.48	0.40

Table no. 2

25-35 yrs age grp	35-45 yrs age grp)
P < 0.01 which is significant	P < 0.001 which is extremely significant