ORIGINAL ARTICLE

Salivary Alkaline Phosphatase- A Risk Indicator in Hemodialysis Patients with Chronic Periodontitis

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Abstract

Introduction: *Periodontitis is an infectious disease of gingival tissue origin leading to alveolar bone destruction and ultimately tooth loss. Alkaline phosphatase (ALP) is a hydrolase enzyme responsible for removing phosphate groups from many types of molecules and is a marker of bone metabolism. Elevated total serum alkaline phosphatase (ALP) values have been associated with increased mortality in the hemodialysis patients and also in the general population.* ***Methods:*** *The study included 20 subjects, 10 in each group in the age group of 30-50 years. Group A comprised of 10 systemically healthy individuals with chronic periodontitis. Group B comprised of 10 hemodialysis dependent Chronic kidney disorders (CKD) patients with chronic periodontitis.* ***Results:*** *The present study showed a significant increase in Alkaline Phosphatase value in hemodialysis-dependent CKD patients with chronic periodontitis (Group B) compared to systemically healthy subjects with chronic periodontitis (p value<0.005).* ***Conclusion:*** *Alkaline phosphatase could be used as a diagnostic marker of periodontitis in hemodialysis-dependent CKD patients. However, ALP cannot be solely responsible for periodontitis in hemodialysis dependent CKD patients but it can be used as an additional aid in diagnosing periodontitis.*

Keywords*: Alkaline phosphatase, periodontitis, chronic kidney disorder, hemodialysis*

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Introduction

Periodontitis is the disease which involves two or more structures of the periodontium including alveolar bone, periodontal ligament, cementum, and gingiva. A susceptible host, virulent pathogens and a nourishing environment will predispose to the periodontal tissue destruction. Even though plaque microbiota is considered as the primary factor responsible for disease prevalence, systemic conditions and factors affecting the host could equally contribute to the same. Chronic kidney disease (CKD) is a worldwide public health problem, with increasing prevalence and potentially lethal adverse outcomes like the progressive loss of kidney function, cardiovascular disease, and premature death. Disturbances in bone and mineral metabolism are common complications of CKD and an important cause of morbidity[1]. Early detection of a disease is a key to its best prognosis. Biomarkers have both diagnostic and prognostic values in case of periodontal disease progression. A number of markers have been identified for both bone formation and bone resorption. Among the biomarkers, alkaline phosphatases (ALP) have been of prime interest especially in a periodontal view-point. ALP activity in human serum is widely used as a biomarker for a variety of disease states particularly the liver, kidney, and bone. The earliest published works about the structure and function of ALP was carried out by Suzuki et al;

The normal laboratory range for ALP is 20 to 140 IU/L (international units per litre)[2].

Periodontitis and ALP

Various studies have demonstrated the increase in the level of salivary ALP in periodontitis which could be related to the alveolar bone loss [3,4]. Studies have evaluated the importance of ALP in osteogenesis and fibrogenesis[5]. A positive correlation was found between enzyme concentration and the mean percentage of bone loss suggesting bone as a source of alkaline phosphatase.

Chronic kidney disorders and ALP

CKD manifested by either one or a combination of abnormalities of calcium, phosphorus and vitamin D metabolism, abnormalities of bone turnover, mineralization, volume, linear growth or strength and vascular or other soft tissue calcification. Lee et al; found alkaline phosphatase to have a cumulative association with mortality in patients with CKD. Woodward and Dean suggested that ALP is produced by bone as an essential agent for growth and repair[6].

Periodontitis and chronic kidney disorders

The relationship between periodontitis and renal disease is still unclear. Periodontitis increases the systemic inflammatory burden leading to worsening of CKD which in turn has been found to negatively affect CKD of patients on hemodialysis therapy[7]. NHANES data estimated the prevalence of periodontal disease and CKD and found it to be 5.3 and 10.6%, respectively and concluded that periodontal disease is associated with a more than a two-fold higher risk of CKD[8]. The present study was conducted with the aim of comparing the ALP levels in saliva between systemically healthy individuals with periodontitis and hemodialysis dependent CKD patients with periodontitis.

Materials and Methods

Ethical clearance was obtained from the institution Ethics committee. This cross-sectional study was conducted in the Department of Periodontics, A. B. Shetty Memorial Institute of Dental Sciences, Mangalore and Hemodialysis unit, K. S. Hegde Hospital, Nitte University, Deralakatte, Mangalore. The total of 20 patients was selected for the study based on the following selection criteria. Inclusion criteria: Subjects with an age group between 30-50 years, systemically healthy, with a minimum of 20 complements of teeth and not received any periodontal therapy in past 6 months and subjects undergoing hemodialysis therapy (Group B).

Exclusion criteria: Pregnant/lactating women, history of smoking, aggressive periodontitis and history of periodontal treatment in past 6 months.

A detailed medical and dental history was recorded. Informed written consent was obtained from all subjects. Periodontal examination: The periodontal status was assessed by measuring the severity of gingival inflammation by using Löe and Silness Gingival index, and the periodontal pocket was measured at mesio-facial, mid-facial, disto-facial, disto-lingual, mid-lingual and mesio-lingual areas in millimeters using Michigan 'O' probe with William's graduation. Collection of saliva: Unstimulated saliva was collected in a sterile container and stored at -20°C later these samples were brought to room temperature and then subjected for estimation of ALP levels. Estimation of Alkaline Phosphatase: For analysis, each saliva sample was centrifuged at 5000 rpm for 10 minutes. Reagents added to about 10microlitre of the supernatant sample by autoanalyzer and the value of ALP estimated in U/L. The reagents used in the estimation of saliva ALP are Reagent 1(R1) Diethanolamine Buffer, (pH 10.2) Magnesium Chloride Reagent 2(R2) p- Nitrophenyl Phosphate. The values obtained were subjected to statistical analysis Unpaired t-test was used to compare the ALP levels between systemically healthy and hemodialysis dependent CKD patients. Mean and Standard Deviation of salivary ALP levels between healthy individuals and CKD patients with chronic periodontitis. $P < 0.005$ was considered statistically significant.

Results

Table: 1

Salivary ALP levels	n	Mean	Std deviation	Mean difference	t	P
Group A	10	100.93	33.6472	235.0710	-5.5310	<.0005*
Group B	10	336.005	130.305			

*statistically significant

Discussion

The present study was designed to compare the salivary ALP levels between systemically healthy individuals with periodontitis and hemodialysis dependent CKD patients with periodontitis. Alkaline phosphatase level was estimated by enzymatic method and spectrometric quantification. The results of the study (TABLE 1) showed a significantly higher salivary ALP levels in hemodialysis dependent CKD patients with chronic periodontitis compared to systemically healthy individuals with chronic periodontitis. This increase could be associated with an increased alveolar bone loss in periodontitis.

Various studies have demonstrated the higher prevalence of periodontal disease in patients with CKD and the systemic inflammatory burden in patients with CKD undergoing HD therapy decreased after non-surgical periodontal therapy[9].

Systemic inflammation is the mechanism proposed for the effect of periodontitis on the development of kidney disease. Both periodontitis and kidney diseases are associated with inflammatory markers such as C-reactive protein[10]. Studies have established an associative relationship of systemic conditions like CVD, DM, pulmonary diseases, osteoporosis, anemia and CKD with oral diseases[11]. Chronic low-level inflammation associated with periodontitis may lead to endothelial dysfunction which plays a major role in the pathogenesis of kidney disease[11].

A study showed a positive correlation between salivary enzyme activity and gingival index values as a predictive indicator for the future periodontal breakdown, therefore it may best serve as a marker in periodontal treatment planning and monitoring[12]. ALP levels in HD patients are closely correlated to other markers of altered bone mineral metabolism[13].

Conclusion

The study attempted to compare the ALP levels in systemically healthy and hemodialysis patients with chronic periodontitis. The result showed an increase in ALP levels in Hemodialysis patients compared to healthy individuals with chronic periodontitis which suggest an increased bone turn over in hemodialysis patients. The study also suggested that ALP is a bone turnover marker and could be used as a predictor for periodontal disease progression. Salivary Alkaline phosphatase level could be valuable to clinicians because it can quantitatively evaluate the inflammatory status of gingival and periodontal tissues. Hence alkaline phosphatase could be used as a diagnostic marker of periodontitis in hemodialysis patients. However further studies with larger sample size are required to conclude the exact role of Alkaline Phosphatase.

Conflict of Interest: *None declared*
Source of Support: *Nil*
Ethical Permission: *Obtained*

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