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Biomedical Engineering's Recent Progress in Biomaterials, Drugs Development, and Medical Devices

Proceedings of the First International Symposium
of Biomedical Engineering (ISBE 2016)



Depok City, Indonesia

31 May-1 June 2016

Editors

Yudan Whulanza, Sugeng Supriadi, Muhamad Sahlan and Basari

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Preface: The First International Symposium of Biomedical Engineering (ISBE 2016)

Research Center for Biomedical Engineering (RCBE) Universitas Indonesia has organized the first International Symposium of Biomedical Engineering (ISBE) in 2016. The conference was conceived in Depok, Jawa Barat with the desire to bring together engineers and scientists with core competence in biomedical engineering and showcase transformative research to innovation. More than 20 national and international institutions were involved in this event.

The first part of the book explains how the engineering of advanced bio-materials has found striking applications in used for biomedical such as stem-cell, drug delivery, DNA extraction, biosensors, tissue engineering and organ regeneration. The second part of the book reviews of novel findings and outlooks in drug development and delivery systems contains contributions in the fields of molecular biology, pharmacology and genetic engineering. The final part introduces the applications of biomedical instrumentations, devices, and assistive technologies in rehabilitation engineering application. The book proceeds to discuss prosthetic & orthotic design and also augmentative & alternative communication (AAC) technology in a near application to the society.

Ultimately, I am very pleased to have edited this book and very grateful to each of the contributors for their dedication and cooperation. This book would not have been possible without their enthusiasm to share knowledge, passion and time. Hopefully, the readers are using this cross-disciplinary discussion for bringing innovation to their current and future research.

Yudan Whulanza
Editor in Chief

Conference Detail

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Alkaline Phosphatase Levels in Patients with Coronary Heart Disease Saliva and Its Relation with Periodontal Status

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Abstract. Coronary heart disease (CHD) is a disease that causes narrowing of the coronary arteries. Currently, there is a hypothesis regarding periodontal infection that increases risk for heart disease. Alkaline phosphatase (ALP) as a marker of inflammation will increase in atherosclerosis and periodontal disease. The objective of this research is analyzing the relationship between the levels of alkaline phosphatase in saliva with periodontal status in patients with CHD and non CHD. Here, saliva of 104 subjects were taken, each 1 ml, and levels of Alkaline Phosphatase was analyzed using Abbott ci4100 architect. We found that no significant difference of Alkaline Phosphatase levels in saliva between CHD patients and non CHD. Therefore, it can be concluded that Alkaline Phosphatase levels in patients with CHD saliva was higher than non CHD and no association between ALP levels with periodontal status.

Keywords: Alkaline Phosphatase, periodontal status, coronary heart disease

INTRODUCTION

Coronary heart disease (CHD) is a systemic disease that has high prevalence in Indonesia and the number of events has increased from year to year. One of the systemic diseases associated with periodontal disease patients is cardiovascular disease. Cardiovascular disease and periodontal disease are inflammatory diseases that are common in today's society. In atherosclerosis, inflammation plays continuously from the cell expression of adhesion molecules into fatty chain formation, the formation of plaques in blood vessels, and eventually plaque rupture [1]. Several in vitro studies concluded that *P. gingivalis* may be associated with atherogenesis because the bacteria can invade endothelial cells, lipopolysaccharide (LPS) triggers cell attachment and produce cytokines in endothelial cells [2]. Antibodies against *P. gingivalis* was consistently associated with elevated levels of C-reactive protein (CRP). Several studies have also reported that the value of CRP levels were higher in subjects who had at least one species of periodontal pathogens when compared with individuals who did not have periodontal pathogens [3]-[5]. The results of this study indicate no increase in CRP relationship with *P. gingivalis* in subgingival plaque that is a periodontal infection. Alkaline phosphatase (ALP) is widely used to indicate the presence of bone and hepatobiliary disorders, but its activity also increased as CRP as a marker of inflammation in atherosclerosis and vascular disease [6][7]. Alkaline phosphatase of CHD associated with C-reactive protein were strongly associated with inflammation, endothelial dysfunction and coagulation. In patients with atherosclerosis also include calcification and increased ALP due to inflammation [7]-[9]. Results are expected to remind colleagues general practitioner and cardiologist about their immunological relationship between the oral cavity with CHD and can be used to predict whether the

levels of ALP in saliva in a person are associated with the prevalence of periodontal disease with coronary heart disease. For patients with CHD knowledge of periodontal status can be used to improve oral hygiene.

The national prevalence of coronary heart disease (CHD) in the statement of Health National Research 2013 increased with age, the highest in the age group 65-74 years is 2.0 percent. Currently there is no research in Indonesia which analyze the levels of ALP in saliva of CHD patients with chronic periodontitis. The purpose of this study is to analyze the relationship between the levels of ALP in saliva in patients with CHD and non CHD with periodontal status.

MATERIALS AND METHODS

Subjects were CHD patients with chronic periodontitis in Harapan Kita, Cardiovascular Hospital, during December 2015 – February 2016. Non CHD subjects were taken from Dental Hospital, Faculty of Dentistry Universitas Indonesia. This study was conducted on 66 samples of CHD patients and 40 samples of non CHD patients as controls, age 40-75 years were selected according to inclusion and exclusion criteria. Sampling was performed at Harapan Kita, Cardiovascular Hospital whereas examination of ALP levels in saliva are conducted at the Laboratory of Clinical Pathology Harapan Kita Cardiovascular Hospital. Materials, tools, sheet approval, explanation of the purpose and objective research and periodontal status sheet was prepared. Sampling saliva was conducted using a funnel and collected in a centrifuge tube. Intra oral examination includes plaque index, calculus index, degree of bleeding, and pocket depth. ALP laboratory data collection taken from saliva samples. Abbott architect ci4100 is a tool with computerized system that is used to analyze the levels of ALP in this study.

RESULTS AND DISCUSSION

Mean of periodontal status (plaque accumulation, calculus accumulation, gingival bleeding, pocket depth and attachment loss) between CHD and non CHD patients (figure 1).

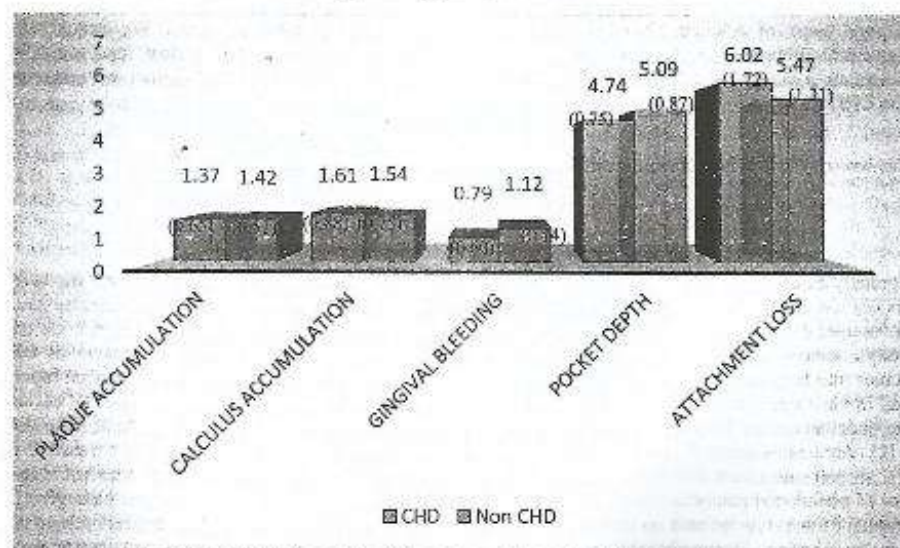


FIGURE 1. Mean of Periodontal Status between CHD and non CHD

Mean of ALP levels in CHD patients was 10.85 (6.85) (U / L) with a range of 5-31 (U / L) and in patients with non-CHD mean of ALP levels was 9.21 (4.66) (U / L) with a range of 5-21 (U / L) (Graphic 2).

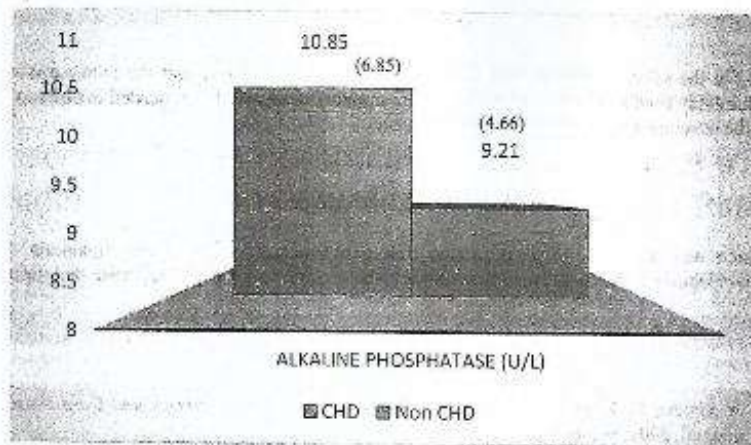


FIGURE 2. Mean of Alkaline Phosphatase Levels between CHD and non CHD

ALP differences in CHD and non CHD subjects were analyzed using non-parametric test of Mann Whitney shows the results no significant difference ($p=0.34$; $p>0.05$). Relationship between levels of ALP with periodontal status on CHD subjects were tested using Spearman's test results showed no significant correlation ($p<0.05$) between the levels of ALP by the accumulation of plaque, gingival bleeding, pocket depth and clinical attachment loss. Relationship between levels of ALP with periodontal status on the subject of non CHD were tested using Spearman's test results showed no significant correlation ($p<0.05$) between the levels of ALP by the accumulation of plaque, gingival bleeding and clinical attachment loss, while the pocket depth is accepted has 0.04 meaningful value.

The results showed that levels of ALP in CHD higher than non CHD, although in a non-parametric bivariate analysis (Mann Whitney) showed no significant differences in both with the p 0.34, but this illustrates the ALP role in both CHD and periodontal disease. This is consistent with research Ishikawa et al. use of saliva as a sample to analyze the levels of ALP on periodontal tissues healthy, gingivitis and periodontitis. Some of the same study showed ALP in periodontitis higher than healthy periodontal tissues [10].

According to Buhlin et al. increased risk of cardiovascular disease in people with periodontal disease caused by germs, germs product or cytokines released from the lesions of chronic periodontal into the bloodstream. This process resulted in a systemic inflammatory response that resembles the profile of risk factors that were found in cardiovascular disease [11]. This study is the first to connect between alkaline phosphatase in saliva with periodontal status on CHD and non CHD, because based on the research Webber, et al [5], there is ALP connection with the process of atherosclerotic lesions, the study also tried to connect the two levels of ALP both CHD and non CHD in periodontitis.

Mean periodontal status between CHD and non CHD showed different results. Accumulation of plaque, gingival bleeding and pocket depths of CHD showed the average lower than non CHD, whereas clinical attachment loss showed CHD mean values higher than non CHD. The relationship between the levels of ALP in saliva with periodontal status (accumulation of plaque, gingival bleeding, pocket depth and clinical attachment loss) for both CHD and non CHD showed no significant differences, except in non CHD pocket depths were significantly different. This is similar to studies conducted Nakamura et al [12], that indicates a link to the ALP in saliva pocket depth without any connection CHD, explained that there is a process of periodontal disease.

Increased ALP activity in the blood was also found in patients with peripheral arterial disease. This disease is a systemic vascular disease that associated with atherosclerosis and vascular inflammation. Correlation with CRP, inflammation, obesity, and atherosclerosis make the ALP can be a potential diagnostic marker or predictor of cardiovascular disease. Alkaline phosphatase is used as an early marker of osteoblastic differentiation, so in this case the ALP contained in saliva and lesions of atherosclerosis, the two groups studied both CHD and non CHD equally suffer from periodontitis, can be seen although the differences in both of ALP levels not significant, but from average ALP levels at CHD showed a higher than non CHD.

CONCLUSION

ALP levels in the saliva of patients with CHD is higher than non CHD, but the increase is not statistically significant. This study need to be continued with a more sample. More studies are needed in order to ascertain more acceptable to the development and advancement of science.

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REFERENCES

1. J. Beck, R. Garcia, G. Heiss. *The Association between Periodontal Diseases and Cardiovascular Diseases*. Ann Periodontol, 2001, vol. 6, pp. 9-15.
2. A.L. Griffen, M.R. Becker, S.R. Lyons, M.L. Moeschberger, E.J. Leys. *Prevalence of Porphyromonas gingivalis and periodontal health status*. J Clin Microbiol, 1998, vol.36, no.11, pp. 3239-3242.
3. K. Yamazaki, T. Honda, T. Odu, T. Nakajima, H. Yoshie, H. Yoshie. *Effect of Periodontal Treatment On The C-Reactive Protein and Proinflammatory Cytokine Levels in Japanese Periodontitis Patients*. J Periodontol Res, 2005, vol. 40, pp. 53-58.
4. F. D'Aiuto, D. Ready, M.S. Tonetti. *Periodontal disease and C-reactive protein-associated cardiovascular risk*. J Periodontol Res, 2004, vol. 39, pp. 236-241.
5. A.B.M. Schulze. *Periodontal Disease and Heart Disease*. Clin Sport Med Int, 2008, vol. 1, no. 8, pp. 9-12.
6. B.A. Dye, K. Choudhary, S. Shea, P.N. Papapanou. *Serum antibodies to periodontal pathogens and markers of systemic inflammation*. J Clin Periodontol, 2005, vol. 32, pp.1189-1199.
7. M. Webber, A. Krishnan, N.G. Thomas, B.M.Y. Cheung. *Association between serum alkaline phosphatase and C-reactive protein in the United States National Health and Nutrition Examination Survey 2005-2006*. Clin Chem Lab Med, 2010, vol. 48, no. 2, pp. 167-173.
8. M. Tonelli, G. Curhan, M. Pfeffer, F. Sacks, R. Thadhani, M.I. Melamed, N.M.P. Wiebe. *Relation between alkaline phosphatase, serum phosphate, and all-cause or cardiovascular mortality*. Circulation, 2009, vol. 120, pp. 1784-1792.
9. F. Parhami, A.D. Morrow. *Lipid Oxidation Products Have Opposite Effects on Calcifying Vascular Cell and Bone Cell Differentiation A Possible Explanation for the Paradox of Arterial Calcification in Osteoporotic Patients*. Arterioscler Thromb Vasc Biol, 1997, vol. 17, pp. 680-687.
10. R. Kumar, G. Sharma. *Salivary Alkaline Phosphatase level as Diagnostic marker for periodontal disease*, 2011, pp. 81-86.
11. K. Buhlin. *Risk factors for cardiovascular disease in patients with periodontitis*. Eur Heart J, 2003;24:2099-2107.
12. M. Nakamura, and J. Slots. *Salivary enzymes origin and relationship to periodontal disease*. J Periodontol Res, 1983, vol. 18, pp.559-569.