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ORIGINAL ARTICLE

Effect of Scaling and Root Planing Treatment on Levels Hs-CRP in Indonesian Patients with Risk of Cardiovascular Disease

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Abstract

Objective: To determine the effect of scaling and root planning treatment on levels of hs-CRP (C-reactive protein) in patients with risk of cardiovascular disease. **Material and Methods:** This research is an experimental research with one group pre- and post-test design. This research was performed to the periodontal patients who came to the clinic and have risk of cardiovascular disease. Medical evaluations included measurement of blood pressure and body mass index were performed. Blood samples were obtained from each subject after over night fasting, high-sensitivity C-reactive protein was measured as an index of inflammation. Blood samples were analysed two times before treatment (scaling and root planning) and three weeks later. Statistical analysis used Paired t-test. The level of significance was set at 5%. **Results:** Means-CRP levels before and after treatment in scaling and root planning were 3.16 ± 2.37 and 2.18±1.56 (p=0.007). **Conclusion:** There are significant differences between hs-CRP levels before and after treatment.

Keywords: Cardiovascular Diseases; Dental Scaling; Root Planing; C-Reactive Protein.

Introduction

In developed countries, cardiovascular diseases cause 50% of deaths while in developing countries account for 16% of deaths [1]. Cardiovascular disease can be defined as a disease that affects the heart or blood vessels by causing a disturbance of blood circulation [1,2]. Atherosclerosis is an inflammatory disease caused by a series of specific molecular and specific responses to an injury. High levels of plasma cholesterol, especially Low Density Lipoprotein (LDL) are the main risk factors that are always associated with the accumulation of plaque on artery walls [3].

Atherosclerosis is a multifactorial disease that is the most common cause of coronary heart disease. It occurs as a result of complex genetic sets and environmental factors [4,5]. In addition, there are new predictors that also participate plays a role in the pathogenesis of cardiovascular disease. These include chronic infection or chronic activation of inflammatory processes such as chronic abnormalities of the oral cavity and teeth, especially periodontal inflammation [1].

Periodontitis is caused by bacteria in dental plaque. Actinobacillus actinomytemcomitans, Porphyromonas gingivalis, Prevotella intermedia, Bacteroides forsythus, are the gram negative bacteria most commonly associated with periodontitis, and gram-positive bacteria, eg Peptostreptococcus micros and Streptococcus intermedius. Bacteria and their products that lead to progressive destruction of the periodontal ligament and alveolar bone [1,4,6,7]. In order to cause damage, the bacteria must (1) colonize the gingival sulcus by attacking the host defense, (2) damage the epithelial crevicular barrier, or, (3) producing substances that may cause tissue damage either directly or indirectly [8,9].

Epidemiological studies were found that local infections of periodontal disease can cause inflammatory mediatorial disorders in systemic disease resulting in atherosclerosis. The occurrence of cardiovascular disease is characterized by an increase in C-reactive protein (CRP), and soluble cellular adhesion, which leads to cellular response and cellular damage [3,9,10].

One of the periodontal disease treatments is scaling and root planing, periodontal therapy aimed to inhibit P. gingivalis to maintain CRP level [6]. Periodontal disease as an infection will stimulate the liver and produce CRP, which is one of the markers of inflammatory reaction of the body, then there will be deposition on the surface of the injured local blood vessels. C-reactive protein will bind to the damaged cells and have an effect on complement and activate phagocytes. Acute phases of proteins, such as C-reactive protein (CRP) and fibrinogen, affect coagulation, platelet activation, and aggregation, contribute to the formation of ateroma [6,11].

Significantly elevated CRP levels have been demonstrated in patients with chronic periodontitis. One study showed that CRP levels were highest in patients infected with periodontal pathogens. CRP is also an in-dependent risk factor for heart disease [1,6,11]. The aim of this study is to determine the effect ofscaling and root planning treatment on levels of hs-CRP in patients with risk of cardiovascular disease.

Material and Methods

Study Design

This research is an experimental research with one group pre- and post-test design. This research was performed to the periodontal patients who came to the clinic and have risk of cardiovascular disease. Subjects must fulfill the inclusion criteria: 1) Patients age between 30-65; 2) Patients with moderate to poor oral hygiene, 3) Patients with Body Mass Index (BMI) ≥25kg/m2 and 4) Patients who are willing to follow the entire series of studies.

Medical evaluations included measurement of blood pressure and body mass index were performed. Classification of blood pressure for adults systolic blood pressure / diastolic blood pressure (mmHg); 120/80 normal; 120-139 / 80-89 pre-hypertension; 140-159 / 90-99 hypertension stage 1; ≥160 / ≥100 hypertension stage 2. For subject's Body Mass Index was grouped as: 25.0-29.9 overweight / at risk; 30.0-34.9 obesity grade 1; 35.0-39.9 obesity grade II; ≥40.0 obesity grade III.

Dental record was taken included assessment of debris and calculus index to get value of oral hygiene index-simplified (OHI-S): 0-1.2 good; 1.3-3.0 moderate and 3.1-6 poor.

Blood samples were obtained from each subject after overnight fasting, high-sensitivity C-reactive protein was measured as an index of inflammation. Blood samples were analysed two times before treatment (scaling and root planning) and three weeks later after scaling and root planning.

Statistical Analysis

The data obtained were processed using IBM SPSS Statistics for Windows Software, version 20 (IBM Corp., Armonk, NY, USA) by using paired t-test. The level of significance was set at 5%.

Ethical Aspects

This research has received permission from the ethical commission of health research Hasanuddin University. Written informed consent was obtained from each subject.

Results

A total of 30 patients were included in the study. Among them, 19 were males (63.3%) and 53.3% had 46-55 years old. 93.3% had moderate oral hygiene status, and 43.3% had obesity grade 1. 33% had hypertension (Table 1).

Mean hs-CRP values before and after treatment based on age were highest 4.9 ± 2.89 in the 56-65 year age group and the lowest in the 36-45 years age group were 1.88 ± 1.16. The mean hs-CRP level was the highest after treatment in the 36-45 year age group of 2.33 ± 2.71 and the lowest in the 25-35 year age group of 2.01 ± 1.4. By sex, women's hs-CRP levels both before and after treatment were higher than in men. Based on oral hygiene status, mean hs-CRP levels before and after treatment moderate oral hygiene was 3.23 ± 2.44 and 2.15 ± 1.6. Poor oral hygiene before and after treatment were 2.21 ± 0.66 and 2.5 ± 1.34. In Body Mass Index (BMI) category, patients with obesity grade 2 had the highest levels of hs-CRP before and after treatment but decreased.

Hypertensive patients had the highest levels of hs-CRP both before and after treatment compared to other groups (Table 2).

Table 1. Characteristics samples based on sex, age, oral hygiene, body mass index and blood pressure.

Variables	N	%
Sex		
Male	19	63.3
Female	11	36.7
Age (in Years)		
26-35	3	10.0
36-45	5	16.7
46-55	16	53.3
56-65	6	20.0
OHI-S		
Moderate	28	93.3
Poor	2	6.7
Body Mass Index (BMI)		
At Risk	8	26.7
Obesity Grade I	13	43.3
Obesity Grade II	9	30.0
Blood Pressure		
Normal	5	17.0
Pre Hypertension	15	50.0
Hypertension	10	33.0

Table 2. The mean values of hs-CRP before and after treatment.

			Mean ± SD hs-CRP Value	
Variables	**Categories**	**N**	Pre	Post
Sex	Male	19	2.65 ± 2.14	1.61 ± 0.89
	Female	10	4.13 ± 2.59	3.26 ± 2.01
Age (in Years)	26-35	3	3.36 ± 3.84	2.01 ± 1.4
	36-45	5	1.88 ± 1.16	2.33 ± 2.71
	46-55	15	2.86 ± 1.94	2.14 ± 1.27
	56-65	6	4.9 ± 2.89	2.21 ± 1.57
OHI-S	Moderate	27	3.23 ± 2.44	2.15 ± 1.6
	Poor	2	2.21 ± 0.66	2.5 ± 1.34
Body Mass Index (BMI)	At Risk	8	2.96 ± 2.31	1.66 ± 1.05
	Obesity Grade I	13	2.64 ± 1.45	2.37 ± 1.78
	Obesity Grade II	8	4.21 ± 3.42	2.4 ± 1.7
Blood Pressure	Normal	5	1.49 ± 1.45	1.31 ± 0.98
	Pre Hypertension	15	3.50 ± 2.11	2.34 ± 1.73
	Hypertension	10	3. 53 ± 2.95	2.39 ± 1.52

Mean of hs-CRP before treatment was 3.16 ± 2.37 and after treatment was 2.18 ± 1.56 indicating 31% level. There was a significant difference between hs-CRP levels before and after treatment ($p = 0.007$).

Table 3. Differences in hs-CRP values before and after treatment.

hs-CRP	N	Mean ± SD	% (Decrease)	p-value
Pre Treatment	29	3.16 ± 2.37	31.0	0.007
Post Treatment	29	2.18 ± 1.56		

Discussion

Periodontitis is a disease that attacks periodontal tissue, caused by microorganism infection in the oral cavity [4]. Epidemiological studies have established that periodontitis is a risk factor for cardiovascular diseases [12]. The prevalence of cardiovascular diseases in patients with periodontitis is 25 50% higher than in healthy individuals [12]. Poor self-reported oral health (as a possible risk factor for periodontitis) and tooth loss (as a possible consequence of periodontitis) are positively associated with a coronary atherosclerotic burden [12].

An association between oral health and cardiovascular disease has been proposed for more than a century. Recently, the possible links between periodontitis and atherosclerosis have intensified and are being investigated for possible association and causality. Common risk factors for these diseases include increasing age, smoking, alcohol abuse, ethnicity, educational and socioeconomic status, being male, diabetes mellitus, and obesity [12,13].

P. gingivalis as one of the bacteria that causes periodontitis that produces endotoxin and triggers an immune response. The entry of bacteria or bacterial products into the circulation and endothelial tissue, where P. gingivalis is able to replicate in endothelial cells, alter the integrity of endothelial cells, and have a mechanism of persistence and development within vascular endothelial cells resulting in increased effects of expression of the media systemic inflammation [2,4,6,14].

Based on Periodontal disease as an infection will stimulate the liver and produce CRP, which is one of the markers of inflammatory reaction of the body, then there will be deposition on the surface of the local vein [6,11]. CRP belongs to the highly conservative pentraxin family of proteins significant to the innate immune reaction. CRP is bound to apoptotic cells, oxidized low-density lipoprotein (ox- LDL) and oxidized phospholipids, but do not bind to native low-density lipoprotein. It is assumed that CRP is involved in modulation of developing atherosclerosis, because CRP and ox-LDL are present in atherosclerotic lesions. Slightly enhanced concentrations of CRP may predict coronary disease [12,15,16].

Significantly elevated CRP levels have been demonstrated in patients with chronic periodontitis. One study showed that CRP levels were highest in patients infected with periodontal pathogens. CRP is also an independent risk factor for heart disease [1,6,11]. A positive relation was found between the periodontal level and the hs-CRP level [17]. PD therapy has improved biomarkers of systemic inflammation and even surrogate indicators of subclinical arterial disease [18]

Based on the results of the research that has been done, there is 31% decrease in hs-CRP levels after treatment of scaling and root planing 31%, this can be used periodontal therapy intended to reduce the level of bacteria, especially P. gingivalis [6]. Statistical test results indicate a

significant difference between hs-CRP levels before treatment with hs-CRP levels after treatment. This is in accordance with previous research that periodontal therapy is associated with a decrease in hs-CRP levels [19].

In this study the number of samples was 30 people but there was one sample that was excluded from the study because the hs-CRP levels of the sample before treatment were too stretch of 124 mg/L, > 10.0 mg/L indicated the possibility of infection/acute inflammation. Chronic inflammation does not result in a very high increase in CRP concentrations, but rather within a low concentration range (<10 mg/L). Increased serum CRP levels are a marker of systemic inflammation, the concentration of CRP in the 1-10 mg/L range may indicate a risk for cardiovascular disease [10]. After treated with scaling and root planing to this sample hs-CRP level decrease to 12,09 mg/L.

Serum IL-6 and CRP levels were reported to increase with age [20]. Increased levels of hs-CRP are also reported in women because of the effects of hormonal changes [21]. Various studies have proven that CRP levels are closely related to obesity, that there is a positive correlation between hs-CRP and BMI [22]. In obesity, there is a chronic inflammatory condition of low levels especially in white adipose tissue. Macrophage accumulation is often found in white adipose tissue. Adipose tissue macrophages will produce several proinflammatory cytokines, such as TNF-α, interleukin-6, monocyte chemotactic protein, transforming growth factor β1, and procoagulant factors. Interleukin-6 will induce liver to produce C-reactive protein [22,23].

Conclusion

There was a significant difference between hs-CRP levels before and after treatment. Lowering in hs-CRP levels after treatment of scaling and root planing may contribute to alleviate risk of coronary heart disease.

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Conflict of Interest: The authors declare no conflicts of interest.

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