

PERIODONTITIS AND CORONARY HEART DISEASE

Farida Juliantina Rachmawaty

Department of Microbiology, Faculty of Medicine, Universitas Islam Indonesia

Email : farida.juliantina@uii.ac.id

Periodontitis is a serious infection or inflammation of the gums that involves the destruction of soft tissues and bones supporting the teeth. The causes of periodontitis are some species of gram-negative bacteria colonizing on dental plaque in the sub gingival area. Poor oral health will increase the incidence of periodontitis infection. Several studies have reported, the disease not only has local effects. Other researchers report that people with periodontal infection have a higher risk for coronary heart disease (CHD) than those who do not suffer. Coronary heart disease is the leading cause of death for non-infectious diseases. Infection causes inflammation that induces endothelial cells to form cytokines and growth factors resulting in thickening of the artery walls. Thus periodontitis increases the risk of coronary heart disease. There was a significant association between periodontitis disease and the incidence of coronary heart disease.

Keywords: periodontitis, coronary heart disease, gram negative bacteria

Introduction

Coronary heart disease is a major cause of death and morbidity in humans. Although precautions have been taken such as dieting, lowering cholesterol and weight treatment, preventing or controlling diabetes and hypertension, this coronary heart disease remains a major health problem¹. Coronary heart disease is the number one cause of death in the world. In 2002, the World Health Organization (WHO) recorded more than 11.7 million people worldwide died from coronary heart disease. Coronary heart disease is a condition of coronary artery vessels hampered by the presence of plaque on the coronary arteries that cause atherosclerosis. The blood vessels should be tasked with supplying blood to the heart muscles².

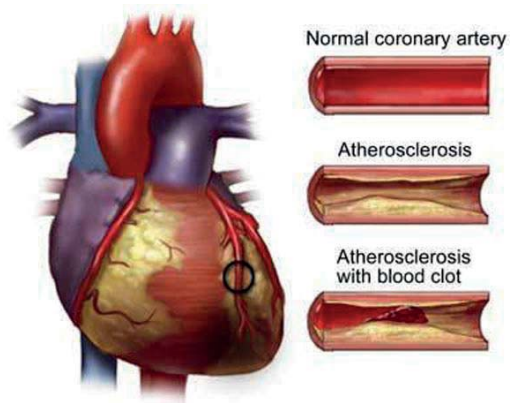


Figure 1. Human Heart and Atherosclerosis³

Coronary heart disease

Coronary heart disease (CHD) is a heart disease caused by abnormalities in the coronary arteries or coronary arteries, which is narrowing or blockage as a result of atherosclerosis that supplies blood and oxygen to the heart. Coronary heart disease can cause unstable angina, myocardial infarction (MI), and heart failure.⁴

According to the World Health Organization (WHO) estimated, 17.3 million people died from cardiovascular disease (CVD) in 2008, representing 30% of all global deaths. CHD declines in many developed countries, this is likely due to improvements in prevention (especially smoking, blood pressure and cholesterol), diagnosis and treatment. But it is increasing in developing and transition countries, partly as a result of increasing longevity, urbanization, and lifestyle changes. In developed countries, CHD is estimated to increase by 30-60% between 1990 and 2020. Over the past decade much knowledge of the pathophysiology of CHD, some of the major risk factors are age (older than 40 years for men, 45 years for women), male gender, family history of CHD, smoking, hypertension, diabetes, obesity, high total cholesterol, high density lipoprotein (HDL-C) cholesterol, high density lipoprotein (LDLC) cholesterol, high triglycerides, low physical activity, and belly fat accumulation.

CHD remains the leading cause of death worldwide. Half of all events associated with CHD are reported to occur in healthy individuals who have little or no traditional risk factors, including dyslipidemia. This

makes attention increasingly shifting to the role of other factors, such as inflammation, in the process of developing atherosclerosis and CHD.⁶

In atherosclerosis, the underlying pathology and responsible for the occurrence of CHD, is the presence of inflammation. Recent observations suggest that process of atherosclerosis is triggered by mild inflammation that alters the coronary artery endothelium and is associated with increased inflammatory markers such as acute phase proteins and cytokines. Recent developments on the important role of inflammatory processes that determine plaque stability have recently focused on inflammatory biomarkers that can help increase risk stratification and identify patient groups that may benefit from certain treatment strategies. Among them, C-reactive protein (CRP), a prototype marker of the inflammatory process, is the most widely studied both as a causal factor and predictor of CHD.⁷

Periodontitis

Periodontal disease is one of the most common dental and oral diseases found in the world community, especially in Indonesia. Periodontal diseases are commonly found gingivitis and periodontitis. The prevalence of periodontal disease is quite high in the community with the incidence rate of disease in all age groups in Indonesia reached 96.58%.⁸ Periodontitis is a disease that attacks periodontal tissue caused by infection of microorganisms in the oral cavity. This leads to chronic inflammation of the dental support tissue consisting of gingiva, alveolar bone, periodontal ligament, and cementum.⁹

Sub gingival microorganisms in the periodontitis state are dominated by gram-negative bacteria. One of the bacteria suspected to cause periodontitis is *Porphyromonas gingivalis*.¹¹

Such bacteria and their products such as lipopolysaccharides can enter the periodontal tissues and blood circulation through the sulcus epithelium and cause changes in the inflammatory response and systemic changes that induce a vascular response.

Signs and symptoms of periodontitis may include:

1. The gums are swollen
2. Gums are bright red or purplish
3. Gums that feel pain when touched
4. Gums are reduced in height, making the teeth look longer than usual
5. The cavity is formed between the teeth
6. Pusps between teeth and gums

7. Breath smells
8. Bad taste in mouth
9. Teeth loose, and
10. Tooth changes when biting (wobbly teeth)

There are several classes of periodontitis, namely chronic periodontitis and aggressive periodontitis. Chronic periodontitis is the most common type, affecting adults in general, but can also affect children. Aggressive periodontitis usually appears in childhood or early adulthood and attacks only a small proportion of people.



Figure 2. Periodontitis¹²

There are several factors that contribute to the increased risk of periodontitis disease, among others:

1. Local factors.

Accumulation of plaque on teeth and gingiva in dentogingiva junction is the beginning of agent initiation in the etiology of chronic periodontitis. Bacteria usually give local effects on cells and tissues of inflammation.

2. Systemic factors.

Most chronic periodontitis occurs in patients with systemic disease affecting the effectiveness of the host response. Diabetes is an example of a disease that can increase the severity of the disease.

3. Environment and smoking behavior.

Environment and smoking behavior can increase the severity of illness.

4. Genetic.

Usually periodontal damage is common in family, this may indicate a genetic factor affecting chronic periodontitis.

Mechanism

Periodontitis begins with the formation of plaque attached to the tooth surface. Dental plaque is a thin layer of multi-species biofilms containing bacterial colonization, bacterial products, and food waste.¹³

In the heart, atherosclerosis is an inflammatory reaction. This process involves the interaction between the immune mechanism and some metabolic substances accompanied by accumulation of lipids in the walls of the coronary arteries.¹⁴ The hypothesis of atherosclerosis, a response to injury, suggests that the onset of lesion formation is characterized by endothelial dysfunction. Endothelial dysfunction may be due to increased levels of Low-Density Lipoprotein (LDL-ox) oxidation, free radical from cigarette smoke, and microorganism infections. The injury that occurs in blood vessels induces endothelial cells to form cytokines and growth factors. Inflammatory responses stimulate proliferation and smooth muscle cell migration to the inflammatory area, resulting in thickening of the artery wall.¹⁵

Correlation of Periodontitis and Coronary Heart Disease

Periodontitis is a risk factor for some systemic diseases.¹⁶ In periodontitis conditions often found an increase in signs of inflammation, which is also an indicator of risk factors for coronary heart disease (coronary heart disease). Bacteria-derived from the periodontal pocket can enter the bloodstream during oral activity such as chewing and brushing. Infections of periodontal structures can accelerate the formation of atherosclerosis that causes coronary heart disease by causing systemic inflammation through the release of endotoxins, proteins, or acute-phase reactors.¹⁷

This is consistent with Hatta's assertion that periodontal disease has a significant association with the incidence of atherosclerotic disease.¹⁶ The results of Beck's study suggest that there is a relationship between periodontal disease with coronary heart disease, but many other variables that become the scaffold.¹⁸ In another study, it showed that patients suffering from periodontitis had 19% greater risk of developing cardiovascular disease than patients without periodontitis.¹¹

Experimental studies conducted by injecting *Porphyromonas gingivalis* suspension (0.5 Mc Farland/1.5x10⁸ CFU/ml) on the left mandibular left or right gingival molar gingiva 3 times a week for 4 weeks indicated the occurrence of atherosclerosis. The lysis enzymes produced by bacteria are thought to cause direct periodontal tissue damage. Other bacterial products, such as endotoxin, activate complementary systems that can lead to the

formation of active proteins. Activation of immune cells by bacteria and their products stimulates the production of enzyme derivatives, cytokines, and other inflammatory mediators that ultimately lead to the destruction of alveolar bone and connective tissue such as periodontal ligaments. The results showed that periodontitis increased the thickness of the arterial wall, intimal collagen disintegration, lipid deposition, embolic fatty, atheroma, stenosis, and endothelial disintegration in the coronary artery.^{19,20}

Response to bacterial infections is considered an important inflammatory stimulus that causes atherosclerosis (the hypothesis of response to injury). Bacteria and its products can invade the blood vessels and cause damage to endothelial cells, affecting fat metabolism, blood coagulation, and thrombogenesis process.¹² The bacteria that cause periodontitis disease can spread through the bloodstream, increase intravascular inflammation, aggravate atherosclerosis in a short time.¹⁰

Some researchers report a positive association between coronary heart disease and periodontal disease.^{22,23,24,25} Although in general the reported relationship is statistically significant but the limitations of these case-managing studies deserve attention and awareness in reading and interpreting the results. Buhlin *et al.*²⁶ compared severe periodontitis patients with individuals who did not have periodontitis (nonperiodontitis). To prove the absence of coronary heart disease is a practice test (exercise test) and through the medical history of the subject. Individuals with periodontitis significantly had circulating monocytes and high CRP and low HDL cholesterol, compared with nonperiodontitis subjects. This study suggests that periodontitis, once considered a pure local disease, may in fact lead to systemic inflammation and lipid changes, which are known to increase the risk of coronary heart disease. Persson *et al.*²⁷ conducted a study of patients with recovered myocardial infarction and compared it with control and obtained results similar to those reported by other researchers. Through his studies Persson *et al.* concludes to use radiographic images of the alveolar bone loss (alveolar bone loss). Radiographic examination is an important and practical way in large studies because it is easier to perform than clinical examination. Radiographic efforts can be done blindly and independently. The results obtained through this radiographic photograph represent a “accumulated effect” of periodontitis and this is the best way to know the severity of periodontitis.²⁷

The association between loss of teeth and coronary heart disease is a reflection of an “proinflammatory” constitutional state effect (eg due to severe periodontitis and the need for retraction). Second, total tooth loss

results in changes in nutritional status such as reduced intake of citrus fruits and vitamin C, which may increase the risk of both inflammatory and cardiovascular disease²⁶. A recent meta-analysis study concluded that there was a significant association between various parameters of dental hygiene and cardiovascular disease. To get clearer picture of which dental health parameters are more meaningful to do with cardiovascular disease, Janket *et al.*²⁸ conducted study comparing Asymptomatic Dental Score (ADS) with Total Dental Index (TDI) and the results were confirmed by angiography examination. Total Dental Index is a parameter proposed by Mattila *et al.*²⁹ first time in 1989 and is a breakthrough in an effort to predict the occurrence of coronary heart disease (myocardial infarction) associated with dental health. In his study, Mattila *et al.* examined the dental health conditions of cases with acute myocardial infarction and compared them with controls. Oral infection of both groups (cases and controls) was assessed by observing dentist caries, endodontic disease and periodontitis (TDI) components. The results showed that in the case group there was much poorer dentition than the control group. Further logistic regression analysis concluded that poor dental hygiene and myocardial infarction showed association or association with an odds ratio (OR) of 1.3. This means that subjects with poor dental hygiene have 1.3 times greater risk of having myocardial infarction than those with good dental health. According to the researchers, the relationship is independent of known risk factors such as age, total cholesterol, triglycerides, hypertension, smoking, and diabetes.

According to Janket *et al.*, TDI using oral lesions as a basis for assessment significant predictor of coronary heart disease, but with asymptomatic abnormalities as a basis for assessing and combining it with some oral lesions, the system may become more sensitive in predicting the likelihood of occurrence coronary heart disease. Several variables tested in the Janket *et al.* Study, there are 5 variables associated with coronary heart disease.²⁸ These variables include: the amount of residual roots, pericoronitis, dental caries, bimaxile edema, and gingivitis. Janket *et al.*²⁸ concludes that the results of his research support the opinion that the greater the dental health score, the stronger it has to do with coronary heart disease.

Nevertheless there are some researchers among whom Lavelle³⁰ doubts whether true periodontal disease is a risk factor for coronary heart disease. According to Lavelle deposition of atheromatous plaques in coronary arteries can also be caused by other infections beside periodontitis, and treatment of periodontal infections can not prevent or alter the prevalence of coronary heart disease.³⁰ Hujoel *et al.* cast doubt on reports that conclusively support the association between periodontal infection and coronary heart disease.³¹

Subjects not suffering from periodontitis or gingivitis may be a group that cares for their health, including maintaining cardiovascular health. Heart disease sufferers who also suffer from periodontitis or gingivitis may have less concern for heart disease prevention efforts. Genco et al. also acknowledged that differences in the way research was conducted would have an effect on the resulting conclusions.³² Some possible causes of inconsistencies in reported results were due to differences in the age of the subjects studied, smoking status and others. Some of these reviews, although some people do not agree, but many researchers proved a significant relationship between periodontitis disease with the incidence of coronary heart disease.

Conclusion

Periodontitis increases the risk of coronary atherosclerosis lesion marked by coronary artery wall thickening, endothelial disintegration, lipid deposition, atheroma, stenosis, intimal collagen disintegration, and embolism fatty. There was significant association between periodontitis disease and coronary heart disease.

Suggestion

A larger sample size is required, with clearer inclusion and exclusion criteria. Some disturbing factors are controlled as much as possible. The age of the subjects between the diagnosed and control groups should be equally sought.

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