

PERIODONTAL INFECTION AS A POTENTIAL RISK FACTOR FOR SYSTEMIC DISEASE

Sumintarti

Departement of Oral Medicine Faculty of Dentistry Universitas Hasanuddin, Makasar

Abstract

Oral infection can have an adverse effect on other organs of the body. Oral infection especially periodontitis may effect the course and pathogenesis of a number of systemic diseases, such as diabetes mellitus, cardiovascular disease, pre-term low birth weight infant and respiratory disease. The purpose of this article is to evaluate the current status of oral infection especially periodontitis as a potential risk factor of systemic diseases. Three main pathways linking oral infection to secondary systemic effects have been proposed: metastatic infection, metastatic injury and metastatic inflammation. Periodontitis can cause bacteria to enter the blood stream and activate immune cells. These activated cells produce inflammatory cytokines that have a destructive effect throughout the entire body. Therefore, periodontitis as a mayor oral infection may effect the host's susceptibility to systemic disease. *Indonesian Journal of Dentistry 2006; Special Edition KPPIKG XIV: 379-382.*

Introduction

The oral cavity is a site of most infections and inflammatory diseases which has recently been associated with systemic disease.¹ Most studies concerning the relationship between oral infection and systemic disease are related to periodontal disease by far the common oral infection.² Periodontal disease can cause bacteria to enter the bloodstream and activate immune cells. These activated cells produce inflammatory biological signals (cytokine) that have destructive effect throughout the entire body.³ Three mechanisms or pathways linking oral infection to secondary systemic effects have been proposed: metastatic infection, metastatic injury, and metastatic inflammation.

Oral infection especially periodontitis may affect the course and pathogenesis of a number of systemic disease such as diabetes mellitus, cardiovascular disease, pre-term low birth weight infant, and respiratory disease.² Chronic periodontitis is probably the most prevalent and

potentially has the strongest epidemiological and plausible mechanistic associations with these systemic diseases.¹

Causal Pathway Oral Infection to Secondary Systemic

Three main pathways linking oral infection to secondary systemic have been suggested in the literature are as follows:^{2,4}

1. Metastatic infection

Oral infection and dental procedure can cause transient bacteremia. The microorganisms that gain entrance to the blood and circulate throughout the body are usually eliminated by the reticuloendothelial system within minutes and as a rule lead to no other clinical symptoms than possibly a slight increase in body temperature.

2. Metastatic injury

Bacterial components, mainly lipopolysacharida (LPS) from Gram-negative bacteria characteristic in periodontal disease, may also affect endothelial integrity, by damaging

endothelium directly. Lipopolysaccharida (LPS) when introduced into the host gives rise to a large number of pathological manifestations.^{2,4}

3. Metastatic inflammation

Immunological injury caused by endotoxins associated with oral bacteria. Soluble antigens may enter the bloodstream, react with circulating specific antibody and form a macromolecular complex. These immunocomplexes may give rise to a variety of acute and chronic inflammatory reaction at the sites of deposition.

Oral Infection Link to Systemic Disease

The periodontium which comprised of the gingival, bone and other supporting tissue that anchor the teeth, play a key role in the interplay between oral health and systemic disease.⁵ Infection in these tissue, primarily by Gram-negative anaerobic bacteria, can initiate a series of inflammatory and immunologic changes leading to the destruction of connective tissue and bone.^{5,6} Due to chronic nature of periodontal disease, which are infection, and involvement of the host's immune system, it seems reasonable that these infections may affect to overall health of individual.

The bacteria associated with periodontal disease can cause bacteria enter and travel into the blood stream and activate immune cells. These activated cells produce inflammatory biological signals (cytokine) that have destructive effect throughout the entire body.^{3,6,7} The pro-inflammatory cytokines such as IL-1, TNF α and gamma interferon as well as prostaglandin E₂ (PGE₂) reach high tissue concentrations in periodontitis.² Periodontal disease may in fact as a potential risk factor for systemic disease.⁷ Recent research has found a relationship between periodontal infection and systemic disease such as diabetes mellitus, cardiovascular disease, pre-term low birth weight infant and respiratory disease.⁶

Systemic Disease Associated with Oral Infection

Diabetes Mellitus

The relationship between diabetes and oral conditions has been shown in several studies, and may be two ways relationship. The production of endotoxins and other bacterial through periodontal infection mediated up regulation of macrophage responses to advanced glycation end products. Diabetes may increase the risk of periodontal disease

which may be associated with poor glycemic control and increased complication from diabetes.^{2,4,8,9}

The severity and prevalence of periodontitis are increased in persons with diabetes and poorly controlled diabetes. Periodontitis may exacerbate diabetes by decreasing glycemic control. This effect indicates a degree of synergism and a link between diabetes mellitus and periodontitis.¹⁰

Cardiovascular Disease

Oral infection may directly contribute to atherogenesis and thromboembolic event by providing repeated systemic vascular challenges of pro-inflammatory cytokine, periodontal pathogens and lipopolysaccharida (LPS). The pro-inflammatory cytokine aspects of cardiovascular disease, the microbial and the exposure may be associated with the more acute coronary heart disease and stroke such as thrombus formation.^{10,11}

The changes caused by infection and/or the inflammatory response are believed to affect the build up of plaque in the inner lining of the blood vessels supplying the heart or brain that occurs in atherosclerosis.^{10,12} Periodontitis and atherosclerosis have complex etiologies, genetic and gender predispositions and may share pathogenic mechanism as well as common risk factors, such as smoking, diabetes, behavioral factors, and age.^{1,13}

Pre-term Low Birth Weight Infant

Periodontal infection may be a risk factor for pre-term low birth weight (PLBW) infant.⁷ Changes in hormone levels during pregnancy promote gingival inflammation termed pregnancy gingivitis.

Periodontal disease is associated with chronic gram-negative infections, which result in local and systemic elevations of pro-inflammatory prostaglandin and cytokine.¹⁴ Maternal periodontal infection may influence pre-term delivery through mechanism involving inflammatory mediators or a direct bacterial assault on the amnion.¹⁴

The theory is that oral bacteria release toxins, which reach the placenta through the mother's blood stream and interfere with growth and development of fetus. At the same time the oral infection causes the mother to produce labor-triggering substances in quickly potentially triggering premature labor and birth.¹¹

Respiratory Disease

The aspiration of oral contents is probably one of clearest link between periodontal disease and respiratory infection.⁸ Perhaps the most direct association between periodontal infection and

systemic disease is seen in periodontitis and respiratory disease. Specifically, periodontal and respiratory pathogens in plaque have been linked to an increased risk for aspiration pneumonia and chronic obstructive pulmonary disease (COPD).¹² There is increasing evidence that oral bacteria especially periodontal pathogens, may alter the course of respiratory infection. Also, it is known that the lower airway can be contaminated by microorganisms through aspiration of oropharyngeal contents, inhalation of infectious aerosols, hematogenous spread or spread from contiguous sites.^{12,15}

Discussion

The oral cavity provides a continuous source of infectious agents and its conditions often reflects progression of systemic pathologic.¹⁶ A large number of publications have suggested that oral infection, especially periodontitis are potential contributing factor to variety of clinically important systemic disease.² There is increasing evidence that the relationship between periodontal disease and systemic disease may be bi-directional. The bi-directional interaction between oral and systemic health. That is, not only systemic disease which has oral manifestation, but periodontal disease can also exacerbate certain systemic condition.⁸

The periodontium plays a key role in the interplay between oral health and systemic disease. Recent research has found a relationship between periodontal infection and more serious health problem such as diabetes mellitus, cardiovascular disease, pre-term low birth weight infant and respiratory disease.⁶ The severity and prevalence of periodontitis are increased in patients with diabetes and are worse in patients with poorly controlled diabetes. Periodontitis may exacerbate diabetes by decreasing glycemic control. This effect indicate a degree of synergism and a link between periodontal disease and diabetes mellitus.^{10, 17} The evidence suggest that periodontitis induced bacteremia will cause elevations in serum pro-inflammation cytokines, leading to hyperlipidemia and ultimately causing an insulin resistance syndrome and contributing to destruction of pancreatic beta cell. Treating chronic periodontal infections is essential for managing diabetes.¹⁸

So far, the causality and possible pathways of the association between periodontal disease and cardiovascular disease remain obscure. Factors that

place individuals at risk factor periodontitis may also place them at risk for cardiovascular disease. Periodontitis and cardiovascular disease may share common risk factors, such as smoking, diabetes, behavioral factors, age and gender. The balance of the evidence suggests that periodontal disease may be independent risk factor for cardiovascular disease.^{1, 17}

The infected periodontium can be regarded as a reservoir for both microbial products and inflammatory mediator, periodontal infections may will represent a pathway of infectious/inflammatory exposure to the maternal fetal unit and may be a potential risk factor for pre-term low birth weight (PLBW) infant.⁸ A proposed mechanism suggest a concentration dependent relationship between increased maternal levels of prostaglandin E₂ in the gingival fluid found in the pocket and PLBW. More researches are needed to confirm how periodontal disease is a risk factor for PLBW infant. This may help to reduce the mortality of premature birth.⁷ The potential role of oral pathogens in the pathogenesis of lower respiratory infections have been documented. These pathogens could be aspirated directly into the lower airway in high numbers especially in patients with severe periodontitis and could then cause infection.

A relationship between poor oral health and respiratory disease has been suggested by a number of recent microbiologic and epidemiologic studies. The factors involved in the pathogenesis of respiratory disease and periodontal disease are multidimensional. Increased attention to oral health to this high-risk population may result in a lower incidence of respiratory disease.^{8, 17}

Conclusion

Oral infection may have an association with the occurrence and severity of a wide varieties of systemic diseases. Oral infection especially periodontitis as a mayor oral infection may effect the host's susceptibility to systemic disease. The periodontal disease and systemic disease association is the infection related host inflammatory response, which may influence a variety of homeostatic mechanisms.

The role of periodontal disease may play in diabetes mellitus, as well as cardiovascular disease, pre-term low birth weight infant and respiratory disease, the best advice is for people to take

excellent care of their oral health to help ensure they keep their teeth as well as maintain overall health.

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