Libyan International Medical University

Faculty Of Basic Medical Science

Link Between Periodontitis and Atherosclerosis

Submitted by : Shatha Ashraf Abdulgader Elmansouri

Supervisor: Dr. Aisha Elsanfaz

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Abstract
This report is designed to update the potential association that forms the basis of understanding for a causal role for periodontitis to atherosclerosis events.

Introduction

Periodontitis is a chronic inflammatory disease that affects the tooth supporting tissue the periodontium. It is the most frequent cause of tooth loss in the adult population. Periodontitis is a multifactorial disease and as such the significant elements are not only the presence of pathogenic bacteria and the immune mechanism, but also the genetic predisposition of the patient. The origin and progress of the inflammatory reaction in the periodontium are a result of the altered interplay of the defense mechanisms in the periodontal tissue to respond to the activity of dental plaque bacteria.The causes of the onset and progress of periodontitis have been investigated for hundreds of years. The first records concerning the disease now called periodontitis date back to the ninth and tenth centuries A.D. with Arabian physicians already ascribing the disease to soft plaque on teeth. The assumption that dental plaque was one of the significant etiological factors was confirmed as recently as the 1960s. During this time, the first articles appeared in which the authors demonstrated that patients' blood serum had enhanced levels of antigens reacting with dental plaque bacteria[1]. On the other hand, in the last decade, it has been demonstrated that atherosclerosis begins as an inflammatory reaction against endothelial cells and other components of the artery wall. The inflammation sites attract accumulation of macrophages, T and B lymphocytes, and mast cells. The blood vessel walls are also covered by deposited fats which led to occlusion of the vessels. Atherosclerosis is however a multifactorial disease. Among the risk factors are circulating lipoproteins (hypercholesterolemia), genetic predisposition, hypertension, smoking, obesity, and diabetes. Epidemiological studies further indicate that infection by various types of bacteria, including periodontopathic ones (Chlamydia pneumoniae, Helicobacter pylori, Porphyromonas gingivalis, Prevotella intermedia, and Aggregatibacter actinomycetemcomitans) and the presence of products of these bacteria (LPS, heat shock protein (HSP)) in serum contributed to the development of atherosclerosis. LPS stimulates monocytes/macrophages by binding to the CD14 as the receptor. A genetically conditioned reaction to bacterial stimulation may play a certain role in pathogenesis of atherosclerosis. Patients who survived myocardial infarction exhibited a higher frequency of allele T(-260) in the promoter of gene for the CD14 receptor than controls[2]. .

Discussion

Atherosclerotic vascular disease (ASVD) is the leading cause of death in the U.S, and one third of Americans have some form of the disease. However, half of those with the disease do not have traditional disease risk factors such as obesity, hypercholesterolemia, hypertension, history of smoking, or genetic background, and thus the cause(s) of rapid atherosclerotic plaque progression and disease is unknown in many patients. Prior observational studies have detected or reported a positive

correlation between periodontal disease (PD) and ASVD, thus PD is proposed as an unrecognized risk factor for ASVD[3]. A recent statement by the American Heart Association supports an association between PD and ASVD that is independent of known confounders, but this report has also stated that current data are insufficient to support a causal relationship. With these studies we examine a potential correlation between chronic infection with a known predominant oral pathogen seen in PD and accelerated atherosclerotic plaque growth using a mouse model for PD and ASVD. In light of observational studies supporting an association between PD and ASVD, several studies have attempted to demonstrate the presence of periodontal bacteria or their components in human atherosclerotic lesions. *Porphyromonas gingivalis* is a Gram-negative periodontal pathogen, which is implicated in ASVD. *P. gingivalis* genomic DNA has been detected in human atherosclerotic plaque by fluorescence *in situ* hybridization (FISH), invasion assays, and culture, indicating metabolically active organisms, which are able to invade, survive, and replicate within atheromatous plaques[4]. Whether *P. gingivalis* plays a direct role in atherosclerotic plaque development is, however, not yet proven as the incidental finding of bacterial organisms or genomes in atheroma may not necessarily demonstrate a true causal relationship. Numerous virulence factors, including bacterial proteases, capsule, and fimbriae allow *P. gingivalis* to modulate its environment to support bacterial growth and invasion, and enable *P. gingivalis* to invade gingival epithelial cells *in vivo* and *in vitro*, as well as human coronary artery endothelial cells *in vitro*. Finally, *in vivo* studies with $ApoE^{null}$ mice have demonstrated that acute infection with *P. gingivalis* results in larger atherosclerotic plaques, but these prior studies did not provide evidence of direct bacterial involvement. Thus, *P. gingivalis* may have a direct effect on atherosclerotic plaque formation by invasion of antigen presenting cells in blood or epithelial cells lining the blood vessel walls, or an indirect effect by increasing soluble inflammatory mediators[5]. However, a study about a group included 15 (30%), while the test group included 35 (70%) subjects. The most common diagnosis was severe periodontitis (40%); moderate and slight periodontitis were also frequent occurrences (32% and 28%, respectively). In the control group, 53.3% had slight, 33.3% had moderate and 13.3% had severe periodontitis. In the test group, those percentages were respectively 22.2%, 44.4% and 33.3%. Patients with atheroma plaque had the highest percentage of severe periodontitis (70.6%). More severe periodontitis was related to atherosclerosis ($P = 0.007$)[6].

Conclusion

Some studies showed an association between periodontitis severity and atherosclerosis, suggesting that periodontal disease might be a risk indicator for atherosclerotic disease.

References

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