FREQUENCY OF CAROTID ARTERY DISEASE IN PATIENTS WITH PERIODENTAL DISEASE

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ABSTRACT:

BACKGROUND:	Carotid artery disease is associated with various risk factors including periodental disease.
AIMS & OBJECTIVE:	To determine the frequency of carotid artery disease in patients with periodontal disease
MATERIAL & METHODS:	This cross-sectional study was carried-out in department of Cardiology, PIC Lahore from June 2019 to June 2020 after approval from hospital ethical committee. Total 100 patients of both genders having periodental disease were enrolled after written informed consent. Color Doppler ultrasound of carotid arteries was done to find carotid artery disease. Data was analyzed using SPSS 22.
RESULTS:	Our results showed that the mean age of patients was 57.8±8.1 years. There were 78% males and 22 % females in sampled population. In our study 48% were smoker, 51% were diabetic and 46% were hypertensive. The majority of patients were having gingivitis in 60%. The mean intima media thickness was 1.4±0.6mm and mean peak systolic velocity in narrowest part was 221±90cm/sec. The carotid artery disease was found in 33% patients of periodental disease. Mild carotid artery disease (<50% stenosis) was found in 13%, moderate (50-69%) disease was found in 16%, severe carotid disease (>70%) was found in 3% and total occlusion was found only in 1% patient. Apart from periodontal disease other risk factors including diabetes, hypertension and smoking were also found to be associated with carotid artery disease i.e. p-value 0.01.
CONCLUSION:	Patients having periodental disease should be screened by carotid artery color Doppler to find carotid artery disease in early stages.
KEY WORDS:	Carotid artery stenosis, periodental disease, hypertension, color doppler ultrasound.

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Author's Contribution: SA: Data Collection. AA: Literature Search. GA: Study design. FU: Questionnaire Design. AT: Data Analysis, Data Interpretation. SY: Carotid Scan.

BACKGROUND:

Various diseases including peripheral artery disease, cardiac artery disease and cerebrovascular disease are caused by atherosclerosis which is a progressive inflammatory disease.[1] Atherosclerosis, developed when formation of plaque occurs in blood vessel at site of ateries intima, which causes narrowing of blood vessels permanently and the arteries get hardened due to plaque build-up around the artery wall. Atherosclerosis is prevalent around the world associated with increased morbidity and mortality in all age groups and both genders.[2] Carotid artery and aortic artery are elastic arteries in which risk of calcification is very high. Earlier the disease process is identified better will be treatment and decreased complications associated with atherosclerosis.[3]

There are various factors leading to atherosclerosis in carotid arteries including advanced age, male gender, and dysfunction of endothelial layer, cigarette smoking, increased lipid levels, uncontrolled sugar levels, family history, decreased daily exercise time, uncontrolled blood pressure and stress.[4] Cerebrovascular events can be avoided by adopting healthy life style, avoid risk factors and identify patients at risk of developing carotid artery disease. Carotid artery disease is caused by cardiac dysfunction other non-cardiac cause includes calcification in carotid artery detected by brain imaging including CT or MR angiography.[5] different complications may arise if disruption of plague occurs and rupture of thrombosis occurs.[6] Many studies, had suggest that inflammatory and immune-related mechanisms get activated by infectious and non-infectious pathogens including helicobacter pylori, Chlamydia pneumoniae, Cytomegalovirus, HIV, Herpes simplex virus-1 and -2, and hepatitis virus B and C, and Epstein-Barr virus, might be a reason to develop atherosclerotic plaque.[7] A possible mechanism or link, between periodontal pathogenic bacteria and atherosclerosis may exist based on the inflammatory mechanisms that is initiated by bacteria which most of the times found in periodontal lesions. Inflammatory cytokines can cause changes in the endothelium such as up-regulation of adhesion molecules leading to leucocyte migration into the intimal layer of the artery formation.[8] The periodontal pathogenic bacteria, such asthose including Porphyromonas gingivalis, Treponema denticola, Tannerella forsythia, and Campylobacter rectus may potentially cause periodontal disease. Periodontal pathogenic bacteria including their bacterial products and inflammatory molecules may travel throughout the human body through the gastro intestinal tract or bloodstream.[9] It is suggested that a systemic immune response, to periodontal infections can increase the development of cardiovascular risk.

The route of periodontal pathogenic bacteria starts from the mouth and it can then cross the gingival epithelial-connective tissue barrier as well as the vascular endothelium and enter the atherosclerotic plaques via the bloodstream, it can raise an inflammatory response, within the plaque.[10] There is a possible link between oral bacteria and formation of atherosclerotic plaques. An oral bacterium, can be entered into the blood-stream following bacteremia and mediators of inflammation may be released into the blood-stream. Additionally, an autoimmune reaction can be occurred against host proteins such as heat-shock proteins (HSPs), because of molecular mimicry. Some oral pathogens may also create toxins with pro-atherogenic action.[11,12]

Rayan et al[13] found an important relationship between carotid artery plaque formation and tooth loss. He found that among those people who had zero to nine tooth missing carotid plague was present in forty six percent patients whereas patients having more than ten tooth loss frequency of carotid artery plague was around sixty percent with significant p-value i.e. $p < 0.05$.

The purpose of this study is to find relation of carotid artery disease with periodontal disease in our local population. Finding the magnitude of disease will help us in formulating the line of action for patients suffering for periodontal disease and poses patients on increased risk of mortality and morbidity.

MATERIAL AND METHODS:

This prospective cross sectional study conducted at the Department of Cardiology, PIC Lahore from June 2019 to June 2020. Sample size was calculated using 95% confidence interval, 5% margin of error and previously reported frequency as 46%. 13 Total number of 100 patients were enrolled by using non probability consecutive sampling technique. Patients of periodontal disease aged 40 to 70 years of both gender were included. Patients having stroke, coronary artery disease, peripheral artery disease or already diagnosed case of carotid artery disease were excluded. SPSS 22.0 version was used to analyze the data.

DATA COLLECTION:

Total 100 patients of periodontal disease were

enrolled after taking written informed consent. Ethical approval was taken from hospital committee. Patients having gingivitis, periodontitis and tooth loss referred from dental OPD for color Doppler were enrolled. Color Doppler was done to find carotid artery disease. Intima media thickness and peak systolic velocity in narrowest part was noted. Carotid artery disease was classified radiologically using color Doppler by the degree of stenosis: less than 50% diameter reduction was labeled as

mild stenosis, 50 to 69% reduction was labeled as moderate carotid stenosis while 70 to 99% was labeled as severe carotid stenosis. Whereas 100% reduction was labeled as total occlusion of carotid artery.

RESULTS:

The mean age of patients was 57.8 ± 8.1 years. There were 78% males and 22 % females in sampled population. Male to female ratio was 3.5:1. Figure 1. In our study 48% were smoker,

51% were diabetic and 46% were hypertensive. The majority of patients were having gingivitis in 60%. Figure 2.The mean intima media thickness was 1.4 ± 0.6mm and mean peak systolic velocity in narrowest part was 221 ± 90cm/sec. The carotid artery disease was found in 33% patients of periodental disease. Mild carotid artery disease was found in 13%, moderate disease was found in 16%, severe carotid disease was found in 3% and total occlusion was found only in 1% patient. Apart from periodontal disease other risk factors including diabetes, hypertension and smoking were also found to be associated with carotid artery
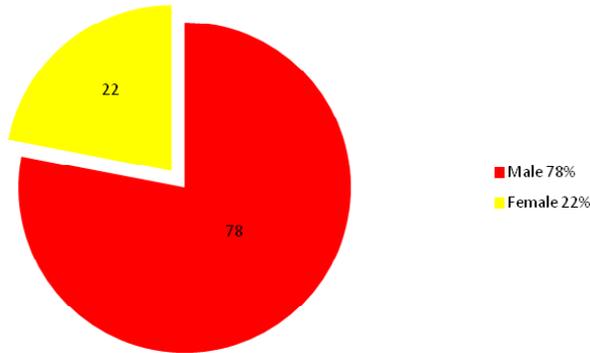

Figure 1: Gender distribution

Table 1: Data stratification according to type of disease

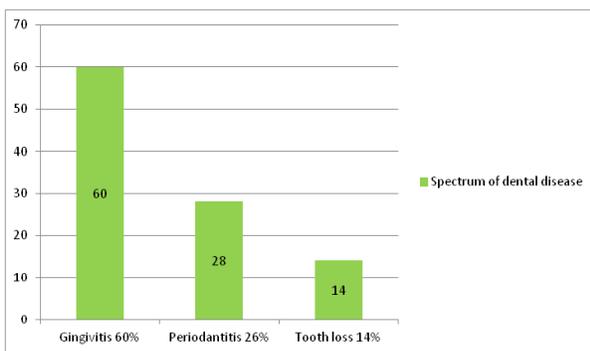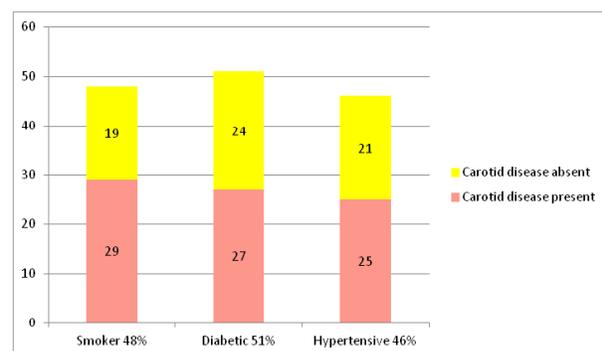| Type of periodontal disease	Mild carotid artery disease	Moderate carotid artery disease	Severe carotid artery disease	Total occlusion	Total number of carotid disease
Gingivitis	6 (10%)	4 (6.6%)	0 (0%)	0 (0%)	10 (16.6%)
Periodentitis	4 (14.2%)	9 (32.4%)	1 (3.5%)	0 (0%)	14 (50%)
Tooth loss	3 (21.4%)	3 (21.4%)	2 (14.2%)	1 (7.7%)	9 (64%)
Total	13 (13%)	16 (16%)	3 (3%)	1 (1%)	33 (33%)

Figure 2: Spectrum of dental disease

Figure 3: Spectrum of dental disease

disease i.e. p-value 0.01. Figure 3. Among 60 patients ofgingivitis 16.6% suffered from carotid disease, among 28 patients of Periodentitis 50% developed carotid artery disease and among 14 patients of tooth loss patients 64% patients suffered from carotid artery disease including 1 patient suffering from total occlusion. Table 1.

DISCUSSION:

Periodental disease is associated with increased risk of carotid artery disease leading to cardiovascular events resulting in increased mortality and morbidity. This study was conducted to find frequency of carotid artery disease in relation to periodental disease. Earlier the disease diagnosed better will be results.

The results of our study were consistent with results from literature review of international data. A study by Hung et al [14] found that patients having periodontal disease have greater chance of developing stroke. A meta-analysis [15] found positive relationship between cerebrovascular events after tooth loss. Another meta-analysis 16 found that tooth loss is associated with increased risk of atherosclerotic arterial disease including coronary artery disease and cerebrovascular events including stroke. In our study we have taken subclinical atherosclerosis as main event in patients of periodontal disease. In another study [17] greater prevalence of carotid disease was found in patients having periodontal disease. The risk increases with increased periodontal disease.

A Meta-analysis[18] including five research papers consisting of (86092 patients) found that patients of periodontal disease have 1.14 times higher risk of getting cerebrovascular events and carotid disease as compared to control patients with no periodontal disease (relative risk 1.14, 95% CI 1.074-1.213, P < .001). The case-control research (1423 patients) indicated much higher risk of getting cerebrovascular events(OR 2.22, 95% CI 1.59-3.117, P < .001). in another cross sectional study the prevalence of atherosclerosis was greater in patients of periodontal disease as compared to normal patients. (OR 1.59, 95% CI 1.329-1.907, P < .001). When the relationship between cerebrovascular events and number of teeth was analyzed, cohort studies showed 1.24 times increased risk (95% CI 1.14-1.36, P < .0001) of development of CHD in patients with <10 teeth.

In Indian literature[19] similar results were found, 67.7% were men and 32.3% were women. The mean age of study population was 58.1 ± 10.6 years, and the age range was 40–98 years. On assessment of vascular risk factors, 35.9% were hypertensive and 23.2% were diabetic. Carotid stenosis less than 50% (mild stenosis) was seen in 238 (15.8%) participants, and significant stenosis (>50% stenosis) was seen in 78 (5.2%) participants. Among the 78 (5.2%) participants with significant stenosis, 45 (3%) had 50–69% stenosis, 25 (1.6%) had 70–99% stenosis, and 8 (0.5%) had total occlusion. Odd ratio was calculated for each risk factor, and after adjustment using multiple logistic regression analysis, long-standing diabetes (>15 years) had the strongest association with significant stenosis (OR = 6.2; 95% CI = 3.41–11.3) followed by long-duration smoking (OR = 5.2; 95% CI = 3.41–11.3).

CONCLUSION:

Periodental disease is one of the risk factors for carotid artery atherosclerosis, and may thus be an important predictor of Carotid Artery disease. Patient having periodontal disease should be screened for CAD. Periodontal disease should be treated early in the course, attention should be given to good dental hygiene.

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