

PREVALENCE OF CAROTID ARTERY CALCIFICATIONS IN DENTAL PATIENTS HAVING TYPE 2 DIABETES MELLITUS USING DIGITAL PANORAMIC RADIOGRAPHS : A CROSS-SECTIONAL PILOT STUDY IN UDAIPUR

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ABSTRACT

Patients with Type 2 Diabetes Mellitus (T2DM) carry an elevated risk for cardiovascular disease and stroke. Carotid artery calcifications (CACs) are critical diagnostic indicators of advanced atherosclerosis. This study aimed to evaluate the prevalence of CACs in 100 subjects with T2DM (n=50) compared to nondiabetic controls (n=50) and to assess the reliability of digital panoramic radiographs (DPRs) as an opportunistic screening tool. The prevalence of CACs was significantly greater in individuals with T2DM than in the age- and sex-matched nondiabetic cohorts. Statistical analysis revealed a compelling positive relationship between T2DM and the presence of CACs. Furthermore, DPRs demonstrated high reliability and clinical utility in identifying these vascular calcifications during routine dental examinations. Hence, it was concluded that there is a strong, positive correlation between Type 2 Diabetes Mellitus and the presence of CACs.

KEYWORDS : Calcified atherosclerotic plaques, Carotid artery calcifications, Diabetes mellitus

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INTRODUCTION

Cerebrovascular accidents or strokes are the third most common cause of morbidity and mortality worldwide. The main cause of cerebrovascular accidents is rupture of atherosclerotic plaques present in carotid arteries. The carotid bifurcation is at the highest risk of atherosclerosis.¹

Macrovascular atherosclerosis is frequent cause of morbidity in patient with type 2 diabetes mellitus, it tends to accumulate within bifurcation of common carotid arteries, & it produces symptoms as plaque forms & embolies to brain.²

Diabetes mellitus increases the risk of cerebrovascular accidents leading to death. Diabetic people are at heightened risk of stroke because hyperglycemia, hyperlipidemia, and hypertension often associated with the disorder have been

implicated as the cause of atherosclerosis of the cervical portion of the carotid artery.³

Patients with carotid artery calcifications (CACs) detectable by panoramic radiography are more likely to have suffered cerebrovascular events. The risk of stroke is increased by 150-400% in patients with diabetes.⁴

In recent years, a number of publications have described the detection of calcifications in the region of carotid bifurcation on panoramic radiographs. An OPG (Orthopantomogram, Panoramic Radiograph) X-ray is a panoramic dental X-ray that captures a wide view of the lower face, including all teeth, jawbones, and surrounding structures, in a single image. It's a common diagnostic tool used in dentistry to assess overall oral health and diagnose various dental issues.

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Various studies have shown that panoramic radiographs taken routinely to evaluate the oral status of diabetic patients due to the high occurrence of dental infections can also be used in detection of CACs presence and evaluation of the possible risk of stroke in them.⁵

Since, there is scarcity of studies reported in the scientific literature regarding the prevalence of CACs in diabetic patients and its correlation with age and gender. The present study had been undertaken with an objective to determine the prevalence of calcified atherosclerotic plaques on panoramic radiographs of patients with Type II diabetes mellitus.

MATERIALS AND METHODOLOGY

This randomised controlled cross sectional pilot study had been conducted involving 100 subjects, both gender, aged 30 to 75 years at the Pacific dental college and Research centre, Bhillo ka bedla, Udaipur, Rajasthan

Amongst 100 subjects, 50 Type 2 diabetic patients and 50 age and sex matched healthy individuals chosen as control were enrolled after obtaining their informed consent

INCLUSION CRITERIA

- 1) A diagnosis of Type 2 diabetes, that is, in the unmedicated stage having a fasting blood glucose (FBG) level >110 mg/dL;
- 2) Age of 30 years or greater, both male and female;
- 3) Ability to stand proper while taking panoramic radiograph.
- 4) Properly taken digital panoramic radiographs with proper visualization of radiographic structures

EXCLUSION CRITERIA

- 1) History of transient ischemic attack
- 2) History of cerebrovascular accident and any cardio vascular disorder.
- 3) Poor quality of their radiographic image (ghost images or distortion)

Panoramic radiographic images were then carefully scrutinized under ambient light through the use of transmitted light from a standard viewing box for detecting the presence of CACs. Any calcifications seen on the radiographs were noted and marked.

Radiographically, the calcified atheromatous plaques appear as nodular, punctuate, and linear , single or multiple discrete radiopaque nodular masses within the soft tissues of the neck, 1.5 cm inferior and 2.5 cm posterior to the cortical rim of the midpoint of angle of mandible at the lower margin of third and fourth cervical vertebra (the area of bifurcation of the common carotid artery).⁶

RESULTS AND STATISTICAL ANALYSIS

The radiographic findings were recorded and Prevalence of CACs was calculated using formula
Presence of CACs / study sample x 100

SPSS software version 22.0 was used for statistical analysis. Chi square test was performed and the values were evaluated

The results of the present study showed that n=7 (7%) had (CACs) on their panoramic radiography, the prevalence of (CACs) on panoramic radiographs was found to be (5.7%) in the diabetic population and (1.3%) in control group, respectively. Therefore, with a statistically significant P value of 0.011 ($P < 0.05$), the prevalence of (CACs) on panoramic radiographs was higher in diabetes patients than in control.

DISCUSSION

Extensive studies highlight carotid plaque evidence presence in bifurcation areas, aiding the identification of asymptomatic individuals at a high risk of stroke, which is particularly pertinent for vulnerable persons prone to ischemic attacks already having diabetes Type 2. There aren't many research that link cardiac risk aspects such as diabetes and hypertension to carotid plaque.³⁻⁵

Determining calcified atherosclerotic plaques presence on patient panoramic radiographs and if individuals with diabetes mellitus had a greater prevalence of atherosclerotic plaques on panoramic radiographs than non-diabetics were the goals of the present investigation.

In related research by Khambete N. (2015)⁷, it was established that individuals had a 26% prevalence of (CACs) on their panoramic radiographs, compared to 6% in the non-diabetic control group. There was a statistically significant difference in CCAAP prevalence between these groups ($P = 0.01410$).

In 2000, Friedlander et al.⁸ reported 20.4% prevalence. In 2002, the same authors reported 24% prevalence in non-insulin-dependent diabetic group and 36% prevalence in insulin-dependent diabetic group of patients.

According to Griniatsos et al (2009)⁹ the current investigation demonstrated a statistically substantial relationship involving diabetes mellitus and the existence of (CACs). Additionally, the findings of this research were in line with those of investigations by Ardakani FE (2007)¹⁰, Khambete (2015)⁷, and Dharma Rao V (2014)², which found evidence of (CACs) on panoramic radiographs of persons having Type 2 diabetes which was in accordance to the present study.

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The findings may be described by the fact that, according to Lamster IB (2008)¹¹ and Ship JA (2003)¹², diabetic patients with hyperglycemia are more likely to have recurrent infections, poor wound healing, and micro- and macrovascular problems. According to Friedlander AH (2000)⁸, macrovascular disease is defined by atherosclerotic alterations in big blood vessels. Its key clinical indications are in the carotid artery (stroke), lower extremities (gangrene), and coronary arteries (angina, myocardial infarction).

The degree of lipoprotein alteration, such as oxidation, glycation, size, and composition, is linked to an increased risk of stroke and coronary heart disease. Diabetes patients had smaller LDL particles and lower levels of core lipids. When the dense, tiny lipoprotein particles reach the artery wall, they are oxidized, taken up by the macrophages in the wall, and esterified, turning the LDL into a foam cell. The buildup of foam cells is the main component of atheromatous plaque. Radiopaque appearance on radiographs is caused by calcium salts absorbed by atheromatous plaque.^{13,14}

Insulin resistance, hyperglycemia, and extreme release of free fatty acids all contribute to harmful metabolic processes in endothelial cells in diabetes. When these systems are activated, endothelial function is compromised, vasoconstriction is increased, inflammation is heightened, and thrombosis is encouraged. The repercussions of plaque rupture and the advancement of atherosclerosis may be made worse by the aberrant platelet activity. Diabetes increases blood coagulability and enhances platelet activity, increasing the risk of atherosclerotic plaque erosion or rupture leading to thrombotic blockage of the artery. According to Beckman JA (2002)¹⁵ and Wagenknecht LE (2003)¹⁶, diabetes not only accelerates the onset of atherogenesis but also causes plaque instability and clinical consequences.

As patients having high risk of (CACs) due to associated risk factors of hyperglycemia, hyperlipidemia, screening of patients in dental clinic with digital panoramic radiography may help in early diagnosis of carotid artery atheroma's or (CACs).

CONCLUSION

According to the current study's limitations, the prevalence of (CACs) was greater in individuals with diabetes mellitus than in age- and sex-matched nondiabetic patients. Our study's findings indicated a compelling positive relationship amid Type II Diabetes mellitus and (CACs) on digital panoramic radiographs. Digital panoramic radiograph appeared to be a reliable aid in diagnosing the (CACs).

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