# Meaningful correlation between asymptomatic retinal arteriole emboli and calcified carotid plaque found on panoramic dental imaging of males with diabetes

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**Objective.** There is ongoing controversy with regard to the stability of calcified carotid artery plaques (CCAPs) seen in the bifurcation area on panoramic images (PIs). Therefore, we sought to evaluate the possibility of these plaques shedding emboli by observing their relationship with ipsilateral retinal emboli.

**Study Design.** The study group included 50 neurologically and visually asymptomatic males with diabetes, with PIs that incidentally demonstrated CCAPs (CCAP+) and contemporaneous digital retinal images that had been obtained for evaluation of diabetic retinopathy. The control group consisted of 50 males with diabetes who were matched for age and body mass index and had undergone both imaging studies and whose PIs were devoid of carotid plaques (CCAP−). The presence of retinal emboli was determined by two ophthalmologists blinded to the patients' medical histories, and the prevalence rates for the two groups were calculated.

**Results.** The presence of asymptomatic retinal arteriolar emboli was found in the eye ipsilateral to the radiographically observed carotid atheroma in 10 of 50 (20%) of the patients in the CCAP+ group, compared with 2 of 50 (4%) in the CCAP− group, and this difference was statistically significant (Fisher's exact $P < .03$).

**Conclusions.** Some male patients with diabetes mellitus type II having calcified carotid artery atheromas in the bifurcation area, as visualized on PIs, may have significant sequelae as evidenced by retinal artery emboli. (Oral Surg Oral Med Oral Pathol Oral Radiol 2016;121:434-440)

Thromboembolic disease arising from atherosclerotic lesions in the cervical carotid distribution is a major cause of embolic stroke. Dental researchers familiar with this issue have, for the past 35 years, documented that panoramic images (PIs) are capable of demonstrating calcified carotid arterial plaques (CCAPs) (Figure 1), with a high degree of interobserver agreement (Cohen kappa value 0.69%).[1-4] The presence of lesions in the bifurcation of the common carotid artery or proximal (initial 2 cm) internal carotid artery (ICA) can be confirmed by duplex ultrasonography, with a sensitivity of 80% and a specificity of 81%,[5] There has, however, been variations in the reported frequency of significant stenosis among patients with incidental panoramic imaging findings of calcifications in the carotid arteries, depending on the populations under study. For example, among a group of male military veterans attending a Veterans Affairs dental service, approximately 20% showed hemodynamically significant stenotic disease (≥50%) on ultrasound study.[6] However, in a mixed-gender study conducted at a university-based dental clinic, 50% of patients with incidentally detected atheromas on panoramic imaging had significant stenosis on ultrasound evaluation.[7] Individuals in both studies having significant stenotic disease were provided medical

## Statement of Clinical Relevance

Male patients with diabetes who show evidence of carotid plaque on panoramic images should be referred for further evaluation, given that some of these lesions are unstable and may be associated with a risk of fatal stroke.

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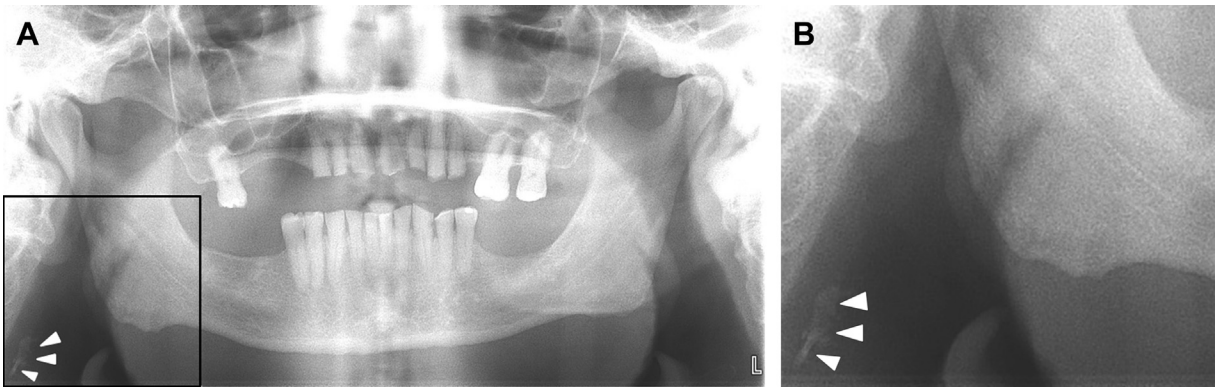


Fig. 1. **A**, Panoramic image of a 68-year-old male with type 2 diabetes, demonstrating calcified carotid artery plaque in the cervical distribution (boxed area, arrowheads). The variegated, verticolinear opacity appears to be situated anterior to the cervical spine. **B**, Magnified view of the boxed area, which has been cropped and enhanced to demonstrate the atheroma (arrowheads).

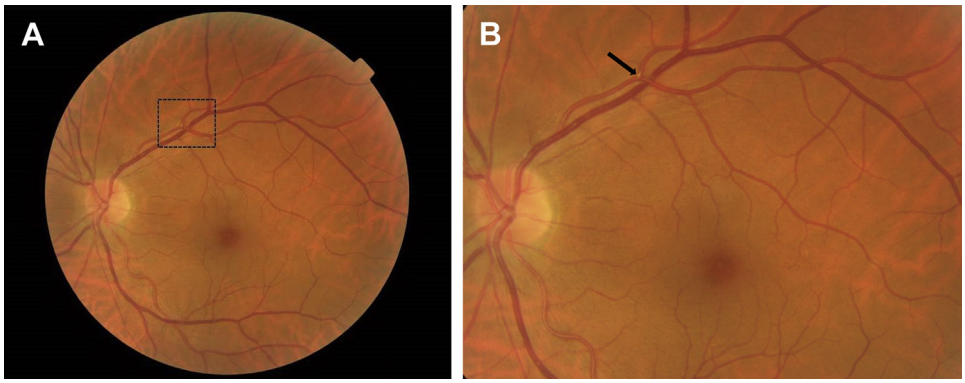


Fig. 2. **A**, Digital retinal image of the left fundus, which demonstrates an arteriolar reflective (bright) cholesterol-like embolus (within the dotted box). **B**, Magnified view of the boxed area, showing an embolus (arrow).

interventions and, on occasion, surgical removal of the lesion (endarterectomy). In a controlled study, it was also demonstrated that these lesions are independent risk factors for future clinically significant ischemic events.[8] However, critics claim that for these lesions to be visible on a PI, they must be so extensively calcified that they are stable and highly unlikely to release emboli with the potential to precipitate an ischemic event.[9,10]

Asymptomatic retinal arteriole emboli (ARAE) (Figure 2) are believed to emanate from unstable plaques located in the very same region as that visualized by the PI: namely, the carotid bifurcation and the ICA.[11] In addition, the ophthalmologic literature has previously documented an association between ARAE and carotid artery plaque, stenosis, risk of stroke, and a hazard ratio of 2.4 of dying from stroke,[11-15] Therefore, to explore the possibility that CCAPs may be related to the development of ARAE, we developed a retrospective, observational, case-control study enrolling patients with both panoramic and digital retinal images.

The present study sought to compare the presence or absence of emboli seen on ipsilateral digital retinal images among groups of patients with or without CCAPs on their PIs. We hypothesized that patients with CCAP (CCAP+) would have a greater incidence of ARAE compared with patients free of CCAP (CCAP−).

## MATERIALS AND METHODS

### Study design and patient sample

To address this research question the investigators designed and implemented a retrospective cross-sectional case-control study. Institutional Review Board approval was obtained and the need for consent was obviated given the retrospective nature of the project, no inclusion of identifiable patient variables, and its compliance with the Helsinki Declaration. The Los Angeles Veteran Affairs (VA) Medical Center's electronic medical records were accessed, and all