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Calcified Carotid Artery Imaged by Computed Tomography

Charley Levy, BA, and Louis Mandel, DDS†*

Cerebrovascular accident, or stroke, is the third leading cause of death in the United States, causing more than 150,000 deaths each year; it also is the leading cause of adult disability. Each year, approximately 780,000 strokes occur in the United States, of which 75% are first-time cerebrovascular accidents.[1] It has been estimated that in 2008, stroke-related medical costs to Americans totaled 65.5 billion dollars.[1] The risk factors include hypertension, hyperlipidemia, diabetes, smoking, and obesity.[2-4]

Strokes are classified as either ischemic or hemorrhagic. During both ischemic and hemorrhagic strokes, the brain is deprived of critical blood and oxygen, causing rapid cell death. Ischemic strokes, comprising approximately 85% of all strokes, are due to the blockage of arteries by either blood clots or the gradual build up of fatty plaque, which consists of fat and cholesterol, with calcification often occurring. This accumulation of plaque within the arteries is known as atherosclerosis. Carotid artery atherosclerosis is a contributor to ischemic stroke and myocardial infarction. A study by Prabhakaran et al[5] found that patients with carotid calcified plaques were more than twice as likely to experience vascular events compared with those without carotid plaques.

Imaging facilitates the detection of carotid artery disease and is critical in identifying those at risk of cerebrovascular accidents. Typically, a physician will diagnose carotid artery disease using carotid ultrasonography.[6] If the ultrasound scan shows signs of carotid artery disease, more advanced imaging in the form of angiography, computed tomography (CT) angiography, or magnetic resonance angiography is used to better quantify the extent of the disease. Once carotid artery disease has been diagnosed, patients will receive a range of treatment options. For less severe cases, medication and lifestyle modifications may be recommended. This includes smoking cessation, the treatment of hypertension, high cholesterol, and diabetes, and the use of blood thinning medications. For more severe cases, surgical intervention might be recommended. The 2 accepted surgical techniques for carotid artery disease are carotid endarterectomy and carotid stenting.[6]

Carotid artery calcification can often be detected by the oral surgeon on a routine panoramic film.[7-9] This incidental finding of radiopacity can indicate a previously undiagnosed and potentially harmful condition. Panoramic films serve as a very popular radiographic prescription for a patient's initial visit. Among general dentists, about 10% of all radiographs taken on dentate patients are panoramic films, with this number being much greater for edentulous patients.[10,11] Additionally, panoramic films are very frequently used for implant dentistry. More than 80% of all implant patients undergo panoramic radiography during the course of their treatment.[12]

On a panoramic film, calcifications of the carotid artery are located posterior and inferior to the angle of the mandible, at about 45° from the angle of the mandible (Fig 1). They are present adjacent to cervical vertebrae 3 and 4.[13] This is the point at which the carotid artery bifurcates into the internal and external carotid arteries. It represents a critical area for the formation of carotid atheromas, which can be circular, ovoid, linear, or irregular in shape.[13]

Studies have shown that 2.5% to 5% of older individuals, with a mean age of 55 to 65 years, have carotid artery calcifications evident on routine panoramic radiographs.[3,4] In a younger population, with a mean age of 32 to 35 years, the incidence has been reported to range from 0.4% to 0.8%.[13,14] Although some studies have suggested an increased prevalence in women, the statistical significance has been disputed.[13]

*Research Assistant, Salivary Gland Center, and Fourth Year Student, Columbia University College of Dental Medicine, New York, NY.

†Director, Salivary Gland Center, and Assistant Dean and Clinical Professor, Division of Oral and Maxillofacial Surgery, Columbia University College of Dental Medicine, New York, NY.

Address correspondence and reprint requests to Dr Mandel: Division of Oral and Maxillofacial Surgery, Columbia University College of Dental Medicine, 630 West 168th Street, New York, NY 10032; e-mail: LM7@Columbia.edu

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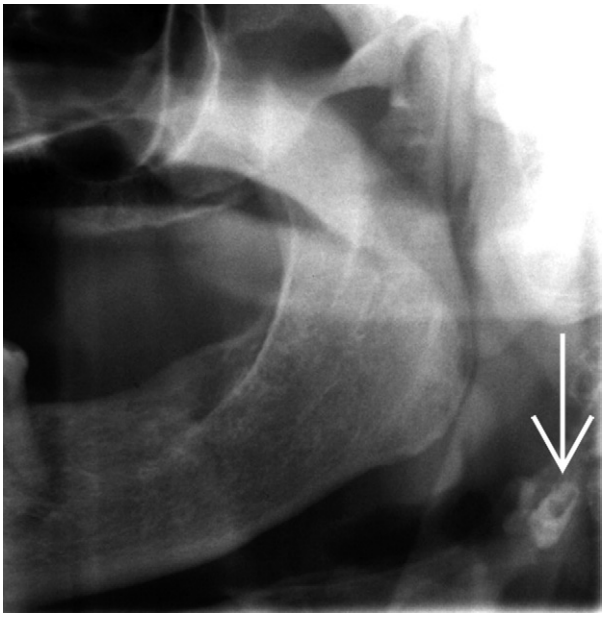

FIGURE 1. Cropped panoramic film demonstrating carotid artery calcification *(arrow)*. Courtesy of Dr Steven Singer.

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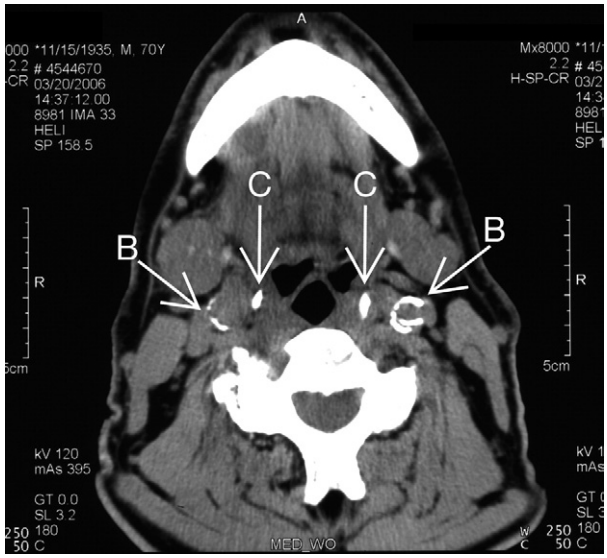

FIGURE 3. CT scan (axial view, no contrast) at lower level than seen in Figure 2 revealing significant bilateral carotid artery calcifications *(B arrows)*, most marked on left side. Note tip of greater horn of hyoid bone *(C arrows)*.

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The reference standard for diagnosing carotid artery calcifications is CT.[15] CT has the ability to illustrate the quantitative extent of the calcifications and stenosis within the artery. In the present report, we studied the value of CT in diagnosing the presence of carotid artery calcification when CT was used for the investigation of an unrelated oral problem. A CT scan was performed as a part of an evaluation of a patient with a right submandibular sialolith. An incidental finding clearly demonstrated the presence of bilateral common carotid artery calcifications.

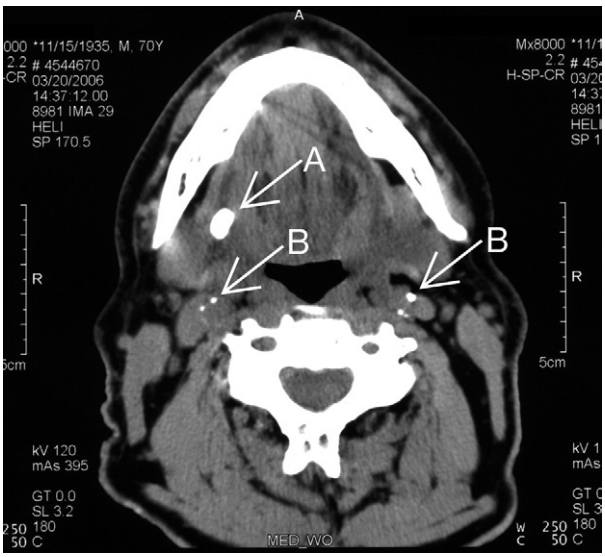

FIGURE 2. CT scan (axial view, no contrast) showing sialolith *(A arrow)* in posterior segment of right Wharton's duct and *B*, bilateral calcifications *(B arrows)* in common carotid artery.

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Report of a Case

A 55-year-old man was referred to the College of Dental Medicine's Salivary Gland Center (Columbia University, New York, NY) because of a 2-year history of sporadic right submandibular salivary gland swellings associated with eating. His medical history indicated that the patient was taking medication for mild hypertension, but he had no other medical problems. The patient was moderately obese and admitted to smoking 1 pack of cigarettes each day.

At the examination, palpation revealed a slightly swollen, firm, and tender right submandibular salivary gland. Intraorally, the right mouth floor was erythematous and elevated. Saliva manually expressed from the right Wharton's duct was cloudy. Intraoral palpation demonstrated a significant hardness in the third molar area of the mouth floor. A tentative diagnosis of a sialolith in the posterior segment of the right Wharton's duct was made.

To clearly define the size of the sialolith, its exact location, and its effect on the submandibular gland, a CT scan was requested. The CT scan confirmed the existence of a 1.2-cm stone in the proximal portion of the duct and associated sialadenitis (Fig 2). Of great interest was the simultaneous and incidental finding of bilateral common carotid artery calcifications (Figs 2, 3). The clearly delineated calcific plaques involved the left artery more extensively than the right vessel. The patient was informed that a medical consultation would be indicated after removal of the sialolith.

Discussion

The CT scan is exquisitely sensitive to minute amounts of calcium. Therefore, it can be instrumental in the diagnosis of any carotid artery calcification or a poorly calcified sialolith.[16] Indisputably, the CT scan is superior to the panoramic radiograph in both sensitivity and specificity for detecting calcifications. The drawbacks of CT are its high cost, its high level of radiation, and the technicality of the procedure.

Two different studies[17,18] investigated how efficient panoramic radiographs are in detecting cervical calcifications compared with CT scans. These studies found that if a patient showed calcification on the CT scan, it would only be visible on the panoramic radiograph 22% to 32% of the time. This is referred to as the sensitivity of the panoramic radiograph. The studies also considered the specificity of panoramic radiographs, or the likelihood that if no calcification is seen on the CT scan, no calcification will appear on the panoramic radiograph. They found the specificity to be 87.5% to 90%. A more general statistical parameter used to compare the results of the panoramic radiographs with those of the reference standard of CT is accuracy. Accuracy is defined as the likelihood that the results from the panoramic radiographs will agree with the results obtained from the CT scans. The accuracy of panoramic radiography has been reported to be 50% to 62.5%.[17,18] From these findings, it is clear that the panoramic film is not as reliable as the CT scan for detecting calcifications. Confusion can occur from the presence of other pathologic radiopacities such as calcified lymph nodes, phleboliths, submandibular salivary gland sialoliths, fractured osteophytes, tonsilloliths, calcified acne lesions, calcified ligaments, or an extended styloid.[19,20]

We are not advocating the use of CT to uncover the presence of carotid artery calcifications. However when an oral problem requires CT, the dental practitioner is in the unique position to diagnose the presence of these calcifications. The oral surgeon has the ability to detect this condition as an incidental finding when ordering a CT scan for suspicion of a sialolith, treatment planning for implants, or investigating a pathologic swelling. The present case report highlights the unrelated CT scan discovery of bilateral carotid artery calcifications in a patient with a submandibular sialolith. Such a finding underlines the dentist's role in the systemic health of the patient and requires a medical referral.

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