



Association of calcified carotid atheromas visualized on panoramic images and aortic arch calcifications seen on chest radiographs of postmenopausal women

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Atherosclerosis of the coronary and carotid arteries resulting in myocardial infarction and stroke is the leading cause of death among postmenopausal women in western Europe, North America and parts of Asia.¹ The illness, which differs from that in men, usually begins 10 years later than in men (≥ 55 years versus ≥ 45 years) when menopause-related alterations in circulating levels of endogenous sex hormones accelerate the process.² Menopause-related mobilization of calcium from bone, as seen in osteopenia and osteoporosis, is associated with reciprocal calcification of previously noncalcified atherosclerotic lesions.^{3,4} The disorder often does not have recognized symptoms and traditional risk factors. Of greatest concern is that the initial indication of disease in 60 percent of instances is a fatal cardiovascular event.^{5,6}

The construct that women often have occult atherosclerosis after menopause has prompted researchers to evaluate a multiplicity of imaging studies used for other purposes to determine which of them also might be used to identify patients with occult calcific vascular disease.⁷ Specifically, the results of studies conducted in Japan,^{8,9} China,¹⁰ Greece,^{11,12} Korea,¹³ Germany¹⁴ and the United States^{15,16} have demonstrated that medically indicated, as well as routine or screening, posterior-anterior (PA) chest radiographs (CRs) of women showing calcified plaques in the aortic arch often are indicative of concurrent cardiovascular disease confirmed by means of both angiography and coronary artery calcium scores on noncontrast enhanced computed tomography (CT). These findings frequently herald an increased risk of experiencing death from myocardial infarction and stroke. The arch, lying within the mediastinum, is formed by the confluence of the ascending and descending aorta and is visible on a PA CR as an opaque bump (the aortic knob) on the left side of the mediastinal shadow, lateral to the air in the trachea at the level of the second and third ribs (Figure 1). In 2009, a method of grading the severity of

ABSTRACT

Background. Occult atherosclerotic disease is the leading cause of death among older women. The authors hypothesized that women with calcified carotid artery plaque (CCAP) visualized on panoramic images were more likely to have aortic arch calcifications (AAC) that were visible on chest radiographs (CRs), a risk indicator of experiencing cardiovascular events, than would matched cohorts who did not have atheromas.

Methods. The authors obtained the CRs of 36 female veterans (≥ 50 years) who had CCAP and atherogenically risk-matched them to those of 36 women without CCAP. A radiologist evaluated the CRs for AAC. Other study variables included age, ethnicity, body mass index and presence or absence of hypertension, diabetes and dyslipidemia. The authors computed descriptive and bivariate statistics.

Results. Women 60 years or older who had evidence of CCAP on their panoramic radiographs were significantly ($P = .022$; 95 percent confidence interval, 1.298-26.223) more likely to have evidence of AAC on their CRs than were similarly aged women who did not have evidence of CCAP. This association was not evident in women younger than 60 years. Among women who were both younger and older than 60 years, there was no evident association between the presence of CCAP and the severity (on a four point scale [0-3]) of AAC calcification.

Conclusion. Prevalence of carotid plaque on panoramic images of women 60 years or older is significantly associated with presence of aortic arch calcifications on CRs.

Practical Implications. Panoramic images of women 60 years or older must be evaluated for CCAP, given their association with AAC. Patients with atheromas should be referred to their physicians for further evaluation given the systemic implications.

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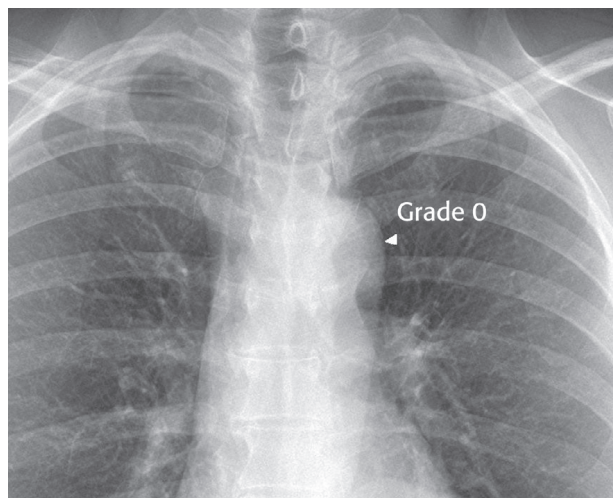


Figure 1. A posterior-anterior chest radiograph showing the aortic knob (arrow) on the left side of the mediastinal shadow. Grade 0, no visible calcification.

aortic arch calcifications (AAC) on PA CRs was developed,⁸ and in 2010 it was shown to be a strong independent predictor of adverse cardiovascular events beyond traditional risk factor indicators.⁹

Each year in the United States, approximately 15 million women undergo panoramic radiographic studies.¹⁷ Images obtained from large populations of women attending dental school clinics revealed that approximately 5 percent of those in their mid-50s (ethnic distribution was not defined) had evidence of calcified carotid artery plaque (CCAP).^{18,19} Figure 2 shows CCAP on a panoramic radiograph. Confirmation of the presence of CCAP lesions by means of ultrasonography demonstrated that panoramic imaging was highly accurate²⁰ and had 80 percent sensitivity, 81 percent specificity and 81 percent accuracy.²¹ Although the results of longitudinal studies conducted in men have demonstrated that CCAP lesions detected by means of panoramic radiography are associated with near-term myocardial infarction and stroke, no such prognostic information has yet been garnered for women.²²

We conducted a study to determine the prevalence and severity of AAC on incidentally obtained PA CRs of women who also had CCAPs that were visible on their panoramic images. We hypothesized that a group of women with CCAP would have a significantly greater prevalence and severity of AAC than would an atherogenically matched group of women who did not have CCAP. We also wanted to determine which, if any, of the traditional atherogenic risk factors distinguished women having both CCAP and AAC on their imaging studies from those who had only CCAP on their panoramic images.

METHODS

Study design and patient sample. We designed and implemented a retrospective study. The Institutional Re-

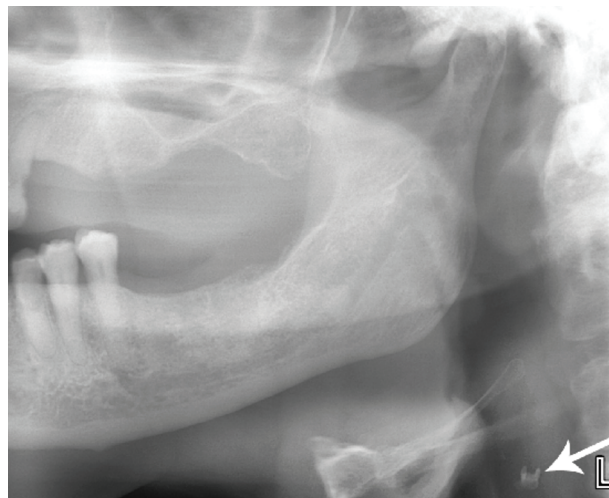


Figure 2. A panoramic image of the maxillofacial complex that has been cropped and digitally enhanced with the manufacturer's provided software shows calcified carotid artery plaque (arrow). The globular opacity lies inferior to the horns of the hyoid bone and anterior to the cervical spine.

view Board (project coordinating center 2013-030328) of the Veterans Affairs Greater Los Angeles Healthcare System approved the study protocol. With the assistance of a medical librarian, we accessed the Veterans Affairs (VA) medical center's dental and radiology services digital libraries and electronic medical records and reviewed the imaging studies of all female patients 50 years or older obtained by members of the VA's medical and dental staff between March 1, 2006, and June 30, 2012.

Chest radiographic examinations were performed by VA staff radiology technicians at a distance of 180 centimeters with the patient standing upright in a PA position during full inspiration.

To be included in the study, patients had to have a panoramic image that showed evidence of CCAP as jointly determined by two dentists (A.H.F., T.I.C.) who were certified by the American Board of Oral and Maxillofacial Surgery and who used the American Academy of Oral and Maxillofacial Radiology–sponsored training packet for identification of carotid artery calcifications on panoramic radiographs.²³ Consistent with these guidelines, these two dentists diagnosed heterogeneous radiopacities in a verticolinear orientation 1.5 to 2.5 cm inferioposterior to the angle of the mandible, adjacent or inferior to the hyoid bone, epiglottis and cervical vertebrae at, above or below the intervertebral space from C3 through C4 as CCAP after ruling out confounding radiopacities that lay in close proximity to the vessel such as salivary calculi, calcified lymph nodes, tonsil-

ABBREVIATION KEY. AAC: Aortic arch calcifications. BMI: Body mass index. CCAP: Calcified carotid artery plaque. CR: Chest radiograph. CT: Computed tomography. PA: Posterior-anterior. VA: Veterans Affairs.

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