

Case Report

Arterial Calcification on Wrist Radiographs May Suggest Need for Evaluation of Atherosclerosis in Asymptomatic Individuals

Lauren E. Watchmaker ¹, Jennifer M. Watchmaker,² and Greg P. Watchmaker³

¹University of Wisconsin School of Medicine and Public Health, 750 Highland Ave, Madison, WI 53726, USA

²Vanderbilt University School of Medicine, 1161 21st Ave S # D3300, Nashville, TN 37232, USA

³The Milwaukee Hand Center, 1535 W. Market Street, Mequon, WI 53092, USA

Correspondence should be addressed to Lauren E. Watchmaker; laurenwatchmaker@gmail.com

Received 10 February 2019; Revised 15 June 2019; Accepted 23 June 2019; Published 3 July 2019

Academic Editor: Amgad N. Makaryus

Copyright © 2019 Lauren E. Watchmaker et al. This is an open access article distributed under the Creative Commons Attribution License, which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.

Asymptomatic individuals with significant coronary artery disease (CAD) are at risk for unanticipated cardiac events including myocardial infarction (MI). Laboratory studies, stress tests, and coronary artery imaging including coronary artery calcium (CAC) scoring evaluate at-risk individuals. Hand and wrist x-rays demonstrating significant arterial wall calcification may provide an additional means to identify asymptomatic individuals at risk for cardiac events. Here we report a case series of patients without known cardiac disease who demonstrated significant calcium deposits in the radial and/or ulnar arteries in radiographs performed for evaluation of their hand conditions. Each series patient was subsequently found to have calcification on coronary artery imaging and an elevated risk of future cardiac events. Our series suggests that peripheral arterial calcifications observed by radiologists and hand specialists may warrant systemic evaluation for atherosclerosis in other areas of the body.

1. Introduction

Every year, about 635,000 Americans have their first heart attack [1]. Not all patients experiencing a cardiac event have prior known disease. The reason is multifactorial and includes individuals with risk factors who do not engage in healthcare and undergo screening tests as well as patients whose tests do not detect cardiac disease which is actually present. Traditionally, electrocardiograms, stress tests, and laboratory studies have been utilized as screening tools; however, more recently, noncontrast computed tomography imaging of the coronary arteries with image acquisition gated to the patient's electrocardiogram has made quantification of coronary artery calcification possible. Coronary artery calcium (CAC) scoring has been demonstrated to not only show current coronary disease but also predict future cardiac events [2, 3]. Budoff *et al.* studied a cohort of 25,253 asymptomatic patients and found that even mildly elevated CAC scores were associated with a 6-fold increase in CAD, and higher CAC scores were associated with up to a 62-fold increased risk of cardiac events within 10 years [4].

Radiologists and hand specialists engage with a broad demographic of patients from newborns with congenital disease to elderly patients with arthritis and fractures. This demographic includes young and middle-aged adults who may be unaware of evolving coronary pathology. Although older individuals with long-standing diabetes are known to develop arterial wall calcification visible on plain radiographs, younger individuals and nondiabetics can also develop such calcifications. The association between peripheral calcification and CAD has already been demonstrated for lower extremity vessels [5]. Following Institutional Review Board review and exemption, we collected a case series of patients with peripheral arterial calcifications on upper extremity radiographs who underwent subsequent CAC testing and report these findings.

2. Cases

Patient 1, a 59 year-old male with no past medical history, presented with wrist pain. An x-ray study of the right wrist demonstrated advanced arthritis in his area of symptoms,

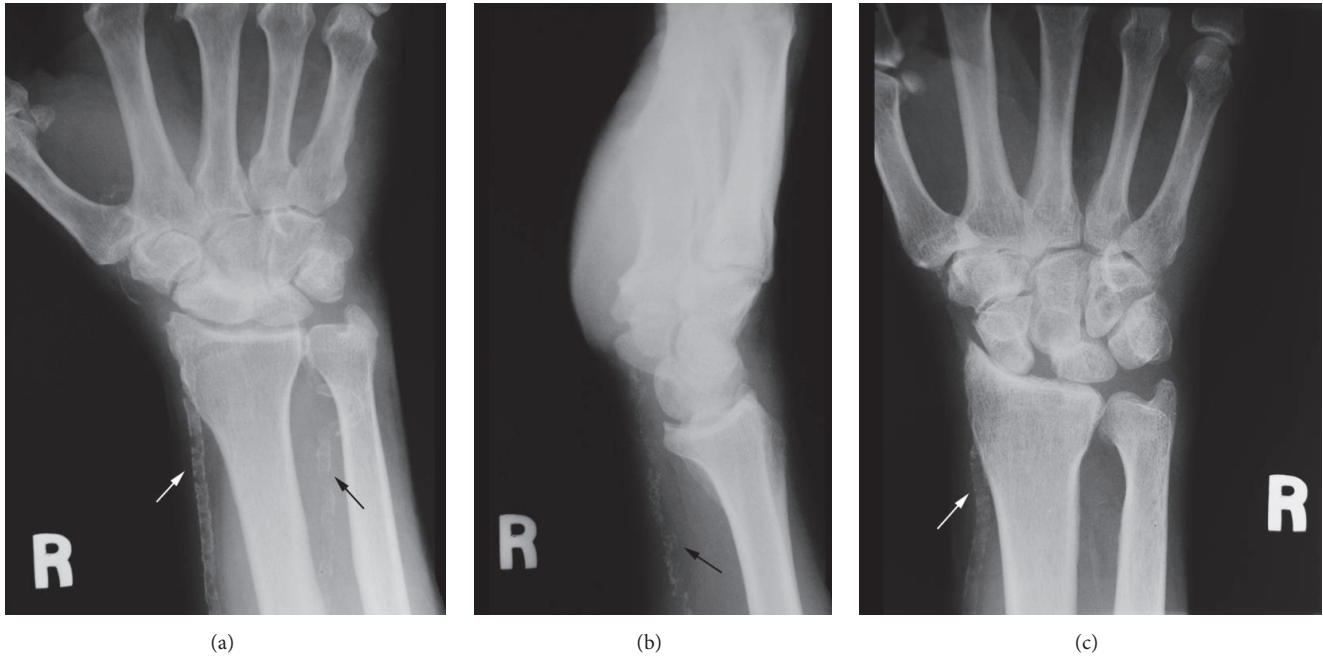


FIGURE 1: (a) Patient 1 with both radial artery (white arrow) and ulnar artery (black arrow) calcification. (b) Patient 2 with ulnar artery calcification. (c) Patient 3 with radial artery calcification.

but also extensive calcification of both radial and ulnar arteries (Figure 1(a)). Based on this finding, further discussion regarding the presence of peripheral vascular disease and cardiac disease was undertaken. The patient denied any personal history of symptoms or previous cardiac workup. It was suggested that the patient considers further evaluation including a CAC score. The scan identified a total coronary calcium score of 424 which indicates extensive plaque burden. Based upon age-adjusted population data, this patient is at a high risk of a future cardiac event.

Patient 2, a 60 year-old otherwise healthy man, presented with pain in his right wrist which developed acutely when lifting a heavy machine. The x-ray study demonstrated scapholunate widening and radiocarpal arthrosis in addition to significant calcification of his ulnar artery which is most clearly seen on the lateral radiograph (Figure 1(b)). Similar to Patient 1, additional history revealed no prior symptoms or workup for CAD. A CAC score of 174 was interpreted as evidence of moderate calcium plaque with possible areas of significant narrowing. All of the calcifications were found in the left anterior descending artery.

Patient 3, a 59 year-old male with a 37-year history of diabetes but no known cardiac disease, also presented with wrist pain prompting an x-ray demonstrating scapholunate advanced collapse as well as arterial calcification (Figure 1(c)). A CAC score of 1412 indicated significant coronary disease.

3. Discussion

In our series of patients with upper extremity calcification, each patient without known cardiac disease was subsequently found to have an elevated CAC score indicating an increased

risk for future cardiac events. Radiologists and hand specialists evaluate radiographs in an age demographic that is at risk for unrecognized CAD. Blais *et al.* found that younger individuals with CAD were more likely than older individuals to have sudden death from an MI as the initial presentation [6]. In the lower extremity, Lehto *et al.* in a large series of non-insulin-dependent diabetic patients found that femoral calcification carried a 1.6x risk of cardiac mortality and strong association of future cardiac events over a seven-year period [7]. In histologic examination of vascularly compromised extremities, O'Neil *et al.* demonstrated that significant medial calcification in addition to intimal thickening lead to narrowing of the vessel and in some instances complete obliteration of the lumen [8].

Radiographically visible arterial calcifications are more prevalent in patients with chronic kidney disease (CKD) and diabetes [9, 10]. This has clinical implications since the radial artery is commonly used as a conduit for coronary artery bypass (CAB) and presence of calcifications may reduce suitability of this graft [11, 12]. Deshpande *et al.* found that 4 patients in their series of 130 had clinically significant radial artery calcification that precluded its use for grafting [13].

Vessel wall calcifications that occur as sheet-like layers within the media of the wall are referred to as Monckeberg's Sclerosis [14]. Medial calcifications reduce arterial wall compliance and have been associated with increased mortality when involving large vessels [15]. Intimal calcifications, by contrast, narrow the arterial lumen more directly and are more likely associated with dyslipidemia and atherosclerotic plaques [14]. Although peripheral calcifications are not uncommon in CKD and diabetic patients, such radiographic findings in the younger or nondiabetic patient may be an

important finding to discuss with the patient and report back to their primary care physician.

Additional research as to the strength of the association between peripheral calcification and future cardiac events will help define this relationship and need for additional workup. Based on this case series, we suggest that incidental findings of radial and/or ulnar artery calcification on routine radiographs may warrant systemic evaluation for atherosclerosis in other areas of the body.

Conflicts of Interest

The authors declare that they have no conflicts of interest.

References

- [1] D. Mozaffarian, E. J. Benjamin, A. S. Go et al., "Heart disease and stroke statistics—2015 update: a report from the american heart association," *Circulation*, vol. 131, no. 4, article e29-322, 2015.
- [2] S. M. Chang, F. Nabi, J. Xu et al., "The coronary artery calcium score and stress myocardial perfusion imaging provide independent and complementary prediction of cardiac risk," *Journal of the American College of Cardiology*, vol. 54, no. 20, pp. 1872–1882, 2009.
- [3] L. J. Shaw, A. E. Giambrone, M. J. Blaha et al., "Long-term prognosis after coronary artery calcification testing in asymptomatic patients," *Annals of Internal Medicine*, vol. 163, no. 1, pp. 14–21, 2015.
- [4] M. J. Budoff, L. J. Shaw, S. T. Liu et al., "Long-term prognosis associated with coronary calcification," *Journal of the American College of Cardiology*, vol. 49, no. 18, pp. 1860–1870, 2007.
- [5] H. S. Shin, M. Jung Park, K. Nyeo Jeon et al., "Lower extremity arterial calcification as a predictor of coronary atherosclerosis in patients with peripheral arterial disease," *Iranian Journal of Radiology*, vol. 13, no. 2, article e33179, 2016.
- [6] C. Blais and L. Rochette, "Trends in prevalence, incidence and mortality of diagnosed and silent coronary heart disease in Quebec," *Health Promotion and Chronic Disease Prevention in Canada*, vol. 35, no. 10, pp. 184–193, 2015.
- [7] S. Lehto, L. Niskanen, M. Suhonen, T. Rönnemaa, and M. Laakso, "Medial artery calcification: a neglected harbinger of cardiovascular complications in non-insulin-dependent diabetes mellitus," *Arteriosclerosis, Thrombosis, and Vascular Biology*, vol. 16, no. 8, pp. 978–983, 1996.
- [8] W. C. O'Neill, K. H. Han, T. M. Schneider, and R. A. Hennigar, "Prevalence of nonatheromatous lesions in peripheral arterial disease," *Arteriosclerosis, Thrombosis, and Vascular Biology*, vol. 35, no. 2, pp. 439–447, 2015.
- [9] P. A. McCullough, V. Agrawal, E. Danielewicz, and G. S. Abela, "Accelerated atherosclerotic calcification and mönckeberg's sclerosis: a continuum of advanced vascular pathology in chronic kidney disease," *Clinical Journal of the American Society of Nephrology*, vol. 3, no. 6, pp. 1585–1598, 2008.
- [10] A. C. Nicolosi, L. L. Pohl, P. Parsons, R. A. Cambria, and G. N. Olinger, "Increased incidence of radial artery calcification in patients with diabetes mellitus," *Journal of Surgical Research*, vol. 102, no. 1, pp. 1–5, 2002.
- [11] A. Dogan, K. Sever, D. Mansuroglu, P. Hacısalihoglu, and N. Kurtoglu, "Mönckeberg's arteriosclerosis: a possible reason for non-use of radial conduit," *Asian Cardiovascular and Thoracic Annals*, 2019.
- [12] T. Ahmad, K. Marimuthu, and K. M. Cherian, "Radial artery calcification in a young coronary bypass patient: a caution," *Asian Cardiovascular and Thoracic Annals*, vol. 26, no. 2, p. 166, 2018.
- [13] R. P. Deshpande, A. Chukwuemeka, A. Iqbal, and J. B. Desai, "Dystrophic calcification of the radial artery," *The Annals of Thoracic Surgery*, vol. 69, no. 6, pp. 1939–1940, 2000.
- [14] K. Amann, "Media calcification and intima calcification are distinct entities in chronic kidney disease," *Clinical Journal of the American Society of Nephrology*, vol. 3, no. 6, pp. 1599–1605, 2008.
- [15] B. Pannier, A. P. Guérin, S. J. Marchais, M. E. Safar, and G. M. London, "Stiffness of capacitive and conduit arteries: prognostic significance for end-stage renal disease patients," *Hypertension*, vol. 45, no. 4, pp. 592–596, 2005.