



MITRAL AND AORTIC ANNULAR CALCIFICATION ARE HIGHLY ASSOCIATED WITH SYSTEMIC CALCIFIED ATHEROSCLEROSIS

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BACKGROUND

Atherosclerosis is a systemic inflammatory process with a predilection for certain anatomic locations. Calcium deposition typically occurs in areas of atherosclerotic lipid accumulation and is a highly organized and regulated process that is very similar to cortical bone formation. Arterial branch points with decreased shear stress or increased turbulence of blood flow and the attachment points of the aortic and mitral valves to their respective annuli are also sites where there is a tendency for atherosclerosis to initiate. The aim of this study was to determine if atherosclerotic calcification in multiple vascular areas is significantly associated with aortic (AAC) or mitral (MAC) annular calcification. Furthermore, this study tested the hypothesis that calcium in the vascular beds would be independently associated with AAC or MAC even after adjustment for traditional CVD risk factors.

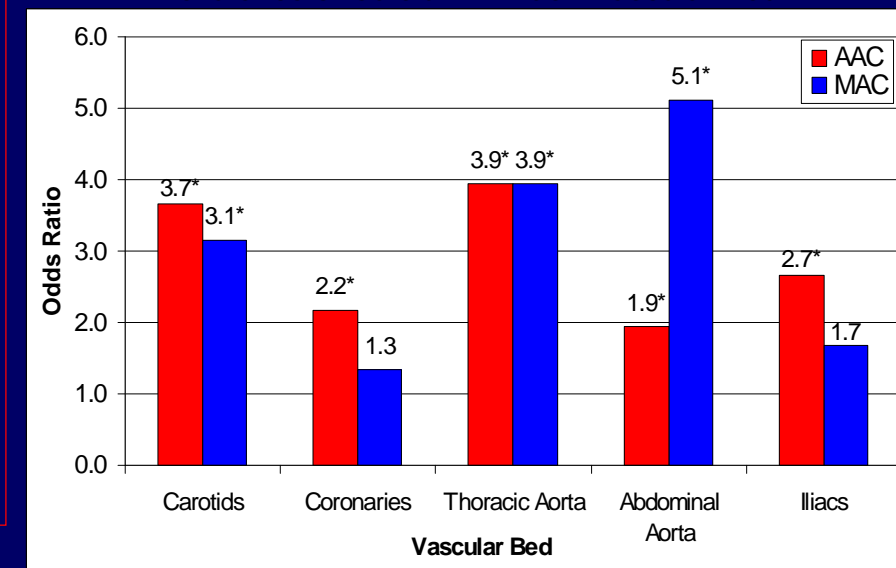
METHODS

From February 1, 2001 to June 13, 2001, 1,242 consecutive asymptomatic patients free of clinical CHD were presented for preventive medicine services at a university affiliated disease prevention center in San Diego, California, and were evaluated for the extent of calcified atherosclerosis in 5 different vascular beds: the carotid, coronary, thoracic aorta, abdominal aorta and iliac vessels. All patients completed a detailed health history questionnaire prior to undergoing the scanning procedure. Subjects were subsequently evaluated for valvular calcification between June and August 2004. Those with a history of aortic or mitral valve repair or replacement were excluded. The presence and extent of valvular and vascular calcification was ascertained by electron beam computed tomography and interrogating the resulting images using the Agatston method.

CONCLUSION

In this cross-sectional study, atherosclerotic calcification in any of 5 distinct vascular beds was significantly associated with calcium in the aortic annulus even after adjustment for traditional CVD risk factors. The same was true for the mitral annulus except for the coronary and iliac vascular beds which were not significantly associated. Further, when adjusting for risk factors and the extent of calcium in the other beds, the increases in calcium located in the abdominal aorta or iliac arteries were significant predictors of aortic annular calcium while the thoracic aorta was significantly associated with calcium in the mitral annulus. Age was the only CVD risk factor that remained significant in the multivariable models, which did not differ by gender. This study provides further support for the hypothesis that valvular calcification is due to atherosclerosis. Additionally, calcium due to atherosclerosis has been found earlier and to a larger extent in the abdominal aorta compared with the other vascular beds presented in this study. This, coupled with the current findings and the significant association between MAC and future CVD events, support the hypothesis that identification of calcified atherosclerosis in the distal aorta would provide the opportunity for earlier identification of atherosclerosis and implementation of prevention strategies for coronary and valvular heart disease.

Odds of Mitral or Aortic Annular Calcification by Prevalence of Calcium in Each Vascular Bed



RESULTS

Cohort Characteristics Stratified by the Presence of Aortic and Mitral Annular Calcium

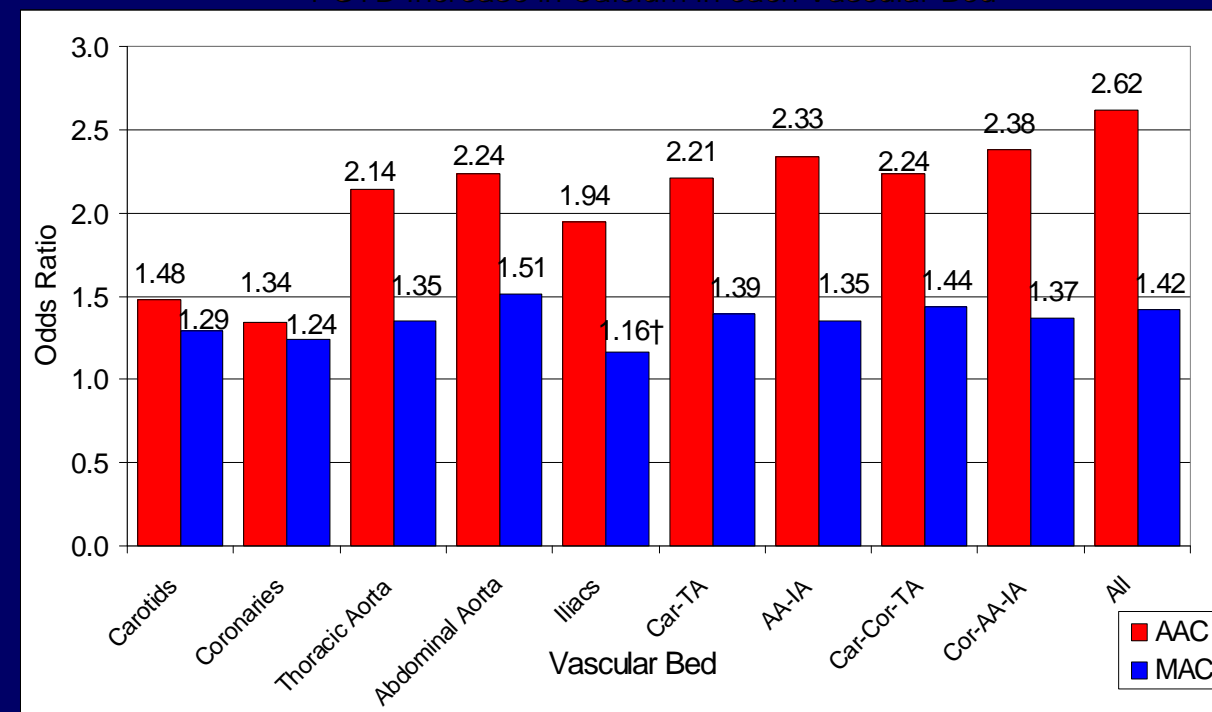
Variable	AAC			MAC		
	Absent	Present	P-value	Absent	Present	P-value
Age [†]	53.6 (9.9)	67.0 (9.0)	<0.01	55.6 (10.6)	70.5 (9.4)	<0.01
Female [‡]	439 (46.4)	120 (40.5)	0.08	520 (45.5)	39 (39.4)	0.24
Carotid Calcium Score [‡]	0 (0-2,035)	64 (0-2,730)	<0.01	0 (0-2,730)	157 (0-2,365)	<0.01
Coronary calcium Score [‡]	1 (0-3,581)	164 (0-6,056)	<0.01	3 (0-4,124)	262 (0-6,056)	<0.01
Thoracic Aorta Calcium Score [‡]	0 (0-6,241)	307 (0-12,676)	<0.01	0 (0-11,730)	575 (0-12,676)	<0.01
Abdominal Aorta Calcium Score [‡]	0 (0-5,131)	992 (0-11,111)	<0.01	9 (0-8,777)	1,663 (0-11,111)	<0.01
Iliac Calcium Score [‡]	0 (0-7,698)	683 (0-16,446)	<0.01	18 (0-16,446)	1,136 (0-13,875)	<0.01
Car-TA Calcium Score [‡]	0 (0-11,524)	734 (0-24,615)	<0.01	0 (0-21,473)	1,404 (0-24,615)	<0.01
AA-IA Calcium Score [‡]	43 (0-23,378)	4,008 (0-49,972)	<0.01	146 (0-46,530)	6,808 (0-49,972)	<0.01
Car-Cor-TA Calcium Score [‡]	8 (0-12,069)	1,180 (0-26,737)	<0.01	35 (0-23,020)	1,671 (0-26,737)	<0.01
Cor-AA-IA Calcium Score [‡]	67 (0-24,507)	4,260 (0-50,644)	<0.01	179 (0-47,314)	7,006 (2-50,644)	<0.01
All Calcium Score [‡]	122 (0-29,137)	5,274 (0-72,839)	<0.01	256 (0-67,194)	9,922 (16-72,839)	<0.01

Correlations Between Predictor Variables and Aortic and Mitral Annular Calcification

Predictor Variable	AAC	MAC
Age	0.51*	0.33*
Carotid Calcium	0.52*	0.35*
Coronary Calcium	0.45*	0.27*
Thoracic Aortic Calcium	0.56*	0.36*
Abdominal Aortic Calcium	0.53*	0.34*
Iliac Calcium	0.50*	0.29*
Car-TA Calcium	0.58*	0.36*
AA-IA Calcium	0.54*	0.33*
Car-Cor-TA Calcium	0.56*	0.34*
Cor-AA-IA	0.53*	0.33*
All Calcium	0.55*	0.34*

*p-value < 0.01, †p-value < 0.05

Odds for Aortic or Mitral Annular Calcification by 1-STD Increase in Calcium in each Vascular Bed



[†]Mean (SD), [‡]Count (%), [‡]Median (Range)

AAC = Aortic Annular Calcium, MAC = Mitral Annular Calcium

Car-TA = carotids + thoracic aorta, AA-IA = abdominal aorta + iliacs

Car-Cor-TA = carotids + coronaries + thoracic aorta, Cor-AA-IA = coronaries + abdominal aorta + iliacs