Original Article

Journal of Cardiovascular Medicine and Surgery
Volume 3 Number 2, July - December 2017
DOI: http://dx.doi.org/10.21088/jcms.2454.7123.3217.5

Profile of Non-Laboratory Based Vascular Age Across the Spectrum of Coronary Artery Disease

Bhakthavatsala Reddy Chirra*, Rama Mohan Pathapati**

Abstract

Introduction: Biological age is unlike from chronological age. Presence of risk factors such as age, obesity, hypertension and diabetes, smoking and family history promotes early vascular (biological) ageing. Early vascular ageing is responsible for the development of coronary events. We assessed the non-laboratory based vascular age across the spectrum of coronary artery disease and correlated with severity and extent of coronary artery disease. *Methods:* Case records all patients undergoing angiogram for acute coronary syndromes were reviewed. Demographic details, coronary risk factors, clinical diagnosis of acute coronary syndrome and angiographic details on coronary arteries involvement was noted. Vascular age was then calculated using a non-laboratory based vascular risk chart. It is derived from a composite score of six pro cardiovascular risk factors which includes age, gender, body mass index, systolic blood pressure (treated and untreated), diabetes and smoking. *Results:* A total of 242 patient records were analysed. Among them 62/242 (25.61 %) patients were having chronic stable angina, 72/242 (29.75%) unstable angina, and 108/242 (44.62%) myocardial infarction. The mean age of the patients was 56.1±10.7, whereas the vascular age and accelerated vascular age was 71.0±12.0 years and 14.5±8.2 (median 15) years respectively. *Conclusion:* We did not find a significant difference in vascular age with either severity or extent of coronary vascular disease, even though the risk factors such as age, gender, hypertension, diabetes and smoking significantly varied across the spectrum of coronary artery disease.

Keywords: Vascular Age; Myocardial Infarction; Unstable Angina; Chronic Stable Angina; Chronological Age; Coronary Arteries.

Authors Affiliation
*Professor, Dept. of Cardiology, **Associate Professor, Dept. of Pharmacology, Narayan Medical College and Hospital, Nellore, Andhra Pradesh 524003, India.

Reprints Requests
Rama Mohan Pathapati
Associate Professor, Dept. of Pharmacology, Narayan Medical College and Hospital
Nellore, Andhra Pradesh 524003, India.
E-mail: pill4ill@yahoo.co.in

Recived on 30.09.2017,
Accepted on 04.11.2017

Introduction

Coronary artery disease is a significant cause of death in the developed world and developing world [1]. The prevalence of cardiovascular disease burden is higher with advancing chronological age, suggesting that atherosclerosis is an integral part of the ageing process. Biological age is unlike from chronological age. Presence of risk factors such as age, obesity, hypertension and diabetes, smoking and family history promotes early vascular (biological) ageing [2]. Early vascular ageing results in altered arterial structure and function, which is in part to chronic inflammation of arterial wall, endothelial dysfunction, vascular remodelling. Increased vascular stiffness and cardiac hypertrophy [3,4,5].

D'Agostino et al. developed a non-laboratory based vascular age from a composite of six cardiovascular risk factors such as age, gender, body mass index, systolic blood pressure (treated and untreated), the presence of diabetes and history of smoking [6]. It replaced serum cholesterol with body mass index and became a validated alternative to laboratory-

based score for quantification of cardiovascular disease [7,8]. This gender-specific non-laboratory based vascular age algorithm is originally developed to assess general CVD risk and risk of individual CVD events. We have used this scale to correlate with the severity and extent of coronary artery disease in patients undergoing angiogram for evaluation of acute chest pain.

Methods

This retrospective study was conducted in the department of cardiology, Narayana Medical College, Nellore. Case records all patients undergoing angiogram for acute coronary syndromes were reviewed. Demographic details, coronary risk factors, clinical diagnosis of acute coronary syndrome and angiographic details on coronary arteries involvement was noted. Vascular age was then calculated using a non-laboratory based vascular risk chart. It is derived from a composite score of six pro cardiovascular risk factors which includes age, gender, body mass index, systolic blood pressure (treated and untreated), diabetes and smoking [6].

Statistical Analysis

Data was presented as mean, standard deviation, numbers and percentages. ANOVA and Chi-square test were used appropriately as inferential tools. Statistical analysis was performed using IBM SPSS Statistics for Windows, Version 21.0. Armonk, NY: IBM Corp. A p-value less than 0.05 was considered significant.

Results

A total of 242 patient records were analysed. Among them 62/242 (25.61%) patients were having chronic stable angina, 72/242 (29.75%) unstable angina, and 108/242 (44.62%) myocardial infarction. The mean age of the patients was 56.1±10.7, whereas the vascular age and accelerated vascular age was 71.0±12.0 years and 14.5±8.2 years respectively (Table 1).

There were 94/242 (26.40%) females and 178/242 (73.60%) males. 99/242 (40.90 %) were hypertensives, 115/242 (47.50 %) were diabetics, 112/242 (46.30 %) were smokers, 58/242(24.00%) had a family history of coronary, artery disease, and majority 90/242 (37.20%) has involvement of single coronary artery on angiography.

On comparison of chronological age and vascular age across both severity and extent of coronary artery disease (Table 3 & 4), we found that majority 115/242 (47.50%) of patients were in chronological age group of 51-65 years, while majority 111/242 (45.90%) were having vascular age above 80 years. Vascular age was statistically similar across severity ($p>0.05$) and extent ($p>0.05$) of disease of coronary artery disease.

Table 1: Demographic parameters across the severity of coronary artery disease

Table 1a

	CSA		USA		MI		Total		P value
	N	Mean ± SD	N	Mean ± SD	N	Mean ± SD	N	Mean ± SD	
Age (years)	62	57.2±10.0	72	55.9±10.8	108	55.7±11.1	242	56.1±10.7	>0.05
Height (cm)	62	161.7±8.3	72	159.9±9.3	108	162.2±8.5	242	161.4±8.7	>0.05
Weight (kg)	62	67.1±12	72	64.7±12.2	108	61.8±10.8	242	64±11.7	<0.05
BMI (kg/m2)	62	25.2±4.0	72	24.4±4.4	108	22.8±3.3	242	23.9±4.0	<0.05
Vascular age (years)	62	73.0±12.0	72	71.0±13.0	108	70.0±12.0	242	71.0±12.0	>0.05
Early Vascular age (years)	62	15±8.8	72	14.7±8.9	108	14.2±7.3	242	14.5±8.2	>0.05

CSA-Chronic stable angina, USA- Unstable angina, MI- Myocardial Infarction

Table 1b

Chronological Age (years)	N	Vascular Age (years)			P value
		Mean ± SD	Min	Max	
<= 35.0	7	42.14±5.11	35	49	<0.0001
36.0 - 50.0	72	61.96±11.96	38	81	
51.0 - 65.0	115	74.95±8.14	52	81	
66.0 - 80.0	48	80.4±2.35	69	81	

Table 2: Comparison of risk factors and vessel involvement across spectrum of acute coronary syndrome

		CSA		USA		MI		Total		P Value
		N	Total N %	N	Total N %	N	Total N %	N	Total N %	
Gender	Female	19	7.90	25	10.30	20	8.30	64	26.40	0.03
	Male	43	17.80	47	19.40	88	36.40	178	73.60	
HTN	No	34	14.00	35	14.50	74	30.60	143	59.10	0.02
	Yes	28	11.60	37	15.30	34	14.00	99	40.90	
DM	No	22	9.10	38	15.70	67	27.70	127	52.50	0.004
	Yes	40	16.50	34	14.00	41	16.90	115	47.50	
Smoking	No	43	17.80	46	19.00	41	16.90	130	53.70	<0.0001
	Yes	19	7.90	26	10.70	67	27.70	112	46.30	
Obesity	No	54	22.30	58	24.00	98	40.50	210	86.80	0.14
	Yes	8	3.30	14	5.80	10	4.10	32	13.20	
Family	No	48	19.80	59	24.40	77	31.80	184	76.00	0.25
history CAD	Yes	14	5.80	13	5.40	31	12.80	58	24.00	
No of Vessels	No disease	19	7.90	28	11.60	0	0.00	47	19.40	<0.0001
Involved	One	12	5.00	21	8.70	57	23.60	90	37.20	
	Two	17	7.00	9	3.70	26	10.70	52	21.50	
	Three	14	5.80	14	5.80	25	10.30	53	21.90	

CSA-Chronic stable angina, USA- Unstable angina, MI- Myocardial Infarction

Table 3: Comparison of chronological age and vascular age across severity of coronary artery disease

		CSA		USA		MI		Total	
		N	Total N %	N	Total N %	N	Total N %	N	Total N %
Chronological Age	<= 35.0	0	0.00	3	1.20	4	1.70	7	2.90
(years)	36.0 - 50.0	17	7.00	21	8.70	34	14.00	72	29.80
(p=0.76)	51.0 - 65.0	33	13.60	34	14.00	48	19.80	115	47.50
	66.0 - 80.0	12	5.00	14	5.80	22	9.10	48	19.80
	>80	0	0.00	0	0.00	0	0.00	0	0.00
Vascular Age	<= 35	0	0.00	0	0.00	1	0.40	1	0.40
(years)	36 - 50	4	1.70	7	2.90	6	2.50	17	7.00
(p=0.48)	51 - 65	11	4.50	17	7.00	34	14.00	62	25.60
	66 - 80	15	6.20	12	5.00	22	9.10	49	20.20
	>80	32	13.20	35	14.50	44	18.20	111	45.90

CSA-Chronic stable angina, USA- Unstable angina, MI- Myocardial Infarction

Table 4: Comparison of chronological age and vascular age across extent of coronary artery disease

		No Disease		One Vessel		Two Vessel		Three Vessel		Total	
		N	Total N %	N	Total N %	N	Total N %	N	Total N %	N	Total N %
Age	<= 35	0	0.00	5	2.10	2	0.80	0	0.00	7	2.90
(years)	36- 50	15	6.20	33	13.60	15	6.20	9	3.70	72	29.80
(P=0.01)	51 - 65	20	8.30	41	16.90	28	11.60	26	10.70	115	47.50
	66 - 80	12	5.00	11	4.50	7	2.90	18	7.40	48	19.80
	>80	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Vascular	<= 35	0	0.00	1	0.40	0	0.00	0	0.00	1	0.40
Age (years)	36 - 50	3	1.20	10	4.10	3	1.20	1	0.40	17	7.00
(P=0.09)	51 - 65	13	5.40	29	12.00	12	5.00	8	3.30	62	25.60
	66 - 80	7	2.90	15	6.20	16	6.60	11	4.50	49	20.20
	>80	23	9.50	34	14.00	21	8.70	33	13.60	111	45.90

Discussion

Vascular disease is a feature of ageing, and coronary vascular events constitute a significant source of morbidity and mortality with premature ageing. In our study 79/242 (32.64%) of our patients with the coronary artery disease were below 50 years. Among them, 38/79 (48.10%) had suffered from acute myocardial infarction. Studies have shown that several risk factors have been suggested; smoking and other forms of tobacco, dyslipidemia and hypertension are significant risk factors in the young [9,10]. We calculated vascular age by using non-laboratory-based coronary risk factors and found that the vascular age is higher than chronological age by a median of 15 years (0-37 years). Majority 45.90% were having vascular age above 80 years when a

majority of patients chronological was between 51.0 - 65.0 years. We also noticed that a significant tendency in increased early vascular ageing with advancing chronological age. Our patient population were having a higher prevalence of diabetes mellitus, hypertension, and smoking; It is possible that these established [11] risk factors for cardiovascular might have contributed to increased vascular age in our study population.

We evaluated non-laboratory based vascular age across the spectrum of angiographically proven coronary artery disease and correlated it with severity and extent of coronary artery disease. We did not find a significant difference in vascular age with either severity or extent of coronary vascular disease, even though the risk factors such as age, gender, hypertension, diabetes and smoking significantly varied across the spectrum of coronary artery disease. Among all the components of non-laboratory based vascular age, systolic blood pressure is a highly dynamic and readily modifiable risk factor. Many of our patients were hypertensive and prescribed with antihypertensive medications. It is possible that changes in systolic blood pressure might have contributed for similar vascular age across the spectrum of coronary artery disease in our report.

Limitations

Gender-specific non-laboratory based vascular age algorithm is originally developed to assess general CVD risk and risk of individual CVD events. The vascular age ranges from <30 years to >80 Years. We rounded >80 years to 81 years for mathematical calculation of early vascular ageing; such a mathematical manipulation gives only approximation rather than actual estimation.

Conclusion

Our patients had a vascular age is higher than chronological age by a median of 15 years. We did not find a significant difference in vascular age with either severity or extent of coronary vascular disease, even though the risk factors such as age, gender, hypertension, diabetes and smoking significantly varied across the spectrum of coronary artery disease.

References

1. Low AF, O'Donnell CJ, Kathiresan S, Everett B, Chae CU, Shaw SY, et al. Aging syndrome genes and premature coronary artery disease. BMC Medical Genetics. 2005 October 31;6(1):38.
2. Jackson R, Lawes CM, Bennett DA, Milne RJ, Rodgers A. Treatment with drugs to lower blood pressure and blood cholesterol based on an individual's absolute cardiovascular risk. The Lancet. 2005;365 9457):434-41.
3. Jani B, Rajkumar C. Ageing and vascular ageing. Postgraduate Medical Journal. 2006;82(968):357-62.
4. Harvey A, Montezano AC, Lopes RA, Rios F, Touyz RM. Vascular fibrosis in aging and hypertension: molecular mechanisms and clinical implications. Canadian Journal of Cardiology. 2016;32(5):659-68.
5. Heineke J, Molkentin JD. Regulation of cardiac hypertrophy by intracellular signalling pathways. Nature reviews Molecular cell biology. 2006;7(8):589-600.
6. D'Agostino RB, Vasan RS, Pencina MJ, Wolf PA, Cobain M, Massaro JM, et al. General cardiovascular risk profile for use in primary care. Circulation. 2008;117(6):743-53.
7. Gaziano TA, Young CR, Fitzmaurice G, Atwood S, Gaziano JM. Laboratory-based versus non-laboratory-based method for assessment of cardiovascular disease risk: the NHANES I Follow-up Study cohort. The Lancet. 2008;371(9616):923-31.
8. Pandya A, Weinstein MC, Gaziano TA. A comparative assessment of non-laboratory-based versus commonly used laboratory-based cardiovascular disease risk scores in the NHANES III population. PloS one. 2011;6(5):e20416.
9. Sharma M, Ganguly NK. Premature coronary artery disease in Indians and its associated risk factors. Vascular health and risk management. 2005;1(3):217-25. PubMed PMID: 17319107. Pubmed Central PMCID: PMC1993956. Epub 2007/02/27. eng.
10. Bhardwaj R, Kandoria A, Sharma R. Myocardial infarction in young adults-risk factors and pattern of coronary artery involvement. Nigerian medical journal: journal of the Nigeria Medical Association. 2014 Jan;55(1):44-7. PubMed PMID: 24970969. Pubmed Central PMCID: PMC4071662. Epub 2014/06/28. eng.
11. Greenland P, Knoll MD, Stamler J, Neaton JD, Dyer AR, Garside DB, et al. Major risk factors as antecedents of fatal and nonfatal coronary heart disease events. Jama. 2003 Aug 20;290(7):891-7. PubMed PMID: 12928465. Epub 2003/08/21. eng.