IOSR Journal of Dental and Medical Sciences (IOSR-JDMS)
e-ISSN: 2279-0853, p-ISSN: 2279-0861.Volume 18, Issue 5 Ser. 17 (May. 2019), PP 01-09
www.iosrjournals.org

"Comparison of Angiographic Severity of Coronary Artery Disease between Premenopausal and Postmenopausal Woman with Acute Coronary Syndrome: A Study inNational Institute ofCardiovascular Diseases andHospital, Dhaka, Bangladesh"

Dr. LakshmanChandra Barai[1]Md. AbulKalam Azad[2]Dr. ShahriarKabir[3]
Dr. Md. Farabi Halim [4]

[1] *Assistant Professor, Cardiology, MBBS, D.CARD, MCPS, National Institute of Cardiovascular Diseases and Hospital, Dhaka, Bangladesh.*
[2] *Medical Officer (Cardiology), MBBS, D.CARD, National Institute of Cardiovascular Diseases and Hospital, Dhaka, Bangladesh.*
[3] *Assistant Registrar, MBBS, D.CARD, National Institute of Cardiovascular Diseases and Hospital, Dhaka, Bangladesh.*
[4] *Emergency Medical Officer, MBBS, D.CARD, National Institute of Cardiovascular Diseases and Hospital, Dhaka, Bangladesh.*
Corresponding Author:Dr. Lakshman Chandra Barai

Abstract:***Introduction:****Epidemiological studies have shown a higher risk of cardiovascular mortality associated with early menopause, but the relation between menopausal age and extent of coronary artery disease after menopause is unknown. We assessed the relation between menopausal age and extent of coronary disease in postmenopausal women with an acute coronary syndrome.*
Methods:*A prospective study was conducted in patients 55 years old undergoing coronary angiography for an acute coronary syndrome. Enrollment was stratified by sex (women/men ratio 2:1) and age (55-64, 65-74, 75-85, and >85 years). Women were administered menopause questionnaires during admission. An independent core lab quantified coronary artery disease extent using the Gensini Score, which classifies both significant (>50%) and no significant lesions. Linear correlation was used to appraise the association between the Gensini score and menopausal age.*
Results:*We enrolled 675 patients, 249 men and 426 women (mean age 74 years). The mean Gensiniscorewas 60 36 in men vs 50 32 in women (P <.001), being higher among men at any age. The median menopausal age of women was 50 years. Risk factors and age at first acute coronary syndrome were identical among women below and above the median menopausal age. The Gensini score in women showed a weak association with age (R ¼ 0.127; P ¼ .0129), but not with menopausal age (R ¼ 0.063; P ¼ .228). At multivariable analysis, ejection fraction, female sex, and ST elevation myocardial infarction were in-dependent predictors of the Gensini score in the overall population.*
Conclusions:*Menopausal age was not associated with the extent of coronary artery disease. Age atfirstacute coronary syndrome presentation, risk factors, and prior cardiovascular events were not affected by menopausal age.*

Keywords:*Atherosclerosis; Coronary angiography; Coronary artery disease; Menopause*

Date of Submission: 13-05-2019 Date of acceptance: 30-05-2019

I. Introduction

Coronary heart disease is the leading cause of death among women, and it has been reported that more women are now dying of coronary disease than men.[1, 2]However, premature deaths prior to the age of 65, and even 75 years, are much more common among men.[2]This mortality advantage among younger women has been attributed to the protective effect of estrogen prior to menopause on the cardiovascular system 3. Some longitudinal studies have shown an association of early natural menopause with cardiovascular4 and total 5 mortality but the possible protective mechanisms of longer esposure to estrogen remains unclear. Whereas some data seem to indicate a direct effect of estrogen on the development of atherosclerosis3 others hypothesize a protective effect mediated through a more revorable cardiovascular risk factor profile6. Lower lipied level and

development of type 2 diabates. In fact the prevails of coronary disease among women is relatively low prior to menopause 6, only approaching equalrates for men and women in the seventh decade of life troponin levels 14: and 3 electrocardiographic sings of myocardial ischemia. Such characteristics are consistent with the diagnosis of acute myocardial infarction. There were no exclusion criteria other than a patient's inability to recall fertility and menopause history. The study was conducted in conformity with the National Institute of Cardiovascular Diseases and Hospital, Dhaka, Bangladesh approved by the ethics committee of the study first parents was on April 15, 2015 and the last one on October 5, 2015.

II. Methods

The LADIES Acute Coronary Syndrome (ACS) study was a multicenter prospective investigation enrolling consecutive patients aged 55 years with an acute coronary syndrome undergoing coronary angiography. Patients were to be stratified according to sex (with a 2:1 ratio of women vs men) and age, comprising 4 age categories: 55-64, 65-74, 75-85, and >85 years. The study enrolled patients with a clinically defined acute coronary syndrome. The following characteristics were all required for inclusion: 1) symptoms suggestive of acute coronary disease (hypertension, diabetes mellitus, smoking dyslipidemia, body mass index, physical activity), prognostic ally relevant variables (such as serum creatinine, body weight, blood hemoglobin, left ventricular ejection fraction); and prior clinical history (prior myocardial infarction coronary angioplasty, bypass surgery heart failure and stroke.

Menopause Questionnaire

Women's fertility questionnaire included age at first and last menstrual period, past use of oral contraceptives, ongoing and past hormone replacement therapy, and whether or not a hysterectomy or oophorectomy had been performed, as well as information on the number of full-term pregnancies. Age at menarche was defined as the age at the first menstrual period. Reproductive life span is calculated by subtracting the age atmenarche from the age presence of hot flushes, their severity, and their duration in years was also noted.

Angiographic Analysis

Extension and complexity of coronary atherosclerosis was addressed by an independent core laboratory blinded to the study group assignment National Institute of Cardiovascular Diseases and Hospital, Dhaka. The complexity of coronary atherosclerosis at coronary angiography was quantified for each patient using the Gensini score, which includes both angiographicallynonsignificant and significant stenoses.15, 16 as a first step, The narrowing of the lumen of any coronary artery was assigned a grade of 1 for 1%-25% narrowing, 2 for 26%-50%, 4 for 51%-75%, 8 for 76%-90%, 16 for 91%-99%, and 32 for total occlusion. Such score was then multiplied by a factor that takes into account the importance of the lesion's position: 5 for left main coronary artery; 2.5 for the proximal left anterior descending and proximal left circumflex (or 3.5 if the left circumflex artery is dominant); 1.5 for the mid-region of the left anterior descending artery; 1 for the distal left anterior descending artery, the first diagonal, the proximal, mid or distal right coronary artery, the posterior descending, the distal left circumflex artery, the mid left circumflex artery (2 if the vessel is dominant), and the obtuse margin; and 0.5 for the second diagonal and the posterolateral branch. The final Gensini score was expressed as the sum of all the individual coronary artery scores. To aid in the generation of Gensini score, at least 5 different planes of view were obtained for each patient. Diagnostic angiograms were also scored according to the SYNTAX score algorithm, a comprehensive anatomic assessment of the coronary disease derived from various preexisting anatomic classifications.[17]

Data Collection

A web based case report from mediolanumNational Institute of Cardiovascular Diseases and Hospital, Dhaka Bangladesh collected data on the characteristic of the acute coronary syndrome electrocardio graphic changes troponim elevation killip class heart rhythm any revascularization the relevant rick factors for Also, in terms of clinical manifestations atherosclerosis, women represent one-third of acute coro nary syndrome admissions prior to the seventh decade of age 11 only reaching the same level as men during the ninth decade[12]. However prospective studies explicity aimed at comparing the severity of coronary disease between sexs are lacking[15]. We undertook a prospective study to investigate the relation between menopausal age and extent of coronary artery disease among postmenopausal women along 4 decades of age and compared with men of the same age. All patients had an indication to conorary angiography due to an acute conorary syndrome.

Sample-Size Calculation and Statistical Analysis

In the lack of background data, no formal statistical sample size computation was envisioned. Nonetheless, for the sake of study planning, and given that the primary analytical goal of the study was the

comparison of Gensini score between women with menopausal age below or above the median menopausal age of the study population, it had been computed that, by assuming an average Gensini score of 16.0 in the overall group of women (with standard deviation of 6.0), by enrolling a total of 530 women (and 265 men), we would be able to show an absolute difference of 2.0 in the mean Gensini score between women with menopausal age below vs above median of the study population, achieving 97% power and 5% 2-tailed alpha, as well as accounting for up to 10% imbalances in group sizes. Such a high power for the primary analysis was decided on in order to allow enough power to investigate for how long any observed difference would last after menopause with age divided into quartiles. However, an interim analysis conducted after including 675 patients showed the lack of any correlation between menopausal age and Gensini score. Thus, it was decided by the steering committee to halt the study for futility at such enrollment milestones.Continuous variables were reported as mean (standard deviation) or median (and interquartile range [IQR]) as appropriate; categorical variables were reported as counts and percentages. Student's t, Mann-Whitney U, and chi-squared tests were applied for bivariate analyses when appropriate. The association between the Gensini score and selected variables, including menopausal age, was per-formed with the Pearson linear correlation test. For multi-variable analysis, binary logistic regression was used, using the presence, as dependent variable, of a Gensini score higher (or lower) than the 75th percentile of the study pop-ulation, and as independent variables all those variables nominally significant (P <.05) at bivariate analysis, yielding adjusted odd ratios with 95% confidence intervals (CI). The Hosmer-Lemeshow goodness-of-fit test was used to assess calibration. A 2-tailed P-value <.05 was established as the level of statistical significance for all tests. All statistical analyses were carried out using SPSS 22 (IBM, Armonk, NY).

III. Results

Patient Characteristics

Ten centers participated in the study; 6 centers contributed 94% of the study population. The final study population consists of 675 patients: 249 men and 426 women. Patient distribution according to age and sex strata is shown in Figure 1.Patients' demographic, clinical, and angiographiccharacteristics are shown in Table 1. Women had significantly lower values of serum creatinine and blood hemoglobin, more hypercholesterolemia, and were much less frequently smokers. However, prior cardiac history was fairly balanced between sexes, with similar values with regard to the prevalence of prior myocardial infarction and revascularizations. The distribution of ST-elevation myocardial infarction (STEMI) vs non-ST-elevation myocardial infarction (NSTEMI) and Killip class were virtually identical for both sexes.

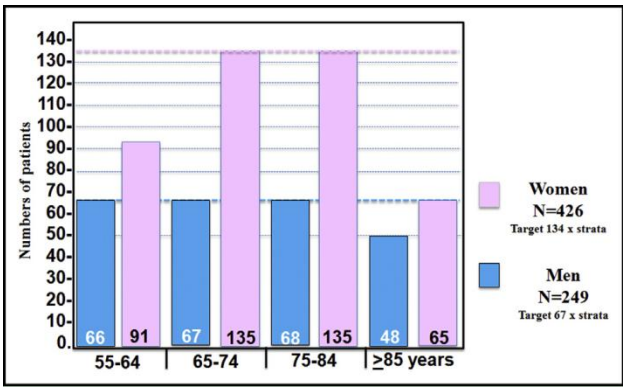

Figure 1 Final enrollment status by age and sex strata;N¼ 350.

Age at Menopause and Cardiac History

The median age at menopause was 50 (IQR 47-53) years. The distribution of risk factors and clinical characteristics among women below and above the median menopausal age is shown in Table 2, with virtually identical features of the 2 populations. Median age from menopause to acute coronary syndrome was 27 (IQR 19-37) years for women with menopausal age below median and 19 (IQR 12-27) years for those above median (P <.001). Menopause had been Physiological for 88% of the patients, with median menopausal age of 51 (IQR 47-53) years, and surgical for 12%, with menopausal age of 45 (IQR 40-48) years. Hormone replacement therapy had been taken by 17.7% of women with menopausal age below median and 9% of those above median (P ¼ .016). The frequency of prior myocardial infarction was identical (15%) among women with menopausal age below or above median. In patients with no history of myocardial infarction, the mean age at acute coronary syndrome was 73.3 10.1 years among women below median menopausal age, and 73.2 9.7 years among those above the median (P ¼ .936).

Table 1: Patient Characteristics.

	All Population (675)		Men (249)		Women (426)		P Value
Age (y)*	74	(65-82)	73	(64-83)	74	(66-82)	.464
Body mass index (Kg/m^2)*	25.7	(23.4-29.1)	26.0	(24.3-29.0)	25.7	(22.9-29.3)	.088
Hemoglobin (gr/dL)	13.2	(12.0-14.3)	13.9	(12.8-15.0)	12.8	(11.6-14.0)	<.001
Creatinine (mg/dL)	0.90	(0.75-1.15)	1.00	(0.85-1.20)	0.84	(0.70-1.07)	<.001
Creatinine clearance (mL/min)	73.9	(55.2-89.8)	77.5	(60.9-95.0)	71.2	(52.7-88.1)	.001
Left ventricle ejection fraction (%)*	50	(40-55)	50	(42-55)	50	(40-55)	.686
Hypertension (%)	509	(75.4)	177	(71.1)	332	(77.9)	.089
Hypercholesterolemia (%)	355	(52.6)	117	(47.0)	238	(55.9)	.043
Smoking habit (%)	292	(43.3)	156	(62.7)	136	(31.9)	.001
Family history of CAD (%)	127	(18.8)	44	(17.7)	83	(19.5)	.678
Diabetes mellitus (%)	171	(25.3)	53	(21.3)	118	(27.7)	.092
Chronic kidney disease (%)	66	(9.8)	23	(9.2)	43	(10.1)	.868
COPD	47	(7.0)	18	(7.2)	29	(6.8)	.930
Cerebrovascular disease	47	(7.0)	12	(4.8)	35	(8.2)	.142
Peripheral artery disease	80	(11.9)	26	(10.4)	54	(12.7)	.499
Malignancies	55	(8.1)	16	(6.4)	39	(9.2)	.293
Prior MI (%)	108	(16.0)	45	(18.1)	63	(14.8)	.282
Prior angina (%)	100	(14.8)	32	(12.9)	68	(16.0)	.352
Prior revascularization (%)							
Prior PCI (%)	110	(16.3)	49	(19.7)	61	(14.3)	.076
Prior CABG (%)	52	(7.7)	19	(7.6)	33	(7.7)	1.000
Diagnosis							
STEMI (%)	331	(49.0)	122	(49.0)	209	(49.1)	1.000
NSTEMI (%)	344	(51.0)	127	(51.0)	217	(50.9)	1.000
Killip class presentation							
I	555	(82.2)	210	(84.4)	345	(81.0)	.377
II	65	(9.7)	22	(8.8)	43	(10.1)	.684
III	44	(6.5)	11	(4.4)	33	(7.7)	.170
IV	11	(1.6)	6	(2.4)	5	(1.2)	.347
Gensini score	49	(28-73)	55	(34-77)	46	(24-68)	.001
Gensini score	53.4	33.6	59.6	35.9	49.7	31.7	<.001
SYNTAX score	14	(7-23)	16	(8-27)	13	(6-21)	<.001
SYNTAX score	16.3	12.9	18.7	13.8	14.9	12.1	<.001

CABG ¼ coronary artery bypass grafting; CAD ¼ coronary artery disease; CKD ¼ chronic kidney disease; COPD ¼ chronic obstructive pulmonary disease; MI ¼ myocardial infarction; NSTEMI ¼ non-ST-elevation myocardial infarction; PCI ¼ percutaneous coronary intervention; STEMI ¼ ST-elevation myocardial.

Infarction.

a) Expressed as median and interquartile range.
b) Expressed as mean and standard deviation.

Age at Menopause and Gensini Score

The mean Gensini score was 58.8 31.1 in patients with STEMI and 47.6 35.3 in patients with NSTEMI (P <.001).

As shown in Table 1, the mean Gensini score was significantly higher among men than among women, and this difference was consistent across all age strata (Figure 2). The Gensini score showed a statistically significant correlation with age among both men and women, although with a weak correlation value (Figure 3). Overall, only 5% of the Gensini score variability (R^2 value) was explained by age in men and <2% in women. The mean Gensini score was similar in women with menopausal age below vs above 50 years (50.0 30.4 vs 49.6 33.5; P ¼ NS), and between women with natural or surgical menopause. The relation between menopausal age and the Gensini score is shown in Figure 4: this relation is statistically nonsignificant with R ¼ 0.063 (95% CI, 0.04-0.16); R^2 of 0.004; P ¼ .228. The relation was similar among women with natural menopause and those with surgical menopause. Similar results have been Observed with regard to the correlation between fertility life span (age at menopause minus age at menarche) and the Gensini score with R ¼ 0.069 (95% CI, 0.03-0.17); R^2¼ 0.005; P ¼ .182. Equally nonsignificant (R ¼ 0.088; P ¼ .0883) was the relationship between the Gensini score and number of menopausal years and at index acute coronary syndrome.The independent predictors of the

Gensini score are shown in Table 3: female sex was independently associated with a lower Gensini score in the overall study population, whereas STEMI, ejection fractionandKillip class at presentation were the independent predictors among women.

Table 2 Patient Characteristics According to Menopause Age (414 Patients)

	Menopause 50 y (226)	Menopause >50 y (188)	P Value
Age (y)*	74(66-83)	74(65-81)	.944
Body mass index (Kg/m^2)*	26.0(23.0-29.4)	25.8(23.1-29.3)	.011
Hemoglobin (gr/dL)	12.7(11.4-14.0)	12.8(11.6-13.8)	.625
Creatinine (mg/dL)	0.85(0.70-1.10)	0.81(0.70-1.05)	.527
Creatinine clearance (mL/min)	68.8(51.9-88.1)	74.0(54.5-87.9)	.552
Left ventricle ejection fraction (%)*	50(40-55)	50(40-55)	.424
Hypertension (%)	181(80.1)	144(76.6)	.464
Hypercholesterolemia (%)	124(54.9)	110(58.5)	.465
Smoking habit (%)	74(32.7)	58(30.9)	.776
Family history of CAD (%)	49(21.7)	33(17.6)	.404
Diabetes mellitus (%)	65(28.8)	50(26.6)	.853
Chronic kidney disease (%)	30(13.3)	13(6.9)	.054
COPD	16(7.1)	11(5.9)	.220
Cerebrovascular disease	22(9.7)	13(6.9)	.357
Peripheral artery disease	30(13.3)	23(12.2)	.907
Malignancies	20(8.8)	18(9.6)	.971
Prior MI (%)	33(14.6)	28(14.9)	.901
Prior angina (%)	42(18.6)	25(13.3)	.282
Prior revascularization (%)			
Prior PCI (%)	33(14.6)	28(14.9)	.420
Prior CABG (%)	16(7.1)	16(8.5)	.847
Diagnosis			
STEMI (%)	112(49.6)	92(48.9)	.867
NSTEMI (%)	114(50.4)	96(51.1)	.867
Killip class presentation			
I	184(81.4)	153(81.4)	.661
II	20(8.8)	19(10.1)	.094
III	18(8.0)	14(7.4)	.646
IV	4(1.8)	2(1.1)	.486
Gensini score (median)	47(27-67)	44(22-69)	.898
Gensini score (mean)	50.030.4	49.633.5	.914
SYNTAX score (median)	12(6-22)	12(6-21)	.995
SYNTAX score (mean)	14.912.1	14.912.5	.986

CABG ¼ coronary artery bypass grafting; CAD ¼ coronary artery disease; CKD ¼ chronic kidney disease (eGFR<60 mL/min/1.72 m^2); COPD ¼ chronicobstructive pulmonary disease; MI ¼ myocardial infarction; NSTEMI ¼ non-ST-Elevation myocardial infarction; PCI ¼ percutaneous coronary intervention; STEMI ¼ ST-elevation myocardial infarction.
*Expressed as median and interquartile range.

IV. Discussion

Specific research on coronary disease in women after menopause is doubtlessly necessary, [13,18] because cardiovascular events are the number one killer among postmenopausal women. A small number of a prospective study have shown the association of early menopause with an increased risk of cardiovascular events and mortality.[4, 19, 20] However, the mechanisms of this possible association have only been hypothesized.[13]Although the effects of age and sex on atherosclerosis may be investigated using retrospective databases of coronary imaging, [21] the impact of menopausal age on subsequent atherosclerosis requires investigation through specific studies. The LADIES ACS study puts a first piece in the puzzle. The data confirm that, at any age after menopause, women have less obstructive coronary disease than men, as also shown by other studies that were, however, unbalanced with regard to age.[22, 23] Whereas the spectrum of cardio-vascular risk factors was similar among men and women in our study, the results of logistic regression analysis show that female sex remains an independent predictor of less coronary atherosclerosis for decades after menopause. As shown by pathology studies, coronary artery disease in women is delayed by 10 to 15 years compared with men, [24] an advantage that, in our study, is maintained up to the ninth decade of age.

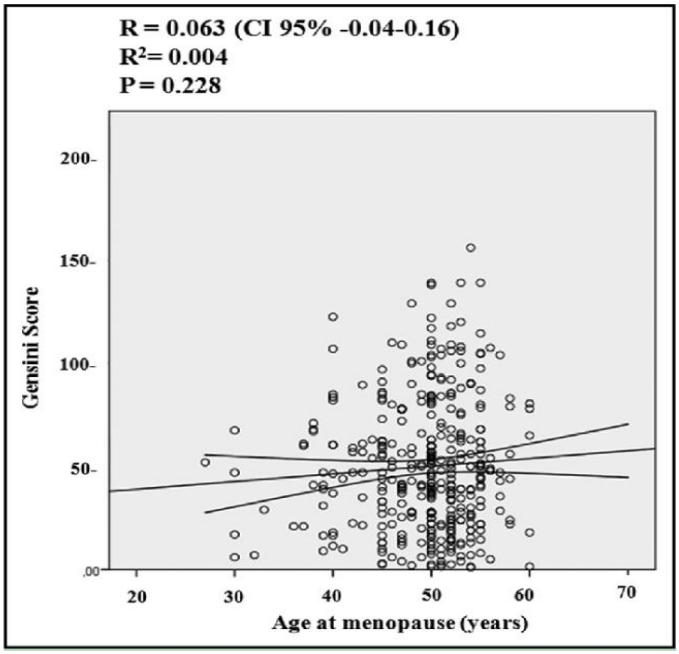

Figure 2 Comparison of Gensini score in men and womenaccording to age classes.

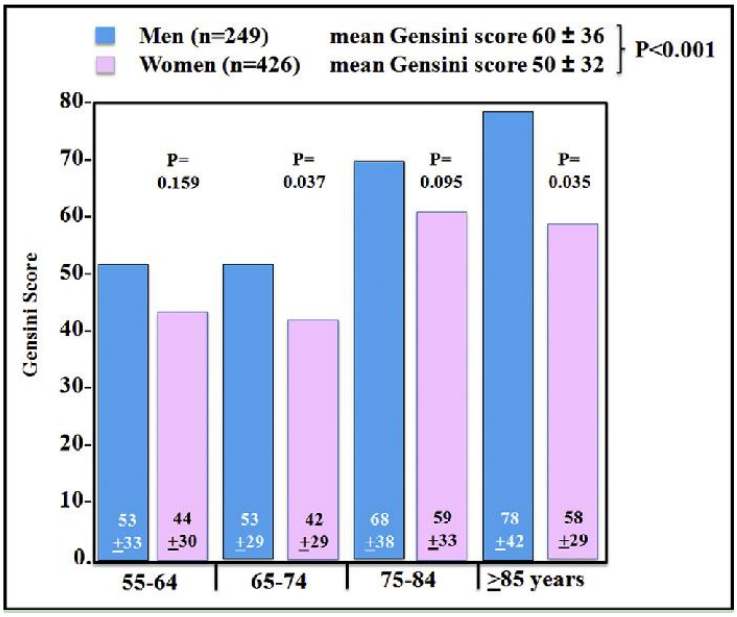

Figure 3 Correlation of Gensini score and age in men and women. CI ¼ confidence interval.

The main finding of the present study is that, at least among women with an acute coronary syndrome, the overall coronary atherosclerotic burden, as quantified by angiography, does not show any relation with age at menopause. This finding is consistent with those of the ELITE trial showing no impact of estradiol replacement therapy on coronary computed tomography measures of atherosclerosis in postmenopausal women.[25] Complementary findings show that women below and above median menopausal age of the study population shared the same distribution of the car-diovascular risk factors and prior cardiac events. Finally, women with menopausal age below the median of the study population did not have an earlier occurrence of myocardial infarction. The findings of similar coronary atherosclerotic burden and age of acute coronary syndrome occurrence should be considered separately, because the link between coronary atherosclerosis and acute coronary syndrome remain, as yet, elusive.[26]Coronary angiography has limitations for the study of atherosclerosis because it counts only angiographically evident luminal narrowings.

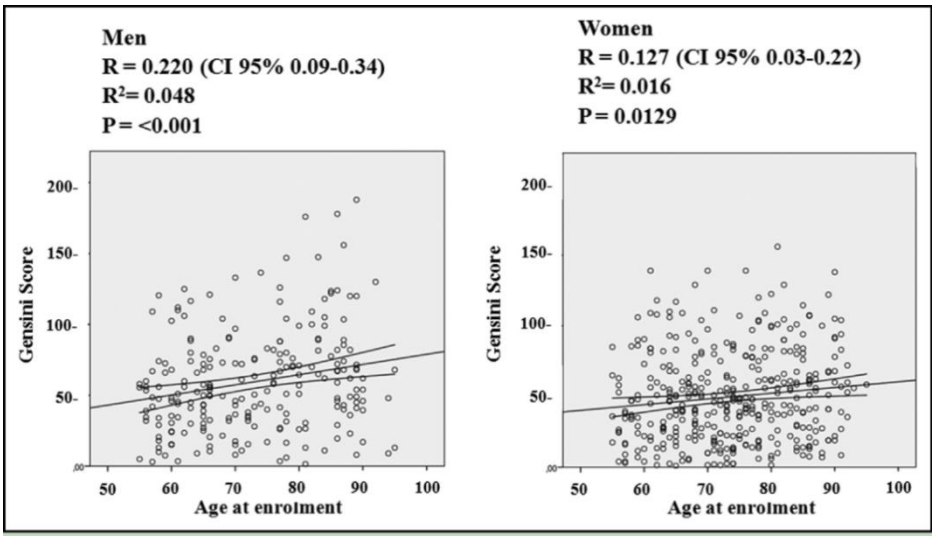

Figure 4 Correlation between Gensini score and age atmenopause in women. CI ¼ confidence interval.

Table 3 Independent Predictors of Higher Gensini Score (>75 Percentile of the Population)

Variable	Wald Chi-Squared	Odds Ratio	95% Confidence Interval	P Value
Overall population				
Ejection fraction	21.934	0.95	0.93-0.97	<.0001
Female sex	8.316	0.57	0.38-0.83	.004
ST elevation MI	6.701	1.68	1.13-2.48	.010
Women				
ST elevation MI	11.286	2.54	1.47-4.37	.001
Ejection fraction	5.259	0.97	0.94-0.99	.022
Killip class	5.082	1.53	1.06-2.22	.024

MI ¼ myocardial infarction.

Features of vascular disease more typical of women include positive remodeling, diffuse atherosclerosis, endothelial dysfunction leading to vasoconstriction, and microvascular disease, although it may be a frequent cause of angina in women, is seldom involved in the pathogenesis of myocardial infarction. A recent prospective study[27] compared the mechanisms of myocardial infarction in men and women with STEMI by using intra-coronary optical coherence tomography, and showed that the final mechanism leading to coronary thrombosis (mostly plaque rupture) is largely the same between sexes, with the exception of those rare cases of coronary dissection, most typical among women. The frequency of multi-vessel dis-ease was also identical for men and women in that study.[28]The angiographic findings of the present study may have been biased by several factors. Firstly, we have included patients with a clearly defined acute coronary syndrome and an indication to coronary angiography as recommended by current guidelines. This feature of our study limits the application of our findings to this specific population, although it represents the great majority of clinical events, including mortality. Secondly, an exaggerated coronary vasoconstriction, leading to diffuse reduction in vessel diameter and failure to discriminate chronic differences, may have biased our findings, particularly among patients with STEMI. Reduced vessel diameter in the acute phase of STEMI has been found by some investigators,[28] but not in larger studies.[29,30] Indeed, the overall Gensini score of our study population was much higher than hypothesized in the planning phase, but this fact should instead be attributed to the limited experience in using angiographic scores in an elderly population. Some inaccuracies in reporting menopausal age may have been an issue in our study, although women unable to recall their menarche and menopause were not enrolled. This was a common issue in most studies investigating the impact of menopause on subsequent outcomes, and investigating menopausal age using questionnaires.[4,19,20,31] More acceptable methods would include either menstrual calendars obtained at the time of waning ovarian function[32] or, even more precisely, by serial hormonal measurements. However, these more accurate methods would imply following a cohort of women from an early age. A study with re-administration of the menopause questionnaire 7.5 years later during follow-up in a sample of 4892 women found only 1 year's variation in the reported menopausal age.[4]these data are confirmed by studies of precision of natural menopause recall.[33-35]

V. Conclusions

The present study gives a definite answer to the original question of whether menopausal age is associated with the extent of coronary artery disease, and the answer is that it is not. Overall, even for decades after menopause, women have significantly less coronary atherosclerosis than men of comparable age. Onset of menopause at a later age is not associated with less coronary disease in the postmenopausal years, at least as it can be assessed by angiographic methods in women with an acute coronary syndrome.

Acknowledgement

We acknowledge the Cardiology department, parents who had given consent, the authority of the National Institute of Cardiovascular Diseases and Hospital and the Data collection team who has collected data successfully.

Conflict of interest: The Author has no conflict of interest.

References

[1]. Mehta LS, Beckie TM, DeVon HA, et al; on behalf of the AmericanHeart Association Cardiovascular Disease in Women and SpecialPopulations Committee of the Council on Clinical Cardiology, Councilon Epidemiology and Prevention, Council on Cardiovascular andStroke Nursing, and Council on Quality of Care and OutcomesResearch. Acute myocardial infarction in women: a scientific statementfrom the American Heart Association. Circulation. 2016; 133:916-947.

[2]. Nichols M, Townsend N, Scarborough P, Rayner M. Cardiovasculardisease in Europe 2014: epidemiological update. Eur Heart J. 2014; 35:2950-2959.

[3]. Mendelsohn ME, Karas RH. The protective effects of estrogen on thecardiovascular system. N Engl J Med. 1999; 340:1801-1811.

[4]. Van der Schouw YT, van der Graaf Y, Steyerberg EW, et al. Age atmenopause as a risk factor for cardiovascular mortality. Lancet.1996; 347:714-718.

[5]. Cooper GS, Sandler DP. Age at natural menopause and mortality. AnnEpidemiol. 1998; 8:229-235.

[6]. Jousilahti P, Vartiainen E, Tuomilehto J, Puska P. Sex, age, cardio-vascular risk factors, and coronary heart disease: a prospective follow-up study of 14 786 middle-aged men and women in Finland.Circulation. 1999; 99:1165-1172.

[7]. Brand JS, van der Schouw YT, Onland-Moret NC, et al; InterActConsortium. Age at menopause, reproductive life span, and type 2diabetes risk. Diabetes Care. 2013; 36:1012-1019.

[8]. Shaw LJ, BaireyMerz CN, Pepine CJ, et al; WISE Investigators.Insights from the NHLBI-Sponsored Women's Ischemia SyndromeEvaluation (WISE) Study: part I: gender differences in traditional andnovel risk factors, symptom evaluation, and gender-optimized diag-nostic strategies. J Am CollCardiol. 2006; 47:4S-20S.

[9]. Lerner DJ, Kannel WB. Patterns of coronary heart disease morbidityand mortality in the sexes: a 26-year follow-up of the Framinghampopulation. Am Heart J. 1986; 111:383-390.

[10]. Stangl V, Baumann G, Stangl K. Coronary atherogenic risk factors inwomen. Eur Heart J. 2002; 23:1738-1752.

[11]. Lopes RD, Alexander KP, Manoukian SV, et al. Advanced age,antithrombotic strategy, and bleeding in noneST-segment elevationacute coronary syndromes. J Am CollCardiol. 2009; 53:1021-1030.

[12]. Savonitto S, Cavallini C, Petronio AS, et al; Italian Elderly ACS TrialInvestigators. Early aggressive vs initially conservative treatment inelderly patients with non-ST-elevation acute coronary syndrome: arandomised controlled trial. JACC CardiovascInterv. 2012; 5(9):906-916.

[13]. Vaccarino V. Ischemic heart disease in women: many questions, fewfacts. CircCardiovascQual Outcomes. 2010; 3:111-115.

[14]. Thygesen K, Alpert JS, Jaffe AS, et al; Writing Group on the JointESC/ACCF/AHA/WHF Task Force for the Universal Definition ofMyocardial Infarction; ESC Committee for Practice Guidelines (CPG).Third universal definition of myocardial infarction. Eur Heart J.2012; 33:2551-2567.

[15]. Gensini GG. A more meaningful scoring system for determining theseverity of coronary heart disease. Am J Cardiol. 1983; 51:606.

[16]. Neeland IJ, Patel RS, Eshtehardi P, et al. Coronary angiographicscoring systems: An evaluation of their equivalence and validity. AmHeart J. 2012; 164:547-552.e1.

[17]. Sianos G, Morel MA, Kappetein AP, et al. The SYNTAX Score: anangiographic tool grading the complexity of coronary artery disease.EuroIntervention. 2005; 1:219-227.

[18]. The EUGenMed, Cardiovascular Clinical Study Group; Regitz-Zagrosek V, Oertelt-Prigione S, Prescott E, et al. Gender in cardio-vascular diseases: impact on clinical manifestations, management, andoutcomes. Eur Heart J. 2016; 37(1):24-34.

[19]. Hu FB, Grodstein F, Hennekens CH, et al. Age at natural menopauseand risk of cardiovascular disease. Arch Intern Med. 1999; 159:1061-1066.

[20]. Wellons M, Ouyang P, Schreiner PJ, et al. Early menopause predictsfuture coronary heart disease and stroke: the Multi-ethnic Study ofAtherosclerosis. Menopause. 2012; 19:1081-1087.

[21]. Min JK, Dunning A, Lin FY, et al; CONFIRM Investigators. Age andsex related differences in all-cause mortality risk based on coronarycomputed tomography angiography findings results from the Interna-tionalMulticentre CONFIRM (Coronary CT Angiography Evaluationfor Clinical Outcomes: An International Multicentre Registry) of 23,854 patients without known coronary artery disease. J Am Coll Car-diol. 2011; 58:849-860.

[22]. Lansky AJ, Ng VG, Maehara A, et al. Gender and the extent of cor-onary atherosclerosis, plaque composition, and clinical outcomes inacute coronary syndromes. JACC Cardiovasc Imaging. 2012; 5:S62-S72.

[23]. Berger JS, Elliott L, Gallup D, et al. Sex differences in mortalityfollowing acute coronary syndromes. JAMA. 2009; 302:874-882.

[24]. Burke AP, Farb A, Malcom G, VirmaniR.Effectof menopause onplaque morphologic characteristics in coronary atherosclerosis. AmHeart J. 2001; 141(2 Suppl):S58-S62.

[25]. Hodis HN, Mack WJ, Henderson VH, et al; ELITE Research Group.Vascular effects of early versus late postmenopausal treatment withestradiol. N Engl J Med. 2016; 374:1221-1231.
[26]. Marzilli M, Merz CN, Boden WE, et al. Obstructive coronaryatherosclerosis and ischemic heart disease: an elusive link! J Am CollCardiol. 2012; 60:951-956.
[27]. Guagliumi G, Capodanno D, Saia F, et al; OCTAVIA TrialInvestigators. Mechanisms of atherothrombosis and vascular responseto primary percutaneous coronary intervention in women versus menwith acute myocardial infarction: results of the OCTAVIA study.JACCCardiovascInterv. 2014; 7:958-968.
[28]. Sahin M, Demir S, Kocabay G, et al. Coronary vessel diameters duringand after primary percutaneous coronary artery intervention. Herz.2014; 39:515-521.
[29]. Cristea E, Stone GW, Mehran R, Kirtane AJ, Brener SJ. Changes inreference vessel diameter in ST-segment elevation myocardial infarc-tion after primary percutaneous coronary intervention: implications forappropriate stent sizing. Am Heart J. 2011; 162:173-177.
[30]. Ntalianis A, Sels JW, Davidavicius G, et al. Fractional flow reserve for theassessment of nonculprit coronary artery stenoses in patients with acutemyocardial infarction. JACC CardiovascInterv. 2010; 3:1274-1281.
[31]. Snowdon DA, Kane RL, Beeson L, et al. Is early natural menopause abiologic marker of health and aging? Am J Public Health. 1989; 79:709-714.
[32]. Soules MR, Sherman S, Parrott E, et al. Executive summary: Stages ofReproductive Aging Workshop (STRAW). FertilSteril. 2001; 76:874-878.
[33]. Colditz GA, Stampfer MJ, Willett WC, et al. Reproducibility andvalidity of self-reported menopausal status in a prospective cohortstudy. Am J Epidemiol. 1987; 126:319-325.
[34]. Hahn R, Eaker E, Rolka H. Reliability of reported age at menopause.Am J Epidemiol. 1997; 146:771-775.
[35]. Rödström K, Bengtsson C, Lissner L, Björkelund C. Reproducibility ofself-reported menopause age at the 24-year follow-up of a populationstudy of women in Goteborg, Sweden. Menopause. 2005; 12(3):275-280.

DR. Lakshman Chandra Barai. "Comparison of Angiographic Severity of Coronary Artery Disease between Premenopausal and Postmenopausal Woman with Acute Coronary Syndrome: A Study in National Institute of Cardiovascular Diseases and Hospital, Dhaka, Bangladesh". IOSR Journal of Dental and Medical Sciences (IOSR-JDMS), vol. 18, no. 5, 2019, pp 01-09.