Original Article

Severity of ischemic heart disease in relation to atherosclerotic cardiovascular risk score and individual atherosclerotic cardiovascular risk factor

*Alam MR,[1] Montaha SS.[2]

Introduction: Atherosclerotic cardiovascular disease (ASCVD) is the most common cause of ischemic heart disease that might leads to stable angina, unstable angina and myocardial infarction. The traditional risk factors for ASCVD include diabetes, hypertension, family history of premature ASCVD, Primary hypercholesterolemia, Metabolic syndrome, Chronic kidney disease, Chronic inflammatory conditions, history of premature menopause and pregnancy-associated conditions, ethnicity, Lipid biomarkers abnormalities and ankle brachial index (ABI <0.9) etc. This research was intended to identify prevailing ASCVD risk factors among the study population along with their 10 years ASCVD risk scores in relation to outcome variable like different severity of coronary artery disease.

Materials and Methods: It was a cross sectional analytic study conducted from January 2020 to June 2020 in Combined Military Hospital, Dhaka. A total 100 samples were purposefully selected for this study. The individual ASCVD risk factors and 10 years ASCVD risk scores were calculated and were compared in relation to severity of ischemic heart disease. Data were analyzed by statistical package for social science version 19(SPSS-19) and p value <.05 were considered significant.

Results: The conventional ASCVD risk factors like smoking, DM, HTN, primary hypercholesterolemia, high LDL, low HDL, high total cholesterol, chronic inflammation, metabolic syndrome and ABI were significantly related to the higher occurrences of severe ischemic heart disease. The others risk factors like age, stress in life, physical exercise and family H/O heart disease had no significant relation to the severity of ischemic heart disease. The occurrences of severe heart disease were higher in those who had intermediate or high ASCVD score than that of low ASCVD score.

Conclusion: Some traditional ASCVD risk factors and intermediate or high ASCVD score are associated with severe ischemic heart disease. However large scale study may be carried out to validate the information in Bangladesh perspective.

Introduction

Atherosclerotic cardiovascular disease (ASCVD) is the most common cause of ischemic heart disease that might leads to stable angina, unstable angina and myocardial infarction. ASCVD is the most common cause of death as well as imposes devastating effect on quality of life[1]. World health organization (WHO) has estimated 3.8 million men and 3.4 million women dies each year since 1990 due to ASCVD[1]. The stable angina is the less severe form of ischemic heart disease that results from myocardial ischemia due to fixed atheromatous stenosis of one or more coronary artery.[1] The more severe form of ischemic heart disease is unstable angina and myocardial infarction results from myocardial ischemia/necrosis due to dynamic/acute occlusion of coronary artery due to atheromatous plaque rupture/erosion with superimposed thrombosis[1]. The traditional ASCVD risk factors are the principal causal foundation and prevention domains of cardiovascular diseases. Those traditional risk factors include diabetes, hypertension, family history of premature ASCVD (males, age <55 yrs; females, age <65 yrs), Primary hypercholesterolemia (LDL-C > 189 mg/dL; non–HDL> 219mg/dL), Metabolic syndrome (increased waist circumference, elevated triglycerides >150 mg/dL, elevated blood pressure, elevated glucose, and low HDL-C), Chronic kidney disease (e GFR 15–59 mL/min/1.73 m^2 with or without albuminuria; not treated with dialysis or kidney transplantation), Chronic inflammatory conditions, such as psoriasis, rheumatoid arthritis(RA), lupus, or HIV/AIDS, history of premature menopause (before age 40 yrs) and history of pregnancy-associated conditions that increase later ASCVD risk, such as preeclampsia, High-risk race/ethnicity (e.g., South Asian ancestry), Lipids/biomarkers: associated with increased ASCVD risk is persistently elevated primary hypertriglyceridemia (≥175 mg/dL, non-fasting), elevated high-sensitivity C-reactive protein (≥2.0 mg/L), Elevated Lp(a) and ankle brachial index (ABI <0.9) etc.[2]

Authors affiliation:

1. *Md. Rabiul Alam, ADMS, 7 Infantry Division, Barishal.

2. Somaya Sidratul Montaha. Asst. Professor, Department of Obstetrics and Gynaecology. Z.H. Sikdar medical College. Dhaka

*Address of correspondence: Colonel (Dr.) Md. Rabiul Alam, ADMS, 7 Infantry Division, Barishal.

Severity of ischemic heart disease in relation to atherosclerotic cardiovascular risk score and individual atherosclerotic cardiovascular risk factor

The ASCVD risk score is to be calculated using different individual risk factors and score predicts individual coronary events in next 10 years. The ASCVD risk is said to be low when the score is less than 5%, borderline when the score is between 5%-7.4%, intermediate when the score is between 7.5%-19.9% and high risk when the score is more than 20%.[3,4]

All individual having potential future risk of ASCVD might need assessment of individual's 10 years absolute risk of ASCVD that can be used for the plan of intensity of intervention specially those who are at moderate to high risk; at the same time, maximize the benefit and reducing the risk of harm of over treatment. The internationally accepted different validated tools are being used to estimates 10 years ASCVD risk based on available traditional risk factors. This research was intended to identify prevailing ASCVD risk factors among the study population along with their 10 years ASCVD risk scores in relation to outcome variable like different severity of coronary artery disease.

Material and Methods: It was a cross sectional analytic study which was conducted in Combined Military Hospital, Dhaka. The enrollment period of study was from January 2020 to June 2020 where all the ACS admitted patients except unwilling cases, primary PCI and past CABG were included. A total 100 samples were purposefully selected for this study. The individual ASCVD risk factors were collected by questionnaires and from investigation reports. The 10 years ASCVD risk scores were calculated by using on line ASCVD risk calculator plus software provided by American College of Cardiology. Data were analyzed by statistical package for social science version 19(SPSS-19). All tests were two sided and $p<0.05$ were considered significant. The trend for the association between severity of ACS and categorical risk factors were tested with the chi-square test. Descriptive statistics (Mean, standard deviations, skewness and kurtosis) were also used to analysis the results.

Results

Table 1 : Frequency distribution of different severity of ischemic heart disease and ASCVD Score (n=100).

Ser. no	Total no (%)	ASCVD Score				Remarks
		High	**Intermediate**	**Borderline**	**Low**	
SA	51(51)	3	48	-	-	
UA	28(28)	26	2	-	-	
MI	21(21)	9	12	-	-	

Table 1 showing the different severity of ischemic heart disease as per severity in which 51% (n=51) participants had stable angina(SA) among those 3 patients had high ASCVD risk score and 48 patients had intermediate ASCVD risk score; 28% (n=28) participants had myocardial infarction (MI) among them 26 patients had high ASCVD risk score and 2 of them had intermediate ASCVD risk score; 21% (n=21) participants developed unstable angina(UA) among them 9 patients had high ASCVD risk score and rest 12 had intermediate ASCVD risk score.

Table 2: Frequency distribution of different ASCVD risk variables in relation to severe ischemic of heart disease (UA and MI) and non-severe heart disease (SA) (n=100).

Variable		NOs	Severe heart disease (UA+MI)	Non severe heart disease (SA)	OR	P value
Age	≥ 50 years	39	20	19	.861	.718
	< 50 years	61	29	32		
Cigarette per day	Smoker	41	25	16	2.279	.046
	Non smoker	59	24	35		
Family H/O Heart disease	Was Present	22	13	09	1.685	.288
	Was not	78	36	42		
DM	Present	63	47	16	51.406	.000
	Not present	37	2	35		
HTN	Present	73	44	29	6.676	.000
	Not present	27	5	22		
Stressed in life	Present	63	30	33	.861	.722
	Absent	37	19	18		
Regular physical exercise	yes	45	20	25	.717	.415
	No	55	29	26		
Primary hypercholesterolemia	Yes	49	32	17	3.765	.001
	No	51	17	34		
LDL	High	48	40	8	23.889	.000
	Normal	52	9	43		
HDL	Low	27	19	8	3.404	.009
	Normal	73	30	43		
Metabolic Syndrome	Present	69	40	29	3.372	.007
	Not present	31	09	22		
Chronic Kidney Disease	Present	-	-	-	-	-
	Absent	100	49	51		
Chronic Inflammatory	Present	07	07	-	1.167	.005
	Absent	93	42	51		
Total Cholesterol	High	58	46	12	49.833	.000
	Normal	42	3	39		

Table 2 showing different ASCVD risk variables, their odd ratio and p-values in relation to different severity ischemic heart diseases. Among all the participants (100 cases), the different ASCVD risk factors were analyzed and compared variable wise different severity of heart diseases. The table II showing that age factor, family history of heart disease, life stress and regular physical exercise was not significantly differ in the causation of severe heart disease than non-severe heart disease(p not significant and OR is less than 1). On the other hand, other ASCVD risk variables like cigarette smoking, diabetes, hypertension, hypercholesterolemia, metabolic syndrome and chronic inflammation were statistically significant in the causation of severe heart diseases (p less than .05 and OR more than 1) than that of non-severe heart disease.

Severity of ischemic heart disease in relation to atherosclerotic cardiovascular risk score and individual atherosclerotic cardiovascular risk factor

Table 3: Distribution of Different Variables related to ASCVD (n=100)

Variable		Total no	Intermediate ASCVD risk scores	High ASCVD risk scores	OR	P value
Age	≥ 50 years	39	24	15	1.038	0.931
	<50 years	61	37	24		
Smoker	Smoker	41	20	21	2.292	0.037
	Non smoker	59	41	18		
Family H/O Heart disease	Was Present	22	10	12	0.868	0.092
	Was not present	78	51	27		
DM	Present	63	28	35	10.313	0.000
	Not present	37	33	4		
HTN	Present	73	40	33	2.888	0.037
	Not present	27	21	6		
Stress in life	Present	63	37	26	1.297	0.548
	Absent	37	24	13		
Regular physical exercise	yes	45	28	17	0.911	0.823
	No	55	33	22		
Primary hypercholesterolemia	Yes	49	23	26	3.304	0.004
	No	51	38	13		
LDL	High	48	19	29	6.411	0.000
	Normal	52	42	10		
HDL	Low	27	13	14	2.068	0.111
	Normal	73	48	25		
Metabolic Syndrome	Present	69	35	34	5.051	0.001
	Not present	31	26	5		
Chronic Kidney Disease	Present	-	-	-	-	-
	Absent	100	61	39		
Chronic Inflammatory condition	Present	7	4	3	1.188	0.830
	Absent	93	57	36		
Total Cholesterol	High	58	24	34	10.483	0.000
	Normal	42	37	5		

Table 3 showing different ASCVD risk variables, their odd ratio and p-values in relation to ASCVD risk score. The table showing that the age, family history of heart disease, stress in life, regular physical exercise, HDL cholesterol and chronic inflammatory conditions has no statistically significant effects in relation to the severity of heart disease(p>.05 and OR more than 1). On the other hand, smoking, DM, hypertension, primary hypercholesterolemia, LDL cholesterol, metabolic syndrome and total cholesterol has significant effects in relation to severity of heart disease (p<.05 and OR less than 1)

Table 4: Distribution of Different Variables accordins fo severity and anociation. (n=100)

Intermediate		ASCVD risk scores		Total	P-value	OR
		High				
SA	Number	48	3	51	0.000	44.308
	%	94.1%	5.9%	100%		
UA and MI	Number	13	36	49		
	%	26.5%	73.5%	100%		
Total	Number	61	39	100		
	%	61.0%	39.0%	100%		

Table 4 showing frequency distribution of different severity of heart disease in relation to ASCVD score, p value and OR. Table shows that among 51 participants developed stable angina (Non severe heart disease), 48 participants had an intermediate ASCVD score and 3 had high ASCVD score. Among 49 participants who developed unstable angina and myocardial infarction (Severe heart disease), among them 13 had intermediate ASCVD score and 36 had a high ASCVD score. The difference of occurrence of non severe heart disease (SA) and severe heart disease (UA&MI) in relation to ASCVD score is statistically significant (p=.000, OR=44.308)

Discussion

Many previous surveys on ACS all over the globe unveiled conventional ASCVD risk factors were the vital domains for both principal foundation and prevention of cardiovascular diseases. In this study, the conventional risk factors of coronary artery disease were considered to find out the statistical relationship, along with the level of significance in relation to different severity of coronary artery disease.

Smoking as risk factors was analyzed and found that it is related significantly in the causation of severe heart disease. This study is similar and consistent with an Italian study done by Cristina Bosetti, E Negriet al. where cigarette smoking was associated with higher rates of severe ischemic heart disease (MI) with OR=3.3.[5] This study is also consistent with the study done by A. Rosengren, L Wallentin, et al. that revealed severe heart disease (MI) is strongly associated with smoking.[6]

In this study, severity of heart disease in relation with DM was statistically significant.(p=0.000, OR= 51.460). Another study done by Rana JS, Liu JY, et al. that revealed Diabetes alone was not a significant higher risk for severe coronary heart disease. (OR=1.7)[10]. The study conducted by A. Rosengren, L Wallentin, et al. that revealed that diabetes alone might induce less ST elevated MI. [6]

The severity of heart disease in relation with HTN was statistically significant (p=.000, OR=6.676). The study conducted by A. Rosengren, L Wallentin, et al. that revealed that HTN might inversely related to ST elevated MI. [6] . This study is not consistent with the study done by A. Rosengren, L Wallentin et al.

Primary hypercholesterolemia was strongly significant to cause severe heart disease.(p= .001, OR= 3.765). The study conducted by Majken K. Jensen, Stephanie et al. on Obesity, Behavioral Lifestyle Factors, and Risk of Acute Coronary Events revealed that primary hyperlipidemia is positively correlated with severe ischemic heart disease. (HR=1.76 in normal body weight person and HR=3.23 in obese person). This study is consistent with Majken K. Jensen, Stephanie et al. studies. [7]

The severity of ischemic heart disease in relation to metabolic syndrome was statistically highly significant. (P=.007,OR= 3.372). A study done by Jassim Al Suwaidi,

Mohammad Zubaid, et al revealed the significant relationship of metabolic syndrome with severe ischemic heart disease(p=.001)[8] . This study is consistent with the study done by Jassim Al Suwaidi, Mohammad Zubaid, et al.

The ABI index in relation to severity of ischemic heart disease was statistically significant (p<. 05). The Study done by Zhi-Jie Zheng, A Richey Shrrettet et al. revealed that ABI index <.90 were four times as likely to have severe heart disease , stroke/TIA as those with ABI>0.90.[9]

The rest other ASCVD risk factors like age, family H/O heart disease, life stress and regular physical exercise were not statistically significant effect on the occurrence of severe heart disease in this study. This observation might require further study to validate the cause effect relationship.

The study also revealed the occurrences of severe heart disease were higher in those who had intermediate or high ASCVD score than that of low ASCVD score. The difference of occurrence of non severe heart disease (SA) and severe heart disease (UA&MI) in relation to ASCVD score is statistically significant (p=.000, OR=44.308)

Conclusion

This research was intended to find out the differences of occurrences of severe and non-severe ischemic heart disease in relation to conventional ASCVD risk factors and ASCVD risk score. The study revealed that among the conventional risk factors; smoking, DM, HTN, primary hypercholesterolemia, high LDL, low HDL, high total cholesterol, chronic inflammation, metabolic syndrome and ABI were significantly related to the higher occurrences of severe ischemic heart disease. The other conventional risk factors like age, stress in life, physical exercise and family H/O heart disease had no significant relation to the severity of ischemic heart disease.

References

1. Raistan SH, Penman ID, Strachan MWJ & Hobson RP. Davidson's principles and Practices of Medicine. 23rd Edition, Elsevier, London 2018.

2. Grundy SM, Stone NJ, Bailey AL, et al. 2018 AHA/ACC/AACVPR/AAPA/ABC/ACPM/ ADA/AGS/APhA/ ASPC/NLA/PCNA guideline on the management of blood cholesterol: a report of the American College of Cardiology/American Heart Association Task Force on Clinical Practice Guidelines. J Am Coll Cardiol. 2018 Nov 10.

3. American College of Cardiology, American Heart Association. ASCVD Risk Estimator. Available at: https://tools.acc.org/ldl/ascvd_risk_ estimator/index. html #!/calculate /estimator. Accessed September 21, 2018.

4. Goff DC Jr, Lloyd-Jones DM, Bennett G, et al.

2013 ACC/AHA guideline on the assessment of cardiovascular risk: a report of the American College of Cardiology/American Heart Association Task Force on Practice Guidelines. J Am Coll Cardiol. 2014;63:2935– 59.

5. Bosetti C, Negriet E al. Smoking and acute myocardial infractionamong women and men: a case control study in Italy. Elsevier preventive medicine.V-29, issue-5, Nov 1999. 343-348

6. Rosengren A, Wallentin L, A KG, Behar S, Battler A, Hasdai D. Sex, age, and clinical presentation of acute coronary syndromes. Eur Heart J 2004;25:663-670.

7. Majken K. Jensen, Stephanie et al..Obesity, Behavioral Lifestyle Factors, and Risk of Acute Coronary Events.http://circ.ahajournals.org/content/117/24/3062

8. Jassim AlS, Mohammad Z, et al. Prevalence of the Metabolic Syndrome in Patients With Acute Coronary Syndrome in Six Middle Eastern Countries. The journal of clinical hypertension. vol. 12 no. 11 November 2010

9. Zhi-JieZheng, A Richey Sharrettet al.."Associations of ankle-brachial index with clinical coronary heart disease, stroke and preclinical carotid and popliteal atherosclerosis: the Atherosclerosis Risk in Communities (ARIC) Study "Elsevier ;Volume 131, Issue 1, May 1997, Pages 115-125

10. Rana JS, Liu JY, Moffet HH, et al. Diabetes and prior coronary heart disease are not necessarily risk equivalent for future coronary heart disease events. J Gen Intern Med. 2016; v-31:387-93