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Brief Article

Comparison of serum homocysteine level in young and middle-aged adult patients with coronary artery disease

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Abstract

Deaths due to coronary artery disease have been increasing in young people aged <40. Studies have reported an association between these deaths with hyperhomocysteinemia. The aim of this study was to compare serum homocysteine levels in middle-aged patients with coronary artery disease. This cross-sectional study was conducted among 52 cardiology inpatients of Bangabandhu Sheikh Mujib Medical University, Dhaka, from March 2021 to February 2022. Among them, 26 were young adults (<40 years, Group I), and 26 were middle-aged (≥40 years, Group II). Serum homocysteine was measured in all of them using an automated immunoassay analyzer. The younger patients had higher (*P*=0.001) median homocysteine (interquartile range) level, 13.5 (7.7 –28.4 mmol/L) compared to the middle-aged group, 10.0 (5.9 – 38.5 mmol/L). The hyperhomocysteinemia (>15 mmol/L) was 16.2% in Group I compared to 12.4% in Group II (*P*=0.001). Therefore, control measures for keeping homocysteine levels within the normal range in young people might be useful.

Keywords: Serum homocysteine, Coronary artery disease, Young adults

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Introduction

Coronary artery disease (CAD) is one of the leading causes of death in the world[1]. It is more diffuse and aggressive, although it strikes at a younger age [2]. In Bangladesh, CAD is one of the leading causes of death in persons over the age of 40 and even in those under 40[3]. According to a recent study, the risk of CAD is higher in the younger population[4]. The prevalence of coronary artery disease in Bangladesh in men (4.6%, 1.3% to 7.9%) was almost twice that in women (2.7%, 0.8% to 4.6%)[5]. Some modifiable risk factors are linked to coronary artery disease like hypertension, dyslipidemia, smoking, diabetes, obesity, lack of physical activity, an unhealthy diet, stress, and hyperhomocysteinemia[6].

Homocysteine is a sulfhydryl containing amino acid[7]. Hyperhomocysteinemia causes endothelial cell damage, smooth muscle cell hyperplasia and vascular

occlusion, all of which contribute to atherosclerosis[8]. About half of patients with untreated hyperhomocysteinemia develop the cardiovascular disease before the age of 30[7]. Hyperhomocysteinemia has been shown in several studies to be an atherosclerotic promoter[9]. Empirical studies showed that homocysteine is a risk factor for coronary artery disease[10].

CAD can be modified through diet and exercise[11]. Treatment with folic acid and vitamin B12 can lower total homocysteine levels while also improving vascular endothelial function[11]. Though age is the most important risk factor of CAD, it is becoming more common in young adults[12]. In Asia, 12-16% of CAD patients are young, and about 25% of heart attacks occur under the age of 40 years. Younger patients have distinct coronary risk factors than older patients: smoking, an elevated body mass index, lack of physical activity, and a family history of CAD are major features in them.[13]

Studies from several countries reported a link between hyperhomocysteinemia and CAD in young patients.[14] A high homocysteine level increases the risk of future CADs. Modification of this at an early age may help young patients with CAD[12]. This research was done to determine whether high homocysteine levels are associated with CAD in young patients with CAD.

Methods

This cross-sectional study was conducted among the cardiology in-patient department of BSMMU, Dhaka, from March 2021 to February 2022. A total of 52 clinically diagnosed young and adult coronary artery disease patients were selected for the study after clearance of the Institutional Review Board (No. BSMMU/2021/7309). Among them, 26 were young adults (<40, group I) and 26 were middle-aged adults (≥40, group II) according to age. The diagnosis was confirmed by electrocardiography, echocardiography, and coronary angiography. The exclusion included a history of renal failure, hepatic failure, malignancy, myocarditis, infective endocarditis, and vitamin B_{12} or folate supplementation within three months. After selection, informed written consent was obtained from each patient. Then, a history was taken, relevant clinical examination was performed by residents of Cardiology, and data were recorded in a pre-designed structured data collection sheet. Two mililitre of fasting venous blood samples were drawn for measurement of serum homocysteine. It was assessed by the Alinity ci immunoassay autoanalyzer (Abbott Diagnostics, USA) by the principle of chemiluminescent microparticle immunoassay (CMIA) with Alinity i homocysteine reagent kit in the Department of Biochemistry and Molecular Biology.

Statistical analysis was done using SPSS version 26. The main values were calculated for continuous variables. The Association of hyperhomocysteinemia (>15 mmol/L) and other categorical variables between groups was determined by Fisher's Exact test. The Mann- Whitney U test was used to compare serum homocysteine between young and middle age adults CAD patients.

Results

Almost 8 in 10 patients were men (**Table 1**). Smoking (*P*= 0.027) was higher in group I than in group II , but diabetes (*P*=0.012) was higher in group II. Hypertension, family history of coronary artery disease, dyslipidemia, and obesity were similar between groups (*P*>0.2). The hyperhomocysteinemia (>15 mmol/L) was 16.2% in Group I compared to 12.4% in Group II (P=0.001). Younger patients had significantly higher (*P*=0.001) median level of homocysteine (13.5 mmol/L) compared to the middle-aged group (10.0 mmol/L) as depicted in **Figure 1**.

TABLE 1 Risk factors distribution in young and middle-aged adults with coronary artery disease

Risk factors	Group I (Young adults) < 40 years		Group II (Middle-aged) ≥ 40 years		*P* (X^2 test)
	n=26	%	n=26	%	
Male sex	20	76.9	22	84.6	0.48
Smoking	17	65.4	9	34.6	0.03
Diabetes mellitus	7	26.9	16	61.5	0.01
Hypertension	16	61.5	20	76.9	0.23
Family history of coronary artery disease	14	53.8	12	46.2	0.58
Dyslipidemia	12	46.2	14	53.8	0.58
Obesity	14	53.8	11	42.3	0.41
Hyperhomocysteinemia, >15 mmol/L	26	16.2	26	12.4	0.001

Obesity indicates body mass index ≥30 kg/meter squared; diabetes, plasma glucose ≥7.0 mmol/L or medication; dyslipidemia, triglycerides ≥150 mg/dL; hypertension, blood pressure ≥140/90 mmHg or medication.

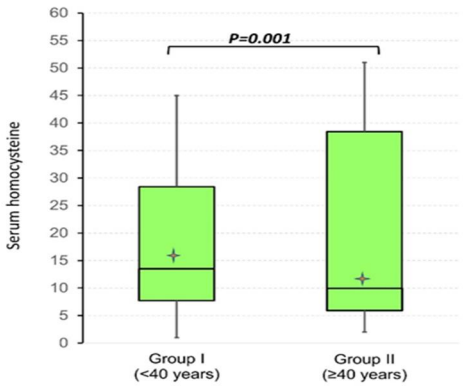

FIGURE 1 Serum homocysteine level in young and middle-aged patients with coronary artery diseases (n=52)

Discussion

This cross-sectional study conducted in Bangabandhu Sheikh Mujib Medical University, Dhaka, observed a significant difference of serum homocysteine levels between young (<40 years) and middle-aged (≥40 years) adults with CAD.

Prevalence of traditional risk factors such as smoking, hypertension, diabetes mellitus, dyslipidemia, family history of CAD and obesity were more prevalent in young patients with CAD. In this study, other risk factors like hypertension, dyslipidemia were higher in middle aged adult than young (76.9% vs. 61.5%) and (53.8% vs. 46.2%), respectively. Family history of CAD and obesity were higher in young than middle-aged adult (53.8% vs. 46.2%) and (53.8% vs. 42.3%) but not statistically significant.

In present study, that mean±SD serum homocysteine level was 16.02±6.42 µmol/L in young, 12.04±7.33 µmol/L in middle aged adult groups. The mean±SD serum homocysteine level was significantly (P=0.001) higher in young than middle aged adult group. Pardesi et al., (2020) observed that higher serum homocysteine level in young than middle aged adult group (78.7±40.94 µmol/L vs. 9.5±3.10 µmol/L) which is statistically significant (P=0.05)[15]. They also reported higher serum homocysteine level was 16.36±7.8 µmol/L in young and 11.7±5.6µmol/L in middle aged adult group (P=0.001).

It was observed that young patients with coronary artery disease had a raised serum homocysteine level than middle aged adult. High level of homocysteine causes proliferation and thickening of smooth muscle cell in blood vessel, oxidative stress and endothelial dysfunction which can lead to coronary artery disease. Young coronary artery disease patients have higher incidences of tobacco use, obesity and increase healthy lifestyle risk factors such as inactivity and alcohol intake. Compared with older patients, where coronary artery disease is prevalent among men and women, young coronary artery disease patients are more likely to be man. Evaluation of serum homocysteine level is significantly associated with the CAD. Therefore, present study may help in disease evaluation of early coronary artery disease in young.

Limitations

The study had some limitations. The sample size of the was small for having a multivariate analysis. The study did not have a healthy control group for a stringent analysis. The study population was selected from one tertiary hospital in Dhaka city. Therefore, the sample may not represent the Bangladeshi population at large.

Conclusion

Serum homocysteine level is significantly higher in young patients with CAD than in middle-aged patients. Therefore, keeping homocysteine levels normal in young people might be important for preventing CAD at a younger age. Studies with enough power for multivariate analysis are necessary.

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Author Contribution

Begum R conceived idea and wrote the manuscript. Islam MS and Khaled MFI were developed the protocol and the manual of the procedure. Bhuiyan MMA, Yesmin MS, Sultana T, and Rahman MQ provided personal, environmental and financial support, tools and instruments that are vital for the project. Rahim KA, Paul D, and Ferdousi S collected the data and analyzed and interpreted them critically. All authors reviewed and approved the final manuscript.

Conflict of Interest

Authors declare no conflict of interest.

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References

1. Chakrabarty U, Datta S, Mukherjee P. Correlation of novel risk factors with syntax score in young and elderly males with coronary artery disease. Journal of Medical Science and Clinical Research 2020;8:388-93; doi: 10.18535/jmscr/v8i1.59
2. Klein LW, Agarwal JB, Herlich MB, Leary TM, Helfant RH. Prognosis of symptomatic coronary artery disease in young adults aged 40 years or less. The American Journal of Cardiology 1987;60 (16):1269-72. doi: 10.1016/0002-9149(87)90606-0
3. Fournier JA, Sanchez A, Quero J, Fernandez-Cortacero JA, González-Barrero A. Myocardial infarction in men aged 40 years or less: A prospective clinical-angiographic study. Clinical Cardiology 1996;19(8):631-6. doi: 10.1002/clc.4960190809
4. Islam AM, Majumder AA. Coronary artery disease in Bangladesh: A review. Indian Heart Journal 2013;65(4):424-35. doi: 10.1016/j.ihj.2013.06.004
5. Zaman MM, Ahmed J, Choudhury SR, Numan SM, Parvin K, Islam MS. Prevalence of ischemic heart disease in a rural population of Bangladesh. Indian Heart J 2007;59(3):239-41. doi: 10.2337/dc06-0431
6. Puri A, Gupta OK, Dwivedi RN, Bharadwaj RP, Narain VS, Singh S. Homocysteine and lipid levels in young patients with coronary artery disease. J Assoc Physicians India 2003;51:681-5. doi: 10.18535/jmscr/v5i9.122
7. Faeh D, Chiolero A, Paccaud F. Homocysteine as a risk factor for cardiovascular disease: Should we (still) worry about it?. Swiss Medical Weekly 2006;136(47-48):745-56. doi: 10.4414/smw.2006.11283
8. Zhang S, Bai YY, Luo LM, Xiao WK, Wu HM, Ye P. Association between serum homocysteine and arterial stiffness in elderly: A community-based study. Journal of Geriatric Cardiology 2014;11 (1):32. doi: 10.1111/j.1365-2362.2011.02481.x
9. Shenoy V, Mehendale V, Prabhu K, Shetty R, Rao P. Correlation of serum homocysteine levels with the severity of coronary artery disease. Indian Journal of Clinical Biochemistry 2014;29(3):339-44. doi: 10.1007/s12291-013-0373-5
10. Pang X, Liu J, Zhao J, Mao J, Zhang X, Feng L, Han C, Li M, Wang S, Wu D. Homocysteine induces the expression of C-reactive protein via NMDAr-ROS-MAPK-NF-κB signal pathway in rat vascular smooth muscle cells. Atherosclerosis 2014;236(1):73 -81. doi: 10.1016/j.atherosclerosis.2014.06.021
11. Liu Y, Tian T, Zhang H, Gao L, Zhou X. The effect of homocysteine-lowering therapy with folic acid on flow-mediated vasodilation in patients with coronary artery disease: A meta-analysis of randomized controlled trials. Atherosclerosis 2014;235(1):31-5. doi: 10.1016/j.atherosclerosis.2014.03.032
12. Kumar V, Kumar T, Sharma AK, Nath RK, Sharma LK, Pandit N, Raj A, Pandit BN. Risk factors, clinical presentation, angiographic profile and 30-day outcomes of young patients (aged≤ 35 Years) with ST-elevation myocardial infarction. Advances in Human Biology 2021;11(2):188. doi: 10.4103/aihb.aihb_125_20
13. Bush N, Sharma YP, Prasad K, Kumar P, Mehrotra S. Comparison of demographic profile, risk factors, and in-hospital outcome in young and old patients with acute coronary syndrome: A single-center experience. Journal of Family Medicine and Primary Care 2021;10(2):871. doi: 10.4103/jfmpc.jfmpc_1975_20
14. Veeranna V, Zalawadiya SK, Niraj A, Pradhan J, Ference B, Burack RC, Jacob S, Afonso L. Homocysteine and reclassification of cardiovascular disease risk. Journal of the American College of Cardiology 2011;58(10):1025-33. doi: 10.1016/j.jacc.2011.05.028
15. Pardesi AT, Patil DP, Jadav NB, Kulkarni P, John D. Plasma homocysteine concentration in acute coronary syndromes. Jpn Heart J 2020;12(18):14-19. doi: 10.31782/ijcrr.2020.121814