



Risk of Diabetes Mellitus in Carotid Artery Involvement among Coronary Artery Disease Patients including History of Infection and Antibiotics Uses

AKM Mustafizur Rahman¹, Farzana Sharmin², Mujammel Haque³, Kaspia Khan⁴,
Mohammad Nazmul Karim⁵

¹Program Officer, beyond 330 and Clinics (Toronto District School Board), Ontario, Canada; ²Assistant Professor, Department Obstetrics and Gynecology, Bangabandhu Sheikh Mujib Medical University, Dhaka, Bangladesh; ³Associate Professor, Department of Pediatrics, Bangabandhu Sheikh Mujib Medical University, Dhaka, Bangladesh; ⁴Registered Practical Nurse, Toronto public health, Toronto, Ontario, Canada; ⁵Sight and Sound Clinic Coordinator, Toronto Foundation for Student Success (TFSS), Oshawa, Ontario, Canada

Abstract

Background: Diabetes mellitus causes involvement of coronary artery diseases. **Objective:** The purpose of the present study was to determine the risk of diabetes mellitus in the involvement of carotid artery among coronary artery disease patients. **Methodology:** This case-control study was conducted in the Department of Cardiology at Bangabandhu Sheikh Mujib Medical University, Dhaka, Bangladesh from July 2013 to June 2015 for a period of two years. Patients who had coronary artery diseases or ischemic heart diseases and diabetes mellitus undergoing coronary angiography were selected as case of this study. In control group, age, sex match patients of IHD undergoing CAG not having DM were included. Every patient was clinically examined by detailed history and physical examination during entry into study. ECG, chest X-ray, echocardiogram, blood sugar (fasting), blood 2 hrs. after 75 gm of glucose and or breakfast were analyzed. Coronary angiography was done in all patients through femoral approach by modified Seldinger technique. Carotid arteriography was performed selective and non-selective method by Hunter head or right Judkin's catheter in standard AP, lateral and oblique views. **Results:** A total number of 100 patients were included in this study. Of them 50 patients were coronary artery disease with diabetes mellitus and another 50 patients were coronary artery disease without diabetes mellitus. The mean height of the DM was 163.4±8.5 cm and in NDM was 160.6±7.1 cm, mean weight of DM 63.5±7.2 kg, in NDM was 62.0±15.4 kg and mean BMI in DM was 26.24±2.36 kg/m² and in NDM was 26.38±2.05 kg/m². The mean total cholesterol in DM was 236.9±34.1 mg/dL and in NDM was 208.0±36.4 mg/dL, mean serum TG in DM 240.5±76.3 mg/dl and in NDM was 207.6±57.8 mg/dl and mean serum IDL in DM was 166.1±130.6 mg/dL and in NDM was 142.8±30.4 mg/dL, no significant mean difference was observed between DM and NDM in height, weight and BMI (P>0.05). **Conclusion:** In conclusion, significant mean difference is observed between DM and NDM in total cholesterol, serum triglycerides.

Keywords: Risk assessment; diabetes mellitus; carotid artery; coronary artery disease

Bangladesh Journal of Medical Microbiology, July 2023; 17 (2):82-87

Introduction

Stroke is the third leading cause of death in worldwide. In United States, causing 167,661 deaths¹. Overall,

approximately 700,000 people will experience either an initial or recurrent stroke each year, with approximately 40,000 more women than men suffering a stroke each year². Ischemic strokes, which are closely related to vascular stenosis, account for 88 percent of all strokes and in addition to the acute clinical and financial consequence there are significant long term effects related to stroke³. Stroke is the number one cause of long term disability with 20.0%

Correspondence: Dr. AKM Mustafizur Rahman, Program Officer, beyond 330 and Clinics (Toronto District School Board), Ontario, Canada; Email: mustafizur.rahman@tfss.ca; ORCID: <https://orcid.org/0000-0001-8453-711X>
©Authors 2023. CC-BY-NC
DOI: 10.3329/bjmm.v17i2.69525

of victims needing institutional care 3 months after the event⁴. Further nearly a quarter of all stroke patients will die within 1 Year following the event, and this number is even higher for those who are above age 65 years⁵.

Epidemiological studies have documented that individuals with clinical cardiovascular disease related to one specific peripheral vascular bed are at a higher risk of clinical disease caused by atherosclerosis at another site, such as the brain⁶. Furthermore, because of the systemic nature of atherosclerosis, the presence of subclinical markers in subjects without evidence of clinical carotid disease associated with a significant increased risk of incidence of carotid disease for both men and women⁷.

Carotid artery involvement in patients with coronary artery disease (CAD) is expected⁸. Patients with carotid artery disease and CAD form a high-risk group and controversy still exists regarding their optimal management. These patients are at risk of major neurological events in the peri and post-operative period of interventional procedure. Hence, preoperative and pre-interventional diagnosis and management of carotid artery disease is important. Surgical endarterectomy has been shown to be superior to medical management in the treatment of critical carotid artery disease⁹. Carotid artery stenting has proved to be a feasible, safe and effective alternative method of treatment for carotid artery disease. The results of carotid artery interventions are comparable to carotid endarterectomy, both on periprocedural and on late follow-up¹⁰. The purpose of the present study was to determine the risk of diabetes mellitus in the involvement of carotid artery among coronary artery disease patients.

Methodology

Study Design and Population: This case-control study was conducted in the Department of Cardiology at Bangabandhu Sheikh Mujib Medical University, Dhaka, Bangladesh. The study was carried out from July 2013 to June 2015 for a period of two years. Patients who had coronary artery diseases or ischemic heart diseases and diabetes mellitus undergoing coronary angiography were selected as case of this study. In control group, age, sex match patients of IHD undergoing CAG not having DM were included. There were several inclusion criteria. Patients suffering from IHD with diabetes mellitus and undergoing CAG were taken as cases. Both sexes are included. Any age of patients suffering from IHD with DM and undergoing

CAG. Exclusion Criteria were patients undergoing CAG without IHD with diabetes mellitus, Patients having previous CVA and TIA, Patients previously underwent carotid endarterectomy or angioplasty or stenting or patients previously underwent CABG or angioplasty.

Study Procedure: Informed consents was taken from all patients included in this study. History and clinical examination findings was recorded in pre-designed proforma. Clinical Evaluation were performed thoroughly. Every patient was clinically examined by detailed history and physical examination during entry into study. The signs and symptoms of the patients were carefully evaluated. Any chest pain, palpitation, shortness of breath was noted. During physical examination, emphasis was given on pulse, blood pressure, and jugular venous pressure, carotid pulse, carotid bruit. Detail drug treatment was recorded.

Laboratory Procedure: ECG, chest X-ray, echocardiogram, blood sugar (fasting), blood 2 hrs. after 75gm of glucose and or breakfast, lipid profile, blood urea and creatinine complete blood count, B.T, C.T platelet count, HBSAg, VDRL were analyzed and also documented. Coronary angiography was done in all patients through femoral approach by modified Seldinger technique. Left and right Judkins' catheter were used to perform coronary angiography. Ionic/nonionic dye was used. Multiple angled views with cranial and caudal angulation were taken to separate branches of left anterior descending (LAD). Left circumflex (LCx) and right coronary arteries. Left ventricular angiography was done in right anterior oblique (RAO) view in all patients and left ventricular ejection fraction and left ventricular end-diastolic pressure (LVEDP) was measured in both the groups. Carotid arteriography was performed selective and non-selective method by Hunter head or right Judkin's catheter in standard AP, lateral and oblique views.

Statistical Analysis: The collected data were checked and coded manually and then entered into computer. The numerical data obtained from the study were analyzed and significance of difference was estimated by using the statistical methods. Data were expressed in frequency, percentage, mean and standard deviation as applicable. Comparison between groups was done by unpaired student's t test, chi-square test, and test as applicable. Analysis of data was done by using computer based SPSS program (version 11.5). Probability less than 0.05 was considered as significant.

Ethical Consideration: All procedures of the present

study were carried out in accordance with the principles for human investigations (i.e., Helsinki Declaration) and also with the ethical guidelines of the Institutional research ethics. Formal ethics approval was granted by the local ethics committee. Participants in the study were informed about the procedure and purpose of the study and confidentiality of information provided. All participants consented willingly to be a part of the study during the data collection periods. All data were collected anonymously and were analyzed using the coding system.

Results

Total 100 patients were included in this study. Of them 50 patients were coronary artery disease with diabetes mellitus and another 50 patients were coronary artery disease without diabetes mellitus. The mean age was found 57.48 years with 6.04 standard deviation (SD) in DM and 55.64 years with 6.34 standard deviation in NDM group and also 56.56 years with 6.49 standard deviation in the whole study population. The value of unpaired t-test was 0.158 and it was insignificant ($p>0.05$). Therefore, there was no age difference in both groups (Table 1).

It was found among male subjects, 86% and 84.0% were DM and NDM respectively whereas 14% female

had DM and 16% had NDM. The difference was statistically insignificant ($p>0.05$) in chi square test (Table 2).

The prevalence of risk factors in both DM and NDM were assessed. hypertension, dyslipidemia, smoking and family history were considered to be the major risk factors for this study. No significant association was observed between DM and NDM group in the selected risk factors. Again, history of uses of antibiotics were also taken and it was found that there was no statistically significant relationship between the case and control group. History of infection was also found in both case and control group which was not statistically significant (Table 3).

The mean height of the DM was 163.4 ± 8.5 cm and in NDM was 160.6 ± 7.1 cm, mean weight of DM 63.5 ± 7.2 kg, in NDM was 62.0 ± 15.4 kg and mean BMI in DM was 26.24 ± 2.36 kg/m² and in NDM was 26.38 ± 2.05 kg/m². The mean total cholesterol in DM was 236.9 ± 34.1 mg/dl and in NDM was 208.0 ± 36.4 mg/dl, mean serum TG in DM 240.5 ± 76.3 mg/dl and in NDM was 207.6 ± 57.8 mg/dl and mean serum IDL in DM was 166.1 ± 130.6 mg/dl and in NDM was 142.8 ± 30.4 mg/dl, no significant mean difference was observed between DM and NDM in height, weight and

Table 1: Age distribution of the Study Subjects

Age Group	Case Group	Control Group	Total	P Value
Less Than 50 Years	2(4.0%)	4(8.0%)	6(6.0%)	
50 to 59 Years	27(54.0%)	26(52.0%)	53(53.0%)	
More Than 59 Years	21(42.0%)	20(40.0%)	41(41.0%)	
Total	50(100.0%)	50(100.0%)	100(100.0%)	
Mean \pm SD	57.48 \pm 6.04	55.64 \pm 6.34	56.56 \pm 6.49	0.158

Table 2: Gender Distribution of the Study Subjects

Gender	Case Group	Control Group	Total	P Value
Male	43(86.0%)	42(84.0%)	85(85.0%)	
Female	7(14.0%)	8(16.0%)	15(15.0%)	0.779
Total	50(100.0%)	50(100.0%)	100(100.0%)	

Table 3: Distribution of Subjects by Selected Risk Factor

Risk Factors	Case Group	Control Group	Total	P Value
Hypertension	32(64.0%)	36(72.0%)	68(68.0%)	0.391
Dyslipidemia	23(46.0%)	22(44.0%)	45(45.0%)	0.840
Smoking	13(26.0%)	8(16.0%)	21(21.0%)	0.219
Family history	9(18.0%)	14(28.0%)	23(23.0%)	0.234
Use of Antibiotics	21(44.0%)	19(38.0%)	40(40.0%)	0.740
H/O Infection	11(22.0%)	9(18.0%)	20(20.0%)	0.319

BMI ($P>0.05$). Significant mean difference was observed between DM and NDM in total cholesterol, serum TG, LDL and serum HDL level ($P<0.05$). Fasting and random blood sugar (7.2 ± 1.7 and 13.5 ± 2.9) were significantly high among the DM ($P<0.05$) (Table 4).

Table 4: Distribution of subjects by selected variable

Risk Factors	Case Group	Control Group	Total
Height	163.4±8.5	160.6 7 1	0.151
Weight	63.5±7.2	62.0±15.4	0.614
Body mass index	26.24±2.36	26.38±2.05	0.386
Total cholesterol (mg/dl)	236.9±34.1	208.0±36.4	0.002
TG (mg/dl)	240.5±76.3	207.6±57.8	0.003
LDL (mg/dl)	166 1±130.6	142.8±30.4	0.011
HDL	39.9± 6.6	45.3 7.4	0.001
Fasting blood sugar	7.2±1.7	5.4-08	0.001
Random blood sugar	13.5±2.9	8.2±1.4	0.001

P value reached from unpaired student's 't' test

Discussion

The study was conducted in Department of Cardiology, BSMMU, Dhaka, from July 2003 to June 2005. This study included 100 patients. Among them 50 patients had coronary artery disease with DM and another 50 patients had coronary artery disease without DM. The aim of the study was to evaluate the magnitude of carotid artery disease in diabetic and non-diabetic patients. The mean age was found 57.48 years with 6.04 standard deviation (SD) in DM and 55.64 years with 6.34 standard deviation in NDM group and also 56.56 years with 6.49 standard deviation in the whole study population. The value of unpaired t-test was 0.158 and it was insignificant ($p>0.05$). Therefore, there was no age difference in both groups.

Among 100 patients 85% are male and 15% female. It shows that small number of female patients attended the hospital for treatment. Because coronary artery disease is less frequent in female. The presence of major risk factors are hypertension, dyslipidemia, Smoking and Family history for this study. No significant association was observed between DM and non DM group in the selected risk factors. Hypertension was 64% vs 72% was followed by Dyslipidemia 46% vs 44%, smoking 26% vs 16%, family history 18% vs 28% in descending order. Our observation is similar with Iqbal et al¹¹. Their finding was hypertension (73.7% vs 50%) was followed by smoking (40% vs 35%), dyslipidaemia (31.3% vs 10.0%), family history of CAD (27.5% vs 20.0%).

In our study we found the mean height of the DM group was 163.4 ± 8.5 cm and in NDM it was 160.6 ± 7.1 cm, mean weight of DM was 63.5 ± 7.2 kg, in NDM it was 62.0 ± 15.4 kg and mean BMI in DM was 26.24 ± 2.36 kg/m² and in NDM was 26.38 ± 2.05 kg/m². The mean total cholesterol in DM was 236.9 ± 34.1 mg/dl and in NDM was 208.0 ± 36.4 mg/dL, mean serum triglycerides in DM group 240.5 ± 76.3 mg/dl and in NDM was 207.6 ± 57.8 mg/dL and mean serum IDL in DM was 166.1 ± 30.6 mg/dL and in NDM was 142.8 ± 30.4 mg/dL. No significant mean difference was observed between DM and NDM in height, weight and BMI ($P>0.05$).

Significant mean difference was observed between DM and NDM in total cholesterol, serum triglycerides, LDL and serum HDL level ($P<0.05$). Fasting and random blood sugar (7.2 ± 1.7 and 13.5 ± 2.9) were significantly high among the DM group ($P<0.05$). Carotid disease can develop concurrently with coronary disease in a significant proportion of patients, even though completely asymptomatic¹².

Coronary artery disease patients, with and without NIDDM, who have similar symptoms at a given age, have similar severity and extent of coronary artery disease. Patients undergoing elective stenting of the carotid, routine coronary angiography reliably disclosure morphologically significant coronary artery disease in 39.0% of patients¹³. In a study⁷, it was found 11.8% significant carotid artery disease in patients undergoing CABG. DM had the highest incidence of carotid disease.

Faggioli et al¹⁴ found 8.7% significant carotid artery disease in patients undergoing CABG needed carotid intervention. DM had the highest incidence of carotid disease. Rath et al¹⁵ showed 12.7% significant carotid artery disease patients undergoing CABG and needed pre and postoperative carotid angioplasty or carotid intervention. Diabetes mellitus was significantly correlated to critical carotid artery disease (79.6% vs 43.8%, $P<0.02$). Diabetes mellitus, type 2 as well as type 1, is a very strong risk factor for the development of coronary artery (CAD) and stroke. Eighty percent of all deaths among diabetic patients are due to atherosclerosis, compared to about 30 percent among nondiabetics¹⁶.

Conclusion

In conclusion patients of coronary artery disease with diabetic mellitus are having higher frequency and severity of Carotid artery disease than non-diabetic

coronary artery disease patients. In this study carotid angiography in patients having coronary artery disease with diabetic mellitus revealed significant carotid artery disease than non-diabetic coronary artery disease patients. Diabetes mellitus has significant association with carotid artery disease. Therefore, carotid angiogram should be done in patients with coronary artery disease specially with diabetes mellitus to detect carotid artery involvement. Treatment of this unheralded carotid artery disease with management of coronary artery disease may reduce cardiovascular mortality and morbidity of these patients.

Acknowledgements

None.

Conflict of Interest

The authors have no conflicts of interest to disclose.

Financial Disclosure

The author(s) received no specific funding for this work.

Authors' contributions

Rahman AKMM, Sharmin F: conceived and designed the study, analyzed the data, interpreted the results; Khan K, Karim MN: wrote up the draft manuscript; Haque M, Khan K: contributed to the analysis of the data, interpretation of the results and critically reviewing the manuscript; Rahman AKMM, Sharmin F: involved in the manuscript review and editing. All authors read and approved the final manuscript.

Data Availability

Any inquiries regarding supporting data availability of this study should be directed to the corresponding author and are available from the corresponding author on reasonable request.

Ethics Approval and Consent to Participate

Ethical approval for the study was obtained from the Institutional Review Board. As this was a prospective study the written informed consent was obtained from all study participants. All methods were performed in accordance with the relevant guidelines and regulations.

Copyright © Rahman et al. 2023. Published by *Bangladesh Journal of Medical Microbiology*. This is an open access article and is licensed under the Creative Commons Attribution Non Commercial 4.0

International License (CC BY-NC 4.0). This license permits others to distribute, remix, adapt and reproduce or changes in any medium or format as long as it will give appropriate credit to the original author(s) with the proper citation of the original work as well as the source and this is used for noncommercial purposes only. To view a copy of this license, please See: <https://creativecommons.org/licenses/by-nc/4.0/>

How to cite this article: Rahman AKMM, Sharmin F, Haque M, Khan K, Karim MN. Risk of Diabetes Mellitus in Carotid Artery Involvement among Coronary Artery Disease Patients including History of Infection and Antibiotics Uses. *Bangladesh J Med Microbiol*, 2023;17(2): 82-87

ORCID

AKM Mustafizur Rahman: <https://orcid.org/0000-0001-8453-711X>

Farzana Sharmin: <https://orcid.org/0000-0001-8085-0889>

Mujammel Haque: <https://orcid.org/0000-0001-7424-9974>

Kaspia Khan: <https://orcid.org/0009-0002-1068-2335>

Mohammad Nazmul Karim,: <https://orcid.org/0009-0001-3172-6168>

Article Info

Received: 7 April 2023

Accepted: 2 May 2023

Published: 1 July 2023

References

- Katsiki N, Mikhailidis DP. Diabetes and carotid artery disease: a narrative review. *Annals of Translational Medicine*. 2020;8(19):1280
- Cosentino F, Grant PJ, Aboyans V, Bailey CJ, Ceriello A, Delgado V, Federici M, Filippatos G, Grobbee DE, Hansen TB, Huikuri HV. 2019 ESC Guidelines on diabetes, pre-diabetes, and cardiovascular diseases developed in collaboration with the EASD: The Task Force for diabetes, pre-diabetes, and cardiovascular diseases of the European Society of Cardiology (ESC) and the European Association for the Study of Diabetes (EASD). *European heart journal*. 2020 Jan 7;41(2):255-323
- Dimic A, Markovic M, Vasic D, Dragas M, Zlatanovic P, Mitrovic A, Davidovic L. Impact of diabetes mellitus on early outcome of carotid endarterectomy. *Vasa*. 2018 Sep 7
- Wei LM, Zhu YQ, Bao YQ, Lu HT, Zhang PL, Zhao YW, Li M, Zhao JG. Atherosclerosis in intracranial or extracranial vessels in diabetic patients and the association with stroke subtype. *Quantitative imaging in medicine and surgery*. 2019;9(6):960-67
- Aronson D, Edelman ER. Coronary artery disease and diabetes mellitus. *Cardiology clinics*. 2014;32(3):439-55
- Go AS, Mozaffarian D, Roger VL, Benjamin EJ, Berry JD, Blish MJ, Dai S, Ford ES, Fox CS, Franco S, Fullerton HJ. Heart disease and stroke statistics—2014 update: a report from the American Heart Association. *circulation*. 2014;129(3):e28-92
- Carson JL, Scholz PM, Chen AY, Peterson ED, Gold J, Schneider SH. Diabetes mellitus increases short-term mortality and morbidity in patients undergoing coronary artery bypass graft surgery. *Journal of the American College of Cardiology*. 2002;40(3):418-23
- Andravs R, Berger JS, Brown DL. Effects of antibiotic therapy on outcomes of patients with coronary artery disease: a meta-analysis of randomized controlled trials. *Jama*. 2005 Jun 1;293(21):2641-7
- Akanda, M.A.K, 1996 'Correlation of the major coronary artery disease risk factors with the severity of coronary arterial lesions,' MD thesis, University of Dhaka
- Hallerstam S, Larsson PT, Zuber E, Rosfors S. Carotid atherosclerosis is correlated with extent and severity of coronary artery disease evaluated by myocardial perfusion scintigraphy. *Angiology*. 2004;55(3):281-8
- Iqbal AT, Ayub M, Salehuddin M. Coronary Angiographic Findings of Symptomatic Patients with Essential Hypertension. *Medicine Today*. 2017;29(1):32-4
- Davis MJ. Pathology of coronary atherosclerosis. Hurst's. The Heart. 2001. Pathology of coronary atherosclerosis. Hurst's The Heart, vol. 1, 10th ed. McGraw-Hill Inc. New York; pp 1095-1108
- Fleisher LA, Beckman JA, Brown KA, Calkins H, Chaikof EL, Fleischmann KE, Freeman WK, Froehlich JB, Kasper EK, Kersten JR, Riegel B. ACC/AHA 2007 guidelines on perioperative cardiovascular evaluation and care for noncardiac surgery: executive summary: a report of the American College of Cardiology/American Heart Association Task Force on Practice Guidelines (Writing Committee to Revise the 2002 Guidelines on Perioperative Cardiovascular Evaluation for Noncardiac Surgery). *Circulation*. 2007;116(17):1971-96
- Faggioli GL, Curl GR, Ricotta JJ. The role of carotid screening before coronary artery bypass. *Journal of vascular surgery*.

1990;12(6):724-31

15. Rath PC, Agarwala MK, Dhar PK, Lakshmi C, Ahsan SA, Deb T, Kumar S, Narasimham RR, Rao PS, Dixit V. Carotid artery involvement in patients of atherosclerotic coronary artery disease undergoing coronary artery bypass grafting. *Indian Heart Journal*.

2001 Nov 1;53(6):761-5.

16. Bidhan, C.G. 2003 'Correlation between carotid atherosclerosis and coronary artery disease in patients with ischaemic heart disease,' MD thesis, Bangabandhu Sheikh Mujib Medical University, Dhaka