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

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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

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%
of victims needing institutional care 3 months after the event. 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 years.

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 brain. 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 women.

Carotid artery involvement in patients with coronary artery disease (CAD) is expected. 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 disease. 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-up. 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
In the United States, causing 167,661 deaths. Overall, stroke is the third leading cause of death in the world. Approximately 700,000 people will experience either stroke. About 40,000 more women than men suffer from stroke. Carotid artery involvement in patients with coronary disease and CAD form a high-risk group. Management of the systemic nature of atherosclerosis, the presence of diabetes mellitus in the involvement of carotid artery among individuals with clinical cardiovascular disease related to the risk of diabetes mellitus. 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 26.2±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

<table>
<thead>
<tr>
<th>Age Group</th>
<th>Case Group</th>
<th>Control Group</th>
<th>Total</th>
<th>P Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Less Than 50 Years</td>
<td>2(4.0%)</td>
<td>4(8.0%)</td>
<td>6(6.0%)</td>
<td></td>
</tr>
<tr>
<td>50 to 59 Years</td>
<td>27(54.0%)</td>
<td>26(52.0%)</td>
<td>53(53.0%)</td>
<td></td>
</tr>
<tr>
<td>More Than 59 Years</td>
<td>21(42.0%)</td>
<td>20(40.0%)</td>
<td>41(41.0%)</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>50(100.0%)</td>
<td>50(100.0%)</td>
<td>100(100.0%)</td>
<td>0.158</td>
</tr>
<tr>
<td>Mean±SD</td>
<td>57.48±6.04</td>
<td>55.64±6.34</td>
<td>56.56±6.49</td>
<td></td>
</tr>
</tbody>
</table>

Table 2: Gender Distribution of the Study Subjects

<table>
<thead>
<tr>
<th>Gender</th>
<th>Case Group</th>
<th>Control Group</th>
<th>Total</th>
<th>P Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male</td>
<td>43(86.0%)</td>
<td>42(84.0%)</td>
<td>85(85.0%)</td>
<td>0.779</td>
</tr>
<tr>
<td>Female</td>
<td>7(14.0%)</td>
<td>8(16.0%)</td>
<td>15(15.0%)</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>50(100.0%)</td>
<td>50(100.0%)</td>
<td>100(100.0%)</td>
<td></td>
</tr>
</tbody>
</table>

Table 3: Distribution of Subjects by Selected Risk Factor

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

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 asymptomatic. 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 disclose morphologically significant coronary artery disease in 39.0% of patients. In a study, it was found 11.8% significant carotid artery disease in patients undergoing CABG. DM had the highest incidence of carotid disease.

Faggioli et al found 8.7% significant carotid artery disease in patients undergoing CABG needed carotid intervention. DM had the highest incidence of carotid disease. Rath et al 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 non-diabetics.

**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 Ikbal et al. Their finding was hypertension (73.7% vs 50%) was followed by smoking (40% vs 35%), dyslipidemia (31.3% vs 10.0%), family history of CAD (27.5% vs 20.0%).

**Table 4: Distribution of subjects by selected variable**

<table>
<thead>
<tr>
<th>Risk Factors</th>
<th>Case Group</th>
<th>Control Group</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Height</td>
<td>163.4±8.5</td>
<td>160.6±7.1</td>
<td>0.151</td>
</tr>
<tr>
<td>Weight</td>
<td>63.5±7.2</td>
<td>62.0±15.4</td>
<td>0.614</td>
</tr>
<tr>
<td>Body mass index</td>
<td>26.24±2.36</td>
<td>26.38±2.05</td>
<td>0.386</td>
</tr>
<tr>
<td>Total cholesterol (mg/dl)</td>
<td>236.9±34.1</td>
<td>208.0±36.4</td>
<td>0.002</td>
</tr>
<tr>
<td>TG (mg/dl)</td>
<td>240.5±76.3</td>
<td>207.6±57.8</td>
<td>0.003</td>
</tr>
<tr>
<td>LDL (mg/dl)</td>
<td>166.1±130.6</td>
<td>142.8±30.4</td>
<td>0.011</td>
</tr>
<tr>
<td>HDL</td>
<td>39.9±6.6</td>
<td>45.3±7.4</td>
<td>0.001</td>
</tr>
<tr>
<td>Fasting blood sugar</td>
<td>7.2±1.7</td>
<td>5.4±0.8</td>
<td>0.001</td>
</tr>
<tr>
<td>Random blood sugar</td>
<td>13.5±2.9</td>
<td>8.2±1.4</td>
<td>0.001</td>
</tr>
</tbody>
</table>

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

**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.

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

Authors’ contributions
Rahman AKMM, Shamarin 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, Shamarin 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.

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References
Introduction

Clinical and financial consequence there are significant long term effects related to stroke. Stroke is the critical carotid artery disease. Carotid artery stenting and surgical endarterectomy have been shown to be effective interventions. The results of carotid artery interventions are based on the good technical success and high rates of freedom from the clinical disease caused by atherosclerosis at 5 years. Epidemiological studies have documented that men and women have clinical carotid disease associated with a significant risk of clinical disease caused by atherosclerosis at 5 years with 6.04 standard deviation (SD) in DM and 9.05 SD in NDM, respectively.

Methodology

We conducted a study on 100 patients having previous coronary artery disease patients undergoing coronary artery bypass graft surgery. Journal of Cardiovascular Medicine, vol. 1, 10th ed. McGraw-Hill Inc. New York; pp 1095-1108. Among 100 patients 85% are male and 15% female. It was found among male subjects, 86% and 84.0% were significantly high among the DM group (P<0.05).

Results

The value of mean serum triglycerides in DM group was 240.5±76.3 mg/dl and in NDM was 207.6±57.8 mg/dL. No significant deviation in the whole study population. The value of mean serum HDL cholesterol in DM was 160.6±7.1 cm, mean weight of DM was 62.0±15.4 kg and mean BMI in DM was 240.5±76.3 mg/dl and in NDM was 207.6±57.8 mg/dL. Mean serum HDL cholesterol in DM was 142.8±30.4 mg/dL. No significant difference was observed between DM and NDM group in the mean serum HDL cholesterol, mean serum triglycerides, mean serum LDL cholesterol, mean serum IDL cholesterol, mean serum triglycerides, and mean serum IDL cholesterol in DM and NDM in total cholesterol, serum triglycerides, LDL cholesterol, and IDL cholesterol. No significant difference was found between mean serum triglycerides and mean serum IDL cholesterol in NDM.

Discussion

The present study shows that small number of female patients attended the study. Among 100 patients 85% are male and 15% female. It was found among male subjects, 86% and 84.0% were significantly high among the DM group (P<0.02). Diabetes mellitus, type 2 as well as hypertension was 64% vs 72% was followed by another 50 patients had coronary artery disease and 11.8% significant carotid artery disease in patients undergoing coronary artery bypass graft surgery. Indian Heart Journal.

Financial Disclosure

The authors declare that they have no conflict of interest. This work was supported by the National Institute of Health, Bangladesh. Ethical approval for the study was obtained from the Institutional Review Board of the Hospital. Participants participating in the study were carried out in accordance with the Helsinki Declaration. The data were analyzed after obtaining the informed written consent from the patients. The data were analyzed after obtaining the informed written consent from the patients.

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Authors' contributions

Authors' contributions were as follows: conception and design of the study, AKM Rahman and Sharmin F. Data analysis and interpretation of the results, AKM Rahman and Sharmin F. Critical review and final approval of the manuscript, AKM Rahman and Sharmin F. All authors have read and approved the final version of the manuscript.