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Original Research Article

Lipid profile and carotid artery intima-media thickness in diabetic and non-diabetic ischaemic stroke

Preetha R. Pillai, Dharmendra Tiwari*, O. P. Jatav, Hindeshwari Rai

Department of Medicine, Gajra Raja Medical College, Gwalior, Madhya Pradesh, India

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***Correspondence:**
Dr. Dharmendra Tiwari,
E-mail: drdtiwari7@yahoo.com

ABSTRACT

Background: Stroke is one of the leading reasons for mortality throughout the world. Measurement of carotid intima media thickness (CIMT) is a reliable marker for the development of atherosclerosis and ischemic stroke (IS). The aim was to study and correlate lipid profile and CIMT in diabetic and non-diabetic IS patients.
Methods: An observational study was done including 120 IS patients divided into two groups- diabetes (n=60, diabetic stroke patients) and non-diabetes (n=60, non-diabetic stroke patients) having age >18 years, admitted in Medicine and Neurology wards of G. R. Medical College, Gwalior, Madhya Pradesh, India between August 2015 to August 2016. Detailed history along with investigations such as fasting blood sugar (FBS), post prandial blood sugar (PPBS) and fasting lipid profile including triglycerides (TG), high density lipoprotein (HDL), low density lipoprotein (LDL), very low density lipoprotein (VLDL) and total cholesterol (TC) was done. The common and the internal carotid arteries of both sides were evaluated ultrasonographically using a high frequency linear probe. All the data were analysed using IBM SPSS- ver.20 software. Data was expressed as percentage. Analysis was performed using two-way ANOVA and independent sample student t test. Pearson correlation was used to establish the relation between the data. P values <0.05 was considered to be significant.
Results: Most common age group among diabetes and non-diabetes IS patients were 51-60 years (26.66%) and 61-70 years (28.33%) respectively with male predominance (75% and 66.67% respectively). Most of the diabetic IS patients had FBS >200 mg/dl (41.66%) and PPBS >250 mg/dl, (50%). Out of 120 IS patients, 55 (45.83%) had CIMT ≤0.8 mm and 65 (54.16%) patients had CIMT >0.8 mm. Lipid parameters including TC (p=0.034), TG (p=0.022), HDL (p=0.039), VLDL (p=0.043) and LDL (p=0.017) were significantly different between groups (p<0.05). Mean CIMT in patients with diabetes and non-diabetes was 1.03±0.255 mm and 0.83±0.54 mm respectively (p=0.006). A significant positive correlation was recorded between CIMT and TC (r=0.36, p=0.006), TG (r=0.48, p=0.0001) and VLDL (r=0.46, p=0.0001) among diabetes stroke patients. Among non-diabetes stroke patients, TC (r=-0.25, p=0.042), TG (r=-0.44, p=0.0003), HDL (r=-0.33, p=0.016) and LDL (r=-0.58, p=<0.001) were negatively correlated and VLDL (r=0.92, p=<0.0001) was positively correlated with CIMT.
Conclusions: Lipid parameters including TC, TG, LDL and VLDL were significantly raised in diabetic stroke patients and had a positive correlation with the risk of stroke. CIMT was significantly high in diabetic stroke patients. Correlation of lipid parameters (TC, TG and VLDL) with CIMT in diabetic stroke patients were significantly positively correlated, in non-diabetic ischemic stroke patients' lipid parameters (TC, TG, HDL and LDL) were negatively correlated.

Keywords: Diabetes mellitus, Dyslipidemia, Ischaemic stroke, Lipid parameters, Stroke risk

INTRODUCTION

In patients with type 2 diabetes mellitus (T2DM) vascular complications because of atherosclerosis is reported to be the major cause of morbidity and mortality. The percentages are high in India as number of patients with diabetes are increasing every year.[1]

Atherosclerosis being the major risk factor is accelerated in patients with diabetes mellitus (DM). Reports have shown that atherosclerotic process takes place simultaneously in carotid, cerebral and coronary arteries.[2]

Carotid intima media thickness (CIMT) can be measured using B mode ultrasonography which is reliable and provide validated estimate of the arterial wall thickness.[3] Out of all the available non-invasive imaging methods CIMT measured by B mode ultrasound is presently recommended by the American Heart Association because it is comparatively safe, non-invasive and affordable method for assessing atherosclerosis.[4]

Hence, present study was performed to study the relationship of CIMT with atherosclerosis risk factors in patients with diabetes and non-diabetic with stroke.

METHODS

An observational study was performed on 120 IS patients having age >18 years who were admitted in Medicine and Neurology wards in G.R. Medical College, Gwalior, Madhya Pradesh, India from August 2015 to August 2016.

Institutional Ethics Committee approval and written informed consent was obtained from each patient before staring study.

All the patients were divided into diabetes (n=60, IS patients with diabetes) and non-diabetes (n=60, IS patients without diabetes) using simple random sampling method.

Patients who fulfilled the criteria for ischemic stroke by standard definition, with and without diabetes were included in the present study. Patients with transient ischaemic attack (TIA), cardiac diseases and hepatic diseases, patients taking lipid lowering drugs that would lower plasma lipid levels, individual less than 18 year's age and patients with haemorrhagic stroke were excluded from the present study.

Detailed history of each patient was recorded. Investigations such as fasting blood sugar (FBS), post prandial blood sugar (PPBS), fasting lipid profile including triglycerides, high density lipoprotein (HDL), low density lipoprotein (LDL), very low density lipoprotein (VLDL) and total cholesterol (TC) was done. HbA1C and ECHO were carried out as required. electrocardiogram (ECG), CT/MRI of brain, carotid Doppler and chest X-ray was also carried out.

Standard diagnostic criteria were employed for defining DM, hypertension and dyslipidemia. Those with newly detected hyperglycemia whose FBS was more than or equal to 126mg%, PPBS more than or equal to 200mg%, RBS more than equal to 200mg% with symptoms and those already taking oral hypoglycemic agents were classified as diabetics.

Resting blood pressure more than or equal to 140/90 mm Hg or those already on antihypertensive drugs were classified as hypertensives. Cut off value for hypercholesterolemia was taken as 200mg% and hypertriglyceridemia was taken as 150mg%.

The common and the internal carotid arteries of both sides were evaluated ultrasonographically using a high frequency linear probe. Patient lies in supine position and the examiner is near the patients head. Tilting the patients head to the opposite side facilitates the examination by increasing the neck exposure. Two parallel lines separated by an anechoic space can be visualized at the levels of the artery wall. These lines are generated by the blood-intima and the media-adventitia interfaces. The distance between these two lines is taken as the carotid intima media thickness. The IMT of the common and the internal carotid arteries were measured within 1cm of the carotid bulb. IMT of only the plaque free segments were recorded. Presence of plaques was also noted. Mean CIMT is used in statistical analysis.

All the data were analyzed using IBM SPSS ver. 20 software. Data was expressed as percentage if and otherwise explained. Analysis was performed using two way ANOVA and independent sample student t-test. Pearson correlation was used to establish the relation between the data. P values <0.05 was considered as significant.

RESULTS

Most of the IS cases were from the age group of 61-70 years [30 (25%)] followed by 51-60 years [28 (23.33%)]. Male [85 (70.83%)] predominance was observed. Most of the patients were having BMI ≥23 kg/m^2 [63 (52.5%)].

Most of the diabetes and non-diabetes IS patients belong to age group of 51-60 years (26.66%) and 61-70 years (28.33) respectively. Most of the patients in diabetes and non-diabetes groups were male (75% and 66.67% respectively).

Out of 120 IS cases, 39 (32.5%) were having hypertension. Out of 85 males and 35 females, 25 (29.41%) and 14 (40%) had hypertension respectively. Most of the diabetic IS patients had FBS>200 mg/dl [25 (41.66%)] and PPBS >250 mg/dl, [30 (50%)].

In present study, dyslipidemic parameters such as TC (≥200mg/dl), TG (≥150mg/dl), LDL (≥100mg/dl), VLDL (≥30mg/dl) and HDL (≤40mg/dl for male and ≤50mg/dl for female) were abnormal in 81 (67.5%), 27 (22.5%), 108 (90%), 27(22.5%) and 80 (66.67%) IS patient respectively.

Out of 55 patients who had CIMT ≤0.8 mm, 13 (23.63%) were from the age group of 51-60 and 61-70 years respectively whereas out of 65 patients who had CIMT >0.8 mm, 17 (26.15) were from the age group of 61-70 years and 15 (23.07%) were from the age group of 51-60 years.

Lipid parameters such as TC (213.64±26.32 vs. 192.46±23.23, p=0.034), TG (147.50±22.16 vs. 114.60±23.64, p=0.022), HDL (38.38±5.22 vs. 42.56±6.55, p=0.039), VLDL (29.48±4.44 vs. 24.59±11.48, p=0.043) and LDL (144.81±26.33 vs. 124.58±26.24, p=0.017) were significantly different between patients with diabetes and non-diabetes respectively (p<0.05).

Mean CIMT in patients with diabetes and non-diabetes was 1.03±0.255 mm and 0.83±0.54 mm respectively (p=0.006).

Table 1: Comparison of different parameters among diabetes and non-diabetes ischaemic stroke patients using CIMT values.

Parameters	Diabetes		P-value	Non-diabetes		P-value
	CIMT ≤0.8mm n=8	CIMT >0.8 mm, n=52		CIMT ≤0.8 mm, n=47	CIMT >0.8mm, n=13	
Age (years)	55.11±15.56	63.43±12.84	0.033	55.57±14.91	62.33±19.32	0.037
FBS (mg/dl)	178.61±33.39	170.43±38.67	0.048	94.98±19.69	99.00±7.21	0.046
PPBS (mg/dl)	276.53±15.89	273.46±18.09	0.041	130.69±19.51	138.56±17.50	0.031
BMI (kg/m^2)	22.12±2.89	23.29±2.02	NS	22.69±2.67	22.43±2.06	NS
TC (mg/dl)	205.02±22.49	219.7±27.42	0.048	191.01±22.82	200.67±25.21	NS
TG (mg/dl)	138.03±19.10	154.24±21.96	0.045	114.92±20.52	112.76±38.57	0.002
HDL (mg/dl)	38.42±4.69	38.35±5.64	NS	43.33±6.57	38.16±4.64	NS
VLDL (mg/dl)	27.53±3.88	30.83±4.37	0.024	22.98±4.11	33.73±2.48	0.024
LDL (mg/dl)	138.81±22.27	149.10±28.42	0.033	124.92±21.32	122.62±47.23	0.033

Data is expresses as mean±SD, FBS; fasting blood sugar, PPBS; post prandial blood sugar, BMI; body mass index, TC; total cholesterol, TG; triglyceride, HDL; high density lipoprotein, VLDL; very low density lipoprotein, LDL; low density lipoprotein, NS; not significant.

A significant positive correlation was recorded between CIMT and TC (r=0.36, p=0.006), TG (r=0.48, p=0.0001) and VLDL (r=0.46, p=0.0001) among diabetes patients with IS. Among non-diabetes patients with IS, TC (r=-0.25, p=0.042), TG (r=-0.44, p=0.0003), HDL (r=-0.33, p=0.016) and LDL (r=-0.58, p=<0.001) were negatively correlated and VLDL (r=0.92, p=<0.0001) was positively correlated with CIMT.

DISCUSSION

Measuring CIMT using non-invasive B mode ultrasonography can easily detect atherosclerosis at an early preclinical stage. It may also aid in the diagnosis of asymptomatic cardiovascular disease. [5]

Rajeev et al did a similar study on 100 patients to assess and correlate CIMT with risk factors of IS reported that most of the patients belong to age group of 61-70 years with male predominance (74%) in patients with and without diabetes which is in accordance to the present study data.[6] Gayathri et al studied 44 patients previously diagnosed Type 2 Diabetes mellitus also reported male predominance.[7] Gayathri et al also compared CIMT value with risk factors of atherosclerosis and atherosclerotic events in T2DM patients by dividing in to CIMT values of ≤0.9mm and >0.9mm. They found that mean FBS, PPBS, TC, TG, HDL, VLDL and LDL were comparable in both the groups (p>0.05). But in present study mean FBS (p=0.048), PPBS (p=0.041), TC (p=0.048), TG (p=0.045), VLDL (p=0.024) and LDL (p=0.033) were significantly different.[7]

Significant difference for lipid parameters was recorded between patients with diabetes and non-diabetes in present study (p<0.05). Arabadzhieva D et al studied lipid profile in 258 IS patients with diabetes and reported that the concentrations of TC and LDL were higher while triglycerides were lower than the normal.[8] Arabadzhieva D et al concluded that prevalence of decreased HDL-cholesterol levels (p<0.001) and elevated LDL-cholesterol (p=0.036) was significantly higher in IS patients than in controls which is in accordance with the present study data.[8]

Nirmala et al studied lipid profile in 30 non-diabetic IS in young and reported that 63.41% of patients had elevated TC, 70% had elevated TG, high LDL value was seen in 46.7% of cases and high VLDL level was recorded in 56.7% of cases. Nirmala et al concluded that TC, TG,

LDL, TC/HDL and LDL/ HDL were significantly raised in patients with IS compared to normal healthy subjects (p<0.001) which is similar to the results obtained by present study.[9] But in present study lipid parameters were significantly higher in patients with diabetes compared to non-diabetes patients. The possible reason for that may be due to inclusion of IS patients in both the groups. On comparing different parameters between diabetic IS patients with CIMT values of ≤0.8 mm and >0.8mm, mean age (p=0.033), FBS (p=0.048), PPBS (p=0.041), TC (P=0.048), TG (p=0.045), VLDL (p=0.024) and LDL (p=0.033) were significantly different also, among non-diabetic IS mean age (p=0.037), FBS (p=0.046), PPBS (p=0.031), TG (p=0.002), VLDL (p=0.024) and LDL (p=0.033) were significantly different but Gayathri et al did not find any such difference.[7]

Mean CIMT in diabetes and non-diabetes IS patients was 1.03±0.255 mm and 0.83±0.54 mm respectively (p=0.006). A similar study by Das et al on 100 consecutive patients of acute IS reported higher CIMT measurement among patients of acute IS than healthy controls (0.849±0.196 vs. 0.602±0.092; p<0.001) which are almost similar to the present study findings.[10] Bettegowda et al also studied CIMT in patients with diabetic and non-diabetic and its correlation with associated risk factors reported that mean intima media thickness diabetic subjects (0.12 cm) were significantly higher than those of the nondiabetic subjects (0.07cm) (p<0.001) which is almost similar to what is reported by present study.[11]

Rajeev et al also reported that 92% patients in case group had CIMT between 0.06-0.20 cm whereas in control group 90% had CIMT between 0.06-0.20cm. Rajeev et al hypothesize that people with risk factors having CIMT above 0.06 cm are more prone for ischemic cerebrovascular accidents.[6] Similar results were recorded in present study. Touboul et al observed that an increased CCA-IMT was associated with brain infarctions, both overall and in the main subtypes, and concluded that an increased IMT may help to identify patients at high risk for brain infarction.[12]

Sau et al observed that CIMT had positive correlation with higher blood levels of HbA1C, TC, TG, LDL, VLDL and negative correlation with HDL. Moreover, the CIMT was better correlated with LDL/HDL and TC/HDL than individual values of TC, TG, LDL, VLDL.[13] Mohan et al and Lorenz et al showed CIMT of all varieties of stroke were significantly higher than nonstroke controls.[14,15] The study had few limitation of being less in sample size; a large clinical trial is needed to confirm the present study finding. HbA1c was not done in all patients due to financial constraints.

CONCLUSION

Total cholesterol, triglycerides, LDL and VLDL were significantly raised in diabetic stroke patients as compared to non-diabetic stroke patients and had a positive correlation with the risk of stroke. CIMT was significantly high in diabetic stroke patients as compared to non-diabetic stroke patients. As CIMT is a reliable, non-invasive, patient friendly, easily available and surrogate marker of atherosclerosis, it can be used as a screening measure in high risk population like hypertensive, diabetics and dyslipidemics for the prevention of cerebrovascular accident and coronary artery disease thereby attaining a drastic reduction in the morbidity and mortality imposed on the population by cerebrovascular accidents. Correlation of lipid parameters with CIMT in diabetic patients of ischemic stroke revealed that TC, TG and VLDL were significantly positively correlated with mean CIMT values, whereas correlation of lipid parameters with CIMT values in non-diabetic ischemic stroke patients showed that TC, TG, HDL and LDL were negatively correlated with mean CIMT values.

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