



## Original Article

# Lipid Profile And Carotid Artery Plaque In Ischaemic Stroke Patients

MN Islam<sup>1</sup>, MN Huda<sup>1</sup>, ASMM Rahman<sup>1</sup>, SKM Afzal<sup>1</sup>, PM Basak<sup>1</sup>, MK Rahman<sup>2</sup>, Khan MMR<sup>2</sup>, ARMS Ekram<sup>3</sup>

### Abstract

Stroke patients have significant lipid abnormality and it is associated with formation of carotid artery plaque. This is an observational study conducted at the department of Medicine, Rajshahi Medical College Hospital, Rajshahi, to observe the frequency of carotid artery plaque in ischaemic stroke patients and its correlation with dyslipidaemia. Fifty patients of stroke with cerebral infarction confirmed by CT scan of brain were included. The frequency of significant carotid artery plaque was on right side 52%, on left side 40% and on both side 34%. Both Left and right internal carotid artery showed positive correlation with serum total cholesterol, LDL cholesterol and HDL cholesterol but it was not statistically significant ( $r < 0.05$ ).

TAJ 2014; 27: No-1: 34-37

### Introduction

Stroke is the third most common cause of death and is the main cause of neurological disability today. Among the risk factors of stroke, dyslipidaemia particularly low-density lipoprotein (LDL) cholesterol is important. Dyslipidaemia and atherosclerosis have got important associations between them.<sup>1-3</sup> Aging is associated with progressive accumulation of atherosclerotic lesions in carotid arteries and its bifurcation point is a favored site for the development of atherosclerotic plaque. The extent of these carotid lesions is directly related to the presence of clinically manifested stroke and transient ischaemic attack.<sup>4</sup> This echolucent carotid artery plaques are associated with increased levels of triglyceride in the fasting and postprandial state.<sup>5</sup> Presence of stenotic atherosclerotic carotid plaque is a well-established risk factor for ischaemic stroke.<sup>6,7</sup> Recent trials have shown that the incidence of stroke can be reduced by using cholesterol lowering drugs which reduce carotid

artery intima-media thickness. In Bangladesh, the exact situation regarding carotid atheroma is not known. Therefore, this study was performed among Bangladeshi patients with ischaemic stroke to observe the frequency of carotid artery plaque in ischaemic stroke patients and its correlation with dyslipidaemia.

### Material and Methods

This descriptive cross sectional study was carried out on 50 consecutive admitted patients, age between 40 to 90 years, presented within 48 hour of symptom onset of stroke. Stroke was defined according to WHO criteria.<sup>8</sup> Ischaemic stroke was confirmed by clinical examination and CT scan of brain. Fasting (at least 12 hours) blood sample was taken from each patient for lipid profile, blood sugar and other relevant investigations. Carotid duplex ultrasound scanning was done in all patients using a Siemens ACUSON CV-70 ultrasound scanner with a 7.5 MHz transducer. Doppler spectral analysis showed three categories

<sup>1</sup> Assistant Professor, Department of Medicine, Rajshahi Medical College.

<sup>2</sup> Associate Professor, Department of Medicine, Rajshahi Medical College.

<sup>3</sup> Professor, Department of Medicine, Rajshahi Medical College.

of stenosis: mild (<30%), moderate (31-69%) and severe ( $\geq 70\%$ ) on the basis of reduction of lumen diameter. Four ultrasonographic plaque characteristics were defined: echolucent, echogenic, mixed pattern and isoechoic. Dyslipidaemia was assessed by raised fasting serum cholesterol  $>200$  mg/dl, LDL  $>130$  mg/d, TG  $>150$  mg/dl and HDL  $<40$  mg/dl (NCEP-2001).<sup>9</sup>

## Results

Among fifty (50) patients of cerebral infarcts, forty (80%) patients were male and ten (20%) were female. Male female ratio was 4:1. Doppler study showed RICA plaque in twenty six (52%) cases and LICA plaque in twenty (40%) cases respectively. Both sided carotid plaque were observed in seventeen (34%) patients (Table-I). Thirteen (26%) plaques were echolucent and thirty three (66%) were echogenic (including mixed and isoechoic). The right internal carotid artery was commonly associated with plaque formation than left (56% vs 40%). Mean intima-media thickness of right internal carotid artery was  $1.20 \pm 0.8$  mm and left internal carotid artery was  $1.46 \pm 0.8$  mm. Left internal carotid artery showed maximum intima-media thickness than right (1.46 vs 1.29 mm).

Seventeen (34%) patients showed mild, ten (20%) patients showed moderate and four (8%) patients showed severe carotid stenosis in RICA and seventeen (34%) patients showed mild, nine (18%) patients showed moderate and three (6%) patients showed severe carotid stenosis in LICA (Table II). Twenty four (48%) cases showed hypercholesterolemia, twenty (40%) cases showed abnormal TG-cholesterol, thirty nine (78%) cases showed high LDL-cholesterol and thirteen (26%) cases showed low HDL-cholesterol (Table-III).

Among the patients of hypercholesterolemia, sixteen (66.6%) had carotid plaque and eight (33.3%) had no plaque. Surprisingly, thirteen (26%) cases had carotid plaque despite of normal cholesterol level. Among the patients of hypertriglyceridemia, eleven (56%) patients showed carotid plaque and nine (45%) patients had no plaque. Patients with abnormal LDL-cholesterol, twenty two (56.4%) cases showed plaque and seventeen (43.5%)

showed no plaque. Seven (53.8%) cases showed plaque and six (46.1%) cases showed no plaque in patients with abnormal HDL cholesterol (Table-IV). Left internal carotid artery showed positive correlation with serum cholesterol, LDL cholesterol and HDL cholesterol but it is not statistically significant ( $r < 0.05$ ). Right internal carotid artery showed positive correlation with LDL and HDL cholesterol and it is also statistically not significant ( $r < 0.05$ ) (Table-V).

## Discussion

This is an observational study and was carried out to find out the correlation between carotid artery plaque and serum lipid profile of ischaemic stroke patients. The risk of stroke increases with age<sup>10</sup> and the majority of the subjects in this study were in between sixth and seventh decade of life and their mean age  $61.72 \pm 11.32$  years. Iqbal et al<sup>11</sup> and Victor and Ropper<sup>12</sup> also showed similar age statistics (mean age  $60.8 \pm 13$  yrs.) in their study patients. This difference is possibility because of poor awareness and poor control of risk factors of cerebral infarction in Bangladeshi as compared to western countries.

Dyslipidaemia and atherosclerosis have got important associations between them.<sup>1-3</sup> Several authors had tried to establish a correlation between dyslipidaemia and atherosclerosis but results were conflicting. Saloner et al<sup>13</sup> showed positive association of carotid plaque formation with serum cholesterol and TG level. Adem et al<sup>14</sup> showed an increase frequency of cortical stroke in low HDL cholesterol patients. But Framingham study failed to establish a significant association between carotid plaque and lipid states. We also found a positive correlation of serum cholesterol, LDL cholesterol and HDL cholesterol with left and right internal carotid artery plaque formation. But unexpectedly this result is statistically not significant. However a large scale study would establish a significant statistical result in future.

## Conclusion:

Dyslipidemia is more associated with carotid artery plaque formation. Left internal carotid artery showed positive correlation with serum total

cholesterol, LDL cholesterol and HDL cholesterol. Right internal carotid artery also showed positive correlation with LDL and HDL cholesterol. So it

can be concluded that dyslipidaemia has an important role in the formation of carotid plaque.

### Tables

**Table I:** Detection of carotid artery plaque of patients

Involvement of carotid artery	No. of patient	Percentage
LICA	20	40%
RICA	26	52%
Both Rt. & LICA	17	34%
No plaque both side	21	42%

**Table II:** Grading of stenosis

RICA	No. of patient	Percentage
Mild $\leq 30\%$	17	34%
Moderate 31-69%	10	20%
Severe $>70\%$	4	8%
LICA		
Mild $\leq 30\%$	17	34%
Moderate 31-69%	9	18%
Severe $>70\%$	3	6%

**Table III:** Lipid profile of stroke patients

Lipid profile	No. of patients	Percent (%)
Total cholesterol ( $\geq 200$ mg/dl)	24	48%
Triglyceride ( $\geq 150$ mg/dl)	20	40%
LDL-cholesterol ( $\geq 130$ mg/dl)	39	26%
HDL-cholesterol ( $<40$ mg/dl)	13	26%

Total no of patients 50, Total cholesterol- Normal ( $<200$  mg/dl), Triglyceride- Normal ( $<150$  mg/dl), LDL-cholesterol- Normal ( $<130$  mg/dl), HDL-cholesterol- Normal ( $\geq 40$  mg/dl).

**Table IV:** Dyslipidaemia in patients with carotid artery plaque

Lipid profile (Abnormal)	Plaque (positive)	Plaque (negative)	Total
Hypercholesterolemia	16 (66.66%)	8 (33.34%)	24
TG-c abnormal	11 (55.00%)	9 (45.00%)	20
LDL-c abnormal	22 (56.41%)	17 (43.59%)	39
HDL-c abnormal	7 (53.84%)	6 (46.16%)	13

**Table V :** Correlation of carotid artery plaque with dyslipidaemia.

(Correlation 'r' value)

Carotid artery plaque	Lipid profile			
	Serum cholesterol	Triglyceride	LDL	HDL
Left Internal Carotid	0.81	- 0.066	0.109	0.083
Right Internal Carotid	- 0.038	-0.085	0.094	0.047

Interpretation: Correlation is significant at the level of 0.05 levels (2-tailed).

### References

- Gorelick PB, Schneck M — Status of lipids as a risk factor for stroke. *Neuroepidemiology* 1997; 16:107-15.
- Benfante R, Yano K, Hwang LJ, Curb JD, Kagan A, Ross W—Elevated serum cholesterol is a risk factor for both coronary heart disease and thromboembolic stroke in Hawaiian Japanese men: implications of shared risk. *Stroke* 1994; 25: 814-20.
- Grotta JC, Yatsu FM, Pettigrew LC, Rhoades H, Bratina P, Vital D, et al—Prediction of carotid stenosis progression by lipid and hematologic measurements. *Neurology* 1989; 39:1325-31.
- Polak JF, Shemanski L, O'Leary DH, Lefkowitz D, Price TR, Savage PJ, Brant WE, Reid C. Hypochoic plaque at USG of the carotid artery: an independent risk factor for incident stroke in adults aged 65 years or older. *Cardiovascular Health Study. Radiology.* 1998; 208: 649–654.
- Gronholdt ML, Nordestgaard BG— Echolucent carotid artery plaques are associated with elevated levels of fasting and post prandial triglyceride-risk lipoproteins. *Stroke* 1996; 27: 2166-72.
- Bock RW, Gray-Weale AC, Mock PA, App Stats M, Robinson DA, Irwig L, Lusby RJ. The natural history of asymptomatic carotid artery disease. *J Vasc Surg.* 1993;17:160 169; discussion 170–161.
- Satiani B, Porter RM Jr, Biggers KM, Das BM. Natural history of nonoperated, significant carotid stenosis. *Ann Vasc Surg.* 1988; 2:271–278.
- Allen CMC, Lueck CJ, Dennis M. Cerebrovascular disease; In *Davidson's Principles and Practice of Medicine*. Boon NA, Colledge NR, Walker RB, Hunter A J. Twentieth edition, Edinburgh, Churchill Livingstone 2006; 1200-1211.
- National Cholesterol Education Program (NCEP). 2001
- Daven PR, Denis M Neurological emergencies; Acute stroke, *J. Neurol- Neurosurg psychiatry* 2000; 68: 277-88.
- Iqbal F, Hussain S, Hasan M. Hypertension, diabetes mellitus and hypercholesterolemia as risk factors for stroke; *Pakistan J. Med. Res.* 2003; 42 (1) :1-10.
- Victor M, Ropper AH. Cerebrovascular disease. In: *Adams and Victor's principles of neurology*. 8th ed. New York: McGraw-Hill, 2005: pp.660-746.
- Salonen JT, Puska P. Relation on serum cholesterol and triglycerides to the risk of acute myocardial infarction, cerebral stroke and death in Eastern Finnish male population. *Int J Epidemiol*, 1983; 12: 26-31.
- Adams RJ, Carroll RM, Nicholos FT, MacNair N, Feldman DS, Feldman EB, et al. Plasma lipoproteins in cortical versus lacunar infraction. *Stroke* 1989; 20: 346-54.

All correspondence to:  
 Dr. Md Nurul Islam  
 Assistant Professor  
 Department of Medicine  
 Rajshahi Medical College.  
 E-mail: nuruldr07@gmail.com