



Association between lipid profile and USG doppler determined carotid stenosis in patients presenting with first-ever acute ischemic stroke

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ABSTRACT

Introduction: Lipid profile and vessel stenosis are associated with stroke, particularly ischemic stroke. This study aimed to explore the association between lipid profile and USG doppler determined carotid stenosis in patients diagnosed with first-ever acute ischemic stroke.

Methods: A retrospective study was conducted at Upendra Devkota Memorial National Institute of Neurological and Allied Sciences, Kathmandu, Nepal over 6 months, among 150 patients who were clinically and radiologically diagnosed with ischemic stroke and underwent Carotid Doppler investigation. During their hospital stay, these patients underwent a fasting lipid profile estimation to assess the presence of hyperlipidemia.

Results: Of the 150 patients included in this study, 97 were males. Most stroke cases were present in those >60 years (54.1%) and right MCA infarction was more common (33.3%). Carotid Doppler finding revealed that Grade III stenosis was most common (34%). The bivariate analysis found that >50% carotid stenosis in patients with ischemic stroke (n=62) was significantly associated with hyperlipidemia (n=67). The odds of having >50% carotid stenosis was 6.4 times higher in those with hyperlipidemia (n=47) as compared to those with a normal lipid profile (n=25). Also, the odds of having hyperlipidemia was 3.5 and 2.2 times higher in smokers and alcohol users respectively.

Conclusion: This study suggests that patients with first-ever acute ischemic stroke concurrently having hyperlipidemia are more likely to have larger carotid stenosis, while hyperlipidemia is more likely to occur in smokers and alcohol users.

Keywords: Carotid Doppler, Hyperlipidemia, Ischemic Stroke

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INTRODUCTION

Stroke remains one of the leading causes of death and disability, following cardiac problems and cancers, even in developed world due to chronic diseases.^[1] Stroke is a sudden onset vascular event that may lead to neurological compromise. It can be transient or permanent. The main cause of stroke is deficient blood supply either in the form of occlusion or rupture of these vessels. There are various risk factors such as hypertension, diabetes mellitus, heart disorders, overweight, obesity and hyperlipidemia, unhealthy diet and use of oral contraceptive pills. ^[2] Atherosclerotic depositions over the media layer of arteries along with these risk factors increase the chances of carotid artery stenosis. Increased lipid profile in an individual lead to increase in atherosclerotic plaque formation and deposition playing a vital role in stenosis. Carotid artery stenosis is a significant independent risk factor which causes 10-20% of transient ischemic attack and stroke.^[3] Various attempts have been made to stratify patients on the basis of carotid artery stenosis. Stenosis of internal carotid artery can be done on basis of NASCET (distal grade of stenosis), ESCT (local grade of stenosis), CC (grade of stenosis between stenosed diameter and proximal non affected CCA).^[4, 5] In our study, we have used a new form of Carotid Artery Stenosis grading, Atherosclerotic Acute Stroke Unit Grade (AASU Grade), which has been devised by a team of neurologists for easier communication between health professionals and a tool for prospective research in future. This study aimed to explore the association between lipid profile and USG doppler determined carotid stenosis in patients diagnosed with first-ever acute ischemic stroke.

MATERIALS AND METHODS

This study was done after approval from Ethical Committee in Upendra Devkota Memorial National Institute of Neurological and Allied Sciences. This study was a retrospective study conducted in 150 patients of stroke who were admitted in our hospital over a period of six months. (1st May, 2019 to 31st October, 2019). All

patients with clinical suspicion of Ischemic Stroke underwent both Computed Tomography (CT scan) and Magnetic Resonance Imaging (MRI). But the primary mode of diagnosis for the patients included in our study was Magnetic Resonance Imaging (MRI) - particularly the Diffusion Weighted Imaging (DWI). Patients with history of previous stroke, CT findings of previous stroke and hemorrhagic stroke were excluded from the study. All patients underwent Carotid Doppler using a linear probe. Complete carotid Doppler study was done to evaluate B/L internal carotid, external carotid and vertebral artery. The Peak Systolic Velocity (PSV) and the presence of plaque at gray-scale or color Doppler imaging were primary parameters for the grading of stenosis. Changes in flow velocity at the point with the greatest arterial stenosis were used to determine peak systolic velocity. Carotid Doppler study for bilateral Carotid Artery system was done. However, for the purpose of our study, larger extent of stenosis was considered.

An overnight fasting 5ml blood from median cubital vein was drawn from the patient and sent for Fasting lipid profile investigation on first day of admission, admitted in our acute stroke unit (ASU). Hyperlipidemia was defined when fasting blood cholesterol level was more than or equal to 200mg/dl and/or triglyceride level more than or equal to 150mg/dl.^[6, 7]

Patient profile and their clinical findings along with laboratory and radiological investigations were found and indexed in Microsoft Excel 2007 spreadsheet. All cases with were studied against AASU grading. AASU grading (grade of carotid stenosis and their corresponding Carotid Doppler findings) was Grade 0 (Normal or no stenosis), Grade 1 (Increased intimo-medial thickness), Grade 2 (< 30% of Carotid artery occlusion), Grade 3 (30-60% of Carotid artery occlusion), Grade 4 (60-99% of Carotid artery occlusion) and Grade 5 (100% Carotid artery occlusion).

Analysis was done using Microsoft Excel. The data was analyzed using Chi-square test for determining association between patients having more than 50% stenosis of carotid artery on carotid Doppler and hyperlipidemia. P<0.05 was considered statistically significant.

RESULTS

A total of 150 patients were diagnosed with stroke on basis of clinical exam, CT scan and MRI brain between the ages of 21 years and 85 years with male(97 patients) and female(53 patients) ratio being 1.8:1. These patients underwent carotid Doppler studies and estimation of fasting lipid profile on first day of admission. The majority of stroke patients are of age group greater than 70year followed by 61-70 (Table 1).

Table 1: Age of stroke patients (n=150)

Age (in years)	n (%)
Up to 30	5(3.3)
31-40	14(9.3)
41-50	17(11.3)
51-60	33(22)
61-70	38(25.4)
>70	43(28.7)

Out of 150 patients, MRI showed right MCA infarction in 50, left MCA infarction in 39, Lacunar infarction in 33, venous infarct in 14, posterior circulation infarct in 11 and watershed infarction in 3 patients (Table 2).

Table 2: Types of stroke according to MRI findings (n=150)

MRI findings	n (%)
Right MCA infarction	50(33.3)
Left MCA infarction	39(25.9)
Lacunar infarction	33(22.2)
Venous Infarction	14(9.2)
Posterior circulation infarction	11(7.3)
Watershed Infarction	3(2.1)

Carotid Doppler study was normal in 12 patients; 27 patients had Grade I carotid stenosis, 26 had Grade II, 51 had grade III, 26 had grade IV and remaining 8 had Grade V stenosis (Table 3).

Table 3: AASU Grading based Carotid Doppler study findings (n=150)

Carotid Doppler findings	n (%)
Normal finding	12(8.0)
Increased intimo-medial thickness (IMT) (Grade I)	27(18.0)
Less than 30% stenosis (Grade II)	26(17.3)
30-60% stenosis (Grade III)	51(34.0)
60-99% stenosis (Grade IV)	26(17.3)
Complete occlusion (100% stenosis) (Grade V)	8(5.4)

Out of 150 patients, 62 patients had carotid stenosis of more than 50% and 88 patients had less than 50% stenosis. In these 62 patients with more than 50% stenosis, 47 patients had hyperlipidemia and normal lipid level was found in 25 patients. In 88 patients who had less than 50% stenosis, hyperlipidemia was present among 20 patients and normal lipid level was found in 68 patients (Table 4). The odds ratio was 6.4 which signified that patient with hyperlipidemia was 6.4 times more likely to have carotid artery stenosis >50% than patient with normal levels of blood lipid profile. This study showed that there was a positive association between hyperlipidemia and carotid Doppler in Ischemic Stroke patients (p<0.05).

Table 4: Carotid stenosis and Hyperlipidemia

Hyperlipidemia	More than 50% carotid stenosis			Odds ratio
	Yes	No	Total	
Yes	47	20	67	6.4
No	25	68	83	
Total	62	88	150	

During the course of our study, it was found that patient with history of smoking and alcohol use had higher incidence of hyperlipidemia. Those who smoked had 4.54 times high odds of developing hyperlipidemia as compared to non-smokers, while those who consumed alcohol had 2.2 times higher odds of developing hyperlipidemia as compared to non-alcohol users.

Table 5: Hyperlipidemia and Smoking

Hyperlipidemia	Smoking			Odds ratio
	Yes	No	Total	
Yes	45	20	65	3.5
No	33	52	85	
Total	78	72	150	

DISCUSSION

In one of the recent studies, it was found that the disability adjusted life years for stroke was 42.2%.^[8] It implies that stroke is one of the leading causes of morbidity. There are many factors which may predispose to development of stroke like

obesity, hypertension, diabetes, smoking, alcohol use, and hyperlipidemia. All of these factors are directly or indirectly leading to formation and destabilization of plaques which play a pivotal role in development of ischemic stroke. It is imperative that a significant association exists between hyperlipidemia in stroke patients.

Table 6: Hyperlipidemia and Alcohol Use

Hyperlipidemia	Alcohol use			Odds ratio
	Yes	No	Total	
Yes	36	26	62	2.2
No	34	54	88	
Total	70	80	150	

Significant positive correlation between carotid artery stenosis and hyperlipidemia was shown by our study. Similar findings were present in multiple studies.^[9, 10, 11] Carotid Doppler is one of the reliable tools to assess vascular morbidity at an early state. The most frequently used parameters for measuring degree of stenosis are peak systolic velocity (PSV) and end-diastolic velocity (EDV). Changes in flow velocity at the point with the greatest arterial stenosis, known as direct signs, are most commonly used to measure the degree of stenosis.^[12,13] Carotid Doppler is useful in finding out plaque deposition in carotid arteries. It has been showed that total cholesterol has the greatest predictive value for the presence of carotid plaque and total cholesterol, low density cholesterol has greater predictive values of intimo-medial thickness. Carotid artery stenosis is a recognized risk factor for ipsilateral stroke.^[14] Our study shows that with increase in age, the chances of developing ischemic stroke goes on increasing. Similarly, male sex has higher incidence of having stroke. Odds ratio calculated in our study shows that people consuming large amount of alcohol and smoking have higher chances of developing Ischemic stroke. Risk factors of carotid atherosclerosis have been evaluated in previous studies and age, sex, smoking and alcohol use, diabetes and hypertension were correlated with extra-cranial carotid atherosclerosis and was found as the major predisposing causes of Ischemic stroke.^[15,16,17]

CONCLUSION

This study suggests that patients with first-ever acute ischemic stroke who have hyperlipidemia are more likely to have more than 50% carotid stenosis determined by USG Doppler. The hyperlipidemic patients are more likely to be smokers and alcohol users.

COMPETING INTEREST

The authors declare that there are no competing interests regarding the publication of this paper.

ACKNOWLEDGEMENT

The authors would like to thank the entire UDM-NINAS family for their support.

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