

Prevalence of Middle Cerebral Artery Stenosis in Population of Bihar: A Transcranial Doppler Study

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Abstract

Background: The prevalence and causes of intracranial arterial stenosis in adults' stroke patients are largely unknown. Hence, it has become a great clinical challenge for neurophysician, neurosurgeon, and radiologist to find out the etiologies of intracranial arterial stenosis.

Material and Method: One hundred patients of aged between 25 and 60 years were selected for the study. Their past history and clinical manifestations were noted that transcranial Doppler (TCD) examination was performed with portable machine (multidrop [R] + DWL), which is a 2 MHz power motion single-channel TCD, middle cerebral arterial (MCA) was approached through temporal windows by the use of standard protocol. Stenosis of arterial was defined by the peak systolic flow velocity more than 140 cm/s for MCA.

Results: The highest clinical manifestation was hypertension (HTN) 75%, followed by diabetes mellitus (DM) 58%, obesity 52%, and hypercholesterolemia 48%, smoker 38%, coronary artery disease (CAD) 32%, and least was peripheral vascular disease 2%. In odds ratio study, HTN was highest 8.5, followed by CAD ratio that was 6 and least ratio was alcoholics 1.6.

Conclusion: The present study revealed the aggravating factors such as HTN, DM, and CAD. Atherosclerosis causes stenosis of MCA and peak systolic velocity more than 140 mc/s for MCA. Hence, the patients having such clinical manifestations will be more prone for stenosis of MCA.

Key words: Temporal acoustic window, Transcranial Doppler, Peak systolic flow, Multidrop B+ DWL, Stenosis

INTRODUCTION

The prevalence of cerebral arterial stenosis varies by their locations. The risk of intracranial arterial stenosis is much higher than that in extracranial arteries in Indian population.^[1] It has been estimated that intracranial arterial stenosis may contribute to 30–50% of ischemic strokes and middle cerebral arterial (MCA) is the most commonly affected.^[2] Moreover, symptomatic intracranial arterial stenosis seems to be relatively unstable due to high frequency of progression.^[3] The prevalence and causes of intracranial arterial stenosis in adult stroke patients are also largely unknown.^[4]

Relationship between intracranial artery stenosis and clinical manifestations in different age groups of patients is still uncertain.

Hence, attempt was made to correlate the various manifestation related MCA stenosis in different age groups and both sexes so that etiologies of the intracranial arterial stenosis can be evaluated and the present study will be valuable guidance for treating the stenosis of intracranial arterial stenosis, especially MCA.

MATERIAL AND METHOD

One hundred adult patients admitted in the Department of Neurosurgery, Shri Krishna Medical College Hospital, Muzaffarpur – 842001, Bihar, were studied.

Inclusion Criteria

Patients aged between 25 and 60 years having high risk but asymptomatic for stroke were selected for the study.

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Exclusion Criteria

The previous history of stroke or transient stroke attack and poor or incomplete echo window for transcranial Doppler were excluded from the studies.

Method

Medical history of hypertension (HTN), diabetes mellitus (DM), hypercholesterolemia coronary artery disease (CAD) and smoking, body mass index (BMI), blood pressure, fasting serum lipids, and fasting blood glucose were noted.

High-risk asymptomatic for stroke population was defined as per the modified Framingham clinical assessment criteria. According to this HTN, DM, history of smoking, excessive consumption of alcohol, CAD, peripheral vascular disease (PVD), high cholesterol, and obesity were taken as vascular risk factors and recorded cardiovascular disease included history of myocardial infarction or angina, fasting cholesterol >200 mg/dl was considered as hypercholesterolemia, and obesity was BMI >30 kg/m².

Transcranial Doppler (TCD) examination was performed with portable Medline (multidrop [R] B + DWL) which is a 2 MHz power motion single-channel traffic channel. Bilateral MCAs were studied through the temporal windows by the use of a standardized protocol. Insonation depth, peak systolic velocity, end-diastolic velocity, and mean flow velocity for all vessels were recorded; cerebral arteries that could not be insonated due to poor acoustic windows were excluded from the study. The presence of intracranial arterial stenosis was diagnosed according to peak flow velocity based on published criteria which were validated against magnetic resonance (MR) angiography and clinical outcomes. The criteria for stenosis of arteries were defined by the peak systolic flow velocity more than 140 cm/sec for MCA.

The duration of study was February 2020–October 2021.

Statistical Analysis

Various findings in MCA stenosis were recorded. The statistical analysis was carried out SPSS software. The ratio of male and female was 2:1.

RESULTS

Table 1 shows the study of clinical manifestations in MCA stenosis patients 75 (75%) HTN, 58 (58%) DM, 38 (38%) smoking, 26 (26%) alcoholics, 32 (32%) CAD, 48 (48%) hypercholesterolemia, 52 (52%) obesity, and 2 (2%) PVD

Table 2 shows the study of odds ratio of various risk factors

Table 2

- 8.5 odds ratio and CI 1.1–5 in HTN
- 2.0 odds ratio and CI 0.7–5 in DM

Table 1: The study of clinical manifestation MCA stenosis patients

(Number of patients: 100)			
S. No.	Manifestations	Number of patients	Percentage (%)
1	HTN	75	75
2	DM	58	58
3	Smokers	38	38
4	Alcoholics	26	26
5	CAD	32	32
6	Hypercholesterolemia	48	48
7	Obesity	52	52
8	PVD	2	2

HTN: Hypertension, DM: Diabetes mellitus, PVD: Peripheral vascular disease

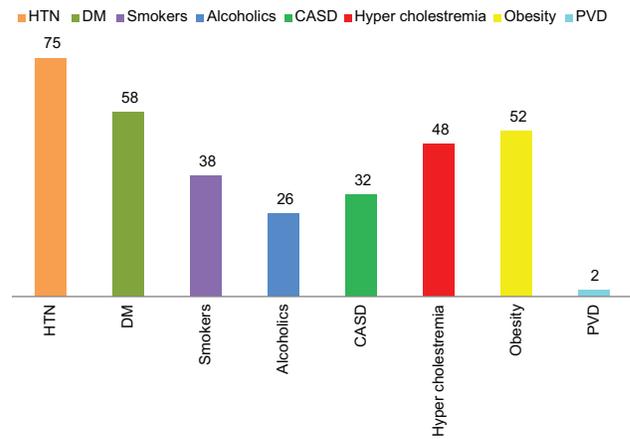
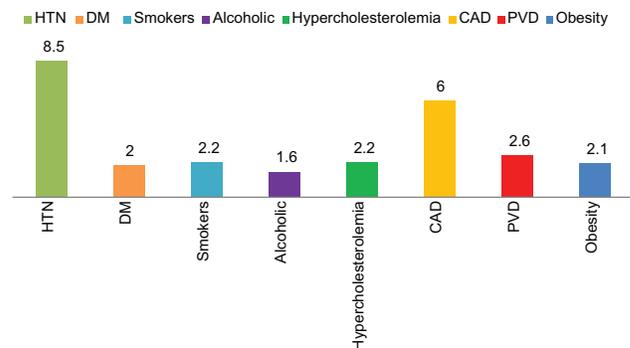


Table 2: The study of odds ratio of various risk factors in MCA stenotic patients

Variables	Odds ratio	95% CI
HTN	8.5	1.1-63
DM	2.0	0.7-5
Smokers	2.2	1-5.3
Alcoholic	1.6	0.6-3.8
Hypercholesterolemia	2.2	1-4
CAD	6	2.7-16.2
PVD	2.6	0.1-16.4
Obesity	2.1	0.8-5.1

CAD = Coronary artery disease, PVD=Peripheral vascular disease, DM: Diabetes mellitus, HTN: Hypertension



- 2.2 odds ratio and CI 1–5.3 in smokers
- 1.6 odds ratio and CI 0.6–38 in alcoholic
- 2.2 odds ratio and CI 1–4 in hypercholesterolemia
- 6 odds ratio and CI 2.7–16.2 in CAD
- 2.6 odds ratio and CI 0.1–16.4 in PVD
- 2.1 odds ratio and CI 0.8–5.1 in obesity

DISCUSSION

Transcranial Doppler (TCD), study of stenosis of MCA among Bihar Population. The clinical manifestations were 75% of HTN, 58% DM, 38% smokers, 26% alcoholics, 32% CAD, 48% hypercholesterolemia, 52% obesity, and 2% PVD [Table 1]. In the study of odds ratio also, HTN had 8.5, CAD had 6, DM 2.0, smokers 2.2, PVD 2.6, and obesity 2.1 [Table 2]. TCD technique was approached, temporal acoustic window to identify MCA [Figure 1] and TCD of the right MCA patient showing peak systolic velocity [Figure 2]. These findings are more or less in agreement with the previous studies.^[5-7]

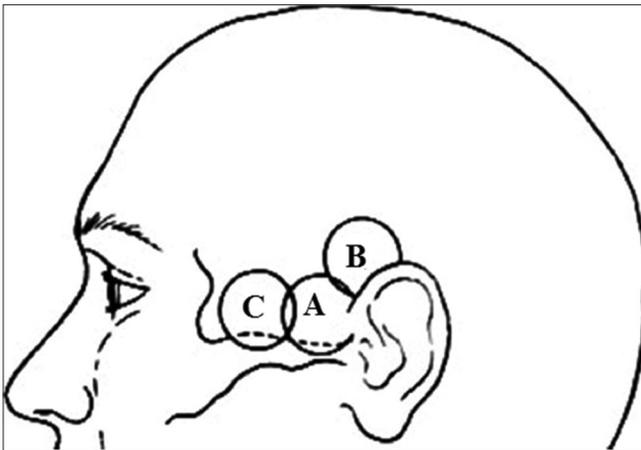


Figure 1: Temporal acoustic windows to identify MCA: a, pre-auricular position; b, posterior window; and c, anterior window. The probe should be placed in pre-auricular region to identify MCA. If not successful, position b should be tried before position c

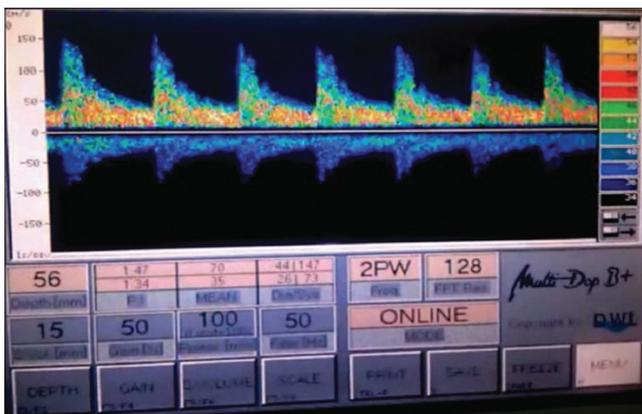


Figure 2: TCD of the right MCA on a patient showing peak systolic flow velocity

Identification of etiology during the treatment and prevention in adult/young stroke patients. The most common etiologies are large artery atherosclerosis (LAA) and small-vessel diseases (SVDs). The causes of LAA and SVD are hypercholesterolemia could be due to obesity, DM, smoking, alcoholics, and rarely PVD. These factors aggravate the stenosis in MAC and results into stroke.^[8] It is also reported that Moyamoya disease plays a key role in stenosis of intracranial arteries. This disease is more prevalent in Asian countries including India.^[9]

Identification of exact mechanism of intracranial stenosis, especially MCA, is challenging. High-resolution MR imaging may be helpful in distinguishing characters of stenosis by offering arterial wall imaging. It is also reported during transcranial color code duplex sonography study that stenosis of intracranial arteries patients was quite variable, that is., from 83 to 94% and 67 to 72%, suggesting that patients with ischemic cerebrovascular disease were prone to intracranial artery stenosis and ischemic stroke.^[10] Hence, SVD etiologies are not clearly understand.

CONCLUSION

The TCD study of intracranial stenosis in different age groups and both sexes and its clinical manifestations is universally accepted and secondary treatment is to avoid lipid or fatty diet, smoking, and alcohol which enables obesity, DM, and HTN. However, this study demands further genetic, cardiovascular, nutritional, pathophysiological, and pharmacological study because exact pathogenesis of stenosis, IHD, and stroke is still unclear.

REFERENCES

1. Kwon SU, Kim JJ, Lee JH. Ischemic stroke in Korean young adults. *Acta Neurol Scand* 2000;101:19-24.
2. Lee HN, Ryu CW, Yuri SW. Vessel wall magnetic resonance imaging of intra cranial atherosclerotic plaque and ischemic stroke. *Front Neurol* 2018;9:1032-4.
3. Ryu WS, Park SS. Long term natural history of intra cranial arterial stenosis MRA follow up study cerebro. *Vasc Dis* 2014;38:2906.
4. Wenjuan XU, Zhang X. Prevalence and outcome of young stroke patients with middle cerebral artery. *MC Neurol* 2021;21:99.
5. Hussian S, Sukumaran S. Pattern of intra cranial versus extra cranial atherosclerotic cerebro-vascular disease in Indian patients with stroke. *J Clin Neurosci* 2003;10:30-4.
6. Wong KS. Global burden of intra cranial atherosclerosis. *Int J Stroke* 2006;1:158-9.
7. Bogousslavsky J, Barnette HJ. Atherosclerotic disease of the middle cerebral artery. *Stroke* 1986;17:1112-20.

8. Rolfs A, Fazekar F, Grittner U, Dichgans M, Martus P, Holzhausen M, *et al.* Acute cerebrovascular disease in the young: The stroke in young fabry patients study. *Stroke* 2013;44:340-9.
9. Ojha R, Huang D. Distribution of ischemic infarction and stenosis of intra-and extracranial arteries in young Chinese patients with ischemic stroke. *BMC Cardio vasc Disord* 2015;15:158-62.
10. Kim JS. Moyamoya disease: Epidemiology, clinical features, and diagnosis *J Stroke* 2016;18:2-11.

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