



ISSN: 0976-3031

Available Online at <http://www.recentscientific.com>

CODEN: IJRSFP (USA)

International Journal of Recent Scientific Research  
Vol. 9, Issue, 7(E), pp. 28009-28013, July, 2018

**International Journal of  
Recent Scientific  
Research**

DOI: 10.24327/IJRSR

## Research Article

# CAROTID DOPPLER EVALUATION OF TRANSIENT ISCHEMIC ATTACK AND STROKE PATIENTS AND ITS CORRELATION WITH CT SCAN HEAD

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DOI: <http://dx.doi.org/10.24327/ijrsr.2018.0907.2375>

### ARTICLE INFO

#### Article History:

Received 15<sup>th</sup> April, 2018

Received in revised form 7<sup>th</sup>

May, 2018

Accepted 13<sup>th</sup> June, 2018

Published online 28<sup>th</sup> July, 2018

### ABSTRACT

**Background and Objectives:** Stroke is one of the most common debilitating diseases with a huge burden related to both mortality and morbidity, ischemic stroke is far common compared to haemorrhagic stroke and also associated with significant carotid stenosis. Hence this present study is carried out to evaluate all the aspects of this disease. **Objectives:** Objective of this study was to 1.To Evaluate stroke and TIA patients with carotid ultrasound Doppler to look for Intima Media thickness, presence and characterization of plaque (type, surface and site), spectral waveform analysis and percentage of stenosis. 2.To find out the prevalence of carotid artery stenosis in stroke patients and TIA patients. 3.Observation/Correlation between percentage stenosis (carotid USG) and infarct size on CT. 4.To find out if there is any association between carotid artery lumen IMT and stenosis with age, hypertension and diabetes. **DESIGN:** Cross sectional single centre study. **Main Outcome Measures:** CT-scan and Carotid Doppler studies on patients admitted into our institution with signs and symptoms of stroke. A detailed and thorough history, physical examination and investigations were performed, studied and noted. **Results:** Out of 75 patients clinically diagnosed as stroke 55 patients showed small infarcts and 20 showed large infarcts in the CT-Scan. 75 patients underwent Doppler Ultrasonography of the Carotid Arteries. The prevalence of the carotid stenosis in this study is 38.7% (29 out of 75 had stenosed carotids). In this study 90.5% of patients with <50 % stenosis had small infarct on CT head, while only 9.5% of these patients had large infarct.62.5% of patients with >50% stenosis had large infarct on CT scan head, just 37.5% of these patients had small infarct. **Conclusion:** Carotid stenosis is one of the common causes of ischaemic stroke. 38% of ischaemic stroke patients had carotid stenosis in our study. -The prevalence of carotid stenosis increases with increase in age, male gender, diabetes mellitus and Hyper tension. - A simple, non-invasive screening procedure like Doppler sonography of the carotid arteries in high risk individuals could therefore have profound diagnostic and therapeutic implications in predicting and preventing a potentially fatal and devastating stroke. -The present study has shown that Carotid Doppler is an important non invasive diagnostic tool. It can be used for screening in high risk asymptomatic patients, patients with history of cerebrovascular events and for determining treatment protocol. Thus it should be used as a first line investigation in these patients supplemented by Magnetic Resonance Angiography whenever required and angiography should be used only in equivocal cases.

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### INTRODUCTION

Stroke is the second most common cause of death next to ischemic heart disease. Infarction accounts to 85% of cases and haemorrhage accounts to 15% of the cases. Atherosclerosis of the carotid artery plays an important cause of ischemic stroke. Mortality and morbidity can be prevented by early diagnosis and treatment. CT and MRI remain the two important investigations to diagnose stroke. CT is the most common investigation used in the diagnosis and treatment of the stroke. Though MRI is superior to it because of the easy availability of

CT and higher cost of MRI, CT helps in finding of size, site, and nature of the lesion in stroke patients.

#### Aims and Objectives

**Aim:** The study aims to determine the correlation of CT scan and carotid Doppler in evaluation of acute stroke and TIA.

#### Objectives

Objective of this study is to evaluate stroke and TIA patients with carotid Doppler ultrasound to assess Intima Media

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thickness, presence and characterization of plaque, spectral waveform analysis and percentage of stenosis. 2. To find out the prevalence of carotid artery stenosis in stroke patients and TIA patients. 3 .Observation/Correlation between percentage stenosis (carotid USG) and infarct size on CT brain. 4. Secondary objective: To find if there is any association between Carotid Artery IMT thickness and stenosis with risk factors such as Diabetes mellitus, Hypertension and Age.

## SUBJECTS AND METHODS

It is a prospective study conducted over a period of two years, involving one group consisting of seventy five patients.

### Inclusion Criteria

Patients with symptoms of stroke and transient ischaemic attack such as Transient episodes of neurological dysfunction, sudden weakness or numbness, hemiparesis, focal neurological deficits, sudden loss of consciousness, altered sensorium, aphasia, slurring of speech, diminution or loss of vision.

### Exclusion Criteria

Evidence of posterior circulation stroke. 2). Evidence of parenchymal haemorrhage as cause of stroke. 3). Evidence of non vascular cause of stroke. 4). Duration of stroke more than 1 week Patients with history of head injury.

## RESULTS

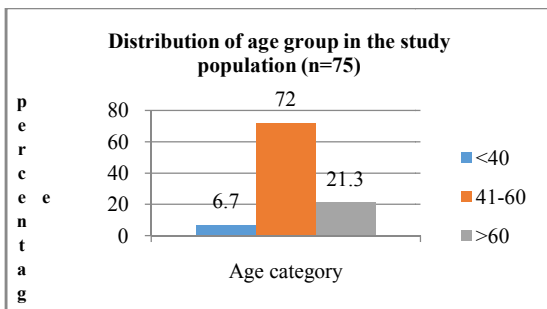
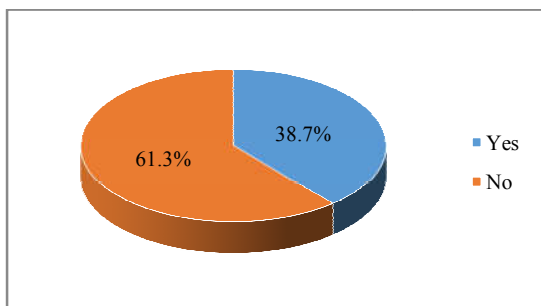


Figure Distribution of age group in the study population

In our study population majority of the people belonged to 41-60 age group category, 21.3 % of the population belonged to the age group of >60 and only 6.7% of the population belonged to >40 age groups.



In our study population, 38.7% of the patients had carotid artery stenosis and 61.3 % had no stenosis.

Table 1 Association between hypertension and intima media thickness

Hypertension	Abnormal IMT		Total n(%)	p-value
	Yes n(%)	No n(%)		
Yes	42(84.0)	15(60.0)	57(76.0)	0.04
No	8(16.4)	10(40.0)	18(24.0)	
Total	50(100.0)	25(100.0)	75(100.0)	

Table 2 Association between diabetes and intima media thickness

Diabetics	Abnormal IMT		Total n(%)	p-value
	Yes n(%)	No n(%)		
YES	39(78.0)	12(48.0)	51(68.0)	0.01
NO	11(22.0)	13(52.0)	24(32.0)	
TOTAL	50(100.0)	25(100.0)	75(100.0)	

Table 3 Association between age and carotid stenosis

Age category	Carotid stenosis		Total n(%)	p-value
	Yes n(%)	No n(%)		
<40	1(3.4)	4(8.7)	5(6.7)	0.43
41-60	20(69.0)	34(73.9)	54(72.0)	
>60	8(27.6)	8(17.4)	16(21.3)	
Total	29(100)	46(100.0)	75(100.0)	

Table 4 Association between diabetes and carotid artery stenosis

Diabetics	Carotid artery stenosis		Total n(%)	p-value
	Yes n(%)	No n(%)		
Yes	20(69.0)	31(67.4)	51(68.0)	0.5
No	9(31.0)	15(32.6)	24(32.0)	
Total	29(100.0)	46(100.0)	75(100.0)	

Table 5 Association between hypertension and carotid artery stenosis

Hypertension	Carotid artery stenosis		Total n(%)	p-value
	Yes n(%)	No n(%)		
Yes	23(79.3)	34(73.9)	57(76.0)	0.4
No	6(20.7)	12(26.1)	18(24.0)	
Total	29(100.0)	46(100.0)	75(100.0)	

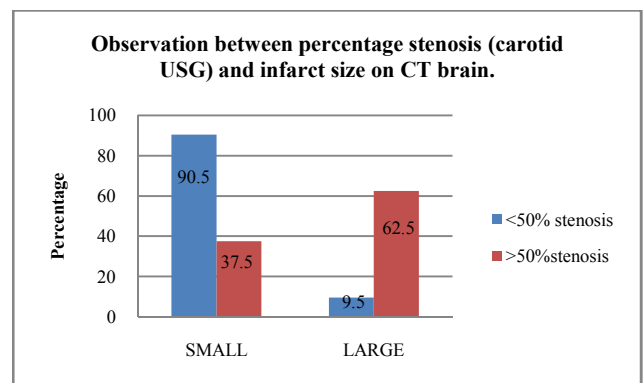


Figure Observation between percentage stenosis (carotid USG) and infarct size on CT brain

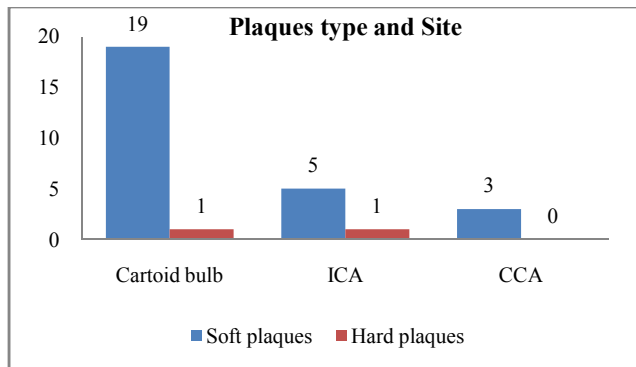
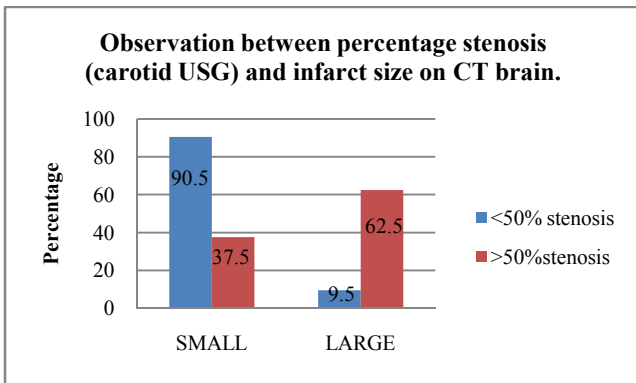


Figure Observation between site and type of plaque

**Cases**

**Case 1:** Case of sudden loss of consciousness with difficulty in moving left upper and lower limbs.

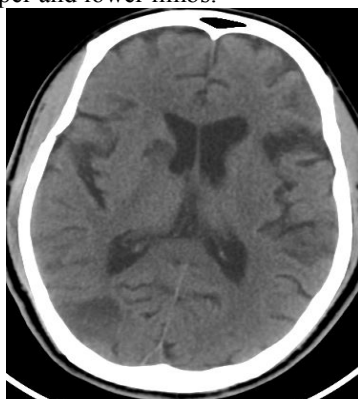


Figure 1 Plain axial CT of Infarct noted in the right corona radiata and occipital region

Figure shows Infarct noted in the right corona radiata and occipital region with CT attenuation value ~22HU. No evidence of mid line shift noted.



Figure Grey scale USG of plaque in right Carotid bulb

Figure shows Soft plaque measuring 1.1 x 0.27 cms noted in the right carotid bulb.

**Case 2:** 50 year old patient came with complaints of difficulty in moving right upper and lower limb. Patient is a known case of diabetes and hypertension.

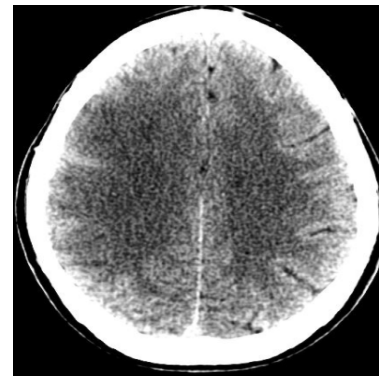


Figure Plain axial CT of Infarct noted in the right high fronto parietal region

Figure shows Large Acute infarct noted in the right high fronto parietal region with loss of grey-white matter differentiation with CT attenuation value ~24HU.

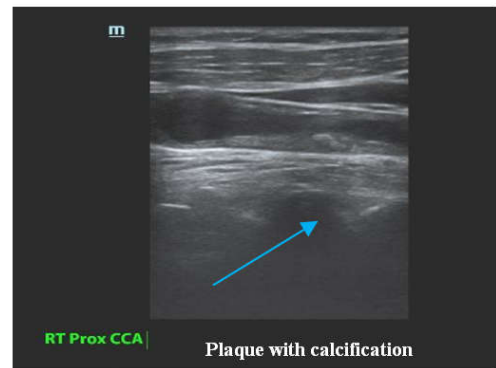


Figure Grey scale USG of plaque in right proximal CCA

Figure Shows plaque with few areas of calcification noted in the right proximal common carotid artery causing significant stenosis (>50%).

**DISCUSSION**

Atherosclerosis of carotid vessels will lead to the plaque formation which in turn causes narrowing and hardening of the carotid vessels. Therefore it is essential to measure the arterial wall thickness and lumen size to rule out the stenosis. Few studies have proven that carotid stenosis is the most important risk factor causing CVA. Keeping this in mind, a study was conducted to prove the association between CVA and carotid artery stenosis.

**Diabetes Mellitus and Carotid Stenosis**

In our study we found out that 69% of the (20 out of 29) diabetic patients developed carotid artery stenosis more commonly than the 31% non diabetic (9 out of 29) patients. However this was not statistically significant. Bharath *et al* and Rajamani *et al* through their study proved that diabetics (22%) develop carotid stenosis more commonly.

### Diabetes Mellitus and IMT

In our study we found out that increase in carotid artery intimal media thickness is more common among diabetics 78% (39 out of 50 patients) than in non-diabetic individuals 28% (11 out of 50 patients). It was statistically significant. Conducted a study among diabetic and non-diabetic subjects and concluded that the IMT is an important diagnostic parameter for the diagnosis of acute ischemic stroke among the diabetic patients.

### Hypertension and Carotid Stenosis

In our study we found out that hypertensive patients 79.3% (23 out of 29) developed carotid artery stenosis more commonly than non hypertensive individuals 20.7% (6 out of 29). However this study was not statistically significant. This study was constituent with the studies done by Duncan *et al*, Sutton *et al* which proved that hypertensive patients develop carotid stenosis more common than non hypertensive patients.

### Hypertension and IMT

In our study we found out that increased carotid artery intimal media thickness is more common among hypertensives 84%(42 out of 50 patients) than in non- hypertensive individuals 16% (8 out of 50 patients) and it was statistically significant. This study was constituent with the studies done by Adaikappan *et al* and Sharma *et al* which had similar results where CIMT is significantly increased in all hypertensive patients when compared with people who are normotensives.

Thickness of intima media is regarded as an important marker of atherosclerosis in the cerebrovascular system and the whole arterial system. It has been proved that thickness of intima media if greater than 0.8mm can lead to early atherosclerotic changes. The mean thickness in stroke and TIA patients is 0.92mm. The study conducted by us showed slightly greater thickness of intima media than the results obtained by the study conducted by Ratnkar sahuo *et al*(2009) in which patient group showed 0.78mm(range 0.5\_1.5mm) and control group showed 0.594mm(range 0.4\_0.9mm).

In our study we noted that 38.7% of the patients in TIA and stroke group showed stenosis with plaques. Whereas study conducted by Ratnakar Sahoo *et al*(2009) showed 30% and studies conducted by Malik Rajesh *et al* and Muhammed al Najim *et al* showed 84% and 63% of stroke patients had plaques respectively. This can be due to difference in study population. But it also shows the increase in the prevalence of carotid artery stenosis in stroke patients. This is explained by increased incidence of atherosclerosis due to changes in lifestyle and better control and management of other conditions causing ischemic stroke like vasculitis, infective endocarditis and Rheumatic heart disease. In our study, patient group with >50% stenosis showed that the prevalence of large infarcts was 62.5% while only 37.5% had showed small infarcts. Whereas 90.5% of patients with <50% stenosis showed small infarcts on CT scan and only 9.5% of the patients with <50% showed large infarcts. This study correlated well with study done by Muhammed -al -Najim *et al* in which large infarcts were more common in patients with >50% stenosis than in patients with <50% stenosis.

### CONCLUSION

Carotid artery stenosis is one of the most common causes of ischemic stroke. In our study we proved that 38% of patients with ischemic stroke had carotid artery stenosis and also proved that patients with >50% stenosis had higher chance of developing large infarcts. Risk factors like age, male gender, Diabetes and hypertension also have influence on the development of carotid artery stenosis. A simple, non-invasive screening procedure like Doppler sonography of the carotid arteries in high risk individuals (DM, HTN) could therefore have profound diagnostic and therapeutic implications in predicting and preventing a potentially fatal and devastating stroke. The present study has shown that Carotid Doppler is an important non invasive diagnostic tool. It can be used for screening in high risk asymptomatic patients, patients with history of cerebrovascular events and for determining treatment protocol. Thus it should be used as a first line investigation in these patients, supplemented by Magnetic Resonance Angiography whenever required, and angiography should be used only in equivocal cases.

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**How to cite this article:**

Raju M.V.S *et al*. 2018, Carotid Doppler Evaluation of Transient Ischemic Attack and Stroke Patients and its Correlation With Ct Scan Head. *Int J Recent Sci Res*. 9(7), pp. 28009-28013. DOI: <http://dx.doi.org/10.24327/ijrsr.2018.0907.2375>

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