

Frequency of Abnormal Intima Media Thickness of Carotid Artery in Obese Individuals by Colour Doppler Ultrasonography

Nosheen Ahmad, Asim Shaukat, Nazish Hameed, Hasan Bokhari

ABSTRACT

Objectives: To determine the frequency of abnormal Intima media thickness of Carotid artery in obese individuals by using color Doppler ultrasonography. **Design:** Descriptive cross-sectional study. **Setting:** Department of Radiology Allied Hospital, Faisalabad. Period: From August 2011 to June 2012, **Methodology:** A total of 96 patients were enrolled in this study. LOGIC 5 Doppler ultrasound machine was used. B-mode ultrasonography of common carotid arteries was performed on both sides with a 7.5 MHz linear array transducer. Intima media thickness was accessed in the distal wall of common carotid artery of both sides 1.0 cm proximal to carotid bulb. **Results:** Mean age of the patients was observed 50.1±5.9 years. Abnormal intima media thickness in right common carotid artery (RCCA) was found to be in 46 (47.9%) patients and in 45 (46.8%) patients in left common carotid artery (LCCA). Mean values of intima-media thickness (IMTs), luminal diameters (LD) and flow velocity (FV) systolic and diastolic of right common carotid artery (RCCA) as follows, 0.74±0.17, 6.90±0.93, 78.91±17.03 and 21.50±5.67, respectively. Mean values of intima-media thickness (IMTs), luminal diameters (LD) and flow velocity (FV) systolic and diastolic of left common carotid artery (LCCA) as follows, 0.74±0.15, 6.85±0.72, 76.58±12.49 and 20.41±5.14, respectively. **Conclusion:** Carotid intima-media thickness testing by using Colour Doppler Ultrasonography is a powerful and noninvasive tool in the early detection of atherosclerotic plaques and carotid artery wall thickening and is an independent predictor of strokes and heart attacks.

Key words: Intima media thickness, Colour Doppler Ultrasonography, Obesity

Corresponding Author

Dr. Nosheen Ahmad

Senior Registrar, Radiology

Allied Hospital, Faisalabad

Contact: +92 300-6652174

Email: drnosheenahmad@hotmail.com

Article Citation: Ahmad N, Shaukat A, Hameed N, Bokhari H. Frequency of Abnormal Intima Media Thickness of Carotid Artery in Obese Individuals by Colour Doppler Ultrasonography. APMC 2016;10(1):41-45.

INTRODUCTION

Obesity is a common health problem in both developed and developing countries, with an overall prevalence of 30% in westernized society.¹ In Pakistan its prevalence is 10.3%.² Patients having BMI >30 was considered as obese individuals.

Obesity is an independent risk factor for developing atherosclerotic changes in great vessels.³

Atherosclerotic plaques are more dangerous than calcific plaque because they tend to dislodge easily and result in ischemic attacks (stroke).⁴⁻⁶

Doppler ultrasonography offers a noninvasive investigation of hemodynamics in carotid vessels thereby helps in the diagnosis of new therapies and prevention of ischemic stroke by providing prophylactic treatment.⁷

Carotid intima media thickness (IMT) have clinical application as a marker of developing atherosclerosis in the setting of various risk factors

like hyperlipidemia, hyperglycemia, hypertension and other metabolic syndromes. From previous studies it has been estimated that prevalence of increase in common carotid artery intima media thickness in obese is 45%.⁸

Stroke is the commonest emergency in any neurology ward in Pakistan. Likewise present life style and rapid urbanization has caused an increase in risk of atherosclerosis in Pakistan as well. It has been estimated in previous studies that in cases of sudden cardiac death 67 % of individuals had varying degree of atherosclerosis.⁹⁻¹¹

Since obesity predisposes to atherosclerosis and coronary syndrome, Carotid artery Doppler is a noninvasive test and has no radiation hazards, so it can be used as a screening tool to detect sub clinical atherosclerosis at an early stage to intimate high risk individuals either change their lifestyle or use

pharmacological measures. By this we can prevent progression of atherosclerosis which leads to fatal outcome like stroke or myocardial infarction etc.

METHODOLOGY

This was a descriptive cross-sectional study undertaken in Department of Radiology, Allied Hospital, Faisalabad. Study was carried out over a period of twelve months from August 2011 to June 2012. Ninety six patients who ranged from > 25 yrs and < 55 yrs of age of both genders with BMI more than 30 were collected from OPD of Radiology and medical department of Allied Hospital Faisalabad. The patients excluded from the study are those with history of Diabetes mellitus, Hypertension, Stroke, Ischemic heart disease and smoking

All the patients were examined with LOGIC 5 Doppler ultrasound machine was used. B-mode ultrasonography of common carotid arteries was performed on both sides with a 7.5 MHz linear array transducer. Ultrasound was done in supine position & elevation of chest by pillow. Intima media thickness was accessed in the distal wall of common carotid artery of both sides 1.0 cm proximal to carotid bulb. The sampling gate was placed at the centre of the arterial axis & flow velocities were recorded only after the signal has stabilized. Peak systolic velocity was measured in the common carotid artery with insonation angle adjusted between 50° & 60° to the course of vessel. The luminal diameter of common carotid artery was measured between the bright internal echogenic lines of parallel vessel wall, & percentage of narrowing of its lumen was measured.

To minimize bias, all of the measurements was taken in the same position at the same level.

Collected data were analyzed through computer software SPSS 17. Frequency & percentage was computed for gender & abnormal hemodynamics in right & left common carotid arteries. Mean & standard deviation was computed for quantitative variables like age, Intima media thickness, luminal diameter & flow velocity.

RESULTS

Regarding age distribution of cases, maximum number of patients 57 (59.3%) were 46-54 years of age and minimum were 15 patients (15.7%) with mean age 50.1±5.9 (Table-1).

Majority of the patients were male i.e. 69 (71.9%) and 27 (28.1%) patients were female (Table-2).

Table 1: Distribution of cases by age

Age (Year)	Number	Percentage
26-35	15	15.7
36-45	24	25.0
46-54	57	59.3
Total	96	100.0
Mean±SD	50.1±5.9	

Table 2: Distribution of cases by sex

Sex	Number	Percentage
Male	69	71.9
Female	27	28.1
Total	96	100.0

Abnormal intima media thickness in right common carotid artery (RCCA) was found to be in 46 (47.9%) patients and in 45 (46.8%) patients in left common carotid artery (LCCA) (Table-3).

Table 3: Abnormal Haemodynamics in Right Common Carotid Artery (RCCA) & Left Common Carotid Artery (LCCA) n=96

Variables	Abnormal haemodynamics	
	Yes	No
Intima media thickness(RCCA)	46 (47.9%)	50 (52.1%)
Intima media thickness(LCCA)	45 (46.8%)	51 (53.2%)

Mean values of intima-media thickness (IMTs), luminal diameters (LD) and flow velocity (FV) systolic and diastolic of right common carotid artery (RCCA) as follows, 0.74±0.17, 6.90±0.93, 78.91±17.03 and 21.50±5.67, respectively (Table-4).

Mean values of intima-media thickness (IMTs), luminal diameters (LD) and flow velocity (FV) systolic and diastolic of left common carotid artery (LCCA) as follows, 0.74±0.15, 6.85±0.72, 76.58±12.49 and 20.41±5.14, respectively (Table-5).

Table 4: Mean values of intima-media thickness (IMTs), luminal diameters (LD) and flow velocity (FV) systolic and diastolic of right common carotid artery (RCCA)

Variables	Mean	SD
Intima media thickness (mm)	0.74	±0.17
Luminal diameter (mm)	6.90	±0.93
Flow velocity (cm/s) systolic	78.91	±17.03
Flow velocity (cm/s) diastolic	21.50	±5.67

Table 5: Mean values of intima-media thickness (IMTs), luminal diameters (LD) and flow velocity (FV) systolic and diastolic of left common carotid artery (LCCA)

Variables	Mean	SD
Intima media thickness (mm)	0.74	±0.15
Luminal diameter (mm)	6.85	±0.72
Flow velocity (cm/s) systolic	76.58	±12.49
Flow velocity (cm/s) diastolic	20.41	±05.14



Figure 1: 50 year old obese female patient with increased intima media thickness of 0.87mm in left common carotid artery 1cm proximal to carotid bulb

DISCUSSION

Atherosclerosis develops in association with the dyslipidemia of obesity. Myocardial infarction and

stroke are the two major causes of early death in the obese people.¹²

The mechanism behind the increased carotid artery vessel luminal diameter in the overweight subjects in the present study may be related to regulatory mechanisms that were present before compensatory enlargement to preserve lumen area and, therefore, vessel diameter may be used as a risk factor indicator

Increased IMT is considered an early marker of atherosclerosis. Cross sectional associations have been reported between IMT and cardiovascular risk and prevalent cardiovascular disease.¹³ Bots et al. found a positive association between carotid IMT and the incidence of strokes of all types.¹⁴

According to Ginaros et al and Semrad et al the thickness of the carotid wall increases with age and is augmented in diabetic subjects.¹⁵

In a study by Keser et al, total 114 patients were included, the male to female: ratio was 1.5:1.¹⁶ In our study, the overall male to female ratio was high. Males were significantly more than females.

In a study by Holaj et al, carotid IMT was determined by ultrasonography. There was significant difference in intima media thickness in patients with obesity/diabetes mellitus as compared to control group (0.892 ± 0.154 mm versus 0.812 ± 0.124 mm; $P < 0.01$).¹⁷

The increased intima media thickness is a predictor of both myocardial infarction and stroke. The combined measure of common-carotid-artery and internal carotid artery intima media thickness is a better predictor of events than either thickness measure taken alone. When statistical adjustment was made for traditional cardiovascular risk factors, carotid-artery intima media thickness remained a significant predictor of cardiovascular events. The strength of the associations between intima media thickness and outcome was at least as strong as the associations seen with traditional risk factors.¹⁸

The procedure of carotid ultrasonography helps in detecting the exact place where the carotid artery has been narrowed. Carotid artery disease, is the main risk factor for stroke. This luminal narrowing of the artery is caused by plaque in a blood vessel. Plaque usually forms when cholesterol, fat and other such substances accumulate in the intimal layer of an artery.¹⁹

A carotid ultrasound is beneficial for previous stroke victims or those at risk. It is used to visualize different types of plaque. Sometimes it is used to

access whether a stent, (a widener for the artery to prevent blockage caused by plaque), is properly placed.¹⁹

With the advance of ultrasound technology, more clinically relevant information such as IMT, plaque morphology and arterial blood flow volume can be obtained in a carotid ultrasound examination and it helps neurologists in the prediction of stroke risk and prognosis of stroke.²⁰

In present study, abnormal intima media thickness was found to be in 47.9% in obese patients. These results are comparable with the findings of Burke et al i.e. 45% in obese subjects.¹¹

CONCLUSION

Carotid intima-media thickness testing by using colour Doppler Ultrasonography is a powerful and noninvasive tool in the early detection of atherosclerotic plaques and carotid artery wall thickening and is an independent predictor of strokes and heart attacks.

REFERENCES

1. Zebekakis PE, Nawrot T, Lasaridis AN, Stassen JA, Fagard RH, Boudier SHA, et al. Obesity, fat distribution and large artery wall properties. *Arterial Hypertension* 2004;13:1-2.
2. Jafar TH, Chaturvedi N, Pappas G. Prevalence of overweight and obesity and their association with hypertension and diabetes mellitus in an Indo-Asian population. *CMAJ* 2006;175:1071-7.
3. Khan NI, Naz L, Yasmeen G. Obesity: an independent risk factor for systemic oxidative stress. *Pak J Pharm Sci* 2006;19:62-4.
4. Kotsis VT, Stabouli SV, Papamichael CM, Zakopoulos NA. Impact of obesity in intima media thickness of carotid arteries. *Obesity* 2006;14: 1708-15.
5. Dennis B, Aziz K, She L, Burke GL, Manolio TA, Aziz SA, et al. High rates of obesity and cardiovascular disease risk factors in lower middle class community in Pakistan. *J Pak Med Assoc* 2006;56:267-72.
6. Mehboob F, Majeed MZ, Zaman SM. An impact of life style and obesity on diabetes, hypertension and hyperlipidemia. *J Fatima Jinnah Med Coll* 2007;1:59-63.
7. Spence JD. Technology insight: ultrasound measurement of carotid plaque-Patient management, genetic research, and therapy evaluation. *Nat Clin Pract Neurol* 2006;12:611-9.
8. Burke GL, Bertoni AG, Shea S, Tracy R, Watson KE, Blumenthal RS, et al. The impact of obesity on cardiovascular disease risk factors and subclinical vascular disease. *Arch Intern Med* 2008;168:928-35.
9. Lo J, Dolan SE, Kanter JR, Hemphill LC, Connelly JM, Lees RS, et al. Effects of obesity, body composition, and adiponectin on carotid intima-media thickness in healthy women. *J Clin Endocrinol Metabolism* 2006;91:1677-82.
10. Mushtaq S, Shafiq H, Sharif MA, Mamoon N, Khadim T. Sudden cardiac death morphological changes in myocardium and coronaries. *Pak J Pathol* 2006;17:38-41.
11. Vicenzini E, Ricciardi MC, Puccinelli, Altieri M, Vanacore N, DiPiero V, et al. Common carotid artery intima-media thickness determinants in a population study. *J Ultrasound Med* 2007;26:427-32.
12. Rexrode KM, Hennekens CH, Willett WC, et al. A prospective study of body mass index, weight change, and risk of stroke in women. *JAMA* 1997; 277:1539-45.
13. Burke GL, Evans GW, Riley WA. Arterial wall thickness is associated with prevalent cardiovascular disease in middle-aged adults. The Atherosclerosis Risk in Communities (ARIC) Study. *Stroke* 1995;26:386-91.
14. Bots ML, Hoes AW, Koudstaal PJ, Hofman A, Grobbee DE. Common carotid intima-media thickness and risk of stroke and myocardial infarction: the Rotterdam Study. *Circulation* 1997;96:1432-7.
15. Semrád B, Lábrová R, Dufková E, Vysočanová P, Fišer B, Honzíkova N et al. Relation between carotid wall thickness, age and baroreflex sensitivity in normotensive and hypertensive subjects. *Physiol Res* 2004;53:55.
16. Keser G, Aksu K, Tamsel S, Ozmen M, Kitapcioglu G, Kabaroglu C et al. Increased thickness of the carotid artery intima-media assessed by ultrasonography in Behçet's disease. *Clin Exp Rheumatol* 2005;23:S71-6.
17. Holaj R, Zelinka T, Wichterle D, Petrak O, Straucl B, Widimsky J Jr. Increased intima-media thickness of the common carotid artery in primary aldosteronism in comparison with essential hypertension. *J Hypertens* 2007;25:1451-7.
18. Topouchian J, Asmar R, Sayegh F, Rudnicki A, Benetos A, Bacri AM et al. Changes in arterial

structure and function under trandolapril-verapamil combination in hypertension. Stroke 1999;30: 1056–64.

19. What is carotid artery ultrasonography? [Online] [cited 2011 June 10]; Available from: http://www.ehow.com/about_5074739_carotid-ultrasonography.html.
20. Stella SY. Carotid ultrasonography: How do I do it? ASUM Ultrasound Bulletin 2004;7:11–14.

- **Dr. Asim Shaukat**
Associate Professor, Radiology
PMC / Allied Hospital, Faisalabad
- **Dr. Nazish Hameed**
Assistant Professor, Radiology
Sargodha Medical College, Sargodha
- **Dr. Hasan Bokhari**
Senior Registrar, Radiology
Allied Hospital, Faisalabad

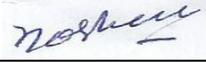
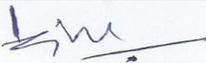
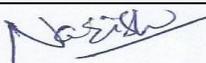
AUTHORS

- **Dr. Nosheen Ahmad**
Senior Registrar, Radiology
Allied Hospital, Faisalabad

Submitted for Publication: 13-10-2015

Accepted for Publication: 21-01-2016

AUTHORSHIP AND CONTRIBUTION DECLARATION

Name of Author	Contribution to the paper	Author's Signatures
Dr. Nosheen Ahmad	Main Author	
Dr. Asim Shaukat	Research Supervision	
Dr. Nazish Hameed	Proof Reading and Manuscript Writing	
Dr. Hasan Bokhari	Statical Supervisor	