COMPARISON OF THE DIAMETER AND CAROTID INTIMA MEDIA THICKNESS IN DIABETIC PATIENTS WITH AND WITH METABOLIC SYNDROME ON ULTRASOUND

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ABSTRACT
Objective: This objective of this study was to compare the diameter and intima media thickness of carotid arteries in diabetic patients with and without metabolic syndrome on ultrasound examination.
Methodology: This cross sectional study was conducted at Radiology department of Lahore General Hospital (LGH) and completed in 6 months using non-probability purposive sampling. We took 100 cases, 50 diabetic patients (group-A) without metabolic syndrome and 50 diabetics with metabolic syndrome (group-B). All patients 20-90 years of age of either sex presenting with confirmed type 2 diabetes mellitus with and without metabolic syndrome were taken in this study. Patients with stroke due to secondary causes like trauma, impaired coagulation or tumor were excluded from this study. Patient's age, gender, IMT, and diameter of Right CCA, Left CCA, Right ICA and Left ICA were measured and compared in both study groups.
Results: In this study mean age of patients in group – A was 49.04 ± 9.78 years and in group-B the mean age 53.72 ± 53.72 years. Intima media thickness (IMT) of right and left CCA and right ICA was statistically higher in group-B (1.10 ± 0.2, 1.09 ± 0.21 and 0.47 ±0.02) as compared to group-A (0.79±0.12, 0.78±0.13 and 0.45±0.03), p-value < 0.001 while IMT of left ICA was statistically same in both groups (in group-A 0.46±0.03 and group B was 0.47±0.03), p-value > 0.05. Diameter of right and left CCA was significantly higher in group-B (6.79±0.1 and 6.66 ± 0.297) as compared to group-A (6.52±0.19 and 6.47±0.32), p-value < 0.001 and diameter of right ICA and left ICA was statistically same in both groups, p-value > 0.05.
Conclusion: Since diabetic patients with metabolic syndrome are at greater risk of developing increased CCA-IMT and increase in CCA-IMT is associated with all subtypes of ischemic stroke, carotid plaque and cardiovascular deaths. So early detection is needed to identify individuals at risk and further prospective studies are recommended to demonstrate the regression of carotid IMT with management of metabolic syndrome in Type 2 DM patients.

Keywords: Type 2 diabetes mellitus, metabolic syndrome, Intima media thickness, Common carotid Artery, Internal Carotid Artery.

INTRODUCTION
Diabetes mellitus (DM) is a major health problem worldwide with its increasing prevalence with more than 180 million people worldwide and would be 366 million diabetic patients by the year 2030 [1].Type 2 diabetes mellitus (T2DM) affects approximately 24 million individuals and is a major cause of morbidity and mortality due to cardiovascular complications. [2]The incidence of cardiovascular disease (CVD) is more common in patients with type 2 diabetes than in the general population. Dyslipidemia, an established risk factor for CVD, is strikingly common in patients with type 2 diabetes, affecting almost 50% of this population. [2]The prevalence of dyslipidemia has increased globally with the advent of newer lifestyles over the past decades. The frequency and patterns of dyslipidemia and the extent of blood lipid abnormality in the general population especially diabetics have drawn considerable attention. [3]

The metabolic syndrome is extremely common worldwide and can be found in approximately one-third of patients with essential hypertension in whom it is a major cause of cardiovascular and renal events, even in the absence of overt diabetes. [4]Traditional and nontraditional cardiovascular (CVD) risk factors associated with metabolic syndrome are present long

before the onset of clinical diabetes, which raises the question about their major role in development of diabetes and CVD. [5, 6]

Patients with type-2 diabetes mellitus have greater incidence of carotid intima media thickness and they are at risk for developing atherosclerosis.[7] This study is designed to compare the diameter and intima media thickness of carotid arteries in diabetic patients with and without metabolic syndrome at Lahore General Hospital Lahore.

MATERIALS AND METHODS

This cross sectional study was done at Radiology department of LGH and was completed in 6 months using non-probability purposive sampling. Using purposive sampling we took 100 cases, 50 diabetic patients (group-A) without metabolic syndrome and 50 diabetics with metabolic syndrome (group-B). All patients 20-90 years of age of either sex presenting with confirmed type 2 diabetes mellitus with and without metabolic syndrome were taken in this study.Patients with stroke due to secondary causes like trauma, impaired coagulation or tumor were excluded from this study. The variables included in the study will be age, gender, Cholesterol, Triglycerides, duration of DM and Fasting Glucose were taken. IMT, and diameter of Right CCA, Left CCA, Right ICA and Left ICA were measured using high resolution ultrasound scanner equipped with a linear array transducer.

All collected data was entered in computer programme SPSS version 20 and analyzed through this software. Mean ± standard deviation will be calculated for quantitative data and frequency and percentage was calculated for categorical data. Mann Whiteny U test was applied to compare both study groups for their quantitative data. P-value < 0.05 will be considered as significant.

RESULTS

In this study mean age of patients in group – A was 49.04 ± 9.78 years and in group-B the mean age 53.72 ± 53.72 years. The mean body mass index in group A and group B was 27.55 and 36.38 respectively, with higher BMI in group- B, p-value < 0.001. The mean Cholesterol level of patients in group – A was 179.56 ± 60.08 and in group-B the mean cholesterol was 324.68 ± 61.57, p-value < 0.01. The mean triglycerides level in group-A and group –B was 150.20 ± 48.37 and 186.28 ± 42.12 respectively, with higher mean triglycerides in group-B, p-value < 0.001. The mean duration of diabetes was higher in group-B (11.40 ± 4.06 months) as compared to group-A (3.40 ± 3.02 months), p-value < 0.001. Moreover mean Fasting glucose in group-A (126.12±67.83) and group-B (295.40 ± 94.79) was also comparable, p-value < 0.001.

Intima media thickness (IMT) of right and left CCA and right ICA was statistically higher in group-B (1.10 ± 0.2, 1.09 ± 0.21 and 0.47 ±0.02) as compared to group-A (0.79±0.12, 0.78±0.13 and 0.45±0.03), p-value < 0.001 while IMT of left ICA was statistically same in both groups (in group-A 0.46±0.03 and group B was 0.47±0.03), p-value > 0.05. Diameter of right and left CCA was significantly higher in group-B (6.79±0.1 and 6.66 ± 0.297) as compared to group-A (6.52±0.19 and 6.47±0.32), p-value < 0.001 and diameter of right ICA and left ICA was statistically same in both groups, p-value > 0.05.

Table-1: Comparison of age, BMI, Cholesterol, Triglycerides, duration of diabetes mellitus and Fasting Glucose in both study groups.

	Study groups	Mean	S.D	p-value
Age (years)	Group-A	49.04	9.78	0.120
	Group-B	53.72	11.08	
BMI	Group-A	24.45	3.24	<0.001
	Group-B	27.55	2.99	
Cholesterol	Group-A	179.56	60.08	< 0.001
	Group-B	324.68	61.57	
Triglycerides	Group-A	150.20	48.37	< 0.001
	Group-B	186.28	42.12	
duration of DM	Group-A	3.40	3.02	< 0.001
	Group-B	11.40	4.06	
Fasting Glucose	Group-A	126.12	67.83	< 0.001
	Group-B	295.40	94.79	

Table-2: Comparison of Intima media thickness and diameters of left, right CCA and ICA in both study groups

		Study groups	Mean	S.D	p-value
IMT	***Right CCA***	Group-A	0.79	.12	< 0.001
		Group-B	1.10	.20	
	Left CCA	Group-A	0.78	.13	< 0.001
		Group-B	1.09	.21	
	Right ICA	Group-A	0.45	.03	< 0.001
		Group-B	0.47	.02	
	Left ICA	Group-A	0.46	.03	> 0.05
		Group-B	0.47	.03	
Diameter	***Right CCA***	Group-A	6.52	.19	< 0.001
		Group-B	6.79	.17	
	Left CCA	Group-A	6.47	.32	< 0.001
		Group-B	6.66	.29	
	Right ICA	Group-A	4.48	.20	> 0.05
		Group-B	4.54	.14	
	Left ICA	Group-A	4.52	.25	> 0.05
		Group-B	4.48	.21	

DISCUSSION

Currently, over 200 million individuals are known to have diabetes mellitus (DM) worldwide and this number is expected to double by the year 2025. [8]Type 2 diabetes mellitus (DM) patients are prone to higher risk of cardiovascular disease and atherosclerotic burden. [9]A local study reported Carotid artery stenosis was observed in 30 (19.2%) diabetics as compared to 20 (9%) non-diabetics (p<0.004). Analysis of percentage stenosis of carotid artery disease in the study population revealed that >70% stenosis was present in 20 (5.3%) with 13 (8.3%) diabetics and 7 (3.1%) non-diabetics (p<0.025). Stenosis of 50–70% was observed in 30 (7.9%) of which 17 (10.9%) were diabetics and 13 (5.8%) were non-diabetics. [10]

A study reported significantly high mean thickness was observed in the common carotid intima media (0.824 ± 0.155 mm) but not in the internal carotid arteries in group II patients (patients with non blood pressure component metabolic syndrome) compared to group I (without metabolic syndrome) patients (0.708 ± 0.113 mm). Group II also had a significant number of patients with increased lesion intima media thickness (≥ 1.1 mm).[7] We in this study found that intima media thickness (IMT) of right and left CCA and right ICA was statistically higher in group-B (1.10 ± 0.2, 1.09 ± 0.21 and 0.47 ±0.02) as compared to group-A (0.79±0.12, 0.78±0.13 and 0.45±0.03), p-value < 0.001 while IMT of left ICA was statistically same in both groups (in group-A 0.46±0.03 and group B was 0.47±0.03), p-value > 0.05. Diameter of right and left CCA was significantly higher in group-B (6.79±0.1 and 6.66 ± 0.297) as compared to group-A (6.52±0.19 and 6.47±0.32), p-value < 0.001 and diameter of right ICA and left ICA was statistically same in both groups, p-value > 0.05. One more study was conducted and they compared hypertensive (group-I) and hypertensive with metabolic syndrome (group-II) and they reported that we observed in patients of the second group significantly increased values for anthropometric parameters such as body mass index(p<0.001), waist circumference (p<0.001) and waist-hip ratio (p<0.001) compared to the first group. The differences between groups considering the levels of total cholesterol (p<0.001),triglycerides (p<0.001), LDL-cholesterol (p<0.001), and HDL-cholesterol (p<0.001) were also statistically significant. The patients from the second group had significantly increased carotid IMT values compared to the patients from the first group (1.27±0.03 mm vs.1.00±0.03 mm, p<0.001). The study revealed that metabolic syndrome is associated with structurally-functional changes of arterial vessels (increased IMT). These findings are in consistent to our finding when we compared these parameters within our population. Furthermore it is also supported that Common carotid intima-media thickness (IMT) and distensibility are markers of structural and functional vessel wall properties. Both parameters have been found in population-based studies to be associated with cardiovascular risk factors and prevalent cardiovascular disease. [11]

Hence in the light of our findings and some evidence from literature we found that metabolic syndrome with Type 2 DM is associated with greater

carotid IMT values than in those diabetics free from metabolic syndrome. Further prospective studies are recommended to demonstrate the regression of carotid IMT with management of metabolic syndrome in Type 2 DM patients.

CONCLUSION

Since diabetic patients with metabolic syndrome are at greater risk of developing increased CCA-IMT and increase in CCA-IMT is associated with all subtypes of ischemic stroke, carotid plaque and cardiovascular deaths. So early detection is needed to identify individuals at risk and further prospective studies are recommended to demonstrate the regression of carotid IMT with management of metabolic syndrome in Type 2 DM patients.

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AUTHOR'S CONTRIBUTION

Dr. Tanweer Ahmad has contributed in selection of the topic, planning the study and final write up, where as Dr. Kiran Sarfraz and Dr. Sadia Imran collected the data and wrote the final results.

REFERENCES

1. Al-Khawaldeh OA, Al-Hassan MA, Froelicher ES. Self-efficacy, self-management, and glycemic control in adults with type 2 diabetes mellitus. Journal of Diabetes and its Complications. 2012;26(1):10-6.
2. Vijayaraghavan K. Treatment of dyslipidemia in patients with type 2 diabetes. Lipids Health Dis. 2010;9(1):144.
3. Wu J-Y, Duan X-Y, Li L, Dai F, Li Y-Y, Li X-J, et al. Dyslipidemia in Shanghai, China. Preventive medicine. 2010;51(5):412-5.
4. Şerban C, Drăgan S, Şuşan L, Caraba A, Păcurari A, Christodorescu R, et al. Metabolic syndrome in relation with intima-media thickness in hypertensive patients. Analele Societatii Nationale de Biologie Celulara. 2010;15(2):247-51.
5. Leite SA, Monk AM, Upham PA, Chacra AR, Bergenstal RM. Diabetology & Metabolic Syndrome. Age (years). 2009;40(11):45.7-10.
6. Ogbera AO. Prevalence and gender distribution of the metabolic syndrome. Diabetol Metab Syndr. 2010;2(1):4.
7. Al-Nimer MS, Hussein II. Increased mean carotid intima media thickness in type 2 diabetes mellitus patients with non-blood pressure component metabolic syndrome: A preliminary report. International journal of diabetes in developing countries. 2009;29(1):19.
8. He C, Gu M, Jiang R, Li J-h. Noninvasive assessment of the carotid and cerebrovascular atherosclerotic plaques by multidetector CT in type-2 diabetes mellitus patients with transient ischemic attack or stroke. Diabetology & metabolic syndrome. 2013;5(1):9.
9. Ibebuogu UN, Nasir K, Gopal A, Ahmadi N, Mao SS, Young E, et al. Comparison of atherosclerotic plaque burden and composition between diabetic and non diabetic patients by non invasive CT angiography. The international journal of cardiovascular imaging. 2009;25(7):717-23.
10. Shahid M, Abid AR, Dar MA, Noeman A, Amin S, Azhar M. Carotid disease in diabetic patients undergoing coronary artery bypass grafting. Journal of Ayub Medical College, Abbottabad : JAMC. 2011;23(3):69-73. Epub 2011/07/01.
11. Simons PC, Algra A, Bots ML, Grobbee DE, van der Graaf Y. Common carotid intima-media thickness and arterial stiffness indicators of cardiovascular risk in high-risk patients the smart study (second manifestations of ARTerial disease). Circulation. 1999;100(9):951-7.