

Original article:

Study of CT scan coronary calcium score in high risk stroke patients at tertiary care hospital

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Abstract:

Introduction: Stroke is one of the most important cause of death and the greatest cause of disability all over the world.

Material and methodology: The present descriptive study was carried out on 622 patients in the department of Radio-diagnosis, RMC, PIMS (D.U), Loni from September 2018 to September 2020. All patients referred to Department of Radiodiagnosis for CT scan coronary calcium score were enrolled for the study.

Results: In this study hypertensive patients with calcium score between 11-100 were 100 (26.9%) and with calcium score > 400 were 188 (50.5%). Comparison of HT and calcium score showed statistically significant results.

Conclusion: Our study assessed subclinical atherosclerosis as defined by CIMT and CACs to develop simple, non-invasive yet sensitive risk-prediction tools to promptly identify those individuals at risk of CVD as valuable clinical strategy that can be more widely implemented in everyday primary care practice.

Keywords: Computed Tomography, stroke

Introduction:

Stroke is one of the most important cause of death and the greatest cause of disability all over the world. Approximately 20% to 30% of the strokes can be related to carotid artery stenosis (CAS).¹ Moreover, due to the aging of the population, the global burden of atherosclerosis, and thereby its clinical consequences will continue to rise in the coming decades.² Computed tomography (CT) and magnetic resonance (MR) are the main non-invasive tools for plaque analysis both in carotid and coronary arteries, whereas other methods such as optical coherence tomography (OCT), and intravascular ultrasound (IVUS) are the main invasive intravascular methods for the assessment of coronary atherosclerosis; conventional doppler-ultrasound (US) also plays a major role in the assessment of carotid artery atherosclerotic disease. A minor but very intriguing role might be played by nuclear medicine techniques and in particular by positron emission tomography (PET), which is the tool that at this point of time can bring us closest to actual molecular/metabolic imaging of carotid and eventually coronary atherosclerosis.^{3,4,5} In simple words, PET might soon be able to provide information about metabolic activity of atherosclerotic plaques through the application of highly specific probes able to indicate plaque activity/vulnerability; this particular and very demanding application might also be in the future a territory that CT and MR might explore with probes developed with the same strategy.⁶ Currently, an accurate clinical diagnosis of coronary heart disease (CHD) relies on coronary artery computed tomography angiography (CCTA) and coronary arteriography (CAG), which are limited by high cost and other factors in clinical application.⁷

Material and methodology:

The present descriptive study was carried out on 622 patients in the department of Radio-diagnosis, RMC, PIMS (D.U), Loni from September 2018 to September 2020. All patients referred to Department of Radiodiagnosis for CT scan coronary calcium score were enrolled for the study. All patients referred to Department of Radiodiagnosis for Carotid artery Doppler ultrasound and CT scan coronary calcium score were enrolled for the study. The enrolled cases were subjected for the following selection criteria.

Inclusion criteria:

1. Patients who are consenting for study.
2. All patients referred to Department of Radiodiagnosis for Carotid artery Doppler ultrasound and CT scan coronary calcium score at Pravara Rural Hospital, Loni.
3. Patients with history of Hypertension, diabetes, hypercholesterolemia or smoking. (High risk patients of coronary artery disease)
4. All genders.

Exclusion criteria:

1. Patient not consenting for study.
2. Pregnant women. (CT scan contraindication)
3. Patient having persistent tachycardia.

CT scan coronary artery calcium score was performed on —SIEMENS-Multislice SOMATOM Perspective 64 rows 128 slice MACHINE

Results:

In this study the mean age was 56.56 years, mean IMT was 0.88 mm, mean calcium score was 286.18 and AP diameter was 7.44 mm.

In this study incidence of patients in age group of 50-60 years was 365 (58.7%) showed highest predominance. In this study male patients 499 (80.2%) were more in number as compared to female patients 123 (19.8%). In this study incidence of HTN was present in 372 (59.3%) patients.

Table 1: Calcium Score wise distribution of the study

	Frequency	Percent
0 (no evidence of CAD)	124	19.9
1-10 (minimal)	23	3.7
11-100 (mild)	101	16.2
101-400 (moderate)	186	29.9
>400 (severe)	188	30.2
Total	622	100.0

In this study total 124 (19.9%) patients do not have any evidence of CAD while 186 (29.9%) and 188 (30.2%) patients had moderate (101-400) and severe (>400) calcium score respectively.

Table 2: Comparison of HTN and calcium score

			Calcium score					Total
			0	1-10	11-100	101-400	>400	
HTN	Absent	N	124	1	1	124	0	250
		%	49.6%	0.4%	0.4%	49.6%	0.0%	100.0%
	Present	N	0	22	100	62	188	372
		%	0.0%	5.9%	26.9%	16.7%	50.5%	100.0%
Total		N	124	23	101	186	188	622
		%	19.9%	3.7%	16.2%	29.9%	30.2%	100.0%

P value=0.001 (S)

In this study hypertensive patients with calcium score between 11-100 were 100 (26.9%) and with calcium score > 400 were 188 (50.5%).

Comparison of HT and calcium score showed statistically significant results.

Discussion:

Cardiovascular diseases represent the first cause of death in the industrialized western world and in the near future, it will probably be the first all over the world.^{8,9} In spite of this knowledge notwithstanding the progress recently made in treating patients with acute cardiovascular diseases, no similar progress has been reached in secondary prevention.¹⁰ Our results showed that Calcium Score value and Carotid Intima Media Thickness had a significant association with diabetes, hypertension, smoker and hypercholesterolemia in the present study.

Carotid atherosclerosis is assessed by ultrasonic determined IMT for predicting CVD, in particular cerebrovascular disease.¹¹ Although assessment of carotid atherosclerosis in the internal carotid artery improves prediction of CVD better than IMT in the common carotid artery, several studies do not include evaluation of IMT in the internal carotid artery due to poor accessibility when using ultrasound. Moreover, scan protocols may vary in terms of visualized segments, scan angles used, definition of carotid plaque, and definitions of cut points for abnormal IMT, and a substantial observer variability has been found.¹² Previously, it has been demonstrated that ultrasound is highly accurate in detecting the presence of large calcified plaques.¹³ In this relation, the non-calcified part of plaques has been associated with carotid ulcerations in vulnerable plaques,⁷¹ while multiple calcifications have been associated with intra-plaque hemorrhage. Moreover, studies have documented a discrepancy and a poor correlation between carotid ultrasound features and CTA regarding plaque ulcerations and stenosis grading in symptomatic patients.

In the present study, IMT showed positive correlation with CS. Similar results by El-Behery AA (2019)¹⁴ et al. Jeevarethi-nam et al, 2017 and Guaricci et al., 2014 also reported a significant correlation was found between IMT and presence of coronary calcification Chu Z (2019)¹⁵ et al showed that CS values were significantly positively correlated with the morphological indicators of carotid plaque burden (wall area, total

area of blood vessels and plaque burden), and that CS values were highly predictive of lipid-rich necrotic nucleus, a histological indicator of plaque stability. This suggests that CS value may be associated with total plaque burden and stability. Studies have shown that the degree of carotid calcification is related to the downstream microemboli in stroke patients.

The relationship that we found between carotid IMT and Calcium score on CT supports the concept that atherosclerosis is a systemic process. However, modest correlations indicate that atherosclerosis may have a heterogeneous distribution. This relationship may be affected by risk factor profile.

Conclusion:

Our study assessed subclinical atherosclerosis as defined by CIMT and CACs to develop simple, non-invasive yet sensitive risk-prediction tools to promptly identify those individuals at risk of CVD as valuable clinical strategy that can be more widely implemented in everyday primary care practice.

References:

- 1] Sitzer M, Müller W, Siebler M, Hort W, Kniemeyer HW, Jäncke L, et al. Plaque ulceration and lumen thrombus are the main sources of cerebral micro-emboli in high-grade internal carotid artery stenosis. *Stroke* 1995;26:1231-3
- 2] Cademartiri F, Balestrieri A, Cau R, Punzo B, Cavaliere C, Maffei E, Saba L. Insight from imaging on plaque vulnerability: similarities and differences between coronary and carotid arteries—implications for systemic therapies. *Cardiovasc Diagn Ther* 2020;10(4):1150-1162.
- 3] Stuijzand WJ, Danad I, Raijmakers PG, Marcu CB et al. Additional value of transluminal attenuation gradient in CT angiography to predict hemodynamic significance of coronary artery stenosis. *JACC Cardiovascular imaging* 2014;7(4):374-386.
- 4] Dalager S, Paaske WP, Kristensen IB, Laurberg JM, Falk E. Artery-related differences in atherosclerosis expression: implications for atherogenesis and dynamics in intima-media thickness. *Stroke* 2007;38(10):2698-2705
- 5] Rafeian-Kopaei M, Setorki M, Doudi M, Baradaran A, Nasri H. Atherosclerosis: process, indicators, risk factors and new hopes. *Int J Prev Med* 2014; 5(8):927-946
- 6] Lasam G, Dudhia J, Anghel S, Brensilver J. Utilization of Echocardiogram, Carotid Ultrasound, and Cranial Imaging in the Inpatient Investigation of Syncope: Its Impact on the Diagnosis and the Patient's Length of Hospitalization. *Cardiol Res* 2018; 9(4):197-203.
- 7] Birmpili P, Porter L, Shaikh U, Torella F. Comparison of Measurement and Grading of Carotid Stenosis with Computed Tomography Angiography and Doppler Ultrasound. *Ann Vasc Surg* 2018; 51:217-224
- 8] Rafailidis V, Chryssogonidis I, Tegos T, Kouskouras K, Charitanti- Kouridou A. Imaging of the ulcerated carotid atherosclerotic plaque: a review of the literature. *Insights Imaging* 2017;8:213–225
- 9] van den Bouwhuisen QJ, Bos D, Ikram MA et al. Coexistence of calcification, intraplaque hemorrhage and lipid core within the asymptomatic atherosclerotic carotid plaque: the Rotterdam study. *Cerebrovasc Dis* 2015;39:319–324
- 10] Hatsukami TS, Ferguson MS, Beach KW et al. Carotid plaque morphology and clinical events. *Stroke* 1997;28:95–100
- 11] Nambi V, Chambless L, He M, Folsom AR, Mosley T, Boerwinkle E, Ballantyne CM. Common carotid artery intima-media thickness is as good as carotid intima-media thickness of all carotid artery segments in improving prediction of coronary heart disease risk in the Atherosclerosis Risk in

Communities (ARIC) study. *Eur Heart J* 2012;33(2):183-190

- 12] El-Behery AA, Badawy ME, El Maebod N, Nassar IA. Carotid artery doppler ultrasound and coronary calcium score in assessment of atherosclerosis in patients with suspected coronary artery disease. *Med J Cairo Univ* 2019;87(5):3401-3416.
- 13] Guaricci AI, Arcadi T, Brunetti ND et al. Carotid intima media thickness and coronary atherosclerosis linkage in symptomatic intermediate risk patients evaluated by coronary computed tomography angiography. *Int J Cardiol* 2014;176 (3): 988-93.
- 14] Jeevarethinam A, Venuraju S, Dumo A et al. Relationship between carotid atherosclerosis and coronary artery calcification in asymptomatic diabetic patients: A prospective multicenter study. *Clin Cardiol* 2017;40(9):752-8.
- 15] Chu Z, Cheng L, Tong Q. Carotid artery calcification score and its association with cognitive impairment. *Clin Interv Aging* 2019;14:167–177

Date of Publishing: 30 March 2021

Author Declaration: Source of support: Nil, Conflict of interest: Nil

Ethics Committee Approval obtained for this study? YES

Was informed consent obtained from the subjects involved in the study? YES

For any images presented appropriate consent has been obtained from the subjects: NA

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DOI: 10.36848/IJBAMR/2020/26215.55565