

PREVALENCE OF CAROTID ARTERY DISEASE IN PATIENTS UNDERGOING CORONARY ARTERY BYPASS GRAFT SURGERY AT KIHD

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Contribution

SAH, MZH and SZR did literature review, research design and also finalized the manuscript, DMJB helped in data collection and data analysis. RS, ID finalized the methodology. SAH, SFH helped in final draft. All authors contributed significantly to the submitted manuscript.

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ABSTRACT

Objective: To find out the prevalence of CAS in patients undergoing CABG surgery at KIHD.

Methodology: This cross sectional study was conducted at the cardiology and cardiac surgery units of Karachi Institute of Heart Diseases, Karachi, Pakistan from September, 2013 to November, 2014. Consecutive patients undergoing CABG surgery at KIHD were included in the study. Doppler ultrasound study of both carotid arteries was done. Patients with previous CABG surgery, congestive cardiac failure and history of stroke or TIA were excluded.

Results: A total of 56 patients were included. Of them 46 were males. The mean age was 56.77 ± 8.72 years. Significant CAS was found in 28(50%) patients. Bilateral CAS was found in 18(32.14%) patients. Unilateral CAS was found in 5(8.93%) on each side.

Conclusion: Significant CAS was found in majority of the patients undergoing CABG at our institution, signifying risk of CVA.

Key Words: Coronary Artery Bypass Grafting, Carotid Artery Stenosis, Coronary Artery Disease, Carotid Artery Doppler Studies.

INTRODUCTION

Coronary artery bypass grafting (CABG) has remained as the gold standard in the management of severe triple vessel coronary artery disease for the past 4 decades world-wide.¹ It is still considered the best treatment option for patients with left main stem disease, poor LV function, and uncontrolled diabetes mellitus.²⁻⁴ Stroke and focal neurological deficit is considered one of the most dreadful complications in patients undergoing CABG operation.⁵

One of the common cause of perioperative stroke and focal neurologic deficit in patients undergoing CABG is the presence of concomitant carotid artery disease (atherosclerosis) leading to carotid artery stenosis and plaque formation.^{6,7} Various methods have been devised for preoperative assessment of carotid artery disease, stenosis and plaque formation in order to predict the probability of perioperative stroke in patients undergoing CABG operation.

Color Doppler scanning with spectral waveform of carotid arteries is an easily available non-invasive method which is cost effective and gives accurate preoperative assessment of the carotid artery disease.⁸ The prevalence of carotid artery disease in patients undergoing CABG varies from 3.5% to 52% in different studies from different regions of the world.⁹ Nevertheless it does show a positive relationship between carotid artery disease and severe triple vessel coronary artery disease.

METHODOLOGY

This cross sectional study was conducted at the Cardiology and Cardiac Surgery Units of Karachi Institute of Heart Diseases, Karachi, Pakistan. The patients selected for this study were on waiting list to undergo coronary artery bypass grafting (CABG) after being diagnosed to have severe coronary artery disease. Data was collected from September, 2013 to November, 2014.

Coronary angiographic findings, Carotid artery findings, and other patient parameters like age, sex, diabetes mellitus, hypercholesterolemia, family history, history of smoking, hypertension, serum creatinine, history of stroke and ejection fractions were all noted from case files. All these factors are known to be associated with carotid artery stenosis.⁹

All these patients were sent to the radiologist preoperatively for carotid Doppler studies which were performed with the patient in supine position with the head slightly extended and tilted to the opposite side. Common carotid arteries, external carotid arteries and internal carotid arteries of both sides were studied and length of plaques, types of plaques and degree of stenosis were recorded. The carotid Doppler studies were performed on Toshiba Nemio 35, Japan using high resolution ultrasound probe (7.5 Mhz).

Gray scale imaging and colour Doppler techniques were used to evaluate size of atherosclerotic plaques, intimal thickness and degree of narrowing in the carotid arteries. Carotid artery stenosis and peak systolic flow were graded using the criteria defined by the society of radiologists in the ultrasound consensus.^{10,11} Patients with incomplete medical records or patients opting for PCI were excluded from the study.

Data collected was entered into the computer and analyzed using the statistical package for the social sciences, version 16 (SPSS inc. Chicago, Illinois, USA). Descriptive statistics such as means and standard deviations were used to summarize quantitative variables while categorical variables were summarized using frequencies and proportions. Students 't' test and 'chi' square test were applied for comparison where appropriate. A p value of <0.05 was taken as statistically significant.

RESULTS

About 56 patients were included in the final analysis. Of them 46 (82.1%) were males and 10 (17.9%) were females. The mean age of the patients was 56.77 ± 8.72 years. The patients baseline characteristics are shown in table-1. Among these patients 34(64.71%) were hypertensives, 33(58.93%) were diabetics, 19(33.93%) had hypercholesterolemia, 24(42.86%) had positive family history of Coronary Artery Disease and 15(26.79%) were smokers. The mean ejection fraction of these patients was $49.48 \pm 11.32\%$.

The coronary angiography findings are shown in table-2. Left main stem stenosis was present in 10 patients, all of them being male patients. LAD was involved in all 56 patients, LCX in 41 patients and RCA in 47 patients. The carotid artery ultrasound findings are shown in table-3. About 31 (55.36%) had carotid stenosis.

Table 1: Demographic Characteristics of Study Population

	Male n (%)	Female n (%)	Total n (%)
No. of Patients	46(82.1%)	10(17.9%)	56 (100%)
Age (years) M±SD	56.50±8.82	58.0±8.53	56.77±8.72
Hypertension (mm of Hg)	25(54.35%)	9(90%)	34(60.71%)
Diabetes Mellitus	24(52.17%)	9(90%)	33(58.93%)
Hypercholesterolemia	15(32.61%)	4(40%)	19(33.93%)
Family History	20(44.48%)	4(40%)	24(42.86%)
Smoking	15(32.61%)	0	15(26.79%)
Stroke	4(8.70%)	0	4(7.14%)
Ejection Fraction (%) M±SD	50.02±11.61	47.0±10.05	49.48±11.32

Table 2: Angiographic Findings of Study Population

	SEX	n	Mean	Std. Deviation	Std. Error Mean	p-value
LM	M	10	62.00	27.406	8.667	
	F	0	.	.	.	
LAD	M	46	78.22	21.513	3.172	.032
	F	10	86.00	14.103	4.460	
DG	M	37	73.38	21.604	3.552	.031
	F	7	87.14	12.536	4.738	
LCX	M	34	75.44	21.011	3.603	.615
	F	7	82.86	19.760	7.469	
OM	M	37	81.76	16.592	2.728	.064
	F	10	89.00	10.750	3.399	
RCA	M	38	82.84	22.818	3.702	.226
	F	9	83.22	13.998	4.666	
PDA	M	34	88.24	17.662	3.029	.066
	F	9	91.11	6.009	2.003	

Significant carotid artery stenosis was found in 28(50%) patients and less than 10% stenosis was found in 3(5.34%) patients, 18(32.14%) patients had significant carotid artery stenosis in both carotid arteries. Unilateral stenosis was found in 5(8.93%) patients each (Table-4). More than 50% stenosis was found in 10(17.56%) on right side and 9(16.07%) patients on the left side, while 10% to 50% stenosis was found in 24 (Right carotid – 11, Left carotid-13) patients.

DISCUSSION

The patients under the current study at KIHD showed high prevalence of carotid artery disease in patients undergoing CABG. The carotid artery disease ranged from non obstructive (<50%) to obstructive (>50%). In our study the ratio of obstructive to non obstructive carotid artery stenosis was almost 50:50, unlike some other studies where ciriloet al reported a prevalence of non-obstructive carotid artery disease of 61.6%, as opposed to 10.2% critical stenosis.¹²

Rather al on the other hand reported non obstructive carotid artery disease in 66.3%, significant carotid artery disease in 5.3% and critical carotid artery disease in 3.7% of patients respectively.¹³ They also demonstrated a higher stroke rate in patients with critical carotid stenosis.

Although critical carotid artery stenosis is an important risk factor for perioperative stroke in CABG surgery patients; the presence of carotid disease irrespective of severity of stenosis heightens the risk of stroke and focal neurological deficits among patients undergoing cardiac surgery as shown by ciriloet al., which demonstrated that out of 31 patients that developed stroke only 8 (26%) had critical carotid artery stenosis, while the rest had non –obstructive

Table 3: Carotid Artery Doppler Findings of Study Population

	SEX	n	Mean	Std. Deviation	Std. Error Mean
RLENGTH	M	4	12.025	7.7021	3.8511
	F	1	7.600	.	.
RCCDIA	M	46	9.757	1.1372	.1677
	F	10	9.790	.7680	.2429
RICDIA	M	46	6.733	1.1173	.1647
	F	10	6.700	.8406	.2658
RECDIA	M	46	5.022	.6844	.1009
	F	10	5.140	.7763	.2455
RIMT	M	46	1.000	.2891	.0426
	F	10	1.000	.1944	.0615
LLENGTH	M	8	12.450	3.2955	1.1651
	F	0	.	.	.
LCCDIA	M	46	9.526	1.2062	.1778
	F	10	9.690	.7264	.2297
LICDIA	M	46	6.467	.9585	.1413
	F	10	6.560	.8222	.2600
LECDIA	M	46	4.861	.7901	.1165
	F	10	4.900	.8907	.2817
LIMT	M	46	1.043	.3038	.0448
	F	10	1.320	.9126	.2886

DIA = Diameter, EC = External Carotid, IC = Internal Carotid

carotid disease.

This finding of patients with non-obstructive carotid artery disease developing perioperative stroke is an eye opener and reinforces the importance of preoperative assessment of carotid artery disease by carotid Doppler studies.

In our study the most common site of plaque formation was internal carotid artery followed by external carotid artery. This is in contrast to the finding of Kallikazaroset al. who reported carotid bulb to be the most common site of plaque formation followed by ICC and ECC.¹⁴

Table 4: Frequency of Carotid Artery Stenosis in Study Population

	< 10%	< 50%	> 50%	Total
Right (n)	2	11	10	23
Left (n)	1	13	9	23
Total (n)	3	24	19	46

CONCLUSION

There is a significant incidence of carotid artery disease in patients undergoing CABG. Routine Doppler ultrasound screening of these patients on list for Cardiac Surgery will identify patients with carotid artery disease and may help in reducing the risk of perioperative stroke and neurological complications.

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