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Role of Various Pre Operative Risk Factors in Outcome Following Coronary Artery Bypass Graft: An Institutional Based Study

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ABSTRACT

Background: Coronary Artery Bypass Graft (CABG) is done in patient with Coronary Artery Disease (CAD) with Normal or decreased Left Ventricular Ejection Fraction (LVEF). Most of the patient with CAD presents with NYHA class II or III.

Methods: It's an analytical study of retrospectively collected data of all patients who underwent CABG for CAD. Data were collected over the period of about 30 months at Nobel Medical College and Teaching Hospital.

Results: There were a total of 54 patients in our study. There was male 38(72%) predominance. There were 49(92.5%) cases having BMI <30 kg/m^2. However only 2 (4%) had COAD, 23 (43%) had DM II, 9 (17%) had abnormal thyroid function, 6 (11%) were dyslipidemic and 1(2 %) had a prior history of CVA. There were 23 (4%)of patients who had history of MI in past and around 45 (85%) had Triple Vessel Disease (TVD).

Conclusion: Among all the pre-operative risk factors HTN and H/O MI had a significant association in improvement in LVEF, similarly thyroid status had a strong association with improvement in NYHA

Keywords: coronary artery bypass graft; pre operative; risk factors; Nepal.

INTRODUCTION

Coronary Artery Bypass Graft (CABG) is done in a patient with coronary artery disease (CAD) with Normal or decreased Left Ventricular Ejection Fraction (LVEF). Most patient with CAD presents with NYHA class II or III.[1,2] There may be various pre-operative risk factors like Gender, Body Mass Index, Active Smoker, Hypertension (HTN), Chronic Obstructive Airway Disease, Diabetes Mellitus type II (DMII), Thyroid Status, Dyslipidemia, Previous CVA, Carotid stenosis, Renal Failure and H/O Myocardial Infraction (MI), which may have a direct or indirect association with postoperative outcome following CABG which is measured as a change in LVEF and NYHA class.[3-6] LVEF and NYHA classes are the most important deciding factor in terms of improvement in patient outcomes, and the presence of various preoperative risk factors like Gender, BMI, Active Smoker, HTN, COAD, DM II, Thyroid Status, Dyslipidemia, Carotid stenosis, Previous CVA, Renal Failure and H/O MI, having direct or indirect relation with change in the outcome of a patient undergoing CABG.[1] The objective of this research is to find the association between preoperative risk factors and post-operative outcomes.

METHODS

This is a retrospective cross-sectional study on 54 patients over a period of thirty months (from Jan 2020 to July 2022) at Nobel Medical College and Teaching Hospital, Biratnagar in the Department of Cardiothoracic and Vascular Surgery (IRC No : 61812022). Sample size was calculated using WHO sample size calculator and data was collected using convenient sampling technique. All the patients who underwent CABG were included in this study. Those patients who expired, lost to follow-up and were unable to communicate were excluded. The risk factors like Gender, BMI, Active Smoker, HTN, COAD, DM II, Thyroid Status, Dyslipidemia, Previous CVA, Carotid stenosis, Renal Failure, and H/O MI will be cross-evaluated with qualitative variables of outcome Change in LVEF and Change in NYHA class using Chi Square test. Data was analyze using SPSS 20.

RESULTS

There was a total of 54 patients in our study, among which 1 patient was excluded from the study because of mortality. The majority of patients who underwent CABG were male 38(72%) and 49 (92.5 %) had a BMI of less than 30. 34 % were active smokers, 45(85 %) were hypertensive and 30(57 %) had carotid artery stenosis. However only 2(4 %) had COAD, 23(43 %) had DM II, 9 (17 %) had abnormal thyroid function, 6(11 %) were dyslipidemic and 1(2 %) had a previous his-

tory of CVA, 23(43%) patients had a history of MI in past and around 45(85 %) had TVD (Table 1).

Table 1. Demographic distribution of various pre-operative risk factors. (n=53)

Variables	Category	Frequency(%)
Gender	F	15(28.3)
	M	38(71.7)
BMI (kg/m^2)	<30	49(92.5)
	≥30	4(7.5)
Thyroid status	No	35(66)
	Yes	18(34)
HTN	No	8(15.1)
	Yes	45(84.9)
COAD	No	51(96.2)
	Yes	2(3.8)
DM	No	30(56.6)
	Yes	23(43.4)
Thyroid status	Normal	44(83)
	Hypothyroidism	8(15.1)
	Hyperthyroidism	1(1.9)
Dyslipedemia	No	47(88.7)
	Yes	6(11.3)
Carotid stenosis	No	23(43.4)
	Yes	30(56.6)
Prior CVA	No	52(98.1)
	Yes	1(1.9)
History of MI	No	30(56.6)
	Yes	23(43.4)
Coronary Artery Anatomy	SVD	1(1.9)
	DVD	7(13.2)
	TVD	45(84.9)

The change in LVEF was stratified into 4 categories namely, no obvious change, change by 1 score, change by 2 score and change by a 3 score. It is based on the amount of improvement noted at 3 months of follow-up following surgery. A change by 1 score is equivalent to an improvement of LVEF by 10 %, similarly change by 2 scores is equivalent to an improvement of LVEF by 20%, and so on. The Association of various pre-operative risk factors with change in LVEF is tabulated in **(**Table 2**),** in which there is a significant association between HTN and history of MI with LVEF. A patient who had a history of HTN has less change in LVEF compared to those without a history of HTN. However, in the case of a patient with H/O MI, they seem to have an improvement in LVEF significantly after surgery. Changes in NYHA are categorized into 3 groups namely, no change, change by 1 score, and change by 2 scores. The Association of pre-operative risk factors with change in NYHA is tabulated in (Table 3**)**, in which there is a strong association between thyroid status with change in NYHA. All the patient with hypothyroidism seems to improve by 1 to 2 scores in this study.

DISCUSSION

CABG is a procedure in which autologous arteries or veins are used as grafts to bypass coronary arteries that are partially or completely obstructed by atherosclerotic plaque.[7-9] CABG is typically performed through a midline sternotomy. The most commonly used bypass conduits are the left internal thoracic artery and the greater saphenous vein.[7-9] The use of a left-internal-thoracic-artery graft to the left anterior descending coronary artery is considered a major quality indicator in CABG in comparison to Percutaneous Coronary Intervention (PCI), especially in patients with Triple Vessel Disease (TVD), Left the main Disease with Diabetic Mellitus and Left Ventricular Dysfunction.[10-12] There is various preoperative risk factor to reflect the outcome of CABG, and there is a strong co-relation with diabetes mellitus, showing CABG to be superior to PCI, where CABG had lower rates of the primary composite outcome of death, myocardial infarction, or stroke (18.7% vs. 26.6%, p=0.005) and of overall mortality (10.9% vs. 16.3%, p=0.05) but a higher rate of stroke (5.2% vs. 2.4%, p=0.03) as compared to PCI. These findings of CABG with diabetes being superior to PIC are supported by the various results of the Future Revascularization Evaluation in Patients with Diabetes Mellitus: Optimal Management of Multivessel Disease (FREEDOM) trial, Bypass Angioplasty Revascularization Investigation (BARI), BARI in Type 2 Diabetes (BARI-2D) trials, Synergy between PCI with Taxus and Cardiac Surgery (SYNTAX)trial and the Randomized Comparison of Coronary Artery Bypass Surgery and EverolimusEluting Stent Implantation in the Treatment of Patients with Multivessel Coronary Artery Disease (BEST) trial.[13-16]Despite of these findings, our study showed no association of diabetes as an important risk factor in term of change in LVEF(p= 0.380) and change in NYHA (p= 0.482) for a patient undergoing CABG. The significant changes in outcome in terms of improvement in NYHA in our study were in a patient with abnormal thyroid status (p = 0.006), whereas in different studies, it showed that overt hyperthyroidism is associated with postoperative arrhythmia complications and pre - and postoperative TSH and free T3 levels may also be helpful to identify mortality and morbidity risk in patients undergoing CABG.[17,18] Likewise change in outcome in terms of improvement in LVEF in our study was in a patient with a history of MI (p=0.004). Overall mortality in our study was 1 out of 54 patients undergoing

Table 2. Association of change in EF with preoperative risk factor.

Variables	Category	Change in LVEF				p-value
		No obvious change (%)	Change by one score (%)	Change by two score (%)	Change by three score (%)	
Gender	F	8(15)	4(7)	2(4)	1(2)	0.62
	M	26(48)	7(12)	1(2)	3(5.5)	
BMI (kg/m^2)	≤30	32(59)	10(19)	3(5.5)	4(7)	1
	>30	2(4)	1(2)	0	0	
Thyroid Status	No	21(39)	7(12)	3(5.5)	4(7)	0.405
	Yes	13(24)	4(7)	0	0	
HTN	No	4(7)	0	3(5.5)	1(2)	.002 *
	Yes	30	11(20)	0	3(5.5)	
COAD	No	32(59)	11(20)	3(5.5)	4(7)	1
	Yes	2(4)	0	0	0	
DM	No	18(33)	6(11)	2(4)	4(7)	0.38
	Yes	16(30)	5(9)	1(2)	0	
Thyroid Status	Normal	29(54)	9(17)	3(5.5)	2(4)	0.236
	Hypothyroidism	5(9)	1(2)	0	2(4)	
	Hyperthyroidism	0	1(2)	0	0	
Dyslipidemia	No	32(59)	8(15)	3(5.5)	4(7)	0.719
	Yes	2(4)	3(5.5)	0	0	
Carotid stenosis	No	16(30)	3(5.5)	1(2)	2(4)	0.674
	Yes	18(33)	8(15)	2(4)	2(4)	
Prior CVA	No	34(63)	10(19)	3(5.5)	4(7)	0.346
	Yes	0	1(2)	0	0	
History of MI	No	24(44)	6(11)	0	0	0.004 *
	Yes	10(19)	5(9)	3(5.5)	4(7)	
Coronary Artery Anatomy	SVD	1(2)	0	0	0	0.547
	DVD	7(13)	0	0	0	
	TVD	26(48)	11(20)	3(5.5)	4(7)	

Abbreviation: BMI: Body Mass Index, HTN: Hypertension, COAD: Chronic Obstructive airway Disease, DM: Diabetic Mellitus, CVA: Cerebrovascular Accident * p-value < 0.05

CABG which comes out to be 1.85%. Referencing other studies, it shows that isolated hypertension is associated with a 40% increase in the likelihood of cardiovascular morbidity in a patient undergoing CABG.[19] This increase remains present regardless of antihypertensive medications, anesthetic techniques, and other perioperative cardiovascular risk factors.[19] Whereas in our study, hypertension had no significant association with the outcome in terms of improvement in LVEF, NYHA, and increase in mortality. Similarly, risk factors like HTN, recent MI, and low EF are common in patients with different degrees of COAD. Among post-CABG complications, patients with different levels of COAD based on STS definition, more frequently developed respiratory failure,[20] but our study showed no significant association with outcome of CABG measured as change in improvement in LVEF and NYHA. Similarly, there are no significant changes in improvement in LVEF and NYHA following CABG risk factors like gender, age, BMI, smoking history, dyslipidemia and carotid artery stenosis. When comparing this result with other studies done worldwide it showed that women report more functional limitations after CABG than men. In addition, the female gender is associated with more pos operative functional impairment after adjusting for these perioperative variables.[21] Likewise among patients undergoing isolated CABG, underweight is an independent predictor for early mortality, and morbid obesity is an independent predictor for late mortality.[22-24] In contrast to this, obese patients may safely undergo coronary artery bypass grafting which does not support the statement of the previous study, that obese patients face a higher mortality risk, also respiratory complications and even wound infections were not increased in this study. Extracranial internal carotid artery stenosis is a risk factor for perioperative stroke in patients undergoing coronary artery bypass surgery.[25-27]Those CABG patients who have TIAs, bilateral carotid artery lesions at least 50% with or without a contralateral occlusion, or a prior CVA with a high grade,

Table 3. Association of NYHA with preoperative risk factor

Variables	Category	Change in NYHA			P-Value
		No Change (%)	Change by one score (%)	Change by two score (%)	
Gender	Female	0	12(22)	3(5.5)	0.396
	Male	4(7)	28(52)	5(9)	
BMI	<30	4(7)	38(70)	7(13)	0.553
	>30	0	2(4)	1(2)	
Active Smoker	No	2(4)	27(50)	6(11)	0.759
	Yes	2(4)	13(24)	2(4)	
HTN	No	0	6(11)	2(4)	0.639
	Yes	4(7)	34(63)	6(11)	
COAD	No	4(7)	38(70)	8(15)	1
	Yes	0	2(4)	0	
DM	No	1(2)	24(44)	5(9)	0.482
	Yes	3(5.5)	16(30)	3(5.5)	
Thyroid status	Normal	4(7)	36(67)	3(5.5)	0.006 *
	Hypothyroidism	0	4(7)	4(7)	
	Hyperthyroidism	0	0	1(2)	
Dyslipidemia	No	4(7)	35(65)	8(15)	0.719
	Yes	0	5(9)	0	
Carotid stenosis	No	0	17(31)	5(9)	0.15
	Yes	4(7)	23(43)	3(5.5)	
Prior CVA	No	4(7)	39(72)	8(15)	1
	Yes	0	1(2)	0	
History of MI	No	2(4)	24(44)	4(7)	0.89
	Yes	2(4)	16(30)	4(7)	
Coronary Anatomy	SVD	0	0	1(2)	0.23
	DVD	1(1)	5(9)	1(2)	
	TVD	3(5.5)	35(65)	6(11)	

at least 70% residual lesion are more likely to have an increased incidence of perioperative neurologic events and appear to benefit from a combined CEA and CABG procedure.[25-27] Insignificant results for cerebrovascular disease in our study might be because the patient does not have more than 70% symptomatic lesion. This higher stroke rate correlates significantly with the increasing age of the CABG patients, with the stroke risk five times greater for patients in their 70s compared with patients between 51 and 60 years old.[25-27]

CONCLUSION

Among all the preoperative risk factors, HTN and H/O MI had a significant association with improvement in LVEF. Similarly thyroid status had a strong association with improvement in NYHA.

Limitation of study

This study is a single-center hospital-based study with a limited sample size, so may not reflect the same result with a different technique in a different center and the finding of this study might not hold the exact mirror for the general population

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Conflict of Interest: None.

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