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Assessment of Coronary Artery Bypass Grafts Status in Symptomatic Patients: An Observational Study

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Abstract

Background: The patency rate of arterial and venous grafts are not fully understood in symptomatic patients following coronary artery bypass grafting (CABG) in developing country like India.

Objective: The study defined the status of Internal Mammary Artery (IMA) and Saphenous Vein Grafts (SVG) in post CABG symptomatic patients (angina, dyspnea, etc).

Method: In this observational study, all symptomatic patients following CABG were included and admitted for Coronary Angiogram (CAG) during the period of January, 2013 to March, 2016.

Results: Within this period, CAG was performed in 216 post CABG patients. The mean age of study subjects was 65.4 +/- 8.06 years. The mean duration following CABG was 9.4 +/- 4.5 years (range: 2-22 years). Left IMA was patent in 84%, whereas, right IMA was patent in 78% grafted vessel. The SVG patency rate was lesser than IMA grafts. SVG was patent in 67% patients of right posterior descending artery (PDA) grafts and 65% of patients of obtuse marginal (OM) artery grafts. Interestingly, SVG patency was more (81%) when it was used for left anterior descending artery (LAD) or diagonal artery (D) grafting. Statistical analysis couldn't demonstrate any cardiac risk factors which could significantly associated with graft occlusion.

Conclusion: After about 10 years of mean duration following operation, our data showed that patency for IMA grafts was worse than expected in our symptomatic patients. The patency rate of SVG to LAD/ D1 was better than SVG to PDA/ OM.

Keywords: Coronary artery bypass grafting; Coronary artery disease; Internal mammary artery graft; Saphenous vein graft; Symptomatic

Introduction

Coronary artery bypass graft (CABG) surgery still remains the standard of care in the treatment of advanced coronary artery disease [1]. It is well recognized that the long-term clinical outcome after myocardial revascularization is dependent on the patency of the coronary artery bypass grafts [1]. Conventionally, invasive coronary angiography (CAG) has been used to assess graft status and evaluate for graft occlusion. CAG in the setting of CABG is important diagnostic tool for the evaluation of bypass graft patency in patients presenting with angina or ischemia [2]. Angiography in the setting of CABG is more complex and challenging. The indication for performing coronary and vein graft angiography in patients with CABG is similar to the patients without bypass surgery [2]. Unstable or symptomatic patients (patients with chest pain and/ or dyspnoea), who are candidates for coronary intervention, should undergo this procedure. Asymptomatic patients (patients without having chest pain or dyspnea) with a large area of ischemia, particularly with the new onset of left ventricular dysfunction or congestive heart failure, may benefit from angiography and intervention [3]. There are paucity of data regarding the status of CABG grafts in the symptomatic patients. We, in this study, had conducted to assess the status of coronary arteries and bypass grafts by CAG when they presented with symptoms suggestive of ischemia and/ or heart failure.

Methods

Study design: It was an observational study which was conducted in a single high volume tertiary care private hospital. The study period was between January 2013 to March 2016. The study design was approved by the institute ethics committee. The written consent was taken from all patients included in this study.

Study patients: All consecutive patients who came following CABG with symptoms suggestive of myocardial ischemia or heart failure were enrolled in this study.

Eligibility Criteria

Inclusion criteria

1. Symptomatic patients (symptoms of angina and/or heart failure) following CABG
2. without having severe renal dysfunction (serum creatinine < 1.6 mg/ dl)
3. Given consent for CAG

Exclusion Criteria

1. Completely asymptomatic patients

2. Having severe renal dysfunction (serum creatinine > 1.6 mg/dl)

3. Didn't give consent for CAG

Study protocol

All those patients who came for follow-up following CABG done in our hospital or outside and fulfilled the eligibility criteria were finally included in this study. We have taken complete history and physical examinations. Echocardiography wvas done in all cases and exercise stress test was done in intermediate risk group patients who had atypical symptoms before CAG. Those having typical symptoms of angina and/or heart failure or had clinical or echocardiographic deterioration were taken directly for CAG. Post angiogram, status of both native and graft vessels were assessed.

Study Endpoints

Primary Endpoint was to find out the status of native coronary artery disease and assess the graft patency.

Secondary Endpoint was to find out the risk factors for bypass graft failure by statistical analysis.

Statistics

All the results were analyzed using the statistical package SPSS 18.0 for Windows (SPSS Inc., Chicago, IL, USA). The numerical variables are demonstrated as mean ± SD, and the categorical variables are presented by raw numbers (percentages). The independent predictors of the graft failure were determined by using the logistic regression model. A p value ≤ 0.05 was regarded statistically significant.

Results

Within this study period, CAG was performed in 216 post CABG patients. The mean age of our study subjects was 65.4 +/- 8.06 years. Almost half (48%) of the study patients belonged to age group of 65 years or less with a male predominant population (88%). There was high prevalence of risk factors like dyslipidemia, hypertension and diabetes was predominant in this study and followed by smoking. Left ventricular (LV) systolic dysfunction (LV ejection fraction < 50%) was demonstrated in about one-third patients. Previous history of myocardial infarction or angioplasty was given in 8% and 10% patients, respectively. The mean duration following CABG was 9.4 +/- 4.5 years (range: 2-22 years) (Table 1).

Table 2 demonstrated the angiographic features of native coronary artery and bypass grafts. Less than ten percent patients had undergone CAG via radial access. About three-fourth of study patients had native triple vessel disease, whereas, in less than ten percent cases, CABG was performed for single vessel disease. Left internal mammary artery (IMA) was patent in 84%, whereas, right IMA was patent in 78% of our study subjects. The venous graft patency rate was lesser than arterial grafts. Saphenous venous graft (SVG) was patent in 67% of patients when it was used for right posterior descending artery (PDA) grafting and 65% of patients where obtuse marginal (OM) artery was grafted. Interestingly, venous graft patency was more (81%) when it was used for left anterior descending artery (LAD) or diagonal (D) grafts.

Table 1: Baseline variables of study patients (n=216).

Characteristics	Number of patients (%)
Age <65 years >65 years	 103 (48%) 113 (52%)
Sex Male Female	 190 (88%) 26 (12%)
Hypertension	161 (74%)
Dyslipidemia	170 (79%)
Diabetes	166 (77%)
Smoker	122 (56%)
LV dysfunction (EF <50%)	71 (33%)
Previous angioplasty	22 (10%)
Previous Myocardial infarction	18 (8%)
Mean duration of following CABG	9.4 +/- 4.5 years

CABG- Coronary artery bypass grafting

Table 2: Angiographic features of native coronary arteries and bypass grafts.

Characteristics	Number of patients (%)
Access Femoral Radial	 201 (93%) 15 (7%)
Coronary artery disease TVD DVD SVD	 166 (77%) 30 (14%) 20 (9%)
Complete arterial revascularization	17 (8%)
Complete venous revascularization	23 (11%)
Coronary artery bypass graft status LIMA to LAD/ D1 Patent Occluded RIMA to D1/ OM/ Ramus/ PDA Patent Occluded SVG to PDA Patent Occluded SVG to OM Patent Occluded SVG to LAD/ D1 Patent Occluded	 161/ 193 (84%) 32/ 193 (16%) 21/ 27 (78%) 6/ 27 (22%) 90/ 135 (67%) 45/ 135 (33%) 73/ 112 (65%) 39/ 112 (35%) 43/ 53 (81%) 10/ 53 (19%)

TVD- Triple vessel disease; DVD- Double vessel disease; SVD- Single vessel disease; LIMA- Left internal mammary artery; RIMA- Right internal mammary artery;
LAD- Left anterior descending coronary artery; D1- First diagonal artery; OM- Obtuse marginal; PDA- Posterior descending artery, SVG- Saphenous venous graft

Table 3: Univariate analysis of factors associated with arterial or venous graft occlusion.

Variables	LIMA		RIMA		SVG to LAD		SVG to D1		SVG to OM		SVG to PDA		P value
	P(161)	O (32)	P(23)	O (8)	P(21)	O (6)	P(24)	O (6)	P(73)	O (39)	P(90)	O (45)	(95% CI)
AGE >65 years	93	12	13	6	15	6	13	4	45	27	53	27	NS
Post CABG >5years	114	30	15	8	16	6	18	6	58	33	71	30	NS
Hypertension	98	20	16	6	13	4	16	5	37	20	46	27	NS
Dyslipidemia	86	18	12	4	10	4	13	3	28	16	31	16	NS
Diabetes	56	15	8	4	09	4	17	5	39	20	43	25	NS
Smoking	60	14	6	3	6	2	10	2	20	12	20	11	NS
LV dysfunction	40	9	5	3	7	3	8	2	18	10	26	10	NS
Diffuse CAD	130	16	16	8	18	5	20	4	68	32	85	32	NS

P= Patent; O= occluded.

Univariate analysis was performed to find out the probable risk factors for graft occlusion in our study subjects. We include risk factors like age (> 65 years), post CABG duration > 5 years, hypertension, diabetes, dyslipidemia, smoking, diffuse CAD and LV dysfunction. Surprisingly, the statistical analysis couldn't demonstrate any cardiac risk factors which could significantly associated w ith graft patency or occlusion (Table 3).

Discussion

Here, in this study we assessed the status of bypass grafts in symptomatic patients following CABG by invasive CAG. Although only few previous studies evaluate the grafts status in symptomatic patients [3-10] but we in this study also tried to find out the risk factors behind the graft occlusion in our patients after a mean duration of about 10 years following CABG. Similar to the previous studies, patency of left IMA and right IMA were more than SVG grafts [11]. Patency of SVG graft in LAD or D1 was better than its placement in PDA or OM artery and this is also in similarity with the previous study [12]. The patency rate of IMA graft was less as this study was performed only on symptomatic patients. Even in symptomatic patients, the SVG patency was seen in almost two-third of the patients enrolled which was little less than the study on the asymptomatic patients.

We didn't include any surgical or procedure related factors associated with graft occlusion as this study was done on diverse population of various hospitals. We included various cardiac risk factors which may have associated with graft occlusion. Although previous studies [13-14] had demonstrated that along with larger (> 2 mm) diameter of vessel grafted, risk factors like diffuse CAD, young age or dyslipidemia may adversely affect the patency rate of graft vessels, but interestingly in this study we didn't find any significant differences among the groups.

This observational study has several limitations like it has not included the procedure related factors which could be the reason behind the graft occlusion and enrolled only symptomatic patients following CABG. We haven't included patients who had died following CABG due to cardiac reasons and we also couldn't compare native vessel disease before CABG and following CABG due to unavailability of full angiographic records in many patients [15]. This study was the first study of its kind which was performed in post CABG symptomatic patient to evaluate the status of both native coronary arteries and graft vessels in our country, India. It gives an idea about the graft status in this subset of patients in the real world population.

Conclusion

In conclusion, we described our observation about the status of bypass grafts in post CABG symptomatic patients. After about 10 years of mean duration following operation, the analysis showed that patency for IMA grafts was better than for SVGs. The patency rate of SVGs was better whereas patency rate of IMA grafts was worse than previous literature in our symptomatic patients following CABG. The patency rate of SVG to LAD/ D1 was better than SVG to PDA/ OM. We didn't find out any important cardiac risk factors associated with graft occlusion.

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