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Timing of Catheterization Post Cabg Surgery: (Tic-Postcabg)

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Abstract

Post coronary artery bypass graft (CABG) patients were arbitrarily divided into 2 groups at the time of cardiac catheterization. Catheterization was performed because of ischemic manifestations. Group A had their surgery less than 5 years (mean 34 ± 20 months). Group B had their surgery more than 5 years (mean 154 ± 59 months). Group A comprised of 33 of 92 patients (36%). Although the 2 groups did not differ in age, sex distribution or risk factors, there was a tendency to have higher percentage of smokers in group A. By multivariate analysis, stenosis of distal anastamosis were more in group A. Patients were operated locally (60%) or abroad. In group A, fewer patients who were operated abroad came for re-cath ($p < 0.009$). Following catheterization, there were no significant differences in modes of treatment (medical vs angioplasty vs surgery) between groups A and B. However surgery (re- CABG) was least indicated in both groups.

Abbreviations

CABG: Coronary Artery Bypass Graft; PCI: Percutaneous Coronary Intervention; CAD: Coronary Artery Disease; HF: Heart Failure

Introduction

Patients with coronary artery bypass grafting (CABG) may redevelop ischemia that necessitates coronary angiography. In addition to native coronary arteries, bypass conduits have to be entered and injected selectively with contrast dye. Either graft failure or native coronary artery disease or both may be the cause of ischemia. There have been many studies that investigate issues related to this topic [1,2]. Smokers who go back to smoking, diabetics with poor control or patients with other risk factors may be candidates for recurrent angina [3]. What we did not come across is whether timing of angiography (sooner or later after CABG) would identify special group of patients.

During routine catheterization of post CABG patients, they could be divided into 2 groups. Those who had their surgery 5 years or less (group A) and those who had their surgery performed longer than 5 years (group B). In addition to comparing presence of risk factors in both groups, we looked at markers of atherosclerosis, post operative medications and vascular anastomosis within each group. The patients were operated locally or otherwise in City Hospital, Paris or Cleveland Clinic, U.S.A. Thus local results of CABG were compared to those of centers abroad. Thirdly, we wanted to compare new native vessel disease (i.e. not involved in their original CABG) or graft failure in groups A and B and their management.

Material and Method

This study availed Ethics Committee approval from the Ethics committee, Ministry of Health in Aug 2013. From September 2013 to July 2014, we enrolled 92 consecutive patients who were catheterized and completed a plan of treatment. All patients were enrolled after getting a signed informed consent. Our center performs 7000 cath cases yearly of which 2000 are percutaneous coronary interventions (PCI). The index center where this study emanates from is a busy and experienced unit. PCI with all complexities are tackled with high success rate. CABG surgery to the tune of 700-750 patients is done yearly by a number of surgeons. On the other hand, many have had their surgeries done abroad. Since the time of catheterization was variable, we arbitrarily divided the total cohort of patients into 2 groups: 5 years or less (group A) and greater than 5 years (group B).

Patient demographics were tabulated. Also years of CABG was noted. The time to recath was calculated in months. The reasons for recath were severe angina, left ventricular failure and recent myocardial infarction. Patients were also catheterized if they developed new bundle branch block, dysrhythmia, or those dropping their ejection fraction by more than 10 percentage points. Also noted was PCI before and after CABG in all patients. Risk factors (smoking, diabetes, hypertension, hypercholesterolemia and family history of coronary artery disease) were ascertained. Also recorded were drug intakes at the time of catheterization. The location of previous surgery was obtained from patient's file. Markers of atherosclerosis or factors promoting as such were noted for both groups.

At catheterization of these post CABG patients, we looked for disease or full patency of native coronary arteries which were not bypassed. Native vessels after insertion of graft conduit was examined and graft disease of arterial or saphenous veins were listed separately. If all grafts were patent, this was noted. There were 4 strategies which were recommended after catheterizations- medical treatment, PCI of native vessel, PCI of graft or re- CABG. The complications rate was noted from the file and included death, myocardial infarction, stroke or need for intra- aortic balloon pump insertion.

Number of patients, in group A and Group B were expressed as percentages and compared to each other by Student's t - tests. Also multivariate analyses of results of the two groups were done.

Results

We recruited 92 consecutive patients who had their CABG done previously. All but one patient were electively catheterized.

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The average age of the full cohort was 62.5 ± 9.5 years with 76 males (82.6%). The patients in group A were 33 and did not differ from group B visa- a-vis, age (mean 60.1 years and 63.8 years respectively). Males predominate with 78.8% in group A vs. 84.7% in group B. The mean number of months at cath time post CABG was 34.2 months for group A vs. 154.6 for group B.

Among classical risk factors (Table 1a), group A had more smokers than group B. The most common reason for catheterization was severe angina (Table 1b). Angina class III and IV was present in 93.9% group A and 84.7% group B. Heart failure occurred in 24.2% and 28.8% for group A and group B respectively. The mean left ventricular ejection fraction was above 50% in both groups. Myocardial infarction occurred at higher percentage for group A compared to group B almost reaching statistical significance. Percentage of PCI before CABG was 18.2% and 13.6% respectively for groups A & B. Post CABG, the PCI percentage increased to 36.4% (group A) and 32.2% (group B). These percentages did not achieve significant difference. Markers of atherosclerosis or factors promoting as such are also tabulated (Table 1a).

Table 1c details the number and type of grafts done for each patient. 37 mammary grafts were put in for 33 patients as well as 3 radial grafts for group A that constituted more recently operated patients. The arterial grafts were 40.4% of the total grafts in this group. A random sample of cath reports pre CABG showed no difference in presence of chronic total occlusion among both groups. Similarly degree of calcification and complexity of lesions were nearly identical, i.e. patients who are referred to surgery have complex disease not amenable to PCI. Table 1d describes the different medications and their percentages in both groups. ACE inhibitors were used more in group A patients and Angiotensin Receptor Blockers were used more in group B (both almost approaching statistical significance).

Table 2 describes the percentage of diseased vs. non-diseased conduits used at catheterization. In particular it points to the location of diseased segments of SVG's. The only parameter that shows statistical significance is distal anastomotic junction of the SVG to native vessel.

Table 3 shows the treatment strategy used for the patients in both groups. Medical treatment or PCI to native vessels or graft conduits are given as percentages. In general diffusely diseases vessels and failed grafts were prescribed medical treatment. The other categories are self explanatory. Nine of 33 patients in group A and 27 out of 59 patients in group B were operated abroad. Within group A, fewer patients were referred for catheterization after CABG.

Table 1a: Risk factors in groups A & B.

Risk factor	Group A	Group B	p value
Smoking	54.5%	42.5%	0.267
Diabetes	75.8%	79.8%	0.667
Hypertension	87.9%	83.1%	0.542
Hyperlipidemia	93.9%	89.8%	0.508
FxHx of CAD	18.2%	11.9%	0.410
Markers of atherosclerosis/factors promoting atherosclerosis			
Prior MI before CABG	19 (57.6%)	22 (37.3%)	0.061
CVA	3 (9.1%)	4 (6.8%)	0.692
CKD	3 (9.1%)	9 (15.3%)	0.405
Dialysis	2 (6.1%)	2 (3.4%)	0.552
PAD	3 (9.1%)	1 (1.7%)	0.097
Previous PCI before CABG	6 (18.2%)	8 (13.6%)	0.559
Previous PCI after CABG	12 (36.4%)	19 (32.2%)	0.689

FxHx: Family History; CAD: Coronary Artery Disease; CABG: Coronary Artery Bypass Graft; CVA: Cerebro Vascular Accident; CKD: Chronic Kidney disease (defined as Serum Creatinine ≥ 130μmol/L); PAD: Peripheral Arterial Disease; PCI: Percutaneous Coronary Intervention.

Table 1b: Reasons for cath.

Criteria	Group A	Group B	p value
Severe angina (Class III-IV)	31 (93.9%)	50 (84.7%)	0.196
Angina classification			
Class I	1 (3%)	3 (5.1%)	0.312
Class II	1 (3 %)	6 (10.2%)	
Class III	23 (69.7%)	38 (64.4%)	
Class IV	8 (24.2%)	12 (20.3%)	
Heart failure	8 (24.2%)	17 (28.8%)	0.641
Current LVEF	53.82 ± 14.54	50.03 ± 10.96	0.162
Drop of EF (≥ 10 units)	1 (3.0%)	2 (3.4%)	0.927
MI	15 (45.4%)	19 (32.2%)	0.211
Change in ECG from NSR to bundle branch pattern	0 (0%)	2 (3.4%)	0.290
Developing dysrhythmia	4 (12.1%)	11 (18.6%)	0.422

LVEF: Left ventricular ejection Fraction.

Discussion

This communiqué reports on 92 patients who were referred for catheterization post CABG. The reason for cath was different manifestations of ischemia: Unstable angina, with or without myocardial infarction or heart failure occurred in over in over 95%.

Table 1c: CABG history.

Criteria	Group A	Group B	p value
Total no. of grafts			
1	2 (6.1%)	8 (13.6%)	0.227
2	7 (21.2%)	12 (20.3%)	
3	14 (42.4%)	27 (45.8%)	
4	9 (27.3%)	11 (18.6%)	
5	1 (3.0%)	1 (1.7%)	
Total no. of grafts	99	162	
Total no. of arterial grafts	40 (40.4%)	61 (37.7%)	0.169
Total no. of venous grafts	59 (59.6%)	101 (62.4%)	0.750
Total no. of mammary grafts	37 (37.4%)	55 (34.0%)	0.077
Total no. of radial artery grafts	03 (3.03%)	06 (3.7%)	0.231

Table 1d: Medication history.

Medication name	Group A	Group B	p- value
ASA	33 (100%)	58 (98.3%)	0.458
Plavix	24 (72.7%)	35 (59.3%)	0.203
Statins	33 (100%)	57 (96.6%)	0.290
Beta Blocker	27 (81.8%)	45 (76.3%)	0.541
Nitrates	23 (69.7%)	40 (67.8%)	0.853
Calcium channel blocker	11 (33.3%)	20 (33.9%)	0.957
ACE- Inhibitors	19 (57.6%)	22 (37.3%)	0.061
ARBs	4 (12.1%)	17 (28.8%)	0.069
Warfarin	1 (3.0%)	8 (13.6%)	0.105

ASA: Aspirin; ACE: Angiotensin Converting Enzyme; ARB: Angiotensin Receptor Blockers.

Table 2: Current graft status.

Classification	Group A	Group B	p value
Total no. of LIMA or RIMA diseased/Percentage of patency of mammary grafts	4 (10.8%)/89.2%	4 (27.3%)/72.7%	0.445/0.555
Total no. of SVG diseased/Percentage of patency of venous grafts	21 (35.6%)/64.4%	41 (40.6%)/59.4%	0.738/0.262
Total no. of radial artery diseased/Percentage of patency of radial artery grafts	0 (0%)/100%	1(16.7%)/83.3%	0.458/0.542
Total no. of proximal anastamosis stenosis	1(1.0%)	7 (4.3%)	0.251
Total no. of proximal stenosis (SVG)	3 (3.0%)	9 (5.6%)	0.446
Total no. of mid stenosis	12 (12.1%)	23 (14.2%)	0.844
Total no. of distal stenosis	1 (1.0%)	4 (2.5%)	0.452
Total no. of distal anastamosis stenosis	8 (8.1%)	5 (3.1%)	0.038*

*Significant at 0.05 level; SVG: Saphenous Venous Graft; LIMA: Left Internal Mammary Artery; RIMA: Right Internal Mammary Artery.

Table 3: Mode of treatment in post CABG patients after catheterization.

Mode of treatment	Group A	Group B	p value
Medical	42.4%	45.8%	0.760
PCI- Native	48.5%	40.7%	0.474
PCI- graft	12.1%	20.3%	0.324
a) No. of PCI to arterial grafts	0 (0%)	2 (3.3%)	0.290
b) No. of PCI to venous grafts	4 (6.8%)	11 (10.9%)	0.456
c) No. of PCI to mammary grafts	0 (0%)	1 (1.8%)	0.458
Surgery	6.1%	3.4%	0.552

PCI: Percutaneous Coronary Intervention.

Table 4: Coronary artery and bypass conduit anatomy in Group A & B.

Sl. No:	Classification	Group A	Group B	p value
1.	New native vessel disease (not bypassed previously)	42.4%	42.4%	0.996
2.	Native vessel disease after insertion of the grafts	30.3%	30.5%	0.984
3.	Graft disease (arterial or venous)	42.4%	57.6%	0.165
4.	Percentage of patency of all grafts	57.6%	42.4%	0.165

Ischemia post CABG is rather frequent (as early as one year post-interval) [1,4] and re-intervention is common [4,5]. However the percentage of symptomatic recurrence was reported. We noticed that catheterization interval post surgery was variable. Arbitrarily, the patients were divided into 2 groups: Group A had their surgery done in 5 years or less and group B was longer than 5 years. The average number of months post CABG was 34 ± 20 for group A and 154 ± 59 for group B.

At the beginning of recruiting the patients, we hypothesized that patients in group A would have higher percentage of risk factors than their counterparts in group B. This did not pan out (Table 1). Smokers were more frequent in group A, although the difference was not statistically significant. In much larger series, smoking and other risk factors caused recurrence of ischemia in post CABG patients [1]. We presume patients with higher risk factor score presented earlier to their treating physician.

The initial CABG surgery was done locally in 60% of the total cohort. In group A, 72.7% of the patients were operated locally. Although the denominator was not known, patients operated abroad came less frequently for catheterization than those operated by local surgeons. Popular centers abroad (one in France and the other in U.S.A) do extensive arterial grafting, especially left internal thoracic artery (LITA) [6-8]. Using arterial conduits have been shown to delay ischemia recurrence [6,7]. Our surgeons have recently started total arterial revascularization.

If risk factors fail to distinguish patients with early vs. late recurrence, then what is the plausible explanation? We checked for factors that promote and/or markers of atherosclerosis, as given in table 1a, and again could not come up with any definite answer. New native vessel disease or graft failure (Table 4) did not discriminate either. Myocardial infarction post CABG was more common in group A. Lesion characteristics (as calcification, bifurcation or total occlusion) were not dissimilar (ascertained from review of 10 randomly selected angios in each group). The only positive discriminator between group A and B is distal anastamotic disease which was more common in group A. There are 2 possible explanations- one is faulty surgical suturing (which is untenable because of different surgeons and centers). The most likely explanation is that PCI proliferation has forced surgeons to accept cases with diffuse disease and poor run off. In the past they were not as likely to accept these cases.

Management of post CABG ischemia has shifted to less re-CABG and more to PCI and medical treatment [4,5] (Table 3). It is reported lower percentage of CABG patients survive or are angina free if they had prior PCI [9-11]. Others have shown that in head to head comparison, survival benefit for PCI post CABG holds for 3 years over re- CABG [4]. Also PCI of native vessels or grafts are simple and safe once the experience has been gained [12,13]. In contrast, re-CABG has higher mortality than first [4,14]. Old literature praises re- CABG as effective treatment for recurrence of ischemia [15,16]. In the era of proliferation of PCI, this trend continues to increase for post CABG. We may see more patients developing recurrence of ischemia and thus requiring re- cath. In our series, very few patients go to re- CABG. The choice between medical treatment and PCI is extensive calcification and/or chronic total occlusion, which favors medical treatment.

Conclusion

A significant number of patients redevelop ischemia early (< 5 years) post CABG. Risk factor analysis did not detect differences in early vs. late presentation with ischemia. It seems that those who went for CABG abroad were less likely to come for recatheterization. Operating on diffuse or very complex disease would lead to recurrence of ischemia early. The challenge is to select cases with good targets to minimize early recurrence of ischemia. Finally, in managing these post- CABG patients, only few are referred for re- CABG. The majority either did PCI or was kept on medical treatment.

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Conflict of Interest

None to specify for any of the authors.

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