Austin Cardio & Cardiovascular Case Reports

Open Access

Austin Publishing Group

Research Article

Impact of Previous Stenting on the Outcome of CABG in Multivessel Disease

Elassy SM*
Department of Cardiothoracic Surgery, Ain Shams University, Cairo, Egypt

***Corresponding author:** Elassy SM, Department of Cardiothoracic Surgery, Ain Shams University, Cairo, Egypt

Received: December 01, 2015; **Accepted:** January 27, 2016; **Published:** January 29, 2016

Abstract

Aim of the Study: To determine if previous coronary stenting has an impact on the outcome of subsequent CABG.

Patients and Methods: Between May 2009 and January 2011, 200 patients who were candidate for CABG, where prospectively divided into two groups Group I had previous PCI (n = 100, mean age 57.20 ± 8.52 years, 9 women) and group II (n = 100, mean age 53.25 ± 7.95, 18 women) had no prior PCI. Group I patients presented with higher incidence previous MI (p value=0.001) and higher mean NYHA class (P = 0.012).

Results: In Group II there was higher mean total number of grafts (P value=0.001), higher incidence of total revascularization (P value=0.001), respectively. In Group I there was a higher incidence of inotropic support usage (P value = 0.001), incidence of arrhythmias (P value = 0.026), incidence of bleeding (P value = 0.002), wound infection (P value = 0.002) and the mean hospital stay (P value = 0.001). Postoperative echo after 3 months showed, more improved parameters of myocardial function in Group I, as evidence by statistically significant more decrease in LVEDD (P<0.001) and LVESD (P=0.015), a significant more improvement in LV paradoxical motion (P<0.001) as well as a non-significant improvement in LVEF %.

Conclusion: Prior PCI increases the morbidity and reduces the improvement of cardiac function after subsequent CABG in multivessel disease patients.

Keywords: Multivessel disease; Stenting

Introduction

Since the introduction of Percutaneous Coronary Intervention (PCI) for treatment of Coronary Artery Disease (CAD), there has been a shift from its primary indication for single isolated single vessel lesion to multivessel disease. [1] Moreover with increased experience, aggressive repeated PCI therapy has become more common. Results from randomized controlled trials and registries comparing PCI and Coronary Artery Bypass Graft (CABG) have shown that PCI is inferior to CABG as regards the need for repeat revascularization and recurrence of angina particularly in patients with diabetes mellitus and complex triple-vessel disease even in the era of Drug Eluting Stents (DES). [2,3,4,5,6,7] Combining the previous facts, will conclude that there is an increasing number of patients with multivessel or triple-vessel disease in whom PCI is initially performed before subsequent CABG. There is some evidence that previous PCI has a negative impact on subsequent CABG [8,9,10], however this topic needs further investigations especially on the impact of PCI on the complexity of coronary disease. We therefore sought to determine whether previous PCI has a prognostic impact on surgical outcome of subsequent CABG.

Material and Methods

This study included 100 patients who benefited from CABG after successful primary PCI (group A) and 100 patients who benefited from primary CABG (group B) at Eldemardash hospital, Ain shams specialized hospital and National heart institute, in the period between May 2009 and January 2011. In group A, 46 patients benefited from bare metal stent and 54 patients benefited from DES. The number of implanted stents varied from 1 to 5 (1.89 + 0.8 stents), with 36 patients benefited from 1 stent, 45 patients benefited from 2 stents, 16 patients from 3 stents, 2 from 4 stents and only 1 patient benefited from 5 stents. Common to both groups, our inclusion criteria were: patients' age between 40 and 70 years, of both sexes, undergoing CABG for multi-vessel disease, with or without the need for surgery for ischemic mitral valve disease. Redo cases, cases presenting with organic valvular heart disease, patients undergoing CABG for single vessel diseases well as those patients needing emergency CABG after failure of PCI were excluded from this study.

As shown in (Table 1), patients' demographic criteria and risk factors were comparable between both groups, with the exception of group A patients being significantly younger and including more females; compared to group B patients. However, patients with primary PCI presented in a more significantly advanced NYHA class, included significantly more patients with previous MI and a non-significant higher proportion of left main disease. On the other hand, group B patients had significantly higher proportion of peripheral arterial disease, compared to patients in group A. Angiograms were scored according to the SYNTAX score algorithm (www.syntaxscore.com) [11] by the Angiographic Core Laboratory (Cardialysis BV, Rotterdam, The Netherlands). Although SYNTAX score is statistically

Citation: Elassy SM. Impact of Previous Stenting on the Outcome of CABG in Multivessel Disease. Austin Cardio & Cardiovasc Case Rep. 2016; 1(1): 1005.

Table 1: Comparison of preoperative variables between both groups: Group A undergoing primary CABG and group B undergoing CABG after PCI.

	Patient groups		P value*
	A (100 patients)	B (100 patients)	
Age (years)	52.9± 7.6	57.2± 8.5	0.001
Female sex	27	10	0.002
DM	59	61	NS
Hypertension	37	27	NS
Dyslipidemia	39	47	NS
Smokers	49	49	NS
Family history of ischemic heart disease	15	10	NS
Previous MI	68	24	0.001
RecentMI	6	7	NS
Previous HF	0	2	NS
Left main disease	19	11	NS
Syntax score	18.8 ± 7.2	20.68 ± 7.6	NS
Euro score	2.1 ± 2.2	2.8 ± 5.4	NS
Preoperative Shock	2	0	NS
UnstableAngina	13	14	NS
Number of diseased vessels	3.3 ± 0.5	3.5 ± 0.5	NS
Ischemic MR	37	40	NS
NYHA FC	1.86 ± 0.94	1.55 ± 0.88	0.012
CCS FC	2.2 + 0.85	2.15 + 1.1	NS
Chronic renal impairment	7	2	NS
COPD	9	10	NS
Pulmonary hypertension	5	1	NS
Peripheral arteriopathies	6	16	0.027

Values are presented as numbers (%) or mean + SD. *= Chi-Square test / Fisher's exact test or unpaired Student's test, as indicated.

comparable in both groups preoperatively, the mean SYNTAX score in group A has increased from 10.96±6.28in angiograms before PCI to 18.8±7.2 in angiograms before CABG. Also, it worth mentioning that when comparing pre PCI and pre CABG SYNTAX score, we have noticed that 20 patients have moved from low score category to intermediate and high score category after PCI (Table 2).

An echo was done within one month preoperatively, before discharge and 3 months after the operation. (Table 3) shows the preoperative echocardiographic data, with group a patients showing significantly larger LVEDD, compared to group B patients. Other echocardiographic data; including LVESD, EF% and LV systolic wall motion abnormality were comparable between the 2 groups.

According to the surgeon's preference, patients were either operated with OPCAB with ACROBAT™ Mechanical Stabilizer System or under routine CPB with mild hypothermia and repeated infusions of antegrade warm blood cardioplegia. In all patients, the Left internal mammary artery was used to graft an Omni present LAD lesion. Total arterial revascularization was attempted whenever feasible, with the use of the right internal mammary artery and/or radial artery of the non-dominant hand; otherwise additional coronary lesions were grafted with a suitable venous conduit. Patients

Table 2: Number of patients in each category of SYNTAX score in both groups: Group A undergoing primary CABG and group B undergoing CABG after PCI.

Syntax score	Group A		Group B
	Pre stent (100 patients)	Preoperative (100 patients)	Preoperative (100 patients)
Low (0-22)	92	72	63
Intermediate (22-32)	8	24	29
High (>32)	0	4	8

Values are presented as numbers.

Table 3: Comparison of echocardiographic data between both groups: Group A undergoing primary CABG and group B undergoing CABG after PCI.

	Patient groups		P value*
	A (100 patients)	B (100 patients)	
LV ESD (cm)			
Preoperative	3.66 ± 0.8	3.86 ± 0.95	NS
Postoperative	3.5 + 0.76	3.45 + 0.75	NS
Mean of the difference	0.12 + 0.57	0.34 + 0.64	0.015
LVEDD (cm)			
Preoperative	5.2 ± 6.5	4.95 ± 0.9	0.21
Postoperative	5.1 ± 0.65	4.45 ± 0.98	0.001
Mean of the difference	0.11 ± 0.6	0.48 ± 0.67	0.001
EF%			
Preoperative	57 ± 9.1	54.57 ± 11.3	NS
Postoperative	58.3 ± 7	60 ± 5.67	NS
Mean of the difference	1.32 + 6.8	4.1 ± 9.1	NS
Paradoxical systolic motion			
Preoperative	58	45	NS
Postoperative	44	16	0.001**

Values are presented as numbers (%) or mean + SD. *= Chi-Square test / Fisher's exact test or unpaired Student's test, as indicated, ** = McNemar test.

with grade 3-4 ischemic mitral regurge were planned to benefit from mitral valve repair. Operative and postoperative data are presented in (Table 4).

Statistical analysis: Data are presented as number (%) or mean + SD. The distribution of categorical data was compared with Chi-Square test or Fisher's exact test, as indicated. Means were compared with unpaired Student's test, as indicated. The means of the differences of recorded echocardiographic data (LVEDD, LVESD and EF %) were compared using unpaired Student test too. On the other hand, amelioration of LV systolic wall motion abnormality after surgery was compared in the 2 groups using the non-parametric McNemar test. A P value of <0.05 was considered as a limit of statistical significance. SPSS 19 statistical package was used for data analysis.

Results

As shown in (Table 4), and compared to group A, Group B patients benefited from significantly larger number of grafts, total revascularization as defined by grafting all stenotic vessels greater than 1.5 mm and/or all stenotic main-branch vessels, was achieved in only 129 patients (64.5%): 79 patients in group A (79%) and 50 patients in group B (50 %; P<0.001). Also, total arterial revascularization was achieved in 19 cases (9.5%): 18 patients in group A (18%) and 1 patient in group B (1%; P<0.001). In addition, 4 patients with grade 3-4 mitral regurge benefited from annuloplasty using Mitral annuloplasty ring (Carpentier-Edwards Classic) (Edwards Life sciences, Irvine, Calif.) size 28 mm. In group A, more patients needed positive inotropic support, were re-explored for bleeding, developed superficial as well as deep wound infection, stayed for longer time in hospital and suffered from more incidences of arrhythmias compared

Table 4: Comparison of operative and postoperative variables between both groups: Group A undergoing primary CABG and group B undergoing CABG after PCI.

	Patient groups		P value*
	A (100 patients)	B (100 patients)	
Number of grafts: a) Number of arterial grafts b) Number of venous grafts	2.47 ±0.85 1.07 ± 0.3 1.39 ± 0.9	3.12±0.73 1.24 ± 0.5 1.89 ± 0.7	0.001 0.001 0.001
Total revascularization	79 (79%)	50 (50%)	0.001
Total arterial revascularization	18 (18%)	1 (1%)	0.001
Mitral valve repair for ischemic MR	0	4	NS
Surgical technique: 1. OPCAB 2. CPB	 35 65	 27 73	NS
ACC time (minutes)	62.7 ± 28.1	68.7 ± 25.6	NS
CPB time (minutes)	91.2±42.6	102.1±33.8	NS
PerioperativeMI	18	17	NS
Use of positive inotropes	62	40	0.001
Use of IABP	13	11	NS
Duration of mechanical ventilation	13.2 ± 12.7	10.24 ± 11.9	NS
Arrhythmias	21	10	0.026
Postoperative heart failure	11	13	NS
Neurologicalcomplications	2	1	NS
Renal impairment	7	2	NS
Endocarditis	0	2	NS
ICU stay (days)	2.9 ± 1.44	3.4 ± 4.5	NS
Death	6	7	NS
Exploration	25	9	0.002
Endocarditis	0	2	NS
Dehiscent sternum	5	10	NS
Superficial wound infection	35	18	0.004
Deep wound infection	15	3	0.002
Organ failure	2	2	NS
Hospital stay (days)	11.3 ± 3.8	9.3 ± 3.8	0.001

Values are presented as numbers (%) or mean + SD. *= Chi-Square test / Fisher's exact test or unpaired Student's test, as indicated.

to group B patients. Other operative and postoperative variables, including mortality and other morbidity figures were comparable between both groups of patients (Table 3).

As shown in (Table 3), parameters of myocardial function were more improved in group A patients, as evidenced by statistically significant more decrease in LVEDD (P<0.001) and LVESD(P=0.015), a significant more improvement in LV paradoxical motion as well as a non-significant improvement in LVEF%, compared to group B patients (Table 3).

Discussion

PCI is often preferred over CABG for its "less invasiveness" especially when bothprocedures are justified.This choice is reinforced by the belief that patients can bereferred to surgery after PCI without a negative impact on subsequent CABG. However there is now cumulating evidence thatprior PCI has a negative impact on subsequent CABG. It is associated with a higher early mortality [12,13] morbidity [12] and MACE rate [9,11,14] with impaired long-term outcome and quality of life [9] and with more unstable angina requiring hospitalization and repeated coronary revascularization during follow-up [8]. Also it has been found to be associated with increased mortality and morbidity and reduced 2 years survival in diabetic patients. [15]

In the current study, although patients with previous PCI appears to have more advanced disease as evidenced by advanced NYHA class and more previous MI, all parameters of myocardial function were more improved after surgery in patients who underwent CABG without previous stenting. The operative results showed less total and arterial revascularization in previous PCI patients. Also, the postoperative outcome in the stent group was inferior to patients who underwent CABG without previous PCI as evidenced by higher rate of overall morbidity, usage of inotropes, arrhythmias, reoperation for bleeding and wound infection. The hospital stay was also significantly higher in stent group. However, our results showed similar rates of in-hospital mortality between the two groups.

Although statistical correlation does not imply causation, yet there are several rational hypotheses to explain the results. Peri-procedural infarction during previous PCI [16] may be the cause for higher incidence of preoperative MI and preoperative higher NYHA class in the stent group. PCI procedures initiate a sequence of local inflammatory reactions which lead to poor targets for grafting this may explainless total revascularization and less number of grafts in the stent group [17]. Coagulopathy from adjunctive anti-platelet therapy especially after DES may explain higher incidence of reexploration for bleeding in Group A [18]. There are other explanations to explain negative impact of stents on CABG as grafts being performed more distally due to the presence of stents (9), instant rest enosis is associated with a higher risk of early venous graft failure [19], post stenting structural changes affecting the stented area and the coronary artery section distal to the stent which would be the target area of a subsequent bypass graftanastomosis [17]. These explanations are summarized and classified into intrinsic pathophysiology, acquired pathophysiology and technical squeal by Rao and colleagues [20].

To our knowledge this is the first study to use SYNTAX score in comparing the complexity of coronary disease between patients who underwent CABG without previous stenting and with previous stenting. Although there were no statistical differences between the two groups preoperatively the results showed that after PCI patients where shifted to the intermediate and high risk score categories which means that when patients are referred for surgery after PCI they seems to have a more complex coronary disease and this might be one of the reasons for negative outcome of PCI on subsequent CABG. Moreover, this negative impact is more manifested with DES.

DES use is associated with increased risks of both early and late stent thrombosis, as well as death and MI [21]. DES impair endothelialization, leaving a potentially prothrombotic substrate within the vessel [22] and leave a further conflict for the surgeon in terms of control of ant platelet medication and whether to perform bypass grafts to a coronary vessel with a DES without critical rest enosis in patients who have multi vessel disease [23]. In our study Group A patients included patients who had DES but in further

study BMS could be compared with DES regarding their impact on subsequent CABG.

Although, we have not compared cost in our study, the fore mentioned clinical concerns are compounded by cost implications; not only are DES significantly more expensive than BMS, but new recommendations that patients remain on clopidogrel for at least a year, and possibly indefinitely, add significantly to overall costs [23].

The conclusion from the findings that prior PCI increases the risk of subsequent CABG is to add to the supply of data against the false belief that CABG can always be safely postponed after an initial PCI in multivessel disease and any cardiac intervention especially in multi vessel disease should be discussed by a multidisciplinary team including a surgeon rather than by the individual cardiologist.

Study Limitations

This study has several limitations. It has been designed as a consecutive, observational, multicenter investigation. The number of enrolled patients limits the explanatory power o four study. Selection of patients of both groups may introduce an underlying bias. Finally we limited our analysis to short-term outcomes.

Conclusion

Prior PCI increases the morbidity and reduces the improvement of cardiac function after subsequent CABG in multivessel disease patients.

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Citation: Elassy SM. Impact of Previous Stenting on the Outcome of CABG in Multivessel Disease. Austin Cardio & Cardiovasc Case Rep. 2016; 1(1): 1005.