Early postoperative outcome of coronary artery bypass grafting in patients with previous coronary stenting

Original Article

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ABSTRACT

Background: Rates of percutaneous coronary intervention have increased dramatically in recent years, whereas rates of coronary artery bypass grafting (CABG) have remained remarkably stable.

Aim: To evaluate the impact of coronary stenting on coronary artery pathology and the way of grafting, the early postoperative outcomes, and complications of CABG surgery following previous revascularization by percutaneous intervention.

Patients and Methods: This prospective study was conducted on One hundred and twenty patients with multi-vessel CAD (coronary artery disease) and indicated for CABG in ASU hospital and Sheikh Zayed Specialized Hospital between February 2019 and March 2024.

Results: There was no significant difference in the incidence of myocardial infarction and cerebrovascular stroke between group A and group B, no significant difference in postoperative cardiac enzymes, ECG, or echocardiography after 3 months of ejection fraction, respectively.

Conclusion: Our study revealed that there was a significant difference in coronary artery pathology, with severe atherosclerosis in group A compared with group B. Total bypass time and cross clamp time increased in group B. Additionally, there was a slight decrease in ejection fraction follow-up in group A after 3 months.

Key Words: Coronary artery bypass grafting, coronary stenting, post-operative outcome.

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INTRODUCTION

While rates of coronary artery bypass grafting (CABG) have remained relatively steady, rates of percutaneous coronary intervention (PCI) have climbed considerably in recent years. The fact that PCI is less intrusive and initially less expensive may contribute to its growing appeal among patients with symptomatic ischemic heart disease[1].

The relative benefits of PCI and coronary artery bypass surgery needs to be reevaluated in light of changes in clinical practice and technology advancements. To provide a solid data base for selecting the optimal course of therapy for patients in a real-world population that surgeons and interventional cardiologists meet daily, the SYNTAX multicenter prospective randomized trial was created[2].

The increased stent performance after the advent of PCI encouraged a more aggressive treatment also in patients with diffuse lesions and multivessel disease. Hence, the number of patients with a history of previous PCI finally referred to CABG surgery has steadily increased over the past years[3].

Subsequent CABG surgery with previous PCI, however, might not achieve the same excellent results, as thoroughly demonstrated in the literature. We therefore sought to determine whether previous PCI has a prognostic impact on the surgical outcome of CABG or not[4].

This study aimed to evaluate the impact of coronary stenting on coronary artery pathology and the way of grafting, the early postoperative outcomes, and complications of CABG surgery following previous revascularization by PCI.

PATIENTS AND METHODS:

This prospective study was conducted on 120 patients with multi-vessel CAD and indicated for CABG in ASU hospital and Sheikh Zayed specialized hospital between February 2019 and March 2024. Patients were divided into two groups: group A: patients with a history of previous PCI and group B: patient with no history of PCI before CABG.

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Inclusion criteria

Patients suffering from ischaemic heart disease with previous coronary stenting of greater than 30 days before surgery, Patients suffering from coronary artery disease without previous stenting and on-pump CABG using CPB.

Exclusion criteria

Combined CABG with other procedures; emergency CABG; redo CABG; preoperative comorbidities: renal (serum creatinine <2, eGFR >70) and hepatic (excessive liver enzymes > twice normal value).

Methods

All patients were subjected to the following:

Preoperative evaluation: Clinical assessment: obtaining a history, doing a thorough physical and cardiac examination, conducting laboratory tests, ordering a chest radiography, 12 lead ECG, echocardiography, Coronary angiography, determining the number and size of stent deployments.

Operative scenario

Patients continue their usual medications until surgery, except for CLOPIDOGREL, which is stopped for 5 days preoperatively.

Surgical approach

General principles

Surgical access to the heart was achieved through median sternotomy, using the same medications and closure techniques for both groups. Distal and proximal anastomoses were performed using fine monofilament polypropylene sutures, aortic cannulation, and two-stage venous cannula. A disposable arterial-venous circuit was used, and a membrane oxygenator and STOCKERT 5 roller Heart-Lung machine were used. After successful weaning from cardiopulmonary bypass, The patient was then transported to the ICU, where they were mechanically ventilated and monitored by ECG, pulse oximetry, direct arterial pressure, CVP measures, blood gases, and serum electrolytes.

Data recorded

Time of aortic cross clamp and extra corporeal circulation, number of grafts, way of grafting, coronary artery pathology and need for endarterectomy, need of inotropes, and need of Intra-aortic balloon pump (IABP).

Postoperative data

The ICU

ICU events were recorded including ICU stay, duration of ventilation in hours, the need for support, dose and duration, Perioperative MI diagnosed by ECG change plus serial cardiac enzymes with or without hemodynamic instability, arrhythmias especially postoperative AF (atrial fibrillation) and Postoperative organ failure.

Follow-up by full clinical assessment after 2 weeks, cardiac enzymes serial at 6, 12, 24, and 48 h after declamping, laboratory investigations, 12 lead electrocardiography in ICU, after 24 h, 7 days and on discharge, Chest radiography on discharge and mortality in the early postoperative period.

Postoperative echo

An echo was done on discharge and ~ 3 months after the operation to monitor LVEDD (left ventricular end diastolic diameter) and Postoperative ejection fraction (EF).

Statistical analysis

Data were collected, revised, coded, and entered to the Statistical analysis was done using IBM SPSS statistics for windows, Version 27.0. Armonk, NY: IBM Corp. The quantitative data were presented as mean, standard deviations and ranges when parametric and median, inter-quartile range (IQR) when data found nonparametric. Also qualitative variables were presented as number and percentages. Tests used were χ^2 test and/or Fisher exact test, Independent t-test, Mann–Whitney test, Paired t-test, Wilcoxon Rank test, and repeated Measures ANOVA test. The confidence interval was set to 95% and the margin of error accepted was set to 5%. So, the *P value* was considered significant as the following: *P value* greater than 0.05: nonsignificant (NS), *P value* less than 0.05: Significant (S) and *P value* less than 0.01: highly significant (HS).

RESULTS:

Showing demographic data in both groups (Table 1).

There was no statistically significant difference found between group A and group B regarding preoperative SYNTAX score *P* less than 0.05 (Table 2).

There was a significant difference between group A and group B regarding coronary artery pathology, total bypass time, and cross-clamp time while there was no statistical difference regarding need for endarterectomy (*P value>0.05*) (Table 3).

There was no statistically significant difference in the incidence of myocardial infarction and cerebrovascular stroke between group A and group B *P values* of 0.402 and 0.315, respectively, (Table 4).

There was no statistically significant difference between group A and group B regarding postoperative cardiac enzymes at 6, 12, 24, and 48 h after surgery *P* greater than 0.05 (Table 5).

There was no statistically significant difference between group A and group B regarding postoperative ECG at 24 h and 7th day after surgery *P* greater than 0.05 (Table 6).

There was no statistically significant difference between group A and group B regarding postoperative echocardiography after 3 months EF *P* greater than 0.05 (Table 7).

There was a statistically significant difference between EF follow-up in the same group. In group A EF was slightly decreased after 3 months. In group B EF was slightly increased after 3 months (Table 8).

Table 1: Comparison between group A and group B regarding demographic data and history of the studied patients

	Group A *N*=60 [*n* (%)]	Group B *N*=60 [*n* (%)]	Test value	*P* value	Significance
Age					
Mean±SD	58.32±8.87	57.05±6.75	0.880•	0.381	NS
Range	39–90	39–70			
Sex					
Female	13 (21.7)	8 (13.3)	1.443*	0.230	NS
Male	47 (78.3)	52 (86.7)			
Smoking					
No	22 (36.7)	19 (31.7)	0.333*	0.564	NS
Yes	38 (63.3)	41 (68.3)			
DM					
No	19 (31.7)	23 (38.3)	0.586*	0.444	NS
Yes	41 (68.3)	37 (61.7)			
HTN					
No	13 (21.7)	15 (25.0)	0.186*	0.666	NS
Yes	47 (78.3)	45 (75.0)			
FH					
No	49 (81.7)	57 (95.0)	5.175*	0.023	S
Yes	11 (18.3)	3 (5.0)			
Previous stroke					
No	60 (100.0)	60 (100.0)	–	–	–
Yes	0	0			
CCU Admission					
No	44 (73.3)	56 (93.3)	8.640*	0.003	HS
Yes	16 (26.7)	4 (6.7)			

P value greater than 0.05: nonsignificant; *P value* less than 0.05: Significant; *P value* less than 0.01: highly significant.
*Chi-square test.
•Independent t-test.

Table 2: Comparison between group A and group B regarding SYNTAX score

SYNTAX score	Group A *N*=60	Group B *N*=60	Test value	*P* value	Significance
Median (IQR)	23 (18.5–30.75)	23 (17.75–28.75)	–1.239≠	0.215	NS
Range	12–42.5	10–39			

P value greater than 0.05: nonsignificant; *P value* less than 0.05: Significant; *P value* less than 0.01: highly significant.
≠Mann–Whitney test.

Table 3: Comparison between group A and group B regarding intraoperative assessment

	Group A *N*=60 [*n* (%)]	Group B *N*=60 [*n* (%)]	Test value	*P* value	Significance
No of distal anastomosis					
Mean±SD	2.72±0.72	2.88±0.8	−1.199•	0.233	NS
Range	1–4	1–5			
Coronary artery pathology					
Mild atherosclerosis	11 (18.3)	26 (43.3)	9.141*	0.010	S
Moderate atherosclerosis	17 (28.3)	14 (23.3)			
Sever atherosclerosis	32 (53.3)	20 (33.3)			
Classic way of grafting					
End to side anastmosis	60 (100.0)	60 (100.0)	–	–	–
Other way					
Venous patch to LAD	3 (5.0)	4 (13.3)	2.596*	0.273	NS
Arterial patch to LAD	2 (3.3)	2 (6.7)			
Need for endarterectomy					
No	50 (83.3)	53 (88.3)	0.617*	0.432	NS
Yes	10 (16.7)	7 (11.7)			
Site of endarterectomy					
LAD	7 (70.0)	5 (71.4)	4.958*	0.421	NS
RCA	1 (10.0)	0			
LAD&OM	1 (10.0)	0			
LAD,PDA	0	1 (14.3)			
LAD, RCA	1 (10.0)	0			
Diagonal	0	1 (14.3)			
Total bypass time (min)					
Mean±SD	91.55±28.41	110.02±40.07	−2.912•	0.004	HS
Range	38–160	45–240			
Cross clamp time (min)					
Median (IQR)	50 (43.5–60)	50 (43.5–60)	−3.178≠	0.001	HS
Range	22–128	24–177			

P value greater than 0.05: nonsignificant; *P value* less than 0.05: significant; *P value* less than 0.01: Highly significant.
*Chi-square test.
•Independent t-test.
≠Mann–Whitney test.

Table 4: Comparison between group A and group B regarding ICU period

	Group A *N*=60 [*n* (%)	Group B *N*=60 [*n* (%)]	Test value	*P* value	Significance
ICU stay (days)					
Mean±SD	3.47±1.24	3.17±1.51	1.189•	0.237	NS
Range	1–7	1–8			
Mechanical ventilation duration (h)					
Median (IQR)	12 (10–21)	13 (7–21.5)	−1.215≠	0.225	NS
Range	4–84	4–135			
Inotropic support					
Median (IQR)	18 (9–33)	25 (13–48)	−1.701≠	0.089	NS
Range	2–98	2–74			

Myocardial infarction					
No	56 (93.3)	58 (96.7)	0.702*	0.402	NS
Yes	4 (6.7)	2 (3.3)			
Cerebrovascular stroke					
No	60 (100.0)	59 (98.3)	1.008*	0.315	NS
Yes	0	1 (1.7)			

P value greater than 0.05: nonsignificant; *P value* less than 0.05: significant; *P value* less than 0.01: highly significant.
*Chi-square test.
•Independent t-test.
≠Mann–Whitney test.

Table 5: Comparison between group A and group B regarding cardiac enzymes at 6, 12, 24, and 48 h postoperative

	Group A No.=60	Group B No.=60	Test value	*P* value	Significance
(Ck-MB) 6					
Median (IQR)	48 (32–99)	75.5 (54.5–92.5)	–0.951≠	0.342	NS
Range	21–1500	20–420			
(ck-MB) 12					
Median (IQR)	38 (28–93.5)	58.5 (36.5–75.5)	–0.908≠	0.364	NS
Range	18–1201	17–370			
(ck-MB) 24					
Median (IQR)	31 (22–71)	40 (28–62.5)	–0.864≠	0.387	NS
Range	12–1202	13–280			
(ck-MB) 48					
Median (IQR)	25 (18.5–48.5)	25 (18.5–40.5)	–0.802≠	0.423	NS
Range	9–1500	8–162			
P value within group	<0.001	<0.001			

P value greater than 0.05: nonsignificant; *P value* less than 0.05: Significant; *P value* less than 0.01: highly significant.
≠Mann–Whitney test.

Table 6: Comparison between group A and group B regarding ECG postoperative

	Group A *N*=60 [*n* (%)]	Group B *N*=60 [*n* (%)]	Test value	*P* value	Significance
ECG at 24 (h)					
NSR	44 (73.3)	53 (88.3)	7.035*	0.134	NS
AF	14 (23.3)	6 (10.0)			
PVC	1 (1.7)	0			
ST	1 (1.7)	0			
LBBB	0	1 (1.7)			
ECG at 7 (day)					
NSR	60 (100.0)	58 (96.7)	2.034*	0.154	NS
AF	0	2 (3.3)			
PVC	0	0			
ST	0	0			
LBBB	0	0			

P value greater than 0.05: nonsignificant; *P value* less than 0.05: Significant; *P value* less than 0.01: highly significant.
*Chi-square test.
•Independent t-test.
≠Mann–Whitney test.

Table 7: Comparison between group A and group B regarding echocardiography after 3 months

	Group A No.=60	Group B No.=60	Test value	*P* value	Significance
EF					
Mean±SD	57.29±7.28	59.26±8.01	–1.388•	0.168	NS
Range	33–75	30–75			
ED					
Mean±SD	4.9±0.62	4.91±0.5	–0.097•	0.923	NS
Range	3.1–6.5	3.9–5.9			

P value greater than 0.05: nonsignificant; *P value* less than 0.05: Significant; *P value* less than 0.01: highly significant.
•Independent t-test.

Table 8: Follow-up for ejection fraction (%) in group A and group B

EF%	Preoperative	On discharge	After 3 months	Test value	*P* value	Significance
Group A						
Mean±SD	57.5±8.09	51.40±8.33	57.29±7.28	33.429	<0.001	HS
Range	35–72	30–73	33–75			
Group B						
Mean±SD	58.57±10.9	53.0±8.47	59.26±8.01	33.407	<0.001	HS
Range	35–76	25–75	30–75			

DISCUSSION

The recommended invasive options for CAD include PCI and CABG. Numerous research have compared the two modalities. Nonetheless, individuals who experience a successful cardiac revascularization procedure can need another invasive procedure later on[5,6].

The study found no statistically significant difference in the mean age between the two groups. The preoperative risk factors in both groups were not statistically different, including diabetes mellitus, hypertension, and smoking.

Group A exhibited a considerably higher prevalence of a positive family history of coronary artery disease compared with group B. Additionally, group A had a greater history of CCU admission with prior MI than group B. Additionally, coronary stents, particularly drug-eluting stents, may be to blame for this. Drugs used in it may cause injury the arterial wall, which in turn causes dysfunctional and denuded coronary endothelium, a persistent inflammatory response, and platelet and neutrophil adhesion. These factors ultimately contribute to severe cardiovascular events. In comparison to the no PCI group, Ueki *et al*.[7] identified higher previous MI in the PCI group.

In this study, there was a nonsignificant diffrence towards higher SYNTAX scores in group A compared with group B. Hamiko *et al*.[8] found no significant difference in SYNTAX score between both groups.

On one side, the presence of coronary stents increases the technical difficulty of surgery, including limitations concerning the number of anastomoses and grafts to be anastomosed to more distal landing zones, possibly resulting in worse graft patency. Furthermore, stents cause a local inflammatory reaction in the coronary vessels' wall resulting in endothelial dysfunction[8].

There was a non-statistically significant difference toward a more frequent need for endarterectomy in group A due to the severity of atherosclerosis in the same group.

Group B had far longer bypass and cross-clamp periods than Group A, which might be explained by the latter group having more distal anastomoses. Additionally, Ueki *et al*.[7] discovered that the non-PCI group had a longer bypass, cross-clamp, and operational times.

There was no difference in the two groups' ACC and CPB timings, according to Eifert *et al*.[9].

IABP usage was not substantially greater in group A, however, postoperative inotrope use was higher in the prior PCI group, which may be associated with higher EDD and preoperative MI incidence.

Hamiko *et al*.[8] revealed that there was no difference in the use of IABP between the two groups; however, the PCI group had greater incidences of IABP use in the Sidney Chocron group[10] and the Eifert team[9].

Postoperative ICU courses revealed that the mean length of ICU stays in group A tended to be nonsignificantly longer than group B. Duration of postoperative mechanical ventilation was also nonsignificantly different, with a longer mean duration in group A.

Hamiko *et al*.[8] also showed that there was no difference in ICU stay and mechanichal ventilation duration between both groups.

Inotropic support requirements in the ICU were not significantly lower in group A compared with group B. The incidence of major postoperative complications, including myocardial infarction was non significantly higher in group A and stroke was nonsignificantly higher in group B. There was a statistically significant decline in CK-MB levels over time in both group A and group B.

Postoperative laboratory investigations and ECG was not different in both groups.

Postoperative echocardiography after 3 months, EF had improved compared with preoperative baselines in both groups. The degree of improvement was significantly greater among patients in group B. End-diastolic diameter remained stable from discharge to 3 months in both groups, with no significant differences between group A and group B at either time point.

Mortality within 30 days of the procedure occurred in three patients all of whom were in group A. No deaths were observed among patients in group B. For the composite endpoint of all-cause death, myocardial infarction, or stroke at 30 days, without a significant difference. Hamiko *et al*.[8] also found no difference in mortality rate between both groups.

Cheng *et al*.[11] found that previous stent group had a significantly greater 30-day mortality rate than did the nonstent group. Also Mohamed Abdulwahab *et al*.[12] and Eifert *et al*.[9] had the same result.

CONCLUSION

According to our research, Previous PCI has a negative impact on the outcome of subsequent CABG regarding morbidity. However there was no significant difference in the postoperative mortality. PCI increases atherosclerosis of coronary arteries and makes repeat revascularization more difficult in techniques and worsens clinical outcome early post operative.

CONFLICT OF INTEREST

There are no conflicts of interest.

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