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*RESEARCH ARTICLE*

# EFFECT OF PREVIOUS PCI ON RESULTS OF CABG IN MULTIVESSEL DISEASE PATIENTS

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## *Abstract*

The number of percutaneous coronary interventions (PCI) prior to coronary artery bypass grafting (CABG) increased drastically during the last decade. Patients are referred for CABG with more severe coronary pathology, which may influence postoperative outcome.

**Methodolgy:-**Outcomes of 200 CABG patients were compared (mean follow-up: 3 months). Group I (n = 100) underwent primary CABG and group II (n = 100) had prior PCI before CABG.

**Result:-** Morbidity, were significantly higher in patients with prior PCI but no difference in mortality. Postoperative echo emphasize lower benefit from CABG in patents coming with recurrence CAD post PCI.

**Conclusion:-** With the growing evidence that previous PCI adversely influences the outcome of subsequent CABG, we may expect that prior PCI emerges as a risk factor in new outcome prediction and risk stratification models in cardiac surgery



## Introduction:-

With technological advances and changes in clinical practice, the respective values of coronary artery bypass surgery and percutaneous coronary intervention needed to be reassessed. The SYNTAX randomized trial is an attempt to provide an evidence base to determine the best treatment option for patients in a real-world population seen by the surgeon and the interventional cardiologist in their daily practice. (***1)***

The previous comparative studies clearly demonstrated that there was no difference between the two therapeutic modalities regarding mortality and non fatal myocardial infarction but patients treated with stenting whether bare metal stent or drug eluting stent required more often repeating revascularization procedures related to restenosis ***(2, 3).***

It is supposed that patients with a previous PCI are at higher risk for CABG, however, only a few studies are available and contradictory: some authors suggest that initial PCI may complicate the operation and may increase postoperative morbidity and mortality. Others describe no difference in postoperative morbidity and mortality. ***(4).***

The objective of this study is Comparing the outcome of patients who undergoes primary CABG and those who had primary PCI as first line of treatment before CABG and come back for CABG due to instent restenosis.



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## Patients and Methods:-

Two hundred patients underwent CABG in the period between May, 2009 and January2011in NHI (National heart institute), they were prospectively divided to two groups, Group I( non stent group) and Group II ( stent group), Our study was built on the guidelines of STS database and Euro score calculation. Group I (n = 100) and group II (n = 100,) with mean number of stents 1.98, 51% of them were Drug eluting stents (DES)).The mean time between PCI and CABG was 11 ± 9 months.

Patients with single vessel disease, combined CABG with other procedure except treatment of ischemic Mitral incompetence, redo CABG and emergency CABG as well as patients after PCI due to dissection or tamponade were excluded from the study to avoid there un predicted effect on the outcome of CABG.

Patients were evaluated by history and physical examination, routine labs, ECG, Carotid Doppler and duplex, study of their coronary angiography SYNTAX score was calculated.

Operative data included OPCAB versus on pump, type of myocardial preservation on pump, time of aortic cross clamp and extra corporeal circulation time, number of grafts, arterial and venous grafts and total or incomplete revascularization**.**

Post operatively data were inotropic supports (dose and duration), use of IABP, ventilation time, Perioperative MI, reopening for bleeding, arrhythmias and its type, post operative organ failure, signs and symptoms of heart failure, superficial and deep wound infection including dehiscent sternum, ICU and Hospital stay, in addition to mortality**.** This was followed by echo pre-operative and 3 months post operative Echocardiographic examination was conducted using a Wingmed Vivid 9 echocardiography device (GE Medical System, Horten, Norway)**.**

Statistical analysis ; was done by collecting the data, revising and verifying it then it was edited on PC. Data was analyzed by Microsoft Office 2003 (excel) and Statistical Package for Social Science (SPSS) version 10.

## Results:-

Extracardiac arteriopathy,preoperative planned valvular surgery (repair or replacement), in addition to CABG (4 vs 0. P value = 0.043) were higher in the first group while unplanned CABG {patient was not admitted for CABG but the decision was made in hospital in a heamodynamically stable patient} (0 vs 8. P value = 0.004) and Previous MI (25 vs 69. P value = 0.00001) were higher in the second group.

Preoperative Coronary aniography showed no statistical difference in number of patients with left main disease or number of diseased vessels. The old theraputic CA was studied also and showed that mean number of stents was 1.98, 51% of them were DES. 30% of the PCI group had multiple intervensions.

SYNTAX score was calculated for group II before theraputic CA and before surgery for group I and II preoperatively. The mean SYNTAX score for group II before stent was 10.96 but it increased to be 18.77 preoperatively which was not significant when compared to group I which was 20.69,).Group II before stent had 92% low score , 8% intermediate score and 0% high score while pre operatively 72% were only low score, 24% intermediate score and 4% have became high score. On the other hand group I had 63% low score , 29% intermediate score and 8% high score**. (Table 1).**

Total revascularization is significantly higher in the non PCI group, where 79 patients were totally revascularized compared to only 50 patients in group B (P value=0.00001) . **(Table 2).**

In fact hospital stay was longer for group II (9.30 ±3.80 days vs 11.23 ±3.80 days) (P value 0.000595). Total morbidity was significantly higher in the second group than the first group (40 vs. 66 P value=0.001).. Mortality rate was the same between the two groups (7 vs 6 P value=0.774). **(Table 3).**

On comparing between preoperative echo and the post operative echo of each patient there were statistical significance towards group I in all criteria which included improvement of dimensions, and EF (**Graph1).**

**Table 1:-**Demographic data and preoperative variables

| | Group I | Group II | P value |
|---|---|---|---|
| Mean Age | 57.20 | 53.25 | 0.000851 |
| MALE/FEMALE | 91/9 | 82/18 | 0.494 |
| Smoking | 48 | 49 | 0.887 |
| Diabetes | 61 | 61 | 1.000 |
| Hypertension | 27 | 37 | 0.130 |
| Dyslipidemia | 47 | 40 | 0.318 |
| Family history | 9 | 15 | 0.933 |
| WBCS (X1000/CCM) | 7.42 | 7.56 | 0.719954 |
| Hb (gm. %) | 14.69 | 13.44 | 0.102066 |
| PLTS (x1000/ccm) | 270.96 | 203.65 | 1.5209 |
| Blood sugar (mg%) | 166.42 | 183.63 | 0.11298 |
| INR | 1.07 | 1.05 | 0.413713 |
| Urea (mg/dl) | 36.10 | 32.70 | 0.134877 |
| CR. (mg/dl) | 0.99 | 1.01 | 0.770131 |
| SGOT (U/L) | 29.34 | 27.02 | 0.260144 |
| SGPT (U/L) | 27.56 | 26.08 | 0.436577 |
| CCS1 | 37 | 19 | 0.016 |
| CCS2 | 25 | 46 | 0.013 |
| CCS3 | 21 | 28 | 0.317 |
| CCS4 | 17 | 7 | 0.041 |
| NYHA1 | 4 | 10 | 0.109 |
| NYHA 2 | 59 | 42 | 0.091 |
| NYHA 3 | 17 | 19 | 0.739 |
| NYHA 4 | 20 | 29 | 0.199 |
| Heart failure. | 2 | 0 | 0.155 |
| Cardiogenic shock | 0 | 2 | 0.155 |
| Unstable angina | 14 | 14 | 1.000 |
| Previous MI. | 25 | 69 | <0.0001 |
| Recent MI | 7 | 6 | 0.774 |
| Previous cardiac surgery | 2 | 2 | 1.000 |
| Extra cardiac arteriopathies | 16 | 7 | 0.046 |
| Mean ESD PRE(cm) | 3.87 | 3.66 | 0.09195 |
| Mean EDD PRE(cm) | 4.95 | 5.21 | 0.02134 |
| Mean EF PRE | 55.59 | 56% | 0.09195 |
| Mean EURO score (logistic) | 2.95 | 2.28 | 0.245961 |
| LT main patients | 10 | 18 | 0.103 |
| Mean No of diseased vessels | 3.34 | 3.28 | 0.35849 |
| SYNTAX score (preoperative | 20.69 | 18.77 | 0.069177 |

**Table 2:-**Operative data variables

| | Group I | Group II | P value |
|---|---|---|---|
| OPCAB | 26 | 35 | 0.167 |
| Mean ACC time (min.) | 69.49 | 61.81 | 0.099376 |
| Mean Bypass time (min.) | 102.07 | 91.47 | 0.092623 |
| Mean No of grafts | 3.12 | 2.46 | 0.000001 |
| Mean No of arterial grafts | 1.24 | 1.07 | 0.00688 |
| Mean No of venous grafts | 1.89 | 1.39 | 0.000001 |
| Total Revascularization | 79 | 50 | <0.0001 |

**Table 3:-** postoperative variables

| | Group I | Group II | P value |
|---|---|---|---|
| Inotropes | 40 | 62 | 0.002 |
| IABP | 11 | 13 | 0.663 |
| Hours of ventilation | 10.22 | 12.31 | 0.19888 |
| ICU stay(days) | 3.30 | 2.89 | 0.391887 |
| Hospital stay(days) | 9.30 | 11.23 | 0.000595 |
| Clinical symptoms of HF | 11 | 11 | 0.919 |
| Reopen for bleeding | 9 | 25 | 0.002 |
| Dehiscent sternum | 9 | 5 | 0.303 |
| Superficial Wound infection | 17 | 38 | 0.001 |
| Deep Wound infection | 2 | 12 | 0.004 |
| Arrhythmias | 10 | 21 | 0.023 |
| Post operative organ failure | 2 | 2 | 0.967 |
| Peri operative MI | 18 | 18 | 1 |
| Total Death | 7 | 6 | 0.774 |

**Table 4:-** 3months postoperative echo

| | Group I | Group II | P value |
|---|---|---|---|
| ESD POST(cm) | 3.46 | 3.50 | 0.714769 |
| EDD POST(cm) | 4.45 | 5.09 | 0.3107 |
| EF POST | 60.20 | 58% | 0.0001 |
| RSWMA POST | 16 | 43 | <0.0001 |

## Discussion:-

The interventionalefficacy and relative benefits have been compared in severalrandomized and observational studies. However, patientswho undergo successful myocardial revascularization may subsequentlyrequire repeat invasive cardiological or surgical intervention. ***(5).***

When a patient is eligible for both procedures, PCI is often preferred than surgery. The initial choice of PCI is reinforced by the perception that patients can safely be referred to surgery after PCI. ***(6).*** However in the ***SYNTAX study,*** 3-year MACCE rates were significantly higher for PCI than CABG; this was mainly driven by higher incidence of the need to repeat revascularization in the PCI arm, in addition to increase number of MI among patients of PCI group, compared to CABG ***(1,7).***

Patients in the PCI group showed higher CCS classification which may signify more clinical deterioration and the more severity of the lesions in the artries post stenting. Also this may be due to the closure of collateral circulation which close after PCI and don't have enough time to reopen during stent thrombosis or restenosis, especially with DES patients, this theory may also emphasize the cause of increase numbers of MI in the PCI group also which was the same as other relative studies. ***(8,9).***

Although the PCI group has higher incidence of previous MI, yet there was no difference between the two groups in the recent MI (within 30 days) before surgery and this was reflected on equal percentage between the two groups in critical preoperative state, but the PCI group has higher number of patients who underwent unplanned CABG. This may be due to the fear of progression of the chest pain to MI in the PCI group which was not the condition with the non PCI group. This also may be due to coronary stents specially DES which are causing arterial wall injury, leading to dysfunctional and denuded coronary endothelium with chronic inflammatory response and platelet and neutrophil adhesion, which in turn are causing adverse cardiovascular events.(7)

The non PCI group in our study showed higher percentage of patients having extra cardiac arteriopathy, this finding may be related to the older age of the non PCI group. This doesn't coincide with other studies which showed no significant difference between both groups. ***(7, 9, 10, 11)***

Regarding the **pre operative echo** it was found that although the preoperative ESD and EF showed no difference yet the EDD was higher in the second group which indicates that previous PCI may have a hidden effect on the myocardiumwhich was noticed by higher incidence of previous MI in the same group. By further evaluation of the preoperative EF by dividing it into good (more than 50%), moderately impaired (30-50%) and severely impaired (less than 30%), no difference was found between the two groups. There was no difference in the preoperative resting segmental wall motion abnormality also. Other studies found no difference between PCI and non PCI group regarding the EF norRSWMA, ESD, EDD. ***(12).***

Angiographycally, some studiesexclude left main disease ***(13),*** butin the present study patients with left main stenosis more than 50% were equal in both groups as well as mean number of diseased vessels (3.34± 0.52 vs 3.28 ± 0.45). This is due to the fact that the study includes only multivessel disease patients, however all PCI group patients with left main stenosis had their left main stenosis post PCI, usually during the first year.

In this study there is approximately equal percentage in group II for DES and BMS, where 51% of them were DES and 49% were BMS, The use the DES didn,t expand the time for the patients before needing subsecuent CABG (11±9 months) but on the contrary its closure with acute thrombosis increased the number of MACCE in the PCI group preoperatively. ***.(14.)***

The two groups were found uniform regarding the mean Euroscore, and mean SYNTAX score(20.69 VS. 18.77) but on comparing the SYNTAX score of group II before stent with preoperative score, we found that it was only 10.96, which was nearly half of its preoperative score. This finding denotes that previous PCI worsen the SYNTAX score preoperatively and hence worsen the vessel more. This could be the effect of the previous PCI or simply a progression of the native disease.

The mean number of distal anastomoses was significantly higher in group I (3.12±0.73) than in the PCI group (2.46±0.85) and it was higher also for venous grafts (1.89±0.7 vs1.39±0.90) and arterial grafts (1.24 ± 0.54 vs 1.07±0.33).

Strangely, although the mean number of diseased vessels was equal preoperatively, the number of grafted vessels was higher in the non PCI group, this is due to higher number of non graftable vessels in the PCI group. This was also found in other comparative studies***.(2).***

These non graftable vessels are due to either propagation of post stent thrombosis to occlude the vessel totally, which is more common, or due to the propagation of atherosclerosis in previously diseased vessel left without intervention (less common). This madethe anastmosis more challenging and risky for the surgeon. But it doesn't affect the choice of the surgical technique as OPCAB was equally used in both groups the same as othther studies(**15).**

In spite the higher numbers of distal anastomoses in group I, There were no statistical diffrence between the two groups in the ACC time (69.49 minutes ± 24. vs 61.81 minutes ±28.40) nor CPB time (102.07minutes± 29.79 vs. 91.47 minutes ±41.49). This may be explained by the less maneuvers done on the vessels in group I such as endarterectomy and/or on lay patch anastomoses due to better target vessels as we noticed***. (16).***

Postoperative inotropes were found to be used more with the previous PCI group rather than group I, howeverfor IABP usage, it was the same in both groups. The higher usage of inotropic support may be related to the lower incidence of total revascularization, higher preoperative EDD and higher incidence of preoperative MI. Other studies showed higher use of both inotropic support and IABP as well. ***(6, 10)***

Overall morbidity was very high in the second group as other studies***. (6, 9, 12, 13),*** the reasons for a higher post operative mobidity in the prior PCI group are not clearly understood however the PCI group patients were presented for surgery with more advanced symptoms and greater urgency. On further analysis of morbidity, the PCI group showed higher incidence of re-exploration, superficial and deep wound infection, but other postoperative parameters were the same in both groups.

Reopening for bleeding was due to the more number of unplanned CABG in group II, with continous use of clopidogrel for long time preoperative (and till the operation in case of emergency operation). In the PCI group,

asprin was not discontinued until the morning of the operation as a precaution against total stent occlusion and perioperative MI (specialy that 51% was DES).

The total hospital stay was longer for the PCI group but the ICU stay was not different.this was the contrary with other studies which had longer ICU stay but same hospital stay for group B***(9).***The difference in the hospital stay in this study was due to the difference of the morbidity specially wound infection which prolong the hospital but doesn,t affect ICU stay, but on the other hand mortality was almost the same between both groups and all of them were in hospital mortality (7 vs. 6). Other studies had the same results ***(14)*** while others stated that PCI group had higher mortality. ***(16, 17).***

All the patients of the study were subjected to follow up for 3 months after the operation. During this period no MACCE happened for any patient of both groups, at the end of this period a postoperative echo was made.

we found that the non PCI group was better than the PCI group in all criteria which included improvment of dimensions, RSWMA.

**Study limitations:-**

The number of enrolled patients limits the explanatory power of our study. Selection of patients for both groups may introduce an underlying bias. We could not elaborate on the factors influencing the surgeons' decisions for number of grafts or conduit selection. It is plausible to study the long term outcome to complete the results of short term outcome.

Although focussing on the SYNTAX score give us better understanding for the severity of the coronary pathology, analysis of the types of the stents, methods of deployment may give more insight on the impact of PCI on suseqent CABG.

## Conclusion:-

Patients with prior PCI presented for CABG with more severe CAD as evidenced by higher CCS classification score, higher incidence of previous MI, unplanned CABG, and higher mean EDD.

With the growing evidence that previous PCI adversely influences the outcome of subsequent CABG, we may expect that prior PCI emerges as a risk factor in new outcome prediction and risk stratification models in cardiac surgery.

## Recommendations:-

Percutaneous Coronary revascularization should be carefully considered against the higher risk it provides for subsequent CABG. The guidelines for intervention should be strictly followed especially in patients with complex coronary lesions who have higher incidence to be referred for CABG.

Surgical scoring systems as EURO score should include an item for previous PCI especially if multiple as one of the factors that increases the risk of subsequent CABG.

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