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# Comparison between coronary artery bypass surgery and percutaneous coronary intervention with drug-eluting stents for Egyptian diabetic patients with Multivessel disease

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## ABSTRACT

***Background:*** With the advances in the interventional field, the usage of DES make the choice of revascularization in diabetic patients with MVD controversial.
***Methods:*** We assigned patients with diabetes and MVD to undergo either PCI with DES or CABG. The patients were followed up for 12 months. The primary outcome was a composite of death, MI, repeated revascularization or stroke.
***Results:*** The study was conducted on 225 patients (116 patients randomly assigned to the PCI group and 109 randomly assigned to the CABG group), 159 males (70.6%), 66 female (29.4%) and their mean age was 57.08±5.79. The mean HbA1c was 7.35%, the mean SYNTAX Score was 24.71, and the mean EuroScore II was 1.04%. No significant differences were seen between CABG and PCI groups in the occurrence of MI at 30 days and 12 months (P = 0.839 and 0.533 respectively), post procedure stroke at 30 days and 12 months (P = 0.234 and 0.612 respectively), for repeated revascularization at 30 days (P = 0.282) and for death at 30 days and 12 months (P = 0.234 and 0.612 respectively). However repeated revascularization after 12 months was significantly higher in PCI with DES group (14 (12.1%) vs 5 (4.6%) patients with P = 0.044).
***Conclusions:*** Diabetic patients with multivessel CAD, comparison between CABG and PCI with DES showed similar mortality, post procedure MI and stroke. However PCI was associated with increased rate of repeat revascularization after 12 months.
Diabetes mellitus, multivessel disease.

**Key words:** Coronary artery bypass graft, Percutaneous coronary intervention, Diabetes mellitus, Multivessel disease

## INTRODUCTION

Diabetes mellitus is a powerful, independent risk factor for cardiovascular disease and accounts for about 25% of all patients requiring myocardial revascularization. Diabetic patients have more extensive and diffuse coronary artery disease (CAD) than non-diabetic patients. Also, they have higher mortality and morbidity after revascularization procedures, including myocardial infarction (MI), and restenosis after balloon angioplasty and bare-metal stenting. (1,2)

Coronary artery bypass grafting (CABG) was generally regarded as a preferred revascularization strategy for patients with multivessel diseases (MVD). However, the advances in the interventional field, especially the advent and development of drug-eluting stents (DES) which significantly reduced restenosis and the need for subsequent repeat revascularizations as compared with bare metal stents (BMS), have largely cut back one of the major limitations of percutaneous coronary interventions (PCI). (3,4)

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The rapid evolution of medical therapy, PCI techniques and cardiac surgery along with the changing patients' profile over the last few decades has required the clinician to make increasingly complex decisions. This has led to significant variations in practices that may be discordant with evidence based clinical practice guidelines. Such variations have an unclear clinical impact. There is hope that with growing efforts to apply multidisciplinary care to the management of complex CAD, that we will arrive at more consistent and balanced decisions. (5)

The aim of this work is to compare the safety and efficacy of coronary artery bypass surgery with PCI with DES in diabetic patients with MVD regarding major adverse cardiovascular events (MACE).

# PATIENTS AND METHODS

## Patients:-

Egyptian diabetic patients with MVD who underwent either CABG or PCI with DES who were admitted to the Critical care department at Cairo university hospital and National heart institute between June 2013 to January 2016 were enrolled in this prospective observational multicenter study. The study protocol was approved by the ethical committee. This study did not interfere with normal routine patient management. The investigator can decide on any treatment that is of the best interest of his patients.

## Inclusion criteria:

**1)** Age ≥18 year's old **(2)** Informed consent given by the patient or immediate relative (first degree) **(3)** Egyptian patients with diabetes and angiographically confirmed MVD with stenosis of more than 70% in two or more major epicardial vessels involving at least two separate coronary artery territories and without left main coronary stenosis. The assignment to CABG or PCI was made on the basis of clinical judgment. The assignment to treatment involved balancing a spectrum of factors, which were weighted differently in each individual patient. Among these factors were extent of CAD, the feasibility of achieving complete revascularization, age, prior surgery, current cardiac function, co-morbidities, specific details of coronary anatomy, general health, pulmonary function, current smoking history, risk of anticoagulation, and likelihood of compliance to continuing clopidogrel therapy. In general, patients with focal disease that was amenable to percutaneous revascularization underwent DES whereas patients with long diffuse disease where complete revascularization could not be accomplished with DES were referred for CABG.

## Exclusion criteria

Included 1) non-diabetic patients, 2) Patients with left main disease or with single vessel disease, 3) Using only BMS or involving BMS with DES in one PCI subject, 4) Concomitant valve surgery, 5) Patients with renal impairment.

## Evaluation of Patients:-

*All included patients were subjected to the following:*

***Full Clinical Evaluation****:*

Including a history and physical examination.

## Laboratory investigations*:*

***CBC (complete blood count):*** Hemoglobin, Hematocrit, White blood cells and platelet count,
***Coagulation profile:*** PT, PC, INR and PTT,
***Kidney Function Tests:*** Na, K, Creatinine and Urea, ***Cardiac enzymes***: CK (creatinine kinase), CK-MB (creatinine kinase - MB) and Troponin and HbA1c (glycated hemoglobin).

These Labs were withdrawn on study day 1 and subsequently thereafter when needed.

12-lead electrocardiogram was performed pre procedure and post procedure or when needed to confirm new ischemic event.

## Echocardiographic evaluation**:**

All patients underwent transthoracic color Doppler echocardiography before and after the procedure to assess systolic and diastolic function, regional wall motion abnormalities (RWMA), left ventricular end diastolic diameter (LVEDD), left ventricular end systolic diameter (LVESD), valvular lesions and mechanical complications. The echocardiography images were obtained using a transducer 2.5 - 3.5 MHz with 2D guided M-mode facilities. All patients were examined in the left lateral decubitus and were angled according to necessity to obtain optimal windows for optimal views, according to the recommendations of the American Society of Echocardiography **(6)**. Images were obtained in the parasternal long axis, parasternal short axis (mid-level), and apical two and four chamber views. Optimization was performed using harmonic imaging, gain, dynamic range, sector width, frequency, and focus to improve signal-to-noise ratio and provide optimal endocardial definition. Images were accepted for analysis according to the guide lines proposed by Gordon et al. (1983), when at least 80% of endocardium was seen. **(7)** Left ventricular end diastolic and systolic volumes and ejection fraction were assessed by apical four chamber and two chamber views with the modified Simpson's method. End-diastole was taken to coincide with the Q-wave on the electrocardiogram, and end-systole was selected by identifying the frame with smallest LV cavity cross-sectional area in both apical views prior to mitral valve opening. The parameters were averaged from three consecutive measurements. **(8)** RWMA, a semiquantitative analysis of the regional systolic function, was assessed. Each segment of the 16-segments of the left ventricle was analyzed individually and scored on the basis of its motion and systolic thickening. **(9)**

## Application of scoring Systems:

The synergy between PCI with Taxus and cardiac surgery (SYNTAX) score (10) which was designed as a comprehensive tool to classify the anatomic complexity and functional severity of a patients' coronary anatomy. It is an amalgamation of five different scoring/classification systems which can be distilled into three basic guiding principles: the first which describes the segments of the coronary artery tree; the second which describes the relative importance of the lesion based on the location and vascular territory to which the lesion impedes flow; the third which describes the complexity of the lesion.

Europian system for Cardiac Operative Risk Evaluation (The Euro) score II (11) is a risk model which allow the calculation of the risk of death after a heart operation. The model asks for 17 items of information about the patient, the state of the heart and the proposed operation, and uses logistic regression to calculate the risk of death.

## Clinical and outcome data:

Primary outcome was freedom from MACE (12) (death, MI, stroke and repeated revascularization) at 30 days and 1 year. Secondary outcome parameters were a safety composite of death, MI, or stroke and procedure related renal failure requiring hemodialysis.

## Myocardial Infarction:

Defined as; a) Within the first 7 days of the revascularization procedure, the presence of new Q waves in at least 2 or more contiguous leads and with elevation of cardiac biomarkers**,** b) After the first 7 days, presence of the following: Typical rise and gradual fall of troponin or more rapid rise and fall of CK-MB for detecting myocardial necrosis with at least one of the following: 1. Ischemic symptoms or atypical symptoms of ischemia; 2. Development of pathologic Q waves on the ECG; 3. ECG changes indicative of ischemia (ST segment elevation or depression); 4. Coronary artery intervention (e.g., coronary angioplasty); 5. Pathologic findings of an acute MI. Troponin rise is defined as elevation >5 x 99th percentile above upper normal level in patients with normal baseline values in PCI related MI and >10 x 99th percentile above upper normal level in CABG related MI Cardiac enzyme elevations in the absence of Q waves will not be considered an event.

**Stroke:** defined as the presence of at least one of the following factors: a focal neurologic deficit of central origin lasting more than 72 hours or lasting more than 24 hours with imaging evidence of cerebral infarction or intracerebral hemorrhage, a nonfocal encephalopathy lasting more than 24 hours with imaging evidence of cerebral infarction or hemorrhage adequate to account for the clinical state, or retinal arterial ischemia or hemorrhage.

**Target Vessel Revascularization:**

Any repeat PCI or bypass surgery to target vessel.

## Acute kidney injury (AKI):

A classification system (RIFLE) has been devised to identify progressively worsening degrees of renal dysfunction. **(13)** It defines three grades of severity of AKI (Risk, Injury and Failure) based on changes of serum creatinine (sCr) and urine output or both and two clinical outcomes (Loss, End-stage renal disease). Risk is defined as a sCr elevation of at least 50% or GFR decline by more than 25% or urinary output less than 0.5 mL/kg/h for at least 6 hours. Injury is considered when the sCr level increased by 100% or GFR decline by more than 50% or urinary output less than 0.3 mL/kg/h for at least 24 hours, and failure is considered when the sCr level is 300% higher than the baseline or GFR decline by more than 75% or urinary output less than 0.3 mL/kg/h for at least 24 hours or anuria for more than 12 hours. Loss is defined as persistent AKI > 4 weeks. End stage is defined as AKI > 3 months.

## The statistics:

Continuous variables were summarized using range, mean ± SD, minimum and maximum. Categorical variables were summarized using frequencies and relative frequencies. A comparison of quantitative variables between the study groups was conducted using a Mann Whitney *U* test for independent samples. For comparing categorical data, chi square test was performed. Exact test was used instead when the expected frequency is less than 5. A probability value (*p* value) of less than 0.05 was considered statistically significant. All statistical calculations were done using SPSS (Statistical Package for the Social Science; SPSS Inc., Chicago, IL, USA) version 22 for Microsoft Windows.

# RESULTS

## Demographic and baseline clinical data:

A total of 225 patients were recruited and scheduled to undergo either CABG (109 (48.4%) patients) or PCI with DES (116 (51.6%) patients). There was statistically significant difference between CABG group and PCI group regarding preoperative LVEDD, LVESD and RWMA (P = 0.004, 0.034 and < 0.001 respectively). Addressing complexity of coronary artery disease by SYNTAX Score and risk of death after a heart operation by Euro score II in CABG and PCI groups showed no statistically significant difference (Table-1).

## Revascularized vessels and number of grafts or stents:

There was no statistically significant differences neither between 3 vessel and 2 vessel diseases in CABG and PCI groups (p = 0.801) nor between number of grafts in CABG group and number of stents in the PCI group (p = 0.069) (Table-2).

## Length and type of stents:

In the PCI group, the total number of stents was 299 stent in 116 patients with total length of stents 65.59 ± 15.87 mm (36-129 mm). 88 (29.44%) were biolomus,

77 (25.75%) were evrolimus, 126 (42.14%) were sirolimus and 8 (2.67%) were zotarolimus.

## Postoperative renal impairment and requirement of dialysis:

Patients underwent CABG developed renal impairment more than patients underwent PCI with statistically significant difference ($P$ < 0.001). Meanwhile addressing requirement of dialysis in the studied patients revealed no statistically significant difference between the two groups ($P$ = 0.059) (Table-3, 4).

## Postoperative echocardiography:

There was statistically significant difference between CABG and PCI groups regarding postoperative LVEDD and LVESD ($P$ = 0.003 and 0.017 respectively). However, there was no statistically significant difference between postoperative EF, RWMA and mechanical complication between the two groups ($P$ = 0.376, 0.059 and 0.484 respectively).

**Table-1. Demographic and clinical data of patients entered into the study.**

| Characteristics | CABG group N: 109 (48.4%) | PCI Group N: 116 (51.6%) | P value |
|---|---|---|---|
| **Age:** (mean±SD (range) in years) | 57.07 ± 5.73 (45-70) | 57.09±5.87 (46-80) | 0.987 |
| **Male: Female sex** (Nº of patients) | 75: 34 | 84: 32 | 0.553 |
| **Medical History** (Nº of patients (%)) | | | |
| • **Smoking** | | | |
| **Smoker** | 37 (34 %) | 35 (30.2 %) | 0.821 |
| **Non smoker** | 48 (44.0 %) | 55 (47.4 %) | |
| **Ex smoker** | 24 (22.0 %) | 26 (22.4 %) | |
| • **Hypertension** | 72 (66.1 %) | 76 (65.5 %) | 0.932 |
| • **Prior MI** | 33 (30.3 %) | 30 (25.9 %) | 0.461 |
| **Glycated hemoglobin** (mean±SD (range)) | 7.37 ± 0.99 (5.6-9.8) | 7.34±0.92 (5.6-9.8) | 0.987 |
| **Scoring systems** (mean±SD (range)) | | | |
| SYNTAX score | 24.98 ± 6.39 (13-40.5) | 24.44 ± 6.88 (11-40.5) | 0.542 |
| Euro Score II | 0.99 ± 0.63 (0.5-4.08) | 1.09 ± 0.82 (0.5-6.59) | 0.263 |
| **Echocardiography** | | | |
| LVEDD (mean±SD (range)) {cm} | 5.31 ± 0.67 (3.8-7.4) | 5.54 ± 0.48 (4.3-6.9) | 0.004 |
| LVESD (mean±SD) (range)) {cm} | 3.80 ± 0.74 (2.3-5.9) | 3.99 ± 0.58 (2.6-5.6) | 0.034 |
| EF (mean±SD (range)) {%} | 54.30 ± 10.24 (30-78) | 52.93 ± 8.54 (28-72) | 0.275 |
| RWMA (Nº of patients (%)) | 72 (66.1 %) | 34 (29.3 %) | < 0.001 |
| **Mechanical complication** (Nº of patients (%)) | 3 (2.8 %) | 0 (0 %) | 0.112 |

**N:** number; **MI:** myocardial infarction; **RWMA:** regional wall motion abnormalities; **LVEDD:** left ventricular end diastolic diameter; **LVESD:** left ventricular end systolic diameter; **EF:** ejection fraction

**Table-2. Revascularized vessels and number of grafts or stents of patients entered into the study.**

| Characteristics | CABG group N: 109 (48.4%) | PCI Group N: 116 (51.6%) | P value |
|---|---|---|---|
| **Re vascularized vessels** (Nº of patients (%)) | | | |
| **3 vessels** | 75 (68.8 %) | 78 (67.2 %) | 0.801 |
| **2 vessels** | 34 (31.2 %) | 38 (32.8 %) | |
| | | | |
| **N. of grafts or stents(**mean±SD (range)) | 2.73 ± 0.73 (1.0-5.0) | 2.58±0.53 (2.0-4.0) | 0.069 |

**N:** number; **MI:** myocardial infarction; **CABG:** Coronary artery bypass grafting; **PCI:** percutaneous coronary interventions.

**Table-3. Type of stents of patients entered into the study.**

| Type | Number of | Number of stents |
|---|---|---|

| | patients | |
|---|---|---|
| | N (%) | N (%) |
| **Biolimus** | 36 (31.05 %) | 88 (29.44 %) |
| **Evrolimus** | 30 (25.86 %) | 77 (25.75 %) |
| **Sirolimus** | 47 (40.51 %) | 126 (42.14 %) |
| **Zotarolimus** | 3 (2.58 %) | 8 (2.67 %) |

**Table-4. Postoperative renal impairment and requirement of dialysis of patients entered into the study.**

| Characteristics | CABG group Nº 109 (48.4%) | PCI Group Nº 116 (51.6%) | P value |
|---|---|---|---|
| Renal impairment (Nº of patients (%)) | 26 (23.9 %) | 7 (6.0 %) | < 0.001 |
| Need for dialysis (Nº of patients (%)) | 6 (5.5 %) | 1 (0.9 %) | 0.059 |

## Major adverse cardiovascular and cerebrovascular events:

Addressing repeated revascularization after 12 month there was statistically significant difference between CABG and PCI group where 14 patients (12.1%) in PCI group required Repeated revascularization compared to 5 patients (4.6%) in CABG group (P = 0.044). Meanwhile Addressing other major adverse cardiac and cerebrovascular events there was no statistically significant difference between CABG and PCI groups in developing MI at 30 day and 12 month (P = 0.839 and 0.533 respectively), for post procedure stroke at 30 day and 12 month (P = 0.234 and 0.612 respectively), for repeated revascularization at 30 day (P = 0.282) and for death at 30 day and 12 month (P = 0.234 and 0.612 respectively). (Table-5,6).

**Table-5. Postoperative Echocardiography of patients entered into the study.**

| Characteristics | CABG group Nº 109 (48.4%) | PCI Group Nº 116 (51.6%) | P value |
|---|---|---|---|
| **Echocardiography** | | | |
| **LVEDD** ((mean±SD (range)) {cm} | 5.20 ± 0.58 (3.2-6.7) | 5.41 ± 0.38 (4.5-6.6) | 0.003 |
| **LVESD** ((mean±SD (range)) {cm} | 3.60 ± 0.67 (2.1-5.3) | 3.79 ± 0.46 (2.7-5.5) | 0.017 |
| **EF** ((mean±SD (range)) {%} | 57.32 ± 9.44 (30-77) | 56.34 ± 6.94 (35-71) | 0.376 |
| **RWMA** (Nº of patients (%)) | 28 (25.7 %) | 18 (15.5 %) | 0.059 |
| **Mechanical complication** (Nº of patients (%)) | 1 (0.9 %) | 0 (0 %) | 0.484 |

**RWMA:** regional wall motion abnormalities; **LVEDD:** left ventricular end diastolic diameter; **LVESD:** left ventricular end systolic diameter; **EF:** ejection fraction

**Table-6. Major adverse cardiovascular events of patients entered into the study.**

| Characteristics (Nº of patients (%)) | CABG group Nº 109 (48.4%) | PCI Group Nº 116 (51.6%) | P value |
|---|---|---|---|
| **Post MI** | | | |
| **1 month** | 5 (4.6 %) | 6 (5.2 %) | 0.839 |
| **1 year** | 7 (6.4 %) | 10 (8.6 %) | 0.533 |
| **Stroke** | | | |
| **1 month** | 2 (1.8 %) | 0 (0.0 %) | 0.234 |
| **1 year** | 2 (1.8 %) | 1 (0.9 %) | 0.612 |
| **Repeated re vascularization** | | | |
| **1 month** | 2 (1.8 %) | 6 (5.2 %) | 0.282 |
| **1 year** | 5 (4.6 %) | 14 (12.1 %) | 0.044 |
| **Mortality** | | | |
| **1 month** | 3 (2.8 %) | 1 (0.9 %) | 0.291 |
| **1 year** | 6 (5.5 %) | 3 (2.5 %) | 0.265 |

**N:** number; **MI:** myocardial infarction

# DISCUSSION

The indications for coronary revascularization are similar in patientspaint with diabetes as in the general population. However, the optimal coronary revascularization modality is controversial. Patients' clinical presentation, comorbid medical conditions, and anatomical characteristics all factor into this decision.

Since diabetes is associated with rapidly progressive diffuse coronary lesions with multivessel involvement, CABG, as opposed to PCI, potentially protects from non-culprit lesion related adverse cardiovascular events. However, CABG is associated with upfront risk of death, MI, and stroke. Over the last two decades, PCI techniques have improved with the use of smaller size catheters, effective antiplatelet and anticoagulant agents, and significant advancement in stent technology. Initially, plain old balloon angioplasty (POBA) was introduced in the era of thrombolytic therapy. Although POBA was a landmark advancement when first introduced, it had shortcomings such as acute artery closure and dissection. **(14)**

These shortcomings were mitigated with introduction of BMS. BMS were later found to have high rates of repeat revascularization due to instent restenosis (ISR)

a pathological response of the vascular endothelium to the damage introduced via placement of stents. (15)

Understanding the pathophysiology of ISR led to the debut of DES that released antiproliferative agents aimed to reduce smooth muscle proliferation and decrease the risk of restenosis. While the first-generation DES achieved their goal of reducing ISR, they were found to have increased rates of late stent thrombosis especially when antiplatelet therapy was withheld. (16)

Eventually, second-generation DES such as the cobalt-chromium everolimus eluting stent (CoCr EES), platinum-chromium everolimus-eluting stent (PtCr EES), and zotarolimus-eluting resolute (ZES-R) stent incorporated evidence based technological advancements in their design which translated into reduced rates of cardiovascular events and mortality. (17, 18).

Besides the safer and better stent designs, the past two decades have also seen introduction of ancillary PCI technologies such as fractional flow reserve measurement guided PCI, which has been shown to improve cardiovascular outcomes. (19, 20).

Furthermore, peri-PCI adjunct medications including newer antiplatelet agents have also improved cardiovascular outcomes.

On the other hand, CABG surgery and perioperative care have also evolved significantly since it was first performed in 1960 at the Albert Einstein College of Medicine–Bronx Municipal Hospital Center (21).

Advancements such as the introduction of off-pump CABG surgery and minimally invasive direct coronary artery bypass, utilization of arterial grafts, contemporary perioperative care, and understanding the association between aortic manipulations with upfront stroke risk have improved cardiovascular outcomes associated with CABG surgery. (22)

The current study was conducted on 225 patients 159 males (70.6%), 66 females (29.4%) and their mean age 57.08±5.79 (45 - 80 years), 148 hypertensive (65.7%), 72 smokers (32%), 63 patients (28%) with previous history of MI. The mean HbA1c was 7.35%, the mean SYNTAX Score was 24.71 and the mean EuroScore II was 1.04%. The primary end point at 30 days and 12 months had occurred in 12 (11.0%) and 20 (18.3%) patients respectively in the CABG group and in 14 (12.0%) and 31 (26.7%) patients respectively in the PCI group. No significant differences were seen between the two groups in the occurrence of the primary end point of death, myocardial infarction, or stroke However, the rate of repeat revascularization at 12 months was significantly higher after PCI 14 patients (12.1%) than after CABG 5 patients (4.6%) (P = 0.044).

These results were concordant with BEST trial 2015 (23) which was a randomized trial at 27 centers in East Asia, after the enrollment of 880 patients (438 patients randomly assigned to the PCI group and 442 randomly assigned to the CABG group). At 2 years, the primary end point had occurred in 11.0% of the patients in the PCI group and in 7.9% of those in the CABG group (P = 0.32).

At longer-term follow-up (median, 4.6 years), the primary end point had occurred in 15.3% of the patients in the PCI group and in 10.6% of those in the CABG group (P = 0.04). No significant differences were seen between the two groups in the occurrence of a composite safety end point of death, MI, or stroke. However, the rate of any repeat revascularization was significantly higher after PCI than after CABG (11.0% vs. 5.4%, P = 0.003).

While in FREEDOM trial 2012 (24) which was a randomized trial, assigned patients with diabetes and MVD to undergo either PCI with DES or CABG. The patients were followed for a minimum of 2 years (median among survivors 3.8 years). The primary outcome measure was a composite of death from any cause, nonfatal MI, or nonfatal stroke.

From 2005 through 2010, 1900 patients were enrolled at 140 international centers. The primary outcome occurred in 352 patients (205 in the PCI group and 147 in the CABG group). The rate of the primary outcome was lower in the CABG group than in the PCI group (P = 0.005). At 30 days, the primary outcome had occurred in fewer patients in the PCI group than in the CABG group (26 vs. 42 patients). At 2-year event rates were 13.0% in the PCI group, as compared with 11.9% in the CABG group. However, 5-year event rates were 26.6% in the PCI group, as compared with 18.7% in the CABG group. There was increased all-cause mortality in the PCI group (P = 0.049), with 5-year rates of 16.3% in the PCI group versus 10.9% in the CABG group.

The concordance between the current study and that of BEST trial (23) may be due to second generation DES that were the predominant type (59.49%) of stents used in this study compared to first generation Sirolimus-eluting and paclitaxel-eluting stents that were used exclusively in 51% and 43% of patients, respectively in the FREEDOM trial (24).

This study showed that patients developed renal impairment in the CABG group statistically significant higher than those in the PCI group [26 (23.9%) vs 7 (6%) patients with P < 0.001]. While there was no statistically significant difference between the two groups as regard requirement of dialysis (P = 0.059).

Similarly Chang et al. 2014 (25) during the index hospitalization, 20.4% of patients in the KPNC cohort and 6.2% of patients in the Medicare cohort developed AKI on the basis of cohort-specific criteria. More CABG patients than PCI patients developed AKI, and more patients with baseline chronic kidney disease developed AKI. The incidence of AKI requiring dialysis during the index hospitalization was low in both cohorts: 0.4% (n = 12) in KPNC and 0.2% (n = 252) in Medicare. The low incidence of AKI requiring dialysis in the KPNC cohort precluded further analysis of this outcome. In the Medicare cohort, the incidence of AKI requiring dialysis was higher in patients undergoing CABG (0.4%) versus PCI (0.1%) (p< 0.001) overall and in the subset of

patients with chronic kidney disease: 2.9% of CABG and 1.3% of PCI patients (p < 0.001).

LVEF in the current study showed no significant difference either preoperative or postoperative in both CABG and PCI group. The mean LVEF in CABG group was 54.30% and 57.32% preoperative and postoperative respectively while in PCI group the mean LVEF was 52.93% and 56.34% preoperative and postoperative respectively.

These results were concordant with the MASS II trial 2013 (26) where LVEF was assessed with transthoracic echocardiography in patients with multivessel CAD, participants of the MASS II trial before randomization to CABG, PCI or medical therapy and re-evaluated after 10 years of follow-up. Of the 611 patients, 422 were alive after 10 years. 350 patients had LVEF reassessed: 108 patients from medical therapy, 111 from CABG, and 131 from PCI. There was no difference in LVEF at the beginning (0.61±0.07, 0.61±0.08،0.61±0.09) respectively, for PCI, CABG and medical therapy (P = 0.675) or at the end of follow-up (0.56±0.11, 0.55±0.11،0.55±0.12, P = 0.675).

Moreover, the current study showed statistically significant difference between CABG group and PCI group regarding preoperative LVEDD, LVESD and RWMA (P = 0.004, 0.034 and < 0.001 respectively) and there was statistically significant difference between CABG group and PCI group regarding postoperative LVEDD and LVESD (P = 0.003 and 0.017 respectively). These parameters were not fully studied in previous trials comparing CABG and PCI in multivessel disease.

David S. et al 1982 (27) studied two dimensional echocardiographic analysis of SWMA before and after coronary artery bypass surgery on 20 patients and concluded that segmental wall motion assessed by two-dimensional echocardiography may improve after revascularization surgery, but the interventricular septum shows impaired motion. This effect of CABG on wall motion is better demonstrated relatively late after operation than early in the postoperative course.

**Limitation of the study:-**

1. Retrospective observational study.
2. Data regarding renal impairment lack objective evidence to exclude preoperative diabetic nephropathy.
3. Short term follow up.

## CONCLUSION

Diabetic patients with MVD had an increased rate of repeated revascularization at 12 months after PCIwith DES than after CABG. MoreoverCABG is associated with increased risk of renal impairment than PCI with DESbut without increase in the requirement of dialysis. A prospective randomized trial with long term follow up of major adverse cardiac and cerebrovascular events is recommended.

## Conflict of Interests

Authors declare that there is no conflict of interests regarding the publication of this paper.

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