Percutaneous Coronary Revascularization Versus Surgery In Multi-vessel Disease

Mohamed Mahmoud [1], Osama Osman[2], G.M. Shaaban[3] and M.M. Nasr[4]

Al-AzharAssiut University Cardiology Departments ([1], [2]), Cardiology National Heart Institute and Cardiothoracic Surgery National Heart Institute ([3,4])
d.mohammedmahmoud@gmail.com

Abstract: Ischemic heart disease (IHD) remains the leading cause of mortality in the world. When it manifests as obstructive coronary artery disease (CAD), it typically presents as angina pectoris or myocardial infarction (MI)**.** Many treatments have been linked to the improvement of mortality from CAD. These include secondary preventive medical therapy and revascularization; initial treatments for acute coronary syndromes (ACS), including ST-elevation myocardial infarction (STEMI); revascularization for chronic angina; treatment for heart failure (HF); and primary preventive therapies, including treatment of hypertension (HTN) and hyperlipidemia. Multivessel coronary artery disease (MVCAD) is characterized by involvement of greater than 1 epicardial coronary artery (CA) or the unprotected left main (LM). The choice of revascularization strategy in this setting remains a critical issue in cardiology. Although coronary artery bypass grafting (CABG) has traditionally been the revascularization strategy for most patients with MV disease, there has been a gradual shift toward percutaneous revascularization (PCI). Early randomized clinical trials showed CABG to be superior to medical therapy. However, trials comparing CABG to bare metal stenting have not shown a mortality benefit. Advancements in interventional techniques will continue to challenge the notion that CABG is the standard therapy for patients with MVCAD. Several ongoing randomized clinical trials comparing CABG to drug eluting stents (DES) will provide valuable insight into the role of each procedure. Limited data suggests that CABG is superior to MV PCI even when drug-eluting stents are used. Several ongoing randomized trials are evaluating the long-term comparative efficacy of PCI with DES and CABG in patients with DM. Though CABG is currently the gold standard for revascularization of patients with unprotected LMCA stenosis, stent implantation in carefully selected patients appears to be both feasible and safe. **Aim of the Work**: The purpose of this study is to compare the safety and efficacy of PCI using Drug Eluting Stents versus CABG in treatment of MVCAD. **Results:** Follow up for one year for all the patients showed that MACE positive patients in group (A) were 36% occurred at 9.78±2.1 months. No mortality was found during that period. On the contrary, group (B) showed 24% MACE positive patients, 8% mortality. All our complications occurred during post procedure hospital stay. The difference between the two groups was statistically insignificant. A Combination of semiquantitative stress echo and the clinical history allows us to define the risk of all late cardiac events for patients with MVD undergoing stenting or surgery. This study demonstrates that dobutamine stress echo is a powerful predictor of late cardiac event after coronary revascularization and is superior to simple clinical risk assessment. O**ur study concluded that:** PCI and CABG are considered for diabetic patients with MVD, inspite of increased need for revascularization after PCI, yet the difference between CABG and PCI is not significant.
[Mohamed Mahmoud, Osama Osman,G.M. Shaabanand M.M. Nasr. **Percutaneous Coronary Revascularization versus Surgery in Multi-vessel Disease.** *Life Sci J* 2015;12(10):8-23]. (ISSN:1097-8135). http://www.lifesciencesite.com. 2

Key words: PCI= percutaneous coronary intervention, CABD= coronary angio bypass graft, echo?

1. Introduction:

IHD remains the leading cause of mortality in the world. It presents as a spectrum of diseases and syndromes ranging from asymptomatic quiescent states to SCD. When it manifests as obstructive CAD, it typically presents as angina pectoris or MI ***(1).*** Although mortality has improved over the past several decades, the increasing burdens of obesity, diabetes, and an aging population challenge health care systems and populations. Many treatments have been linked to the improvement of mortality from CAD. These include secondary preventive medical therapy and revascularization; initial treatments for ACS, including STEMI; revascularization for chronic angina; treatment for HF; and primary preventive therapies, including treatment of HTN and hyperlipidemia ***(2)***. MVCAD is characterized by involvement of greater than 1 epicardial CA or the unprotected LM. The choice of revascularization strategy in this setting remains a critical issue in cardiology. Although CABG has traditionally been the revascularization strategy for most patients with MVD, there has been a gradual shift toward PCI. Early randomized clinical trials showed CABG to be superior to medical therapy. However, trials comparing CABG to bare metal stenting have not shown a mortality benefit. Advancements in PCI techniques will continue to challenge the notion that

CABG is the standard therapy for patients with MV CAD. Several ongoing randomized clinical trials comparing CABG to DES will provide valuable insight into the role of each procedure. Patients with diabetes represent an increasingly commonand high-risk cohort. Furthermore, patients with diabetes with CAD tend to have a greater extent of atherosclerotic burden that are manifested as follows: longer lesions, multiplelesions, more complex plaque morphology, and calcification.In addition, patients with diabetes are morelikely to have major comorbidities such as HF, chronic kidney disease (CKD), and peripheral vascular disease (PVD). In some series, the prevalence of MVCAD in diabetic cohorts is up to 80%.Randomized trials comparing MVPCI with balloon angioplasty or bare metal stents to CABG consistently demonstrated the superiority of CABG in patients with treated DM. In the setting of diabetes CABG had greater survival, fewer recurrent infarctions or need for re-intervention. Limited data suggests that CABG is superior to MVPCI even when DES are used. Several ongoing randomized trials are evaluating the long-term comparative efficacy of PCI with DES and CABG in patients with DM ***(3).*** Significant LM CAD is characterized as angiographic stenosis of ≥50% of this segment of the coronary tree. It is found in 2.5% to 10% of all patients undergoing diagnostic coronary angiography procedures. Though CABG is currently the gold standard for revascularization of patients with unprotected LMCA stenosis, stent implantation in carefully selected patients appears to be both feasible and safe ***(4)***.Many cardiologists consider it reasonable to assume that PCI using DES ought to be considered equivalent, if not superior, to CABG. The argument made is that in previous randomized clinical trials comparing PCI to CABG, restenosis was the determining factor favoring surgery, an event that clinical experience suggests is no longer as frequent. In the absence of a definitive clinical trial to support this view, how should the prudent, cutting edge cardiologist evaluate the data and manage their patients ***(5)***.

Aim of the Work:

The purpose of this study is to compare the safety and efficacy of PCI using DES versus CABG in treatment of MVCAD.

2. Patients and methods

1-Patients:

This study was conducted on 50 patients with IHD in the Cardiology departments of National heart Institute from April 2011 to August 2012. 25 of them will undergo PCI using drug eluting stents while the other 25 will undergo CABG. All patients underwent diagnostic coronary angiography which showed MV lesions with good distal run off that could be treated either by PCI or CABG. **The patients were divided into two groups:** 1-Group (A) included 25 patients who underwent PCI to accessible lesions. 2-Group (B) included 25 patients who underwent CABG for diseased vessels.

Study Design: 300 patients were assigned from April 2011 to August 2012 from the Cath Lab of the National Heart Institute after reporting of MVCAD, all these patients were sent to the outpatient clinic to assess their fitness for our inclusion criteria.**161** patients were fit to our inclusion criteria and therefore they were subjected to the committee including a consultant cardiologist, consultant cardiothorathic surgeon who had decided the management option of these patients either according to the Syntax score which is: an angiographic tool grading the complexity of CAD. The SYNTAX score reflects a comprehensive anatomical assessment, with higher scores indicating more complex CAD; 1-A low score was defined as 22, 2-An intermediate score as 23 to 32, and 3-A high score as 33. from SYNTEX score those 161 patients divided into 1**36** patients clearly indicated for MV PCI having low syntax score 2- **75** patients clearly indicated for CABG having high syntax score 3- For the remaining **50** patients the committee determined that equivalent anatomical revascularization could be achieved with either treatment. They are fit for either CABG or PCI according to their anatomical criteria and all of them accepted either treatment, and those patients were having intermediate Syntax score. Those 50 patients are the study patients who enter a randomization for either PCI or CABG which was done within one month from the diagnostic Angiography and Dobutamine stress echo that was done before the coronary revascularization. **Inclusion Criteria:** Patients were included if they: 1-Have MVCAD, manifested by a-Typical chest pain or angina equivalent. -ECG changes suggesting CAD. b -Wall motion abnormalities by echo if present. **Exclusion Criteria:** -Patients were excluded if they are: 1- ≥80 years of age 2-Severely impaired LV function 3-Have less than 3vessel disease 4-Have prior revascularization procedures. 5-Have experienced an acute MI within 24 h before the procedure. 6– Multi-organ dysfunction. **Methods:** All patients will be subjected to 1-informed consent 2- full history taking before and after the procedure including all cardiological symptoms. 3-Full clinical examination before and after the procedure. 4-12-lead ECG pre and post- intervention.5- Full Conventional transthoracic Echocardiography (TTE) done by using a 2.5 MHz transducer of the commercially available phased-array scanner, Philips IE-33 echocardiography machine. All parameters was done according to the American Society of Echocardiology (echo) to assess LV

function and wall motion abnormality (WMA)before the intervention with a re assessment after 6 and 12 months. 6- Dobutamine stress echo or thallium study before and after the procedure to assessment of ischemic myocardium. 7- **Coronary angiography:** A detailed discussion with the patient and his family about benefits of coronary angiography, methods for revascularization and possible complications was done. Informed consent was signed by the patient after his approval of the procedure. All patients received aspirin 150 mg/day for one week pre-procedural (if not taking it before) and continued post-procedural for life. All patients received clopidogrel 75 mg (4tablets=300mg), at least one day pre-procedural followed by 75 mg / day after procedure for one year. Angioplasty and stent implantation were performed according to standard clinical practice: 1-Through femoral approach if accessible or radial if not using Seldinger's technique. 2-Unfracionated heparin 10000 units were given before the intervention. 3-Direct stenting was done or balloon predilatation according to the criteria of each individual lesion. 4-Drug eluting stents only were used for revascularization in diabetic patients. 5-Angiographic success is achieved if the residual stenosis of the dilated segment was less than 20%. 6-All patients underwent PCI were instructed to receive clopidogrel 75 mg daily for at least one year in addition to aspirin 150 mg daily. **All patients underwent CABG:** 1-Were instructed to stop clopidogrel and aspirin 5 days before procedure. 2-Carotid duplex were done prior to the procedure 3-Venous duplex were done to both lower limbs prior to the procedure. 4- Arterial duplex were done to both upper limbs prior to the procedure. 5- Pulmonary function tests were done also prior to the procedure.6-Both arterial and venous grafts were used for revascularization 7- Venous grafts used were saphenous vein grafts (SVG).8- Arterial grafts used were left internal mammary artery (LIMA), right internal mammary artery (RIMA) and radial artery. All these patients provided a written consent; the protocol and the consent were consistent with the national heart institution protocols. Patients were treated with the intention of achieving complete revascularization of all vessels at least 2.5 mm in diameter with stenosis of 70% or more as identified by local interventional cardiologists and cardiac surgeons. The surgical technique for CABG, approaches used for stent implementation and the post procedure medication regimen were chosen according to local clinical practice. **Follow-up Protocol:** ***(A) In hospital follow up****:* Patients were followed up during hospital stay after revascularization for: *i.* Mortality: Including all causes of death whether cardiac or cerebral or others. ii. Morbidity: As acute Q wave MI diagnosed by: a. Appearance of any symptoms or signs of acute chest pain. B. New ECG changes (ST-T wave changes and pathological Q wave). C. Elevated cardiac enzymes. iii. Need for revascularization. Iv. Occurrence of any neurological or vascular events. V. Others. Duration of hospital stay was documented in the medical record of each patient. ***(B) Outpatient six months follow up:*** For all 50 patients the following was done: 1-Duration of stay at home and ability to return to work was documented for each patient. 2-Close observations of all the patients and detailed history taking for early detection of any major adverse cardiac events (MACE) including: 1-All causes of sudden cardiac death 2- Unstable angina or MI, diagnosed by: a. Appearance of any symptoms or signs of acute chest pain. B. New ECG changes (ST-T wave changes and pathological Q wave). C. Elevated cardiac enzymes. iii. Need for revascularization whether surgical or PCI. **Echo** for detection of any change in LVEDD, LVESD, LVPW, IVS thickness and EF. ***(C) Out patient 12 months follow up:*** For all 50 patients the following was done: 1- Close observations of all the patients and detailed history taking for early detection of any major adverse cardiac events (MACE) that mentioned before and 2-**Echo** for detection of any change in LVEDD, LVESD, LVPW, IVS thickness and EF. **3-Stress Echo** for assessment of EF, WMA, wall motion score index, delta wall motion score index. **Statistics**: All the data obtained were analyzed statistically using statistical package, version (6). Quantitative variables were expressed in the form of mean ± standard deviation (SD). Qualitative variables were expressed as frequency and percentage. Arithmetic mean or average ($\bar{\chi}$): ($\bar{\chi}$) = (X) / n where (X)= the sum of individual values. N= the number of measurements. Standard deviation (SD): $\sqrt{d2/n-1}$ d^2= the sum of squared deviation of individual values from the arithmetic mean of the series. n – 1 = degree of freedom for the sample. Comparison between quantitative variables was carried out by student T test of two independent samples. One way ANOVA test was used instead of student T test in cases of more than two quantitative variables, expressed as F-ratio and P-value. The results were considered of statistical significance if p value was < 0.05. Limits of significance: 1. Non significant: At P> 0.05. 2. Significant: At P<0.05. 3. Highly significant: At P< 0.01.

Results: This study was conducted in the period from April 2011 to August 2012. The initial study population consisted of 300 patients, but only fifty patients reached the final study. The patients were divided into two groups: **Group (A)** included 25 patients who underwent PCI to accessible lesions. **Group (B)** included 25 patients who underwent CABG for diseased vessels.

Baseline data: **Demographic data: Age:** In group (A), the age of the patients ranged from 38 to 78 years with mean age 61.56 ± 10.76 years, while in group (B) the age of the patients ranged from 36 to 78 years with mean age 57.04 ± 10.37 years. The difference between the two groups was statistically insignificant (*P*> 0.05) (table 2). **Weight:** In group (A) their weight ranged from 61 to 123 kg with mean value 88.52 ± 17.81 kg, while in group (B) their weight ranged from 65 to 128 kg with mean value 89.52 ± 18.18 kg. The difference between the two groups was statistically insignificant (*P*> 0.05) (table 2). **Height:** In group (A) their height ranged from 151 to 192 cm with mean value 171.24 ± 12.20 cm, while in group (B) their height ranged from 151 to 186 cm with mean value 168.36 ± 9.85 cm. The difference between the two groups was statistically insignificant (*P*> 0.05).

Clinical analysis of the patients showed that. 1. Sex: In group (A) 17 patients were males (68%) and 8 patients were females (32%), while in group (B) 15 patients were males (60%) and 10 patients were females (40%). Difference between the two groups was statistically insignificant (*P*> 0.05) (table 3). **2. Visceral obesity:** In group (A) 15 patients had visceral obesity (60%), versus 17 patients in group (B) (68%). Difference between the two groups was statistically insignificant (*P*> 0.05) **3. Smoking:** In group (A) 15 patients were smoker (60%), versus 16 in group (B) (64%). Difference between the two groups was statistically insignificant (*P*> 0.05) (table 3). **4. Family history:** In group (A) 16 patients had positive family history of IHD (64%), versus 17 in group (B) (68%). Difference between the two groups was statistically insignificant (*P*> 0.05). **5. Blood pressure:** In group (A), mean baseline systolic blood pressure (SBP) was 135.72 ± 14.86 mmHg while the mean baseline diastolic blood pressure (DBP) was 85.4 ± 9.56 mmHg. In group (B), mean baseline systolic blood pressure (SBP) was 137.84 ± 15.01 mmHg while the mean baseline diastolic blood pressure (DBP) was 85.28 ± 11.65 mmHg. Difference between the two groups was statistically insignificant (*P*> 0.05) (table 4). **6. Medical treatment:** In group (A), diuretics was the treatment in 3 patients (12%), beta blockers 19 patients (76%), calcium channel blockers in 4 patients (16%), ACEI in 16 patients (64%) and ARBS in 4 patients (16%) (Figure1). While in group (B), diuretics was the treatment in 10 patients (40%), beta blockers 19 patients (76%), calcium channel blockers in 7 patients (28%), ACEI in 16 patients (64%) and ARBS in one patient (4%) (Figure 2).

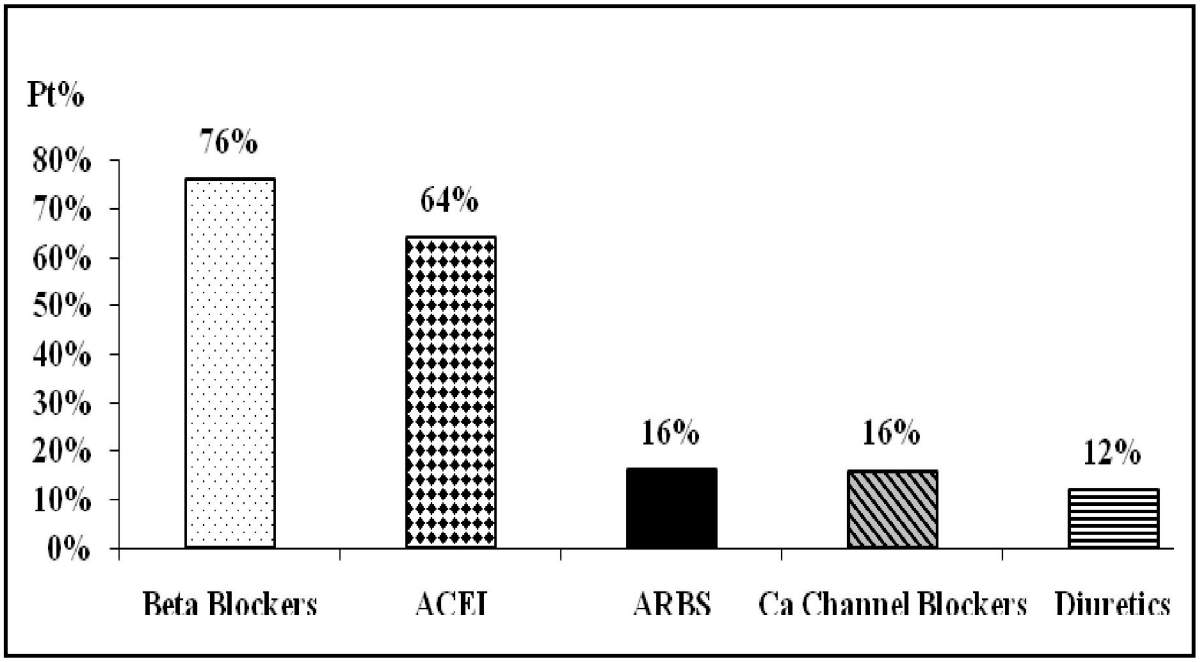


Fig. (1): Medical treatment for group (A):

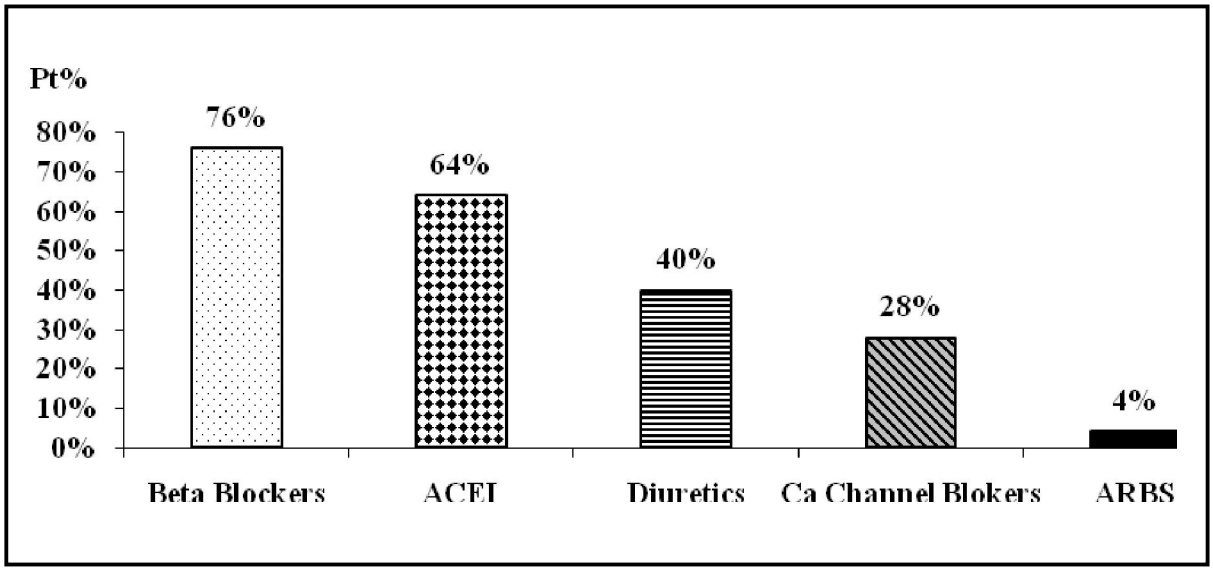


Fig. (2): Medical treatment for group (B):

Laboratory data: 1, Blood sugar: In group (A), mean baseline fasting blood sugar (FBS) was 164.28 ± 58.21 mg/dl while the mean baseline 2 hour post prandial blood sugar (PPBS) was 250.84 ± 93.91 mg/dl. In group (B), mean baseline FBS was 175.6 ± 58.87 mg/dl, while the mean baseline 2 hour PPBS was 255.6 ± 88.67 mg/dl. Difference between the two groups was statistically insignificant (*P*> 0.05). **Diabetes treatment:** In group (A), 10 patients were on oral hypoglycemic agents (40%), 12 patients were on insulin (48%) and 3 patients were on both (12%). While in group (B), 16 patients were on oral hypoglycemic agents (64%), 6 patients were on insulin (24%) and 3 patients were on both (12%). Difference between the two groups was statistically insignificant (*P*> 0.05) (figure 3). **2, lipid profile:** In group (A), 24 patients had uncontrolled lipid profile (96%), only 11 patients were on lipid lowering agents (44%), 9 patients of them were on statins (36%) and 2 patients on fibrates (8%). While in group (B), 22 patients had uncontrolled lipid profile (88%), only 9 patients were on lipid lowering agents (36%), 8 patients of them were on statins (32%) and one patient on fibrates (4%). All patients in the study had values within the normal ranges, concerning blood picture, platelets count, serum Creatinine, K and coagulation profile.

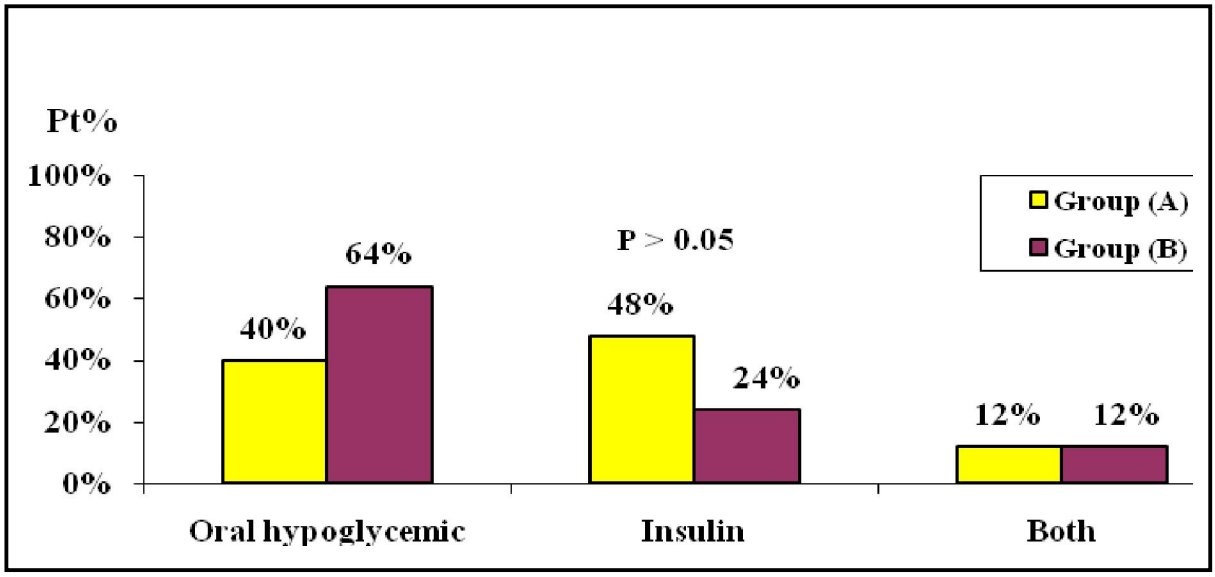


Fig. (3): Diabetes treatment of two studied groups:

Radiological data: 1.ECG: In group (A), 18 patients had ST-T changes and abnormal Q waves at their ECG (72%), while in group (B), 17 patients had ECG changes (68%). Difference between the two groups was statistically insignificant (*P*> 0.05) **Echo:** Echo study shows that, in group (A) mean baseline of EF was 50.880 ± 6.547 %, while in group (B), mean baseline EF was 50.600 ± 5.737 %. Difference between the two groups was statistically insignificant (*P*> 0.05). The Study also shows that in group A the mean base line of the Wall Motion Score Index (WMSI) was 1.275 ± 0.293, while in group II the mean base line of WMSI was 1.295 ± 0.395. Difference between two groups was statically insignificant (p>0.05). **Stress Echo:** findings for **group (1) Stress Echo** the peak dose of dobutamine infusion was 38µg/kg/min. Atropine, 0.84 ± 0.61 mg, was administered to (32%) patients. Heart rate increased from 73 ± 13 beats/min to 128±16 beats/min. At rest, the ejection fraction was 50.880±6.547 and the systolic function was impaired in 80%. Resting WMA was present in 56% patient. EF changed from 50.880±6.547 at rest to 47.920±4.453 at peak stress. Of patients with no resting WMA, inducible ischemia developed in (100%) patients. Ischemic threshold, detected at a heart rate (HR) of 111 ± 19 beats/min and a dobutamine infusion rate of 30±10µg/kg/min. An abnormal LVESV response was noted in (14%) patients the resting WMSI for group 1 was 1.275±0.293. Abnormal LVESV response, normal or failure to decrease on stress, was found in 6 pts. Of the positive tests, 10 pts were positive at low dose (≤12 min) and 7 pts at high dose (>12 min up to 17 min), and 8 pts during or after atropine infusion. The WMSI at peak dose increased up to 1.590±0.264 during DOB. Delta WMSI was 0.315 for DOB.

Group (2) Stress Echo the peak dose of dobutamine infusion was 36±9µg/kg/min. Atropine, 0.64±0.51 mg, was administered to (35%) patients. HR increased from 66±10 beats/min to 130 ± 16 beats/min. at rest, the EF was 54±14% and systolic function was impaired in (72%) patients. Resting WMA was present in (48%) patients; EF increased from 54±14% at rest to 64 ± 17% at peak stress. Ischemic threshold was, detected at a HR of 118±19 beats/min and a dobutamine infusion rate of 30±10µg/kg/min. Abnormal LVESV response, normal or failure to decrease on stress was found in 4 pts. Of the positive tests, 6 pts were positive at low dose (≤12 min) and 10 pts at high dose (>12 min up to 17 min), and 9 pts during or after atropine infusion. The WMSI from 1.295±395 at peak dose increased up to 1.590±0.196. Delta WMSI was 0.295±0.18 for DOB.

Revascularization data: Group (A): 1-Stent Number: Mean baseline of number of stents per patient was 2.76 ± 0.78 stent with minimum number 2 stents and maximum number 4 stents. **2-Stent Diameter:** Mean baseline of stent diameter per patient was 3.27 ±0.26 mm with minimum diameter 3 mm and maximum diameter 4 mm (table 8). **3-Stent length:** Also mean baseline of stent length per patient was 18.72 ±3.989 mm with minimum length 12 mm and maximum length 33 mm. **4-Target vessel:** Number of stents deployed at LAD was 33 stents (48%), RCA 20 stents (29%), LCX 10 stents (15%), D_1 2 stents (3%), OM_1 2 stents (3%), OM_2 one stent (1%) and PDA one stent (1%) (Table 1).

Table (1): Target vessel for revascularization for group (A):

Target vessel	Number	Percent (%)
LAD	33	48%
LCX	10	15%
RCA	20	29%
D_1	2	3%
OM_1	2	3%
OM_2	1	1%
PDA	1	1%

5-Types of stents:

Table (2): Types of stents for revascularization for group (A):

Type of stent	Number	Percent (%)
Endeavor sprint	22	32%
Biomatrix	14	20%
Cypher	3	4%
Nobori	3	4%
OptimaJet	8	12%
Artax	4	6%
TaxusLiberte	2	3%
Promus Element	4	6%
Lucspan	1	1%
Endeavor	4	6%
Taxi Core	2	3%
Alex Stent	1	1%
Infinium	1	1%

All patients had angiographic success with TIMI III flow.

Group (B) 1-Number of grafts: Mean baseline of number of grafts per patient was 3.16±0.62 grafts. **2. Types of grafts:** Arterial grafts used in 38 lesions (48%) and venous grafts used in 41 lesions (52%). Regarding type of grafts used, LIMA was used in 26 lesions (33%), RIMA in 5 lesions 6%, radial artery in 7 lesions (9%) and SVG in 41 lesions (52%).

Follow up data: (A) ***In hospital outcome:*** **Complications:** ***i. MI*** In group (A), no patient had

MI, while in group (B) four patients had MI (16%) (Proved by new dynamic ECG changes and elevated cardiac enzymes with clinical picture), two of them had anterior MI (8%) and other two patients had inferior MI (8%). Difference between the two groups was statistically significant ($P< 0.05$) (table 12).**ii. *Revascularization*** In group (A), no patient needed revascularization, also in group (B) no patient underwent revascularization (table 12). Iii ***Mortality*** In group (A), there was no mortality, while in group (B) two patients died (8%). Difference between the two groups was statistically insignificant ($P> 0.05$) (table 3). ***iv Renal impairment*** In group (A), two patients had elevated kidney function and oliguria (8%), while in group (B) four patients had renal impairment (16%). Difference between the two groups was statistically insignificant ($P> 0.05$) (table 12). V. ***Others***. In group (A), two patients had minor hematoma at site of puncture and fever (8%), while in group (B) 13 patients had different complications (52%) as following: 1-3 patients had AF (12%). 2- 2 patients had pneumothorax (8%). 3- 2 patients had anemia (8%). 4- 3 patients had pericardial effusion (12%). 5-One patient had chest infection (4%). 6-One patient had pleural effusion (4%). 7- 1 patient had wound infection (4%). Difference between the 2 groups was statistically significant ($P<0.05$) (table 3 and 4). So within hospital course, in group (A) there was no MACE positive patients. While in group (B) 6 patients were MACE positive (24%), 2 patients died (8%), 2 patients had anterior MI (8%) and 2 patients had inferior MI (8%) (Proved by new dynamic ECG changes and elevated cardiac enzymes with clinical picture). Difference between the two groups was statistically significant ($P< 0.05$) (table 3).

Duration at hospital: In group (A), mean duration of hospital stay was 2.76 ± 1.96 days with minimum duration one day and maximum duration 7 days. While in group (B) mean duration of hospital stay was 15.16 ± 7.66 days with minimum duration 7 days and maximum duration 30 days. Difference between the two groups was statistically significant ($P< 0.05$).

Follow Up Echo after Six Months: Echo study shows that, in group (A) mean EF was 51.400 ± 9.845 %, while in group (B), mean EF was 51.760 ± 7.655 %. Difference between the two groups was statistically insignificant ($P> 0.05$). The Study also shows that in group A the mean WMSI was 1.346 ± 0.298, while in group II the mean WMSI was 1.285 ± 0.261. Difference between two groups was statically insignificant ($p>0.05$).

Table (3): In hospital outcome for both groups:

	Group (A)		Group (B)		*P* value
	Number	Percent	Number	Percent	
Myocardial infarction.	0	0 %	4	16%	$P< 0.05$
Revascularization	0	0 %	0	0 %	-
Mortality	0	0 %	2	8 %	$P> 0.05$
Renal impairment	2	8%	4	16%	$P> 0.05$
Other complications	2	8%	13	52%	$P< 0.05$
MACE positive	0	0 %	6	24 %	$P< 0.05$
Duration of hospital stay (days).	2.76 ± 1.96		15.16 ± 7.66		$P< 0.05$
Duration to return to work (days).	8.16 ± 3.13		63.9 ± 40.8		$P< 0.05$

Table (4): Other complications at hospital for group (B):

Complication	Number of patients	Percent
AF	3	12%
Pneumothorax	2	8%
Anemia	2	8%
Pericardial effusion	3	12%
Chest infection	1	4%
Wound infection	1	4%
Pleural effusion	1	4%

Outpatient 12 months clinical outcome: **Complications: i. *MI*** In group (A), one patient had anterior MI (4%) (Proved by new dynamic ECG changes and elevated cardiac enzymes with clinical picture). While in group (B) no patient had MI. Difference between the two groups was statistically insignificant ($P> 0.05$). ii. ***Revascularization*** In group (A), nine patients underwent revascularization (36%). Eight patients had unstable angina (32%) and one patient had anterior MI (4%). While in group (B) no

patient underwent revascularization. Difference between the 2 groups was statistically significant (*P*< 0.05). Iii. ***Mortality*** In group (A), there was no mortality, also in group (B) there was no mortality. So during 12 months follow up, in group (A) 9 patients were MACE positive (36%). 8 patients had unstable angina (32%) and 1 patient had anterior MI (4%). Mean duration of occurrence of complications was 9.78 ± 2.1 months. While in group (B) there was no MACE positive patients. Difference between the two groups was statistically significant (*P*< 0.05). So in group (A) 9 patients were MACE positive (36%) occurred during 12 months follow up. While in group (B) 6 patients were MACE positive (24%) occurred within hospital course. Difference between the two groups was statistically insignificant (*P*> 0.05). **Echo:** Echo study shows that, in group (A) mean EF was 52.200±12.038%, while in group (B), mean EF was 53.036±11.996 %. Difference between the two groups was statistically insignificant (*P*> 0.05). The Study also shows that in group A the mean WMSI was 1.346 ± 0.298, while in group II the mean WMSI was 1.285 ± 0.261. Difference between two groups was statically insignificant (*p*>0.05). **Stress Echo outcomes. In Group 1:** The peak dose of dobutamine infusionwas 38±9 g/kg/min. Atropine, 0.54±0.61 mg, was administered to (30%) patients. HR increased from 63±13 beats/min to 128±16 beats/min. Resting WMA was present in (40%) patients; among these. EF increased from 52.200± 12.083 % at rest to 53.360±11.996% at peak stress. Of patients with no resting WMA, inducible ischemia developedin (24%) patients. Ischemic threshold was detected at a HR of 120±19 beats/min and a dobutamine infusion rate of 35±10 g/kg/min. An abnormal LVESV response was noted in (8) patients. The resting WMSI for group 1 was 1.301±0.307. The DOB test was negative in 3 patients and positive in 22. Of the positive tests, 10 patients were positive at low dose (≤12 min), 7pt at high dose and 5 pts with atropine infusion. The WMSI at peak dose increased up to 1.312±0.28 during DOB (*p*<0.005 vs. rest WMSI). Delta WMSI was 0.29±0.18 for DOB (p=NS). **In Group 2:** The peak dose of dobutamine infusion was 36±9g/kg/min. Atropine, 0.54±0.61 mg, was administered to (40%) patients. HR increased from 65±13 beats/min to 128±16 beats/min. EF at rest was 51.721±9.365 and reached 50.760±10.421 of patients with no RWMA inducible ischemia developed in 18% of patients. Ischemic threshold detected at a HR of 130±19 beats/min and a dobutamine infusion rate of 36±3 g/kg/min. An abnormal LVESV response was noted in 3 patients. The resting WMSI for group 2 was 1.300±0.282 The DOB test was negative in 4 patients and positive in 19 pt. Of the positive tests, 3 patients were positive at low dose (≤12 min) and 6 pts at high dose (>12 min up to 17 min), and 10 patients during or after atropine infusion. The WMSI at peak dose increased up to 1.348± 0.267 during DOB. Delta WMSI was 0,048. **Restenosis (ISR) data for group (A):** Coronary angiography showed 9 patients had ISR (36%). 5 patients had diffuse ISR (56%) and four patients had focal ISR (44%). 3 patients had De Novo lesions (33%). Management of these cases were CABG in 1 patient (11%) and PCI in 8 patients (89%).

Comparison between MACE positive and MACE negative for group (A): *Stress echo results as a predictors of late cardiac events:* In MACE positive patients: 8 patients experience stress induced angina on stress echo. Significant ST segment depression developed in 6 patients. The HR threshold for ischemia (<70% of the maximal age- and sex-related HR) was in7 patients and it was >70% maximal age- and sex-related heart rate) in 2 patients, the severity of stress-induced ischemia as expressed by delta WMSI was > 0.1 in 7 patients. **In MACE negative** patients 5 patients developed stress induced angina on stress echo. Significant ST segment depression developed in 3 patients. The HR threshold for ischemia (<70% of the maximal age- and sex-related HR) was in 4 patients and it was >70% maximal age- and sex-related HR) in 11 patients, the severity of stress-induced ischemia as expressed by delta WMSI was < 0.1 in 14 patients as in (tables 5 and 6).

Table (5): Stress echo outcome for group A.

Group A	MACE						Chi-square	
	Positive (n=9)		Negative (n=16)		Total			
	N	%	N	%	N	%	X^2	P-value
Stress induced angina	8	88.89	5	31.25	13	52.00	7.667	0.006*
ST segment depression	6	66.67	3	18.75	9	36.00	5.740	0.017*
Ischemic threshold <70%	7	77.78	4	25.00	11	44.00	6.512	0.011*
Delta WMSI was > 0.1	7	77.78	2	12.50	9	36.00	10.653	0.001*

Table (6): Stress echo outcome for group B.

Group B	MACE						Chi-square	
	Positive (n=6)		Negative (n=19)		Total			
	N	%	N	%	N	%	X^2	P-value
Stressinduced angina	5	83.33	4	21.05	9	3.60	7.677	0.006
ST segment depression	4	66.67	4	21.05	8	3.20	4.360	0.037
Ischemic threshold <70%	4	66.67	12	63.16	16	6.40	0.024	0.876
Delta WMSI was > 0.1	4	66.67	4	21.05	8	3.20	4.360	0.037

Type of treatment of DM:

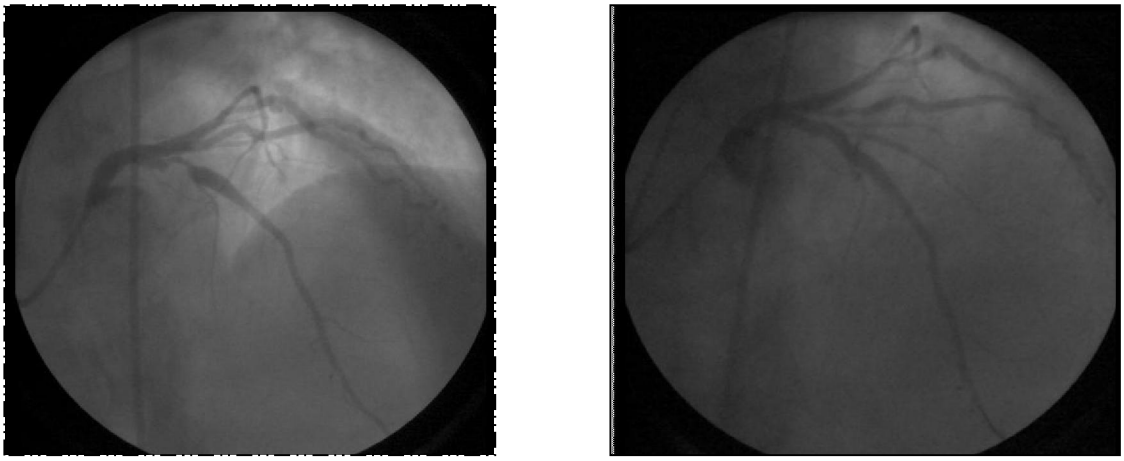
Treatment of DM in MACE positive patients was insulin in 6 patients (67%) and insulin with oral hypoglycemic agents in 3 patients (33%), on the other hand treatment of DM in MACE negative patients was insulin in 6 patients (38%) and oral hypoglycemic agents in 10 patients (62%). Difference between the two groups was statistically significant (*P*< 0.05). **Duration of DM:** Meanduration of DM in MACE positive patients was 18.1±7.39 years; on the other hand mean duration of DM in MACE negative patients was 10.93±6.38 years. Difference between the two groups was statistically significant (*P*< 0.05). **Number of stents:** Mean of number of stents per patient in MACE positive patients was 3±0.78 stent, while mean number of stents per patient in MACE negative patients was 2.63±0.72 stent. Difference between the two groups was statistically insignificant (*P*> 0.05). **Stent diameter:** Mean value of stent diameter per patient in MACE positive patients was 3.2±0.2 mm, while mean value of stent diameter per patient in MACE negative patients was 3.3±0.3 mm. Difference between the two groups was statistically insignificant (*P*> 0.05). **Stent length:** Mean value of stent length per patient in MACE positive patients was 18.2±4.75 mm, while mean value of stent length per patient in MACE negative patients was 19±3.6 mm. Difference between the two groups was statistically insignificant (*P*> 0.05).

Comparison between MACE positive and MACE negative for group (B): ***Stress echocardiography results As Predictors' of late cardiac events:*** In MACE positive patients:5 patients developed stress induced angina on stress echo. Significant ST segment depression developed in 4 patients. The heart rate threshold for ischemia (<70% of the maximal age- and sex-related heart rate) was in 4 patients and it was >70% maximal age- and sex-related heart rate) in 2 patients, the severity of stress-induced ischemia as expressed by delta WMSI was > 0.1in 4 patients. IN MACE negative patients 4 patients developed stress induced angina on stress echo. Significant ST segment depression developed in 4 patients. The heart rate threshold for ischemia (<70% of the maximal age- and sex-related heart rate) was in 12 patients and it was >70% maximal age- and sex-related heart rate) in 7 patients, the severity of stress-induced ischemia as expressed by delta WMSI was < 0.1 in 15 patients. **Type of treatment of DM:** Treatment of DM in MACE positive patients was insulin in 2 patients (33%) and oral hypoglycemic agents in 4 patients (67%), on the other hand treatment of DM in MACE negative patients was insulin in 4 patients (21%), oral hypoglycemic agents in 12 patients (63%) and both in 3 patients (16%). Difference between the two groups was statistically insignificant (*P*> 0.05). **Duration of DM:** Meanduration of DM in MACE positive patients was 10.17±3.25 years; on the other hand mean duration of DM in MACE negative patients was 10.53±4.89 years. Difference between the two groups was statistically insignificant (*P*> 0.05). **Number of grafts**: Mean value of number of grafts per patient in MACE positive patients was 3.5±0.56 grafts; while mean value of number of grafts per patient in MACE negative patients was 3.05±0.62 grafts. Difference between the two groups was statistically insignificant (*P*> 0.05) **Type of grafts:** *In MACE positive patients:* Arterial grafts used in 10 lesions (48%) and venous grafts used in 11 lesions (52%).Regarding type of grafts used, LIMA was used in 7 lesions (34%), RIMA in 3 lesions 14% and SVG in 11 lesions (52%). *In MACE negative patients:* Arterial grafts used in 28 lesions (48%) and venous grafts used in 30 lesions (52%). Regarding type of grafts used, LIMA was used in 19 lesions (33%), RIMA in 2 lesions 3%, radial artery in 7 lesions (12%) and SVG in 30 lesions (52%). Difference between the two groups was statistically insignificant (*P*> 0.05) (table 7).

Table (7): Follow up data of group (B) regarding types of grafts:

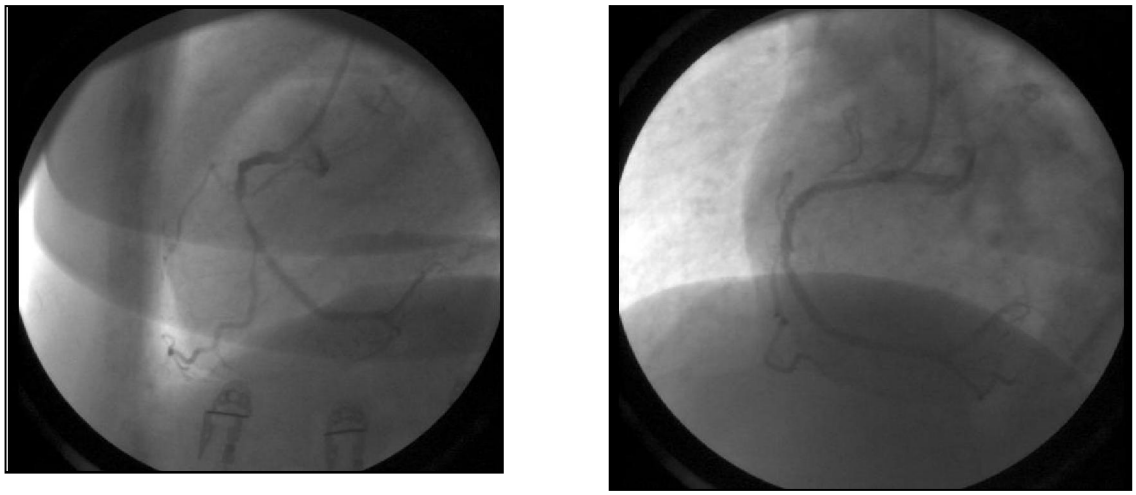
Type of grafts	MACE positive		MACE negative		P value
	Number	Percent	Number	Percent	
LIMA	7	34%	19	33%	P > 0.05
RIMA	3	14%	2	3%	
Radial artery	-	-	7	12%	
SVG	11	52%	30	52%	

Selected cases



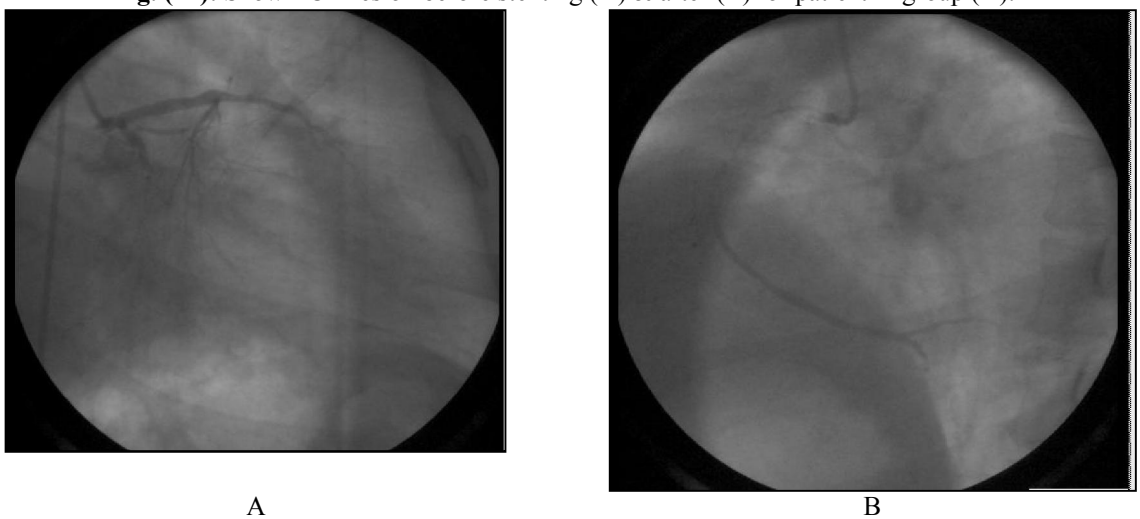
A B

Fig. (20): Show LAD lesion before (A) & (B) after stenting for patient in group (A).



A **B**

Fig. (22): Show RCA lesion before stenting (A) & after (B) for patient in group (A).



A B

Fig. (24): (A) Show LAD & LCX lesion (B) RCA lesion before CABG for the same patient in group (B).

4. Discussion:

CVD is the leading cause of mortalityamong patients with DM, accounting for up to80 % of diabetes-related deaths. And approximately25 % of all patients undergoing coronary revascularizationhave concomitant diabetes ***(6).*** As compared with nondiabetics, patients with DM are associated with accelerated atheroma, increased lesion complexity, and increased risk of mortality, MI, and repeat revascularization after PCI ***(7)***. Although CABG is considered as a preferred revascularization strategy in patients with LM and/or MVCAD, it also poses increased risk of cerebral vascular events and perioperative morbidities, particularly for patients with DM ***(8).*** The treatment of patients with CAD continues to evolve; all three strategies-medical therapy, surgical revascularization, and PCI -have changed. Medical therapy with intense risk-factor modification and treatment with a statins, aspirin, and ACEI, should be used unless contraindicated. Surgical therapy has also changed with the introduction of minimally invasive and beating heart surgery. PCI has perhaps changed radically with adjunctive therapy-glycoprotein IIb/IIIa inhibitors, thienopyridines, and reliance on stent implantation. The future, with new distal protection devices and DESs, should continue to see increased numbers of patients who can benefit from PCI what is the optimal revascularization strategy for patients with MVCAD: PCI or CABG? Although both procedures have been available for 30 years, the debate remains unresolved. Several studies have compared outcomes for CABG and PCI), but most were done before the availability of stenting, which has revolutionized the latter approach. Aiming to clear answer to the question about the best way of revascularization to ischemic patients with MVD, we performed this study on50 patients ***(9) & (10).***

Our result **agree** with ***Fiorette et al. 2010 (26)*** who studied the prognostic value of preoperative dobutamine stress echo, relative to clinical risk assessment, in predicting late cardiac events in which 360 patients undergoing coronary revascularization were studied. All patients underwent clinical evaluation for the presence of cardiac risk factors (smoking, HTN, angina, diabetes, history of HF) and dobutamine stress echo. LV wall motion was evaluated at rest, and the extent and severity of stress-induced new WMA were quantified. The HR threshold at which new wall motion abnormalities occurred was noted. Patients were followed perioperatively and for 19±11 months postoperatively, and the occurrence of cardiac events was noted. It was found that 32 cardiac events occurred (11 cardiac deaths, 11 nonfatal MI, and 10 incidents of unstable angina). By multivariate regression analysis, the occurrence of extensive (three or more segments) or limited (one or two segments) stress-induced new WMA and previous infarction independently predicted late cardiac events, elevating the risk by 6.5-, 2.9-, and 3.8-fold, respectively***. (11).***

Our result agree with ***yang et al., (2008) (30)***in which, 1212 patients were identified as having had a revascularization for MVD, and 831 patients who met the selection criteria were enrolled. The DES group had 441 patients and the CABG group had 390 patients. A 12-month clinical follow-up was completed in 420 patients (95.2%) in the DES group and 375 (96.2%) in the CABG group. in which the average follow-up duration was 21.1±6.7 months in the DES group and 23.1±8.8 months in the CABG group. The 12-month rates of MI and repeat PCI and CABG were significantly higher in the DES group than in the CABG group ($p<$ 0.034, ±0.001, and 0.034, respectively). The cumulative rates of composite death, CVA, or MI were not significantly different between groups ($p<$ 0.180). The cumulative 12-month MACCE rate was significantly higher in the DES group at 13.0% than the 4.2% rate in the CABG. Clinical outcomes according to the presence of treated diabetes are. In the DES group, the rates of composite death/MI/CVA and MACCE were significantly higher among patients with diabetes ($p<$ 0.011 and 0.012, respectively). In the CABG group, no significant differences were found in the rates of clinical events, including death, CVA, MI, CABG, repeat PCI, and overall MACCE between the diabetic and nondiabetic patients ***(12).*** Our results **concordant** with Bravata 2011 who compared the effectiveness of PCI and CABG in patients for whom coronary revascularization is clinically indicated. Angina relief was greater after CABG than after PCI, with risk differences ranging from 5% to 8% at 1 to 5 years ($P<$ 0.001). The absolute rates of angina relief at 5 years were 79% after PCI and 84% after CABG. Repeated revascularization was more common after PCI than after CABG (risk difference, 24% at 1 year and 33% at 5 years; $P<$ 0.001), the CABG–PCI hazard ratio for death favored PCI among patients with the least severe disease and CABG among those with the most severe disease ***(13)***.

Our results agree with those of ***Takagi 2005 (28)*** who compares initial revascularization strategies of PTCA and CABG, in 3371 patients with CAD who were suitable for either treatment method. The data suggested that patients who are clinically and angiographically suitable for CABG or PTCA are at low risk of death or MI over the subsequent 3 years, and neither method of revascularization is associated with a major prognostic advantage. The combined end point of cardiac death and non fatal MI occurred in 169 PTCA patients and 154 CABG patients. The rate of additional non-randomized interventions (PTCA

and/or CABG) in the first year of follow up was 33.7% and 3.3% in patients randomized to PTCA and CABG respectively (P = 0.006). During early follow up, the prevalence of angina was considerably higher in PTCA patients than in CABG patients, probably because of incomplete revascularization and restenosis in the PTCA group. This difference has attenuated however at 3 years because of the effects of additional revascularization procedures among the PTCA patients and early graft occlusion among the CABG patients. But authors did not consider effect of DM on IHD patients**,** Subsequent improvements in both PCI and surgical techniques in the last few years, may now limit the validity of any conclusions that have been drawn from these earlier studies. Reevaluation was especially important in the case of angioplasty, since several studies showed that coronary stenting improves the immediate and mid-term results of PCI and necessitates fewer repeated revascularization procedures than did angioplasty without stenting. In view of these considerations, several studies have been designed to compare the use of coronary stent as an adjunct to balloon dilatation versus CABG in management of MVD ***(14).***

Our results partial **agree** with that of the stent or surgery trial ***(SOS,2008)*** which randomized 988 patients with MVCAD to either stent assisted PCI or CABG. The incidence of death or MI was similar in both groups (P = 0.8). There were fewer deaths in the CABG groups (2%) than in the PCI group (5%) (P = 0.01). 21% of patients in the PCI group required additional revascularization procedures compared with 6% in the CABG groups (P< 0.0001). Although the use of coronary stents has reduced the need for repeat revascularization when compared with previous studies that used balloon angioplasty, the rate remains significantly higher than in patients managed with CABG. Also the study did not consider subgroups including diabetic patients ***(15).***Our results **agree** with syntax trial results which The SYNTAX trial randomized 1800 patients with three-vessel or LM CAD to undergo CABG or PCI using Taxus Express paclitaxel-eluting stents (Boston Scientific). The primary endpoint was a MACCE (i.e., death from any cause, stroke, MI, or repeat revascularization) during the 12-month period after randomization. MACCE occurred more frequently in the PCI group (17.8% for PCI versus 12.4% for CABG; p = 0.002), in large part because of an increased rate of repeat revascularization (13.5% versus 5.9%; p <0.001). At 12 months, the rates of death and MI were similar between the two groups; stroke was significantly more likely to occur with CABG (2.2%, versus 0.6% with PCI; p = 0.003). This study also risk stratified patients based on the complexity of their CAD with a "SYNTAX score" given to each patient, with higher scores reflecting more severe and complex disease burden. The event rates were similar between the two treatment groups for patients with low SYNTAX scores (0 to 22) or intermediate SYNTAX scores (23 to 32). Among patients with high SYNTAX scores (≥33, indicating the most complex disease), those in the PCI group had a significantly higher event rate at 12 months than those in the CABG group ***(16) & (17).*** Our results concordant with that of the **ERACI II** study which randomized 450 patients with MVD to either PCI with stent implantation or CABG. During the first 30 days, PCI patients had lower major adverse events (death, MI, repeat revascularization procedures and stroke) compared with CABG patients (3.6% vs. 12.3%, P = 0.002). Death occurred in 0.9% of PCI patients vs. 5.7% in CABG patients, (P< 0.013); and MI occurred in 0.9% of PCI vs. 5.7% of CABG patients, *(*P<0.013). At follow-up (mean 18.5 ± 6.4 months), survival was 96.9% in PCI vs. 92.5% in CABG, *(*P<0.017). Freedom from MI was also better in PCI patients compared to CABG patients (97.7% vs. 93.4%, P<0.017). Requirements for new revascularization procedures were however, significantly higher in the PCI group than in the CABG group (16.8% vs. 4.8%, P<0.002). PCI with stent implantation showed better survival and freedom from MI than did conventional surgery, at the expense of significantly higher repeat revascularization procedures Also our results agree with that by ***(18),*** for the **A**rterial **R**evascularization **T**herapies **S**tudy Group **(ARTS)**, which randomized 1205 patients to undergo PCI or CABG provided the same extent of revascularization could be achieved by either technique. The study, demonstrated no significant difference between the 2 groups in terms of the rates of death, stroke or MI. Among patients who survived without a stroke or MI, 16.8% of those in the stenting group underwent a second revascularization, as compared with only 3.5% of those in the surgery group. The rate of event free survival at one year was 73.8% among the patients who received stents and 87.8% among those who underwent CABG (P<0.001). As measured one year after the procedure, coronary stenting for MVD was less expensive than CABG and offered the same degree of protection against death, stroke and MI. However, stenting was associated with a greater need for repeated revascularization ***(18).***As regards diabetic patients with MVD, the **B**ypass **A**ngioplasty **R**evascularization **I**nvestigation **(BARI) trial (2007)** demonstrated that, initial CABG was associated with a markedly lower 5-year mortality rates relative to initial PCI (19.4% vs. 34.5% respectively) (P=0.003). This result triggered a National Heart, lung and Blood Institute (NHLBI) clinical alert recommending CABG in this patient group. However, this recommendation has not been

fully accepted in part because the results of other randomized trials have not been completely consistent with BARI **(**Another concern was that in the BARI trial, diabetes was not a pre specified group for analysis, and the BARI population with diabetes was relatively small and highly selected. So our results **disagree** with that of BARI. Although the **C**oronary **A**ngioplasty versus **B**ypass **R**evascularization **I**nvestigation **(CABRI, 2003),** demonstrated greater survival at 2 years in 122 patients with diabetes undergoing CABG, the combined results of the **E**mory **A**ngioplasty versus **S**urgery **T**rial **(EAST)** ***(19),*** **CABRI (2003)** and the randomized intervention treatment of angina **(RITA)** trial***(9),*** which included 233 randomized patients with diabetes, demonstrated similar 5-year mortalities in the patients treated with PCI (15%) and CABG (12%). A more recent study by, assessed 5-year mortality of 7159 consecutive patients with diabetes who underwent coronary revascularization in northern New England during 1992 to 1996. After adjusting for differences in baseline clinical characteristics, patients with diabetes treated with PCI, had significantly greater mortality relative to those undergoing CABG (*P*=0.037). Mortality risk tended to increase more among patients with 3-vessel diseases than among patients with 2-vessel diseases. This study supports the BARI conclusion on initial revascularization of patients with diabetes and MVD ***(17)***. Our results partially **agree** with that of the **AWESOME** study which randomized 232 patients to undergo CABG and 222 for PCI. The 30-day survivals for CABG and PCI were 95% and 97%, respectively. Survival rates for CABG and PCI were 90% versus 94% at six months and 79% versus 80% at 36 months (*P* = 0.46). So they concluded that PCI is an alternative to CABG for patients with medically refractory myocardial ischemia and a high risk of adverse outcomes with CABG. **Finally** our results partially agree with that of ***Hannan et al. 2008 (27)*** which used the PCI Reporting System registries for the state of New York to identify patients who underwent revascularization for MVCAD between January 1997 and December 2000. At 3 years, after adjustment for differences in the baseline characteristics between the CABG and the PCI patients, the mortality rate was at least 25% lower with CABG than with PCI in all anatomic subgroups, and the difference was statistically significant. The survival curves began to diverge remarkably early in favor of CABG, and the difference steadily increased over the 3 year follow up period. Among patients with diabetes the difference was even greater: The mortality rate was at least 30% with CABG than with PCI in all anatomic sub groups. The rate was also at least 30% lower with CABG in patients with reduced left ventricular ejection fraction with three vessel disease or two vessel diseases involving the proximal left anterior descending artery. Only 4.9% of patients who underwent CABG a repeat revascularization procedure, compared with 35.1% for those treated with PCI (*P*< 0.001). ***(20).*** So our results **agree with most of the previous studies,** with exception that, our study showed no mortality at group (A) in comparison to group (B) which had 8% mortality rate. This could be explained by the fact that all our patients were elective cases. As well as most of complications of patients for group (B) occurred post procedure, which prove that these complications were due to surgical procedures, not due to disease process.

Regarding group (A), duration of DM was significant predictor of ISR. Meanduration of DM in MACE positive patients was 18.1±7.39 years, versus 10.93±6.38 years in MACE negative patients. Difference between the two groups was statistically significant. The only study relating duration of DM with adverse outcome Following PCI was the PTCA versus CABG Emory University study by ***Weintraub et al., 2007 (29)*** **where** long standing DM (> 10 years) had increase mortality with PTCA versus CABG, but no stent trial studied the duration of DM in its diabetic population as predictor of ISR. The explanation of this finding in this study is the delirious effect of hyperglycemia accumulating over years on the vessel wall and activating all the elements of ISR process. Hyperglycemia retards endothelial regeneration post stenting with prolonged interaction of platelets with vessel wall in the absence of protective nitric oxide and prostacyclin and also exposes smooth muscle cells for a long time to blood born mitogens. This effect is mediated by hyperglycemia itself or through AGES and/or free radial formation (Hyperglycemia has adverse haemostatic profile with increased platelet activity, increased coagulation state and decreased fibrinolysis. All these factors are favoring thrombus formation which acts as nidus for initial hyperplasia. **Finally** hyperglycemia through interaction of AGES with monocytes leads to formation of insulin like growth factor-1 which stimulates the platelet derived growth factor and beta transformation growth factor and both mitogenic factors lead to smooth muscle cell proliferation and extracellullar matrix production with neointima formation ***(21).***

In comparison, group (B) showed meanduration of DM in MACE positive patients was 10.17±3.25 years, versus 10.53±4.89 years in MACE negative patients. Difference between the two groups was statistically insignificant. This fact is a new evidence that, complications on group (B) were due to surgical procedures not due to disease process. Regarding group (A), Insulin therapy was statistically significant predictor of ISR. Treatment of DM in MACE positive patients was insulin in 6 patients (67%) and insulin

with oral hypoglycemic agents in 3 patients (33%). On the other hand treatment of DM in MACE negative patients was insulin in 6 patients (38%) and oral hypoglycemic agents in 10 patients (62%). Difference between the two groups was statistically significant. The findings of our study regarding insulin therapy and ISR were initially shown by ***Abiziad et al. (2002),*** who found insulin requiring diabetics relative to non-insulin requiring diabetics relative to non diabetics to have high rates of TLR as 28% versus 17.6% versus 16.3% and lower cardiac event free survival as 60% versus 70% versus 76% poststenting. ***(10)*** Showed higher mortality in insulin requiring diabetics than non insulin requiring diabetics as 9.3% versus 2.4%, after 13 months follow up post PCI. ***(23)*** Also found higher mortality post PCI in insulin requiring diabetics than non insulin requiring diabetics than non diabetics as 3.05% versus 1.75% versus 1.46%. ***(22) & (10)***. Explained the role of insulin in the pathogenesis of ISR as: 1-Stimulation of smooth muscle cell migration and proliferation. This action is shared by insulin and insulin like growth factor-1. 2-Insulin stimulates extracellullar matrix formation. 3-Introduction of coronary spasm. 4-Insulin decrease fibrinolysis by producing more PAI-1 which enhances thrombosis at stent struts ***(8).*** **Takagi *2005* *(28)*** Showed hyperinsulinemia to produce greater intimal hyperplasia after stenting. It is important to mention that this trophic actions act independent of glycemic control as most patients studied seemed to have glycemic control.

In comparison, group (B) showed treatment of DM in MACE positive patients was insulin in 2 patients (33%) and oral hypoglycemic agents in 4 patients (67%). On the other hand treatment of DM in MACE negative patients was insulin in 4 patients (21%), oral hypoglycemic agents in 12 patients (63%) and both in 3 patients (16%). Difference between the two groups was statistically insignificant. This fact is concordant with hypothesis that complications on group (B) were due to surgical procedures not due to disease process ***(14).***

Regarding group (A), stent length was not a predictor of ISR. Our results **disagree** with the work of ***(24)*** that showed stent length rather than number of stents to be independent predictor of ISR. This due to that all patients in our study had MVD ***(24)***.

Regarding group (A), stent number was not a predictor of ISR. Our results **disagree** with the work of ***(25)*** who showed multiple stenting to be a predictor of ISR. This due to that all patients in our study had MVD ***(25).***

Regarding to group (B), type of the graft did not affect the clinical outcome. Our results disagree with the work of ***(16)*** who found that using arterial grafts provided superior clinical outcome with a lower rate of angina recurrence, graft occlusion and late cardiac events when compared to venous graft. This fact is concordant with hypothesis that complications on group (B) were due to surgical procedures not due to disease process. Longer duration for follow up may be needed to discover difference between arterial and venous grafts ***(16).***

Study limitation: 1-The small number of the study cohort is a limiting factor to consolidate our findings and to validate the relationship equation derived from its results. 2-Short duration for follow up. As longer duration for follow up would have been a plus to make the results more conclusive. 3-Lack of use of HbA1c as a measure of glycemic control.4-Lack of measure of fasting serum insulin for detection of hyperinsulinemia.

Summary The choice of CABG versus PCI for multi vessel disease is a complicated decision and requires understanding the details of a person's coronary anatomy, what type of revascularization can be accomplished with each procedure, estimates of the increased short-term morbidity and mortality of surgery that are patient-specific and account for comorbidities and severity of illness, patient-specific estimates of long-term survival, and other outcomes such as repeated revascularization. This information must then be considered in the context of a patient's preference for trading off the up-front risks and benefits of CABG versus PCI against the long-term risks and benefits of these procedures. Sometimes the details of a patient's anatomy or other medical conditions make the decision relatively straight forward. More often, the decision making is difficult, because patients and physicianstry to weigh small differences in short-term risks and benefits against small differences in long-term risks and benefits. Although we had access to some of this information, some of it was unavailable, and we cannot comment on what actually finalized the choice of revascularization procedure. Within the past decade, several randomized controlled trials have been published comparing percutaneous coronary intervention (PCI) to coronary artery bypass graft surgery (CABG). The aim of this work is to study morbidity and mortality of patients with multivessel coronary artery disease after PCI compared with those after CABG. This study was conducted on fifty diabetic patients with ischemic heart disease who showed multivessel lesions with good distal run off that could be treaded either by PCI or CABG. **This study concluded that: 1-**PCI and CABG are considered for diabetic patients with MVD, inspite of increased need for revascularization after PCI, yet the difference between CABG and PCI is not significant.**2-**A Combination of semiquantitative stress echo and the clinical history allows us to define the

risk of all late cardiac events for patients with MVD undergoing stenting or surgery. **3-**The dobutamine stress echo is a powerful predictor of late cardiac events after coronary revascularization. **4-** Most of complications of CABG have occurred post procedure. **5-** Long duration of DM and use of insulin therapy are highly significant predictors of ISR in diabetics.

References

1. Boehrer JD, Lange RA, Willard JE, Hillis LD. Markedly increased periprocedure mortality of cardiac catheterization in patients with severe narrowing of the left main coronary artery. *Am J Cardiol*. 1992;70:1388-1390.
2. Caracciolo EA, Chaitman BR, Forman SA, *et al.*Diabetics with coronary disease have a prevalence of asymptomatic ischemia during exercise treadmill testing and ambulatory ischemia monitoring similar to that of nondiabetic patients. An ACIP database study. ACIP Investigators. Asymptomatic Cardiac Ischemia Pilot Investigators.*Circulation*. 1996;93:2097-2105.
3. Doron Aronson, Elazer R. Edelman. Revascularization for coronary artery disease in diabetes mellitus: Angioplasty, stents and coronary artery bypass grafting. Springer Science+Business Media, LLC 2010.
4. Lloyd-Jones D, Adams R, Carnethon M, *et al.*: Heart disease and stroke statistics—2009 update: a report from the American Heart Association Statistics Committee and Stroke Statistics Subcommittee. *Circulation,* 119:480–86; erratum 119:e182. 2009.
5. Lloyd W. Klein.Are Drug-Eluting Stents the Preferred Treatment for Multivessel Coronary Artery Disease? Rush Medical College, Chicago, Illinois, and Clinical Cardiology Associates, Gottlieb Memorial Hospital, Melrose Park, Illinois. 2005.
6. Meredith IT, Worthley, S Whitbourn, R, *et al.* Clinical and angiographic results with the next-generation resolute stent system: a prospective, multicenter, first-in-human trial. RESOLUTE Investigators JACC Cardiovasc Interv, 2 (10), pp. 977–985. 2009.
7. Meredith IT, Worthley, S Whitbourn, R, *et al.* Long-term clinical outcomes with the next-generation Resolute Stent System: a report of the two-year follow-up from the RESOLUTE clinical trial. Euro Intervention, 5 (6), pp. 692–697. 2010.
8. Hammoud T, Jean-Francosis Tangaay and Bourassa MG: Management of CHD. Therapeutic options in diabetics J Am Coll Cardiol; 36: 355-365. 2008.
9. Henderson RA, Pocock SJ, Sharp SJ, Nanchahal K, Schulpher MJ and Buxton MJ.: Long term Results of RITA- 1 trial: clinical and cost comparison of coronary angioplasty and coronary artery bypass grafting. *Lancet*; 352: 1419 – 1425. 2002.
10. Joseph T, Marco J and Fajadat J: Clinical outcome after coronary stent implantation and diabetes. Tenth Complex Coronary Angioplasty Course Book, 169-175. 2005.
11. D, Mariarosaria Arnese, MD; Paolo M. Fioretti, FESC; Eric Boersma, BSE; Ian R. Thomson, Riccardo Rambaldi, Hero van Urk. Sustained Prognostic Value of Dobutamine Stress Echocardiography for Late Cardiac Events After Major Noncardiac Vascular Surgery. the Thoraxcenter (M.A., P.M.F., E.B., R.R.) and the Department of Surgery (D.P., H. van U.), University Hospital Rotterdam-Dijkzigt and Erasmus University, Rotterdam, The Netherlands; and the Department of Anesthesia (I.R.T.) University of Manitoba, Winnipeg, Manitoba, Canada. 2010.
12. Jeong Hoon Yang, Hyeon-Cheol Gwon, Soo Jin Cho, Joo Yong Hahn, Jin-Ho Choi, Seung Hyuk Choi, Young Tak Lee, Sang Hoon Lee, Kyung Pyo Hong, and JeongEuy Park,. Comparison of Coronary Artery Bypass Grafting With Drug-Eluting Stent Implantation for the Treatment of Multivessel Coronary Artery Disease. (Ann Thorac Surg;85:65–70. 2008.
13. Dena M. Bravata, MS; Allison L. Gienger, BA; Kathryn M. McDonald, MM; Vandana Sundaram, MPH; Marco V. Perez, MD; Robin Varghese,, MS; John R. Kapoor, Reza Ardehali,; Douglas K. Owens, MS; and Mark A. Hlatky,. Systematic Review: The Comparative Effectiveness of Percutaneous Coronary Interventions and Coronary Artery Bypass Graft Surgery. Ann Intern Med;147. 2011
14. Takagi T, Alasaka T and Yamamura A: Troglitazone reduce neointimal proliferation after coronary stent implantation in patients with NIDDM. J Am Coll Cardiol; 1529-1535. 2005
15. SOS Investigators: CABG versus PCI with stent implantation in patients with multivessel CHD (The Stent or Surgery) Trial. Lancet, 360: 965-970. 2008.
16. Muneretto C, Negri A, Bisleri G, Manfredi J, Terrini A, Metra M, Nodari S and Cas LD: Evaluate the mid-term results of myocardial revascularization using arterial grafts compared to standard CABG technique using venous graft.

Department of Cardiac Surgery, University of Brescia Medical School, Brescia, Italy, 2005.
17. Niles WN and McGrath DP: Survival of patients with diabetes and multivessel CHD after PCI or surgery. Results of large regional prospective study. J Am Coll Cardiol; 37: 1008-1015. 2006.
18. Serruys PW and Sousa JE: Comparison of CABG and stenting for treatment of multivessel disease. N Eng J Med, 344: 1117-1124. 2009.
19. Hamm CW, Riemers J and Ischinger T: A randomized study of coronary angioplasty compared with bypass surgery in patients with symptomatic multi-vessel coronary disease. *N Engl J Med*; 331: 1037-1043. 2002.
20. Hannan EL, Racz MJ and Walford G: Long term out-comes of coronary artery bypass grafting versus stent implantation. N Eng J Med, 352: 2174-2183. 2008.
21. Weintraub WS and Stein B: Outcome of CABG versus PTCA in diabetics with multivessel CHD. J Am CollCardiol; 31: 1-9. 2007.
22. Abiziad A, Kornowski R and Mintz GS: The influence of diabetes mellitus on acute and late outcomes following coronary stent implantation. J Am Coll Cardiol; 32: 584-589. 2002.
23. Mukherjee D, Smith D and Shae D: Significantly higher mortality in patients with IDDM compared to patients with NIDDM and non-diabetics underlying coronary interventions. Eur H J, 4: Suppl 610. 2002.
24. Kasoka S and Jonathen M: Angiographic and IVUS predictors of ISR. J Am Coll Cardiol, 32: 1630-1635. 2007.
25. Kastrati A and Schomig A: Interlesion dependence of the risk for restenosis in patients with coronary stent placement in multiple lesions. Circulation; 97: 2396-2401. 2002.
26. Fioretti Paolo M. Don Poldermans, MD; Mariarosaria Arnese, MD; MD, FESC; Eric Boersma, BSE; Ian R. Thomson, MD; Riccardo Rambaldi, MD; Hero van Urk, MD. Sustained Prognostic Value of Dobutamine Stress Echocardiography for Late Cardiac Events After Major Noncardiac Vascular Surgery. the Thoraxcenter (M.A., P.M.F., E.B., R.R.) and the Department of Surgery (D.P., H. van U.), University Hospital Rotterdam-Dijkzigt and Erasmus University, Rotterdam, The Netherlands; and the Department of Anesthesia (I.R.T.) University of Manitoba, Winnipeg, Manitoba, Canada. 2010.
27. Hannan EL, Racz MJ and Walford G: Long term out-comes of coronary artery bypass grafting versus stent implantation. N Eng J Med, 2008, 352: 2174-2183.
28. Takagi T, Alasaka T and Yamamura A: Troglitazone reduce neointimal proliferation after coronary stent implantation in patients with NIDDM. J Am Coll Cardiol, 2005; 1529-1535.
29. Weintraub WS and Stein B: Outcome of CABG versus PTCA in diabetics with multivessel CHD. J Am Coll Cardiol; 2007, 31: 1-9.
30. Yang Jeong Hoon, Hyeon-Cheol Gwon, Soo Jin Cho, Joo Yong Hahn, Jin-Ho Choi, Seung Hyuk Choi, Young Tak Lee, Sang Hoon Lee, Kyung Pyo Hong, and Jeong Euy Park,. Comparison of Coronary Artery Bypass Grafting With Drug-Eluting Stent Implantation for the Treatment of Multivessel Coronary Artery Disease. (Ann Thorac Surg 2008;85:65–70).

9/22/2015