Multivessel Percutaneous Coronary Intervention in Patients with Acute ST-segment Elevation Myocardial Infarction in Same Sitting

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Key Words : *Acute MI, Multivessel PCI, Primary PCI, Infarct related artery.*

Abstract:

Background: *Aim of the study was to evaluate the primary procedural success of Multivessel Percutaneous coronary intervention in patients with acute ST-segment elevated myocardial infarction at the same sitting.*

Methods: *Total 23 (13.4%) patients were enrolled in this very preliminary study, among the total 171 patients who had primary PCI at our center from Jan 2010 to February 2015. Among them, Male: 20 and Female: 3. Total 52 stents were deployed in 46 territories. Mean age were for both male and female were 54 yrs. Associated coronary artery disease risk factors were Dyslipidemia, High Blood pressure, Diabetes Mellitus, positive family history for coronary artery disease and Smoking.*

Results: *Among the study group; 17(74%) were Dyslipidemic, 11(47.8%) were hypertensive; 8(34.8%) patients were Diabetic, positive family history 4(17.4%) and 9(39%) were all male smoker. Female patients were more obese (BMI: M 26: F 27). Common diagnosis at admission based on ECG evidence was; Inferior wall myocardial infarction: 12 (52.2%), Anterior wall myocardial infarction 9(39.1%) and lateral 2(8.7%). Common stented territory was left anterior descending artery 9(39.1%), right coronary artery 7(30.4%), and left circumflex artery 7(30.4%). Stent used: Bare metal stent 3 (5.7%), DES: 49 (94.2%). Among the different drug eluting stents, Everolimus 26 (52%), Sirolimus 8(15.4%) and Zotarolimus 9(17.3%), Paclitaxel 2 (3.8%), Biolimus 2 (3.8%), Genous 2 (3.8%).*

Conclusion: *In the current prospective non randomized study, we found that the multivessel primary PCI for ST elevation myocardial infarction with non-culprit vessel are suitable for PCI at the same sitting with better in-hospital and 1 yr survival outcome.*

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Introduction:

The primary objectives of percutaneous coronary intervention (PCI) in patients with ST- segment elevation myocardial infarction (STEMI) are to restore epicardial flow and myocardial perfusion in the culprit vessel. However, pathophysiological process is not limited to the culprit vessel.[1] It is estimated that 40% to 65% of the patients presenting with STEMI have multivessel disease (MVD), which has been associated with worse clinical outcomes as compared with single-vessel disease. [2,3] Patients with MVD have in addition to the culprit lesion, 1 or more significant lesion in nonculprit vessel. STEMI patients with MVD are at higher risk of heart failure and Cardiogenic shock and associated with two times higher mortality during hospitalization and long term follow up.[4] Although, ACC/AHA guideline for PCI in STEMI not to recommend PCI of non-culprit lesion during primary PCI(pPCI) of culprit lesion in patients without haemodynamic compromise (Class III, Level of Evidence: C). [5,6] Many of the investigator showed that PCI of a non-infarct artery at the time of pPCI is associated with worse clinical

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outcomes.[7-9] The recommended PCI strategies for STEMI patients with MVD were defined as follows: The Culprit vessel only PCI (Culprit PCI), strategy was defined as PCI confined to culprit vessel lesion only.[3] The Multivessel Percutaneous coronary intervention (MV-PCI) strategy was defined as well as e" 1 nonculprit vessel lesion was treated. The staged PCI strategy was defined as PCI confined to culprit vessel lesions only, after which e" 1 lesions in nonculprit vessel were treated during planned secondary procedures.[10] With the advent of technical improvement in the coronary intervention, evolution of noble drug eluting stent (DES), anti platelet therapy, intravascular imaging, FFR, active discussion regarding the safety of MV-PCI have been under taken. We have carried out, this very preliminary non-randomized prospective cohort on pPCI in STEMI patients with multivessel coronary artery disease and followed up clinically at our cardiac outpatient department.

Methods:

Study Population:

From January 2010 to February 2015, total 171 patients with acute STEMI had pPCI, after getting written consent from patient as well as the first degree relative. Patient who refused pPCI were treated with Thrombolysis and excluded from the study. Among these 171 patients, only 23 (13.4%) patients have MVD. Primary PCI of infarct related artery was done along with the non-culprit vessel in same sitting.

Definitions and Coronary Angiography

The diagnosis of acute myocardial infarction was based on clinical presentations, increased cardiac biomarkers Troponin-I and 12-lead electrocardiogram findings. Among these patients, the diagnosis of STEMI was made when their ECG shows acute ST elevation of at least 1 mm in two or more contiguous limb leads or 2mm in precordial leads.

The pPCI was defined when it is performed in patients within 12 hrs of onset of STEMI. The culprit artery was determined with ECG, Echocardiographic and angiographic findings by each operator.

The definition of infarct related artery (IRA) revascularization of only one culprit lesion in multivessel CAD during the index hospitalization. MVD was defined as a significant stenosis in $\geq$1 major epicardial vessel or side branch.[7,26] The definition of MV-PCI, is PCI of $\geq$2 coronary vessel including culprit artery during the index hospitalization.

A successful PCI was documented by self reporting operator in our center and accepted when defined to achieve angiographic success without associated in-hospital major clinical outcomes such as death, MI, cerebrovascular event and emergency CABG.

Coronary angioplasty was performed according to standard rules. Thrombus suction and predilatation was optional before stent implantation with a shorter balloon to avoid geographic miss. A successful procedures was defined as TIMI-3 antegrade flow, and <20% residual stenosis in two orthogonal views. Post-deployment dilation was performed at high inflation pressure in all patients.

In-hospital complications including in-hospital mortality were analyzed. Primary clinical endpoint is cumulative major adverse cardiac event (MACE), include all cause death, myocardial infarction, repeated revascularization, and repeat PCI and CABG. Re-PCI includes target lesion revascularization (TLR), target vessel revascularization (TVR) and non-culprit vessel revascularization. Secondary, endpoints are defined as mace and each component during 1-month follow up, stent thrombosis during the 12 month follow-up and each component of MACE during the 12-month follow up.

Drug Therapy

All the patients received Aspirin 300 mg/day and Clopidegrol as a loading dose 300 mg prior to PCI and continued for 9-12 months and received atorovastatin along with standard medical management for CAD. During the procedure, an intravenous heparin bolus (100IU/Kg) and GP IIb/IIIa receptor blocker Integrillin were administered as required. The use of GP IIb/IIIa Receptor blocker was recommended as per protocol. Quantitative angiographic measurements of the target lesion were obtained in order to deploy

correct size stent. In the event of chest pain, post-procedural ECG was measured and compared with the baseline. Check angiogram were taken, whenever indicated.

Stents:
Among the stent used; BMS used were micro-Driver, DES: Resolute Integrity (Medtronic, USA), Cypher (Cordis, USA), Promus Element (Boston Scientific, USA) and Endeavor Resolute (Medtronic, USA, Xience Prime, Xience V , Xience Integrity (Abbott vascular), Biomatrix (Biosensor) and Bioengineered Genous stent(OrbusNeich).

Data: Data were presented as mean ± SD with percentage. Significant culprit coronary artery lesion was defines as stenosis as greater than 70% narrowing in angiogram with ECG changes of infarct artery related territory and serum Troponin-I level and clinical symptoms.

Results:
Table I. Shows the profile of studied population. Female patients were more obese (BMI; M 26: F 27). CAD risk factors were more in male than female. Table II. Shows the average size of stent used. Fig 1. Shows the percentage distribution of CAD risk factors. Among the study group; 17(74%) were Dyslipidemic, 11(47.8%) were hypertensive; 8(34.8%) patients were Diabetic, FH 4(17.4%) and 9(39%) were all male smoker. Fig 2. Shows the percentage distribution of common presentation of acute STEMI; Inferior wall MI was in 12 (52.2%), Anterior wall MI was 9(39.1%) and lateral was 2(8.7%). Fig 3. Shows the percentage distribution of the pPCI territory; Left anterior descending artery (LAD) 9(39.1%), Right coronary artery (RCA) 7(30.4%), Left circumflex artery (LCX) 7(30.4%).

Table-I
Demographic Profile of patient.

	Male	Female
Number	19	4
Age (yrs)	54.1±8.5	54.3±9.1
BMI(kg/m^2)	26.0±3.2	27.0±4.7
SBP(mmHg)	125.0±15.7	130.0±10.0
DBP(mmHg)	74.5±5.2	80±10
No. Risk Factor	2.4±0.6	2.3±0.6
Creatinine mmol/L	1.3±0.3	1.04±0.3

Data were presented as Mean ± SD.

Table II
Average size of Stent used with inflation pressure.

	Length (mm)	Diameter (mm)	Inflation Pressure (ATM)
LAD	29.6±11.7	2.9±0.3	14.1±1.1
RCA	29.3±13.8	3.0±0.4	13.7±1.4
LCX	22.5±6.6	2.7±0.3	13.3±1.2

Data were presented as Mean ± SD.

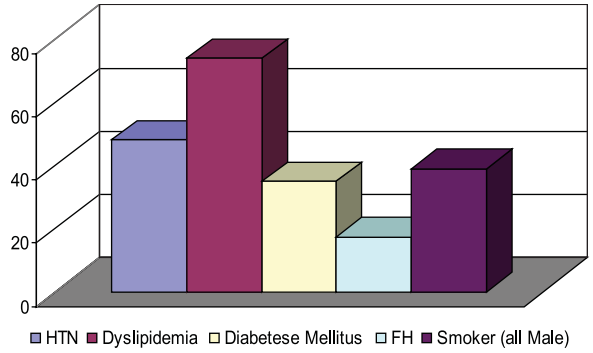

Fig.-1: *Percentage distribution of CAD Risk Factors.*

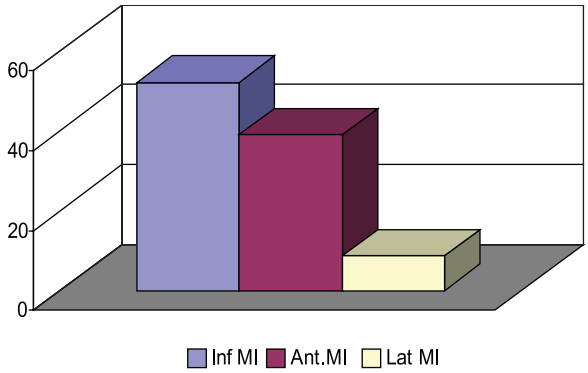

Fig.-2: *Percentage distribution of acute STEMI on presentation.*

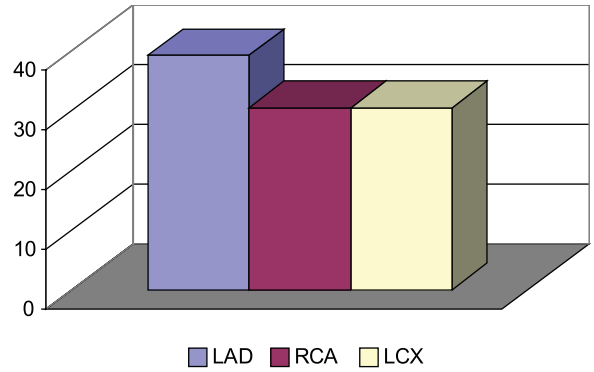

Fig.-3: *Percentage distribution of primary PCI of Infarct realted artery.*

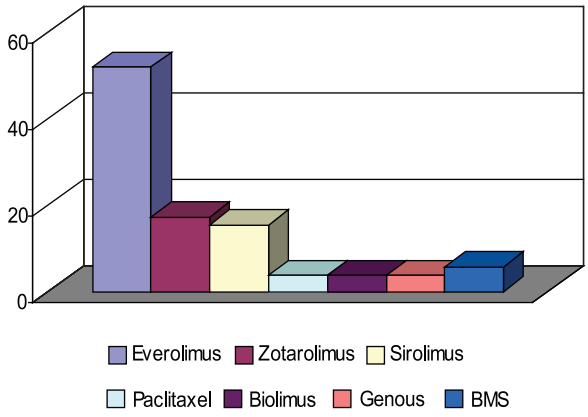

Fig.-4: *Percentage Distribution of Different Stent.*

Fig 4. Shows the percentage distribution of different DES and bare metal stent (BMS). Among the different DES, Everolimus 26 (52%), Sirolimus 8(15.4%) and Zotarolimus 9(17.3%), Paclitaxel 2 (3.8%), Biolimus 2 (3.8%), Genous 2 (3.8%) was used.

Discussion:

Patients with acute ST-Segment Elevation myocardial infarction (STEMI) are effectively treated with emergency angioplasty, to restore blood flow to the coronary artery judged to be causing the myocardial infarction, also known as culprit artery.[11,12] These patients may have major stenosis in coronary arteries that were not responsible for the MI.[1] Some of the physicians have taken the view that stenosis in non-infarct arteries may cause serious adverse cardiac events that could be avoided by performing PCI during the initial procedures.[8, 13] Others have suggested that medical therapy with antiplatelet, lipid lowering and blood pressure lowering drugs is sufficient and the risk of preventive PCI outweigh the benefit.[7, 14] The meta analysis supports the ACC/AHA guideline advising the performance of primary PCI for STEMI confined to the culprit vessel only.[5,15] MV-PCI should be discouraged and significant nonculprit vessel lesions should only be treated during planned staged procedures. Although safe, PCI remains associated with potential serious procedural complications, such as restenosis, stent thrombosis, and contrast induced nephropathy. Therefore, international guidelines, recommended using PCI, selectively in cases in which the benefit of a revascularization outweighs the risk complications. It has been hypothesized that for the selected STEMI patients with cardiogenic shock, PCI of the nonculprit vessel in the acute phase is able to reduce (border zone) ischemia and improve survival.[16,17] In addition when ≥1 culprit lesion is suspected; MV-PCI may also be beneficial.[1] MV-PCI may also be convenient for the patient, as no second procedures are necessary. Further, there are logistic and economic reasons to perform MV-PCI as it may limit staged procedure, length of hospital stay and medical cost as well.

On the contrary, the possible reason of not to perform MV-PCI in STEMI patient is the enhanced thrombotic and inflammatory environment during acute MI, contributes to a higher risk of procedural complications.[18,19] Factors that increase the risk in MV-PCI in STEMI patients are related to the complexity and duration of the procedures.

Primary PCI in acute STEMI patients is a primary target of treatment, as it reduces the rate of death and MACE of these acute STEMI patients. Many have MVD, for which the ACC/AHA guide line recommend IRA revascularization, except for the case of haemodynamic instability, which can be managed with multivessel revascularization.[3,5] Because of the short and long-term mortality of acute STEMI patients with MVDs are higher than those with single vessel disease.[2,4] It seems that PCI of non-culprit vessel at the time of pPCI would maximize recovery of whole ventricle function by improving myocardial perfusion, thereby producing better clinical outcome. It is known, that vulnerable plaque distribution not limited to IRA in ACS, accounting for the recurrence of angina pectoris, ACS and need for re-PCI of non-IRA.[20] This supposition is supported by the fact that DES has reduced restenosis and by fact, that the clinical result of MV-PCI have been improved with the availability of technical support of IVUS, FFR and use of a variety of GP IIb/IIIa inhibitors.[21-23]

Very recently, a randomized study called the preventive angioplasty in acute myocardial infarction (PRAMI) trial, was to determine whether performing preventive PCI as part of the procedure to treat the infarct artery would reduce the combined incidence of death from cardiac causes, nonfatal myocardial infarction or refractory angina.[24] PRAMI study has demonstrated that

patients with STEMI and multivessel coronary artery disease undergoing infarct related artery (IRA) PCI, preventive PCI in nonculprit arteries with major stenosis significantly reduced the risk of adverse cardiovascular events, as compared with PCI limited to IRA.

The (Korea acute myocardial infarction registry) KAMIR[25] investigators did not find any significant differences between IRA revascularization and multivessel revascularization in the rates of 12-month MACE and support the current guidelines that recommend IRA revascularization in haemodynamic stable STEMI patients in the setting of primary PCI. They also suggested that multivessel revascularization might be equally safe and beneficial compared with IRA revascularization done by an experienced interventionist and in the case of multiple culprit lesion if suspected.[25]

In our present era in interventional cardiology, primary PCI is commonly practiced interventional procedure in opening the clogged artery, after having diagnosed as an acute ST-segment elevated myocardial infarction (STEMI). However, a detail on MV-PCI in the same sitting in these patients population with STEMI is not available.

Therefore, we have carried out this very preliminary non-randomized cohort on patient admitting in our hospital with the admission diagnosis of acute ST-segment elevated myocardial infarction. In our present study, total 171 acute STEMI patients have primary PCI for the designated period. Total 23 (13.4%) patient has MVD with STEMI. Primary PCI was done in infarct related artery and the non-culprit vessel in same sitting. Among the studied patients, ECG evidenced admission time diagnosis was inferior wall MI, followed by Anterior and Lateral wall MI. Most commonly stented pPCI territory were; LAD followed by RCA and LCX. Total, 6 (26.1%) patient has double stent in the infracted territory. Drug-Eluting stents were more commonly used stents in pPCI. Among the different DES, the mostly used Everolimus eluting stents followed by Sirolimus, Biolimus and Zotarolimus Eluting stents; and Paclitaxel, Genous.

We found that our patients are doing well >1-year after the procedure without any MACE, i.e., in-hospital mortality, re-infarction, acute or late stent thrombosis. All of our studied patients remain clinically asymptomatic and being regularly followed-up in the cardiac OPD.

Very recently, the PRAMI trial results showed that in patients with acute STEMI, the use of preventive PCI to treat non-infarct coronary artery stenosis immediately after PCI in infarct artery conferred substantial advantages over not performing these additional procedures. The combined rate of cardiac death nonfatal MI or refractory angina was reduced by 65%, an absolute risk reduction of 14 percentage points over 23 months.

Therefore, we recommend doing pPCI in STEMI patients with MVD. To do or not to do pPCI in STEMI patients with MV disease in the same sitting, depends on individual operator expertise and discretion, the disease extent, lesion severity and patient haemodynamic stability and overall the availability of resources. In our current study, number of the patient was very small. Therefore, we were unable to confirm its superiority over staged PCI. In this regards, we need more patient population inclusion; and to do randomized comparative study with "same sitting" and "staged pPCI" in patient with STEMI with a mandatory angiographic follow-up.

Conclusion:

In the context of our experiences at the Apollo hospitals, we are able to demonstrate the multivessel revascularization of non-culprit lesion during primary PCI of target vessel in the same sitting is safe and uneventful during the procedure and patients remain asymptomatic e" 1 yr after follow without any major adverse cardiac events. Therefore, we recommend for same sitting multivessel PCI, during primary PCI in patients with STEMI and will ensure more myocardial salvage and cost effective for the patient in context of our financial circumstances.

Conflict of Interest - None.

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