

Study of Clinical, Angiographic Profile and Outcome of Patients Undergoing Coronary Angioplasty of Left main Coronary Artery: MCVTC Experience.

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Abstract

Background and Aims: Coronary artery bypass graft is the treatment of choice for left main disease. However the results from several large multicenter trials have shown that the angioplasty of left main disease is an alternative treatment. The aim of this study was to assess the outcome of patients undergoing angioplasty of left main disease.

Methods: This prospective study was conducted at Manmohan cardiothoracic vascular and transplant center, Maharajgunj, Kathmandu, Nepal. Twenty-Five patients with a diagnosis of left main coronary artery disease who underwent coronary angioplasty were enrolled in the study. The cases were followed up and outcomes on follow up were assessed.

Results: Patients with left main disease enrolled in this study belonged to the age group of 51 to 77 years. The mean age of patients was 64.7±8.12 with 68% (17) male and 32% (8) female. Among 25 patients 3 patients had single vessel disease, double vessel in 10 patients and triple vessel in 12 patients. Three patients (12%) had previous history of percutaneous coronary intervention and 1 (4%) had previous history of coronary artery bypass graft. All patients underwent successful procedure with unprotected left main stenting in 14 cases (56%). There was few major and minor complications and no procedure related mortality and in hospital death.

Conclusion: Left main coronary angioplasty is a safe and alternative procedure to CABG with low incidence of major clinical events.

Keywords: Coronary Artery bypass Graft (CABG); PCI (Percutaneous Coronary Intervention); Unprotected Left main Coronary Artery (ULMCA).

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Introduction

Left Main (LM) coronary artery disease incidence varies between 4 to 7%.¹ It portends higher prognostic risk as a result of larger myocardial territory at risk. Patients with unprotected left main coronary artery disease treated medically has a 3-year mortality rate of 50%.^{2,3} Coronary artery bypass graft (CABG) has been the therapy of choice for left main coronary artery disease for several decades.⁴ But the non inferior result of percutaneous coronary intervention

(PCI) in these patients have changed the scenario and have shown the beneficial use mainly in high surgical risk patients. Many recent studies have focused on the safety and efficacy of stenting of left main disease with similar complications as compared to CABG.^{5,6,7}

The advances in PCI techniques and stent technology have allowed the evaluation of the role of PCI for LM disease with minimal complications.

Methods

From 2018 January to 2019 December over two years period at Mammoan cardiothoracic Vascular and Transplant center (MCVTC), a total of 25 patients diagnosed as LM coronary artery disease who refused for CABG were enrolled in the study. A significant stenosis was defined as an LM coronary artery narrowing of $\geq 50\%$.¹ Both protected and unprotected LM were enrolled in the study. Unprotected left main stenosis was defined as a significant narrowing of the left main coronary artery without visible flow through collaterals or bypass grafts to the left anterior descending or left circumflex artery.⁸

The angiographic data were analyzed with SYNTAX (Synergy between PCI with TAXUSTM and Cardiac Surgery) score and classified as low (0-22), intermediate (23-32), and high (≥ 33).^{9,10} The inclusion criteria of the study were high surgical risk for which surgeon refused for CABG and patients preference for PCI. Procedural success was defined as a residual intraluminal narrowing of $< 20\%$ obtained by coronary angiography without major cardiac procedural complications.

All the patients were followed-up clinically. Coronary angiography was not performed if the patients had no clinical presentation of myocardial ischemia or staged PCI done for non-LM lesions.

Results

During the period, a total of 25 patients had undergone LM coronary angioplasty. The mean age of the patients was 64.7 ± 8.12 years with male predominance. The clinical characteristics of the study group are shown in Table 1.

Procedure

In all patients, the vessel was accessed via the femoral artery. Angioplasty was elective in 18 patients and urgent in the remaining 7 patients. In 20 patients (80%), the lesions were predilated using a conventional balloon catheter and in 5 patients (20%), the stent was implanted directly. The median diameter and length of the stents were 3.6 ± 0.4 mm and 20.2 ± 6.4 mm, respectively. During the procedure intra-aortic balloon pump (IABP) was used in 2 patients and PCI was successful in all patients (Table 2). For distal LM lesion, provisional stenting from LM to left anterior descending artery (LAD) or left circumflex artery (LCX) with wire protection to LAD or LCX was done and in few patients DK Crush technique was done for bifurcation lesion. For ostial and mid shaft lesion, stenting from ostium to mid shaft was done.

After angioplasty all patients were given dual antiplatelet agents (Aspirin and clopidogrel) and were followed up clinically.

At the time of diagnostic angiography, 10 patients (40%) were known to have stable angina, 8 (32%) had Unstable angina (USA)/ Non ST elevation myocardial infarction (NSTEMI) and 7 (28%) had ST elevation myocardial infarction (STEMI). The mean left ventricular ejection fraction in these patients was $45 \pm 11.2\%$ with 8 patients (32%) having ejection fraction $\leq 30\%$ (Table 1).

Among 25 patients, 3 patients had single vessel disease, double vessel in 10 patients and triple vessel in 12 patients. Three patients (12%) had previous history of PCI and 1 (4%) had previous history of CABG. Unprotected left main was in 14 patients (56%) (Table 2). All patients received drug-eluting stents without Intravascular ultrasound (IVUS) guidance.

Table 1: Clinical characteristics of patients who received left main coronary artery stent.

| Patients Characteristics | Number | Percentage (%) |
|---|---------------------------------------|----------------|
| Age (years) | Mean: 64.7 ± 8.12 SD Range: 51-77 | |
| Sex | | |
| Male | 17 | 68 |
| Female | 8 | 32 |
| Family History of Coronary Artery Disease | 2 | 8 |
| HCV Positive | 1 | 4 |
| History of Smoking | 8 | 32 |
| Diabetes | 8 | 32 |
| Hypertension | 10 | 40 |
| Dyslipidemia | 3 | 12 |
| Chronic Kidney Disease | 3 | 12 |
| Clinical Presentation | | |
| Stable Angina | 10 | 40 |
| Unstable Angina | 5 | 20 |
| NSTEMI | 3 | 12 |
| STEMI | 7 | 28 |
| LV Systolic Function (EF) Mean \pm SD | $45 \pm 11.2\%$ | |

Table 2: Lesion and procedural characteristics.

| Patients Characteristics | Number | Percentage (%) |
|-----------------------------------|-----------------|----------------|
| Coronary Artery Disease | | |
| Single Vessel Disease | 3 | 12 |
| Double Vessel Disease | 10 | 40 |
| Triple Vessel Disease | 12 | 48 |
| Only Left Main Disease | 0 | 0 |
| Unprotected LM | 14 | 56 |
| Protected LM | 11 | 44 |
| Previous History of PCI | | |
| Previous History of CABG | 1 | 4 |
| Use of IABP | 2 | 8 |
| Syntax Score | | |
| Low: 0- 22 | 4 | 16 |
| Intermediate: 23-32 | 7 | 28 |
| High : ≥ 33 | 14 | 56 |
| Mean \pm SD | 35.2 \pm 11.5 | |
| Coronary Angioplasty | | |
| LM to LAD: | 16 | 64 |
| LM to LCX: | 8 | 32 |
| Only LM | 1 | 4 |
| Multi Vessel PCI: | 16 | 64 |
| Procedure Success | 25 | 100 |
| Target Lesion | | |
| Ostial LM | 5 | 20 |
| Mid LM | 3 | 12 |
| Distal LM | 17 | 68 |
| Procedural Characteristics | | |
| Single Stent | 6 | 24 |
| Bare Metal Stent (BMS) | 0 | 0 |
| Drug Eluting Stent (DES) | 25 | 100 |
| Direct Stenting | 5 | 20 |
| Total Stent Length | 30 mm | |
| IVUS Guided PCI | 0 | |

During procedure till hospital stay few major and minor complications occurred. The minor complications were vasovagal attack in two patients (8%), hematoma at the punctured site in one patient (4%) and contrast allergy in one patient (4%). The major complications occurred in 5 patients (20%) which were acute pulmonary edema in two patients (8%), one patients (4%) developed cardiogenic shock, which subsequently recovered and two patients (8%) developed arrhythmia after the procedure. However there was no procedure related mortality with no in hospital death and no emergency CABG was required (Table 3).

Table 3: In hospital outcome.

| Outcome | Number | Percentage (%) |
|---|--------|----------------|
| Periprocedural/Post Procedural MI | 0 | 0 |
| Stent Thrombosis | 0 | 0 |
| Emergency CABG | 0 | 0 |
| Acute Pulmonary Edema | 2 | 8 |
| Cardiogenic Shock | 1 | 4 |
| Stroke | 0 | 0 |
| Cardiac Tamponade | 0 | 0 |
| Arrhythmia | 2 | 8 |
| Ventricular Tachycardia | 1 | 4 |
| Atrial Fibrillation | 1 | 4 |
| Death (Procedure Related/ In Hospital/Cardiac/Noncardiac) | 0 | 0 |

Follow Up

All patients were followed up clinically for a mean follow up of 11.4±5.6 months (range 3–24 months) after the procedure by undergoing detailed questioning in a cardiology out patient department and by a phone call. Among 25 patients, 96 % were under close follow up and 1 lost to follow up with even no contact on phone. During follow-up, 6 patients (25%) presented with major clinical events with both Acute Coronary Syndrome (ACS) and other cardiac cause (Table 4). One patient died on follow up on readmission due to refractory heart failure. There was no repeat need of revascularization either PCI or CABG in any patients.

Table 4: Clinical outcome on follow up (N:24)

| Outcome | Number | Percentage (%) |
|---|-------------------|----------------|
| Readmission for Acute Coronary Syndrome | 3 | 12 |
| USA/NSTEMI | 3 | 12 |
| STEMI | 0 | 0 |
| Repeat CAG | 3 | 12 |
| Stent Thrombosis | 1 (Non LM Lesion) | 4 |
| Readmission for other Cardiac Cause | 3 | 12 |
| Heart Failure | 2 | 8 |
| Ventricular Tachycardia | 1 | 4 |
| Readmission for Stroke | 0 | 0 |
| Repeat Revascularization | | |
| PCI | 0 | 0 |
| CABG | 0 | 0 |
| Death | 1 | 4 |

Discussion

Although CABG remains the standard therapy for LM coronary artery disease, several studies have demonstrated the clinical outcomes of LM revascularization.^{11,12} Advances in CABG and PCI techniques assessed in recent randomized trials showed that PCI for LMCA disease is a safe option with similar long-term survival rates to CABG surgery particularly in those with low and intermediate anatomic risk.^{13,14} A large amount of data from observational registries to clinical randomized trials supports the feasibility, efficacy and safety of stenting compared with CABG for the treatment of LM coronary artery disease.¹⁵⁻²⁰

The mean age of patients in our study was 64.7±8.12 years with male predominance. The major risk factors for CAD in our study were diabetes and hypertension (32% and 40% respectively). In the study conducted by Marti V et al hypertension and diabetes were 57 and 52% respectively.²¹ The majority of patients in our study presented with stable angina and on angiography most of the patients had Triple Vessel Disease (TVD) (48%). In the study conducted by Hsiao-Yang Cheng et al²² the majority of patients presented with USA/NSTEMI and most of the patients had TVD (44%) on coronary angiography.

There were 3 Chronic Kidney Disease (CKD) patients (12%) with TVD and LM disease who had undergone successful coronary

angioplasty in our study. This was similar to the study conducted by Hsiao-Yang Cheng et al²² where 15 % were CKD patients. Whereas in another study conducted by Marti V et al²¹ 5% cases were of CKD.

During angioplasty most of the patients had undergone LM to LAD stenting (64%) with only LM stenting in 1 patients (4%). The procedure was successful in all patients (100%) which was similar (100%) to various other conducted studies.²³⁻²⁶

In another study conducted by W.T. Ruifrok et al²⁷ the PCI was successful in 98% cases. During the procedure, IABP was used in 2 patients (8%). There was no procedure related mortality and emergency CABG done in our study. This was similar to the study conducted by Hsiao-Yang Cheng et al²² where 9.9% had use of IABP and no procedure related mortality and emergency CABG needed. In another study conducted by W.T. Ruifrok et al²⁷ procedure related mortality was in 1 patients (0.8%) and need of emergency CABG was in 1 patients (0.8%). PCI of LMCA can be done even without surgical back up facility and many centers are doing it with good short term and long-term results.

Five patients (20%) had major complications during and after procedure which comprised pulmonary edema, cardiogenic shock and arrhythmia but there was no in hospital death after procedure on first admission. In the study conducted over 38 patients by Marti V et al²¹ 10% had major complications and in hospital mortality was 15%. In another study conducted by W.T. Ruifrok et al²⁷ there was 7 (5.9%) in hospital death (among 118 cases) primarily related to cardiac cause. Similarly in another study conducted on 200 patients by A. Gagnor et al²⁸ the major complications occurred in 44% with in hospital mortality of 11%.

In our study during follow up (mean:11.4±5.6 months) 6 patients (25%) had major clinical events in the form of ACS and other cardiac cause but no patients developed stroke even on follow up period. There was 1 cardiac death (4%) by the end of follow up period. In the study conducted by W.T. Ruifrok et al²⁷ the major cardiovascular events at the end of follow up period (average:8 months) was 36% with cardiac death in 6.8% cases and total death of 25% (both cardiac and non cardiac) at the end of follow up period. In another study conducted in 70 patients by Hsiao-Yang Cheng et al²² within 1 year follow up 37% cases were hospitalized due to major cardiovascular events and all cause mortality rate was 28% (cardiac 11%, non cardiac 17%).

Study Limitations

This was a non-randomized prospective study with a small sample size. There was no use of IVUS in our study due to unavailability of IVUS machine in our center. Due to small sample size, this findings could not be fully generalized to all other patients, so a large randomized study is recommended for further confirmation of best revascularization strategy for significant LM stenosis.

Conclusion

PCI of LM coronary artery is a safe and effective procedure with low incidence of major cardiac events. Patient selection is crucial and must be based on proper heart team discussion.

Conflict of Interest: None

Acknowledgement: None

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