EMIRATES MEDICAL JOURNAL

ISSN - 0250 - 6882

August 2006

Volume 24 Number 2

Official Publication of the
Emirates Medical Association

Percutaneous coronary intervention (PCI) - An emerging alternative to bypass surgery for unprotected left main artery disease

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Abstract - *Both technological advances (including stenting and atherosclerotic techniques) and increased operator experience have led to the resurgence in percutaneous revascularization of unprotected left main disease over the past few years. We present our experience in two patients who undergone PCI for left main stem stenosis in different clinical settings.*

Keywords: Unprotected left main coronary artery disease, percutaneous coronary intervention

The management of left main coronary artery disease (LMCD) has been unchanged over the last two decades. Coronary artery bypass grafting (CABG) has remained the principal form of revascularization for LMCD since 1980s.[1]

Ever since Gruentzig first described percutaneous dilatation of coronary stenosis in 1978, there has been interest in trying to develop this technique to treat left main (LM) disease.[2] The past decade has witnessed rapid technological advances in interventional cardiology and this has led to providing an effective percutaneous revascularization approach to LM disease both on an emergency as well as on an elective basis.

Case Reports

Patient No. 1

A 40-year-old civil engineer was admitted to our hospital with chest heaviness and shortness of breath of one-hour duration. His electrocardiogram revealed extensive antero-lateral and inferior myocardial infarction. He was immediately thrombolysed with Tenecteplase within the window period. However, because of extensive myocardial infarction and in spite of all the medication, he was hypotensive and progressed to cardiogenic shock along with respiratory failure. He was intubated and placed on mechanical ventilator and was started on inotropic support for haemodynamic stability. His echocardiogram showed ejection fraction of 35-40%.

He was taken for emergency coronary angiography. An intra-aortic-balloon pump (IABP) was inserted via the left femoral artery. Coronary angiography showed 70% stenosis (mid-shaft) of left main coronary artery, 90% stenosis of proximal left anterior descending (LAD) and subtotal occlusion of posterior left ventricular branch (PLV) of right coronary artery (RCA). CABG was deemed very high risk and hence angioplasty/stenting was performed. Direct stenting with drug eluting stents was performed to the LM (Cypher 3.5 x 8 mm), LAD (Cypher 3 x 18 mm) and balloon angioplasty with stenting to PLV (Taxus Express 2.5 x 20 mm) (*Fig. 1 & Fig 2*). He received glycoprotein IIb/IIIa inhibitor infusion. His condition improved and was taken off IABP and mechanical ventilator over a 48-hour period. Check angiography done the next day revealed patent stents with TIMI III flow.

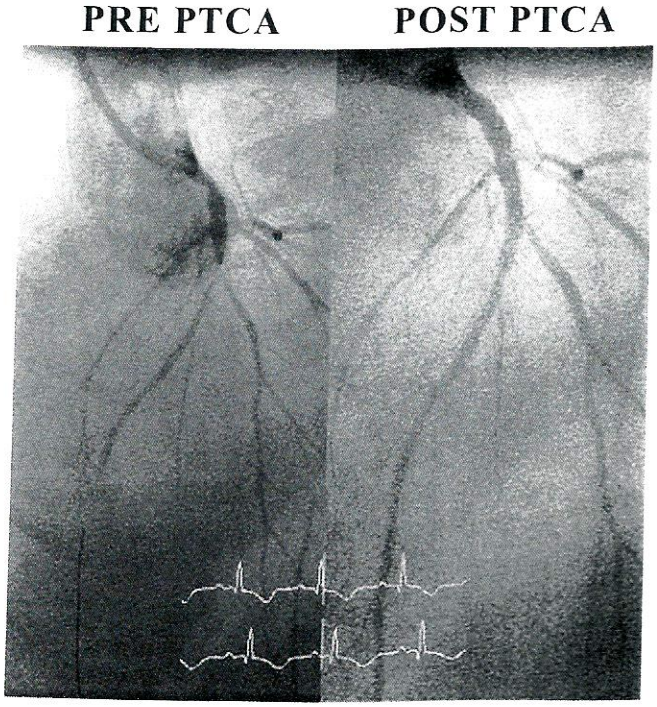

Fig. 1: Pre and Post PTCA images (LAO cranial view) of midshaft LM / LAD stenoses successfully stented. (Patient no. 1)

2.5 x 13 mm stent *(Fig. 4)*. He received Glycoprotein II b/IIIa infusion. Check angiography done 24 hour later revealed excellent angiographic results in LM, LAD, circumflex and obtuse marginal artery.

Both the patients recovered well and were able to return back to their work without discomfort.

The follow up angiography was possible only in the first patient who presented initially with cardiogenic shock. The other patient refused to undergo any further invasive investigation.

The follow up check angiography of first patient done on 13th March '05 revealed patent drug eluting stents in mid-shaft left main with distal left main stem 60% stenosis and patent drug eluting stent in proximal LAD. Plaque disease was seen distal to the stent. Distal RCA stent was occluded.

Based on the above findings he was referred for coronary artery bypass grafting. He underwent unprotected LMCA PCI in the setting of acute myocardial infarction with triple vessel disease, as he was considered a very high-risk surgical candidate. PCI proved to be an effective alternative to CABG in this case.

Comment

Left main coronary artery diseases (LMCD) is defined as more than 50% left main narrowing, usually characterized by symptoms of unstable angina, sometimes with haemodynamic compromise, diffuse ST depression in inferior and precordial leads on ECG,[3] the poor prognosis in patients with LMCD is due to sudden death and massive infarction. The diagnosis is made by coronary angiography. CABG is the first line of therapy while PCI is emerging as a possible alternative to surgery in select group of patients.

The initial experience of balloon angioplasty of LMCD was disappointing. Despite excellent procedural success, the medium and long-term outcome following unprotected LM angioplasty was poor.[4]

Recent technological advances including stenting with drug-eluting stents, development of novel atheroabalative techniques such as debulking procedure, use of intravascular ultrasound and effective antiplatelet agents as well as increased operator experience have led to resurgent interest in percutaneous revascularization of unprotected LMCD over the past few years.[5]

Protected LMCD angioplasty is regarded safe with high success rate and has become a generally accepted alternative to CABG.[6] Park *et al* reported a series of 42 consecutive patients with unprotected left main stenosis and normal LV function (> 40%). The procedural success rate was 100% with clinical recurrence of symptoms at 6 month-follow-up of 17% and angiographic restenosis of 22%.

Clinique Pasture experience has been very vast and they have performed unprotected left main stenting in 214 consecutive patients (mean age 74+/- 8 yrs.) This group included 24% diabetics, 22% had previous MI, 13% with renal impairment and the mean left ventricle ejection fraction (LVEF) was 56 +/- 8%. The majority (65%) of patients had three-vessel disease and lesions other than LM were treated in 63% of cases. Long term clinical follow up (36+/-20 months) was done for 98% of patients. The 5-year survival estimate was also presented which showed that survival was 91%, 78% and 49% at 1, 3 and 5 years respectively.

The risk of sub-acute thrombosis after stent placement using current anti-thrombotic and anti-platelet regimens is estimated at about 1%. The first report by Ellis *et al* on 107 cases revealed that LVEF was the most important predictor of in-hospital death.[6]

Park *et al* reported the long-term outcome of 127 consecutive patients who underwent elective stenting of unprotected LMCA.[7] At two years the cumulative survival rate was 97.1% and the cardiac event free-interval survival rate was 86.9%. Silvastri *et al* showed similar results in low risk patients.[8] In the series of Park *et al* after six months, there was no cardiac or target lesion revascularization, indicating long-term clinical course may be excellent after unprotected LMCA stenting in selected patients with normal LV function.[9]

The unprotected left main trunk multicenter assessment (ULTIMA) registry investigators reported long-term clinical outcome after PCI of unprotected LMCA in 279 patients. The independent clinical correlates of all cause mortality were LVEF <30%, mitral regurgitation grade 3 or 4, presentation with myocardial infract and shock, creatinine >2.0 mg/dl and severe lesion calcification. 13.7% patients died in the hospital and the rest were followed for a period of 19 months. The 1-year incidence was 24.2% for all cause mortality, 20.2% for cardiac mortality, 9.8% for myocardial infraction and 9.4% for CABG.[10]

The occurrence of restenosis is major current limiting factor to the long-term success of unprotected LM intervention. The major determinant of restenosis was reference vessel size. In complex lesion subsets includ-

ing smaller LM vessels, and bifurcation lesion debulking either alone or combined with balloon angioplasty or stenting has been proposed as an alternative to stenting alone.

The studies reveal that the acceptable indications for unprotected LM PCI are:

- Emergent clinical situation such as acute left main occlusion.
- Patient with preserved LVEF >40% and distal bifurcation lesion involving the ostium of LAD or left circumflex (LCX) when one of the 2 distal vessel is either small or occluded.
- Low risk patient with good ventricular function and left main anatomically suitable for stenting i.e. short, non-calcified, osteal and mid-shaft lesion.
- Surgically high risk or inoperable patients with major co-morbidity such as COPD or dialysis dependent renal failure.
- Patient with left main stenosis and multivessel diffuse disease with anatomic characteristics, which may preclude satisfactory bypass grafts.

On the basis of data, it is apparent that patients undergoing unprotected LMCA PCI are the ones with serious co-morbidities and therefore have high event rates. PCI may be considered an alternative to CABG for a select group of patients especially low risk group and highly symptomatic inoperable patients.

Due to high rate of restenosis in initial 6 months, it is strongly recommended to have surveillance coronary angiography at 2 and 4 months post PCI. Judicious patient selection remains important to decide which patients are inoperable and may benefit from PCI.

It is fair to conclude that CABG surgery is still the first choice for the majority of patients with LMD, but PCI is a viable option in selected group patients.

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