Precise Percutaneous Coronary Intervention of LAD Ostial Stenosis by Using Afzal's Technique: An easy but Innovative Procedure

Afzalur Rahman, Farhana Ahmed, Mohammad Arifur Rahman, Syed Nasir Uddin, Md. Zillur Rahman, Tariq Ahmed Chowdhury

Department of Cardiology, National Institute of cardiovascular Diseases, Dhaka.

Key Words :
IHD, Percutaenous coronary intervention, Left anterior descending artery, Afzal's technique.

Abstract:

Background: *The ostial left anterior descending coronary artery (LAD) lesion is an important target for coronary revascularization because its location subtends a large territory of myocardium. Ostial lesions have a reputation of being fibrotic, calcified, and relatively rigid. Greater degraees of rigidity and recoil resulted in lower acute gain and higher rates of target lesion revascularization (TLR) following percutaneous coronary intervention (PCI). In addition, procedural complications such as dissections, vessel closure and myocardial infarction were more frequent. Aim of the study was to evaluate a simple but innovative technique to deal with significant LAD ostial lesion.*

Methods: *This prospective study was conducted between January 2010 and February 2013. Patients with significant angiographic de novo ostial LAD artery stenoses were identified and screened for study eligibility. An ostial stenosis was defined as an angiographic narrowing of e" 70% located within 3 mm of the vessel origin. Study included all consecutive patients with ostial lesions who underwent elective PCI and stent deployment. The study population consisted of 36 patients.*

Results: *Among 36 patients 27 (75%) were male. mean age was 55.75 ± 8.07 years. 21 (58.3%) had diabetes, 15 (41.7%) hypertension, 21 (58.3%) hypercholesterolemia, 24 (66.66%) were smoker and 18 (50%) had F/H of CAD. Among them 6 (16.7%) had STEMI, 9 (25%) had NSTEMI, 12 (33.3%) had UA and 9 (25%) CSA. CAG showed 15 (41.7%) SVD, 15 (41.7%) DVD and 6 (16.7%) were TVD. LAD ostial stenosis were 83.16 ± 10.14%. Considering procedural characteristics, DES were 33 (91.7%) and BMS were 3 (8.3%). DES polymers were Evarolimus 15 (41.7%), Zotarolimus 12 (33.3%) and Biolimus 6 (16.7%). Mean stent length were 21.75 ± 8.07 mm. Mean stent diameter were 2.83 ± 0.28 mm. Minimum follow up time was 9 months and maximum follow up time was 44 months. There were no MACE but Angina (CCS II) were 2 (5.55%) and LVF (NYHA II) were 1(2.77%).*

Conclusion: *Precise placement of LAD ostial stent is always challenging. Several technique applied but results not always satisfactory. Our strategies were precise location of stent implantation at ostium by adopting special technique of simultaneous balloon placement from distal LM to proximal LCX preventing unwanted stent movement during its placement and also properly guiding us for precise stent placement at the ostium. Parked balloon from distal LM to LCX will also be helpful for quick measure for any plaque shifting into LCX.*

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Introduction:

The ostial LAD lesion is an important target for coronary revascularization because its location subtends a large territory of myocardium. Ostial disease is traditionally defined as a lesion arising within 3 mm of the vessel origin. The precise stent placement in coronary artery ostium is technically difficult and poses special challenges for interventional cardiologists. "Geographic miss" that is leaving a portion of the lesion uncovered by a stent can result in early restenosis.[1]

Ostial lesions have a reputation of being fibrotic, calcified, and relatively rigid.[2,3] Ostial disease is felt to be additionally resistant to dilatation and prone to recoil due to the greater was to evaluate a simple but innovative technique to deal with significant LAD ostial lesion.[4]

Address of Correspondence: Dr. Mohammad Arifur Rahman, Department of Cardiolgy,National Institute of cardiovascular Diseases, Dhaka, Bangladesh. Email: drarif79@yahoo.com

Methods:

This prospective study was conducted between January 2010 and February 2013. Patients with significant angiographic de novo ostial LAD artery stenoses were identified and screened for study eligibility. An ostial stenosis was defined as an angiographic narrowing of e" 70% located within 3 mm of the vessel origin. Study included all consecutive patients with ostial lesions who underwent elective PCI and stent deployment with either drug eluting stent (DES) or bare metal stent (BMS) in a native LAD ostial coronary artery. The population consisted of 36 patients. Exclusion criteria were target vessel reference diameter smaller than 2.5 mm, stent implantation during cardiogenic shock or as a bridge to emergency CABG, contraindication to antiplatelet agents, myocardial infarction within 48 hours, heavily calcified ostial lesions. All patients were pre-treated with Aspirin and Clopidogrel. Dual antiplatelets were prescribed for e"12 months preferably lifelong. The primary endpoints included major adverse cardiac events MACE (death, MI, need for repeat revascularization procedure CABG or angioplasty).

Results and discussion

Equipment selection is crucial while intervening LAD ostial lesion. Less aggressive guide catheters are recommended to avoid deep engagement and wedging. Side-hole catheters are not usually recommended as the warning sign of pressure damping from catheter wedging and occlusion of flow is obscured. In most cases a standard wire is appropriate. A buddy wire may be used to provide additional stability, or as a marker in side-branch. Hydrophilic wires may facilitate rapid wiring of vessels with tortuosity or distal disease. When deciding whether to implant a DES or BMS at an ostial site, assessment of lesion-specific (e.g., vessel size, lesion length) and patient-specific (e.g., diabetes, bleeding risk) factors are relevant as for any lesion. At ostial sites, DES appear to have equivalent safety to BMS but with lower MACE due to lower restenosis.[5] DES may therefore be preferred at location-critical sites such as the ostial LAD. In general, either femoral or radial approach is suitable for any lesion in the hands of experienced operators using appropriate equipment. It is important to recognize that catheters may behave differently, particularly from a right radial approach. Consequently, guide catheter access and stability may on occasion be superior from the left radial approach as compared to the right radial. When pulling back catheters in the LCA from a right radial approach, there is an initial tendency to more deeply engage them ostium (as is commonly seen for an Amplatz catheter from any approach). There may be less stability for standard Judkins catheters for the RCA from a right radial approach and catheters with greater reach may be required. Greater calcification and lesion rigidity at ostial sites plus the risk of significant plaque shift may dictate a plaque modification or debulking strategy. Predilatation with an (undersized) compliant or semi-compliant balloon is recommended in all cases. If a compliant balloon fails to expand fully an undersized non-compliant balloon may be used at higher pressure. In markedly fibrotic or moderately calcified ostial lesions, a cutting balloon is a useful adjunct.[6] Ostial PCI requires very precise stent positioning to obtain full lesion coverage, yet avoid unnecessary proximal extension which may result in obstruction of major vessels or excessive overhang into the aorta. Suboptimal visualisation in aorto-ostial lesions due to guide catheter disengagement and resultant poor contrast opacification. Excessive stent movement with cardiac contraction. Oscillation of the LAD stent increases the risk of inaccurate placement. In some cases even with correct stent positioning there will be a degree of proximal stent protrusion. This may impinge on the parent vessel or side-branch. The more acute the angle is, the greater the risk of suboptimal stent positioning. Minimising the effect of respiratory or cardiac motion is special consideration. In a conscious patient this will result in a relatively short time window for stent positioning. An alternative is to suggest gentle shallow breathing. Cardiac motion is usually most problematic for the ostial LAD. Pharmacological methods (such as Esmolol, Adenosine and Atropine) or rapid ventricular pacing and partial pre-inflation technique may be used. Failure to adequately size or expand a stent or to recognize poor stent expansion will result in higher rates of angiographic restenosis and TLR. This is a common failure when treating ostial disease.

Table-I

Baseline clinical characteristics of study population (n=36).

Age, y	55.75 ± 8.07
Male	27 (75%)
Risk factors	
Current smoking	24 (66.66%)
Diabetes mellitus	21 (58.3%)
Hypertension	15 (41.7%)
Dyslipidaemia	21 (58.3%)
F/H of CAD	18 (50%)
Indication for procedure	
STEMI	6 (16.7%)
NSTEMI	9 (25%)
Unstable angina	12 (33.3%)
Stable angina	9 (25%)

Table-II

Angiographic profile of study population (n=36).

CAG findings	
SVD	15 (41.7%)
DVD	15 (41.7%)
TVD	6 (16.7%)
LAD lesion type	
Type A	12 (33.3%)
Type B	18 (50%)
Type C	6 (16.7%)
LAD ostial stenosis %	83.16 ± 10.14

Table-III

Procedural characteristics of study population (n=36).

Vessels stented	
LAD alone	12 (33.3%)
LAD+ LCX	6 (16.7%)
LAD +RCA	12 (33.3%)
LAD + OM1	3 (8.3%)
Stent used	
BMS	3 (8.3%)
DES	33 (91.7%)
DES Polymer	
Evarolimus	15 (41.7%)
Zotarolimus	12 (33.3%)
Biolimus	6 (16.7%)
Others	
Stent length (mm)	21.75 ± 8.07
Stent diameter (mm)	2.83 ± 0.28
Inflation pressure (atm)	13.83 ± 1.26
Inflation time (seconds)	21.04 ± 1.94

Table-IV

Follow up and outcomes of study population (n=36).

Follow up time (months)	9-44
Angina (CCS II)	2 (5.55%)
LVF (NYHA II)	1(2.77%)
MI	0
Stroke	0
TLR	0
CABG	0

Procedural consideration : Usually RAO caudal or LAO caudal view is used to examine LAD ostial disease (Fig 1). First both the LAD and Cx vessels are wired. The LAD lesion was predilated. A balloon was positioned from LM to proximal LCX and parked there. For precise LAD Ostial PCI we made sure that the proximal radio-opaque marker must be positioned proximal to the ostial LAD by super zooming, RAO caudal or LAO caudal view. As there was a balloon was positioned from LM to proximal LCX and parked there practically there was no oscillation of the LAD stent during positing and thus its help for precise LAD Ostial placement (Fig 2). Then keeping the parked balloon in position from LM to proximal LCX, the LAD stent was deployed very carefully across the lesion with precise LAD coverage (Fig 3). And then post dilatation done. If the procedure is performed accordingly LAD ostial lesion covered by stent properly (Fig 4).

Among 36 patients 27 (75%) were male. mean age was 55.75 ± 8.07 years (47- 63 years). 21 (58.3%) had diabetes, 15 (41.7%) hypertension, 21 (58.3%) hypercholesterolemia, 24 (66.66%) were smoker and 18 (50%) had F/H of CAD. Among them 6 (16.7%) had STEMI, 9 (25%) had NSTEMI, 12 (33.3%) had UA and 9 (25%) CSA (Table I). CAG showed 15 (41.7%) SVD, 15 (41.7%) DVD and 6 (16.7%) were TVD. Lesion types were 12 (33.3%) type A , 18 (50%) type B and 6 (16.7%) were type C (Table II). LAD ostial stenosis were 83.16 ± 10.14%. Considering procedural characteristics, stented vessels LAD alone were 12 (33.3%), LAD+ LCX were 6 (16.7%), LAD + RCA were12 (33.3%), LAD + OM1 were 3 (8.3%). DES were 33 (91.7%) and BMS were 3 (8.3%). DES polymers were Evarolimus 15 (41.7%), Zotarolimus 12 (33.3%) and Biolimus 6 (16.7%). Mean stent length were 21.75 ± 8.07 mm.

Fig.-1: *LAD ostial disease (RAO Caudal and LAO caudal view).*

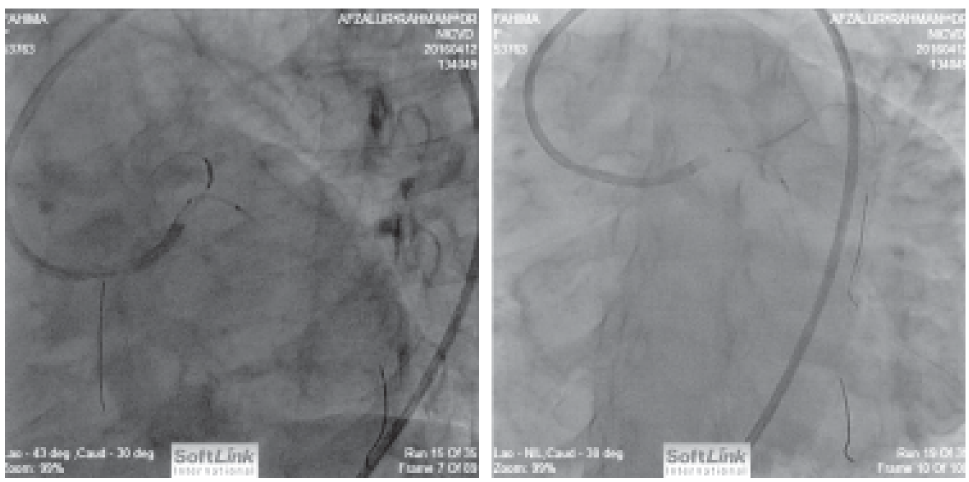

Fig.-2: *A balloon parked at LM to LCX keeping stent at LAD ostium.*

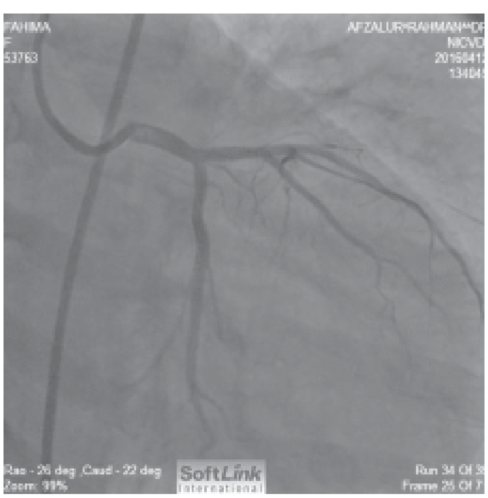

Fig.-3: *Deployment of LAD ostial stent supported by balloon parked at LM to LCX.*

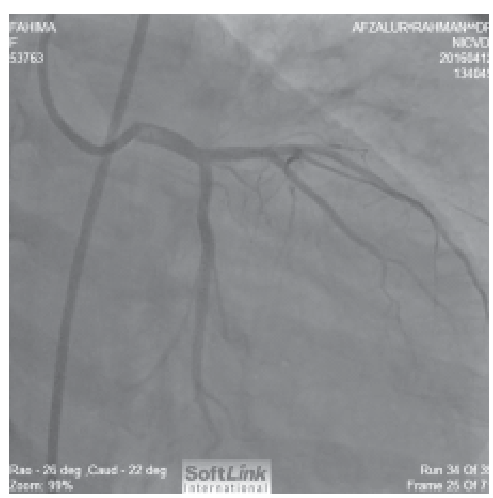

Fig.-4: *TIMI III flow achieved with proper positioning of the stent with full covering of LAD ostium.*

Mean stent diameter were 2.83 ± 0.28 mm. Mean inflation pressure were 13.83 ± 1.26 atm. Mean inflation time were 21.04 ± 1.94 seconds (Table III). Minimum follow up time was 9 months and maximum follow up time was 44 months. There were no MACE but Angina (CCS II) were 2 (5.55%) and LVF (NYHA II) were 1(2.77%) (Table IV).

Percutaneous intervention on LAD ostial lesions can pose unique challenges and is associated with higher procedural and medium-term complication rates. Ostial disease is traditionally defined as a lesion arising within 3 mm of the vessel origin. A decision must be made at the outset as to whether precise positioning of the stent at the ostium should be attempted, or whether stenting across the LCX back into the LMS is preferable. The presence or absence of an ostial 'nub' or stump to facilitate proximal positioning, The angle of the bifurcation with the LCX angles <75° are associated with greater difficulty in stent positioning and increased risk of plaque shift . The presence of significant plaque in the distal LMS or LCX ostium may dictate an alternative PCI strategy or referral for coronary artery bypass surgery. The presence of heavy calcification which may impair visualization and stent positioning, limit stent expansion and increase the risk of stent edge dissection or restenosis.

For precise LAD Ostial PCI It is necessary to reiterate that the stent is within the radio-opaque markers on the stent balloon and thus the proximal marker must be positioned proximal to the ostial LAD . Excessive stent movement during Stent placement may be particularly problematic with ostial LAD stenting, as seen in where oscillation of the LAD stent increases the risk of inaccurate placement. Techniques to prevent excessive stent movement: Respiratory motion – A breath-hold, gentle shallow breathing. Cardiac motion: Pharmacological methods (such as Adenosine and Atropine) ,Rapid ventricular pacing and partial pre-inflation technique. Simultaneous balloon placement is technically simple approach for prevention of unwanted stent movement during stent placement. Operators should also consider 7 Fr guiding catheter, super zooming, RAD caudal or LAD caudal view and DES stent with High radial force and good visibility of the stent.

Drug eluting stents have a potent anti-inflammatory, immunosuppressive, and anti-proliferative effect.[9,10] Drug eluting stents (DES) have been shown to reduce the incidence of restenosis even in very complex lesions,[11,12] but critical ostial lesions were not included in many trails .[13-15]

Study Limitations

There are several important limitations in this study. First, we do not have the control group. Second, the choices regarding treatment strategies for the ostial LAD lesions were left to discretion of the operators and were not based on randomized assignment. Treatment strategies were chosen according to the various anatomic features of the ostial LAD lesions. Third, angiograms were not analyzed by a core angiographic laboratory; therefore, the adjudication of ostial lesion was left to the judgment of the local investigators. Fourth, we could not address the issue of lesion progression of LMCA and ostial LCX because we did not evaluate the follow-up angiograms. Fifth, because we could not fully monitor the study patients, there is potential for underreporting of adverse events with potential for bias.

Conclusion:

We herein report unique strategies for the management of critical LAD ostial lesions. Our strategies were precise location of stent implantation at ostium. Simultaneous balloon placement from distal LM to proximal LCX prevented the unwanted stent movement during its placement and also properly guides us for precise stent placement at the ostium. Follow up results showed minimal adverse events which are comparable with other approved techniques of LAD ostial PCI. So it may be concluded that this technique is quick, effective, and technically simple approach for successful treatment of LAD Ostial lesion.

Conflict of Interest - None.

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