



Case Report

Management of a difficult case scenario with left anterior descending artery (LAD) chronic total occlusion (CTO) in the setting of limited resources

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Abstract

Revascularization with percutaneous coronary intervention to a chronic total occlusion of a coronary artery is a controversial topic. Incidence of coronary CTOs are reported to be as high as 20% in usual practice. We report a case of a 58 year old man presenting to a paid hospital facility with congestive heart failure New York Heart Association (NYHA) Class III and angina of Canadian Cardiology Society class (CCS) II-III following high risk unstable angina a month ago and myocardial infarction (MI) ten months ago with renal impairment and poor LV systolic function. 2D Echocardiogram demonstrated viable ischaemic myocardium of the LAD territory and coronary angiogram revealed double vessel coronary artery disease with moderate distal left main coronary (LMCA) stenosis and proximal LAD CTO. We achieved successful results of revascularization of LAD CTO by PCI despite compromised operator accessibility to supportive measures due to financial constraints. This case illustrates the value of attempting PCI to coronary CTO in an appropriate patient with limited access to resources.

Introduction

A Chronic Total Occlusion (CTO) is defined as a 100% occlusion in a coronary artery with Thrombolysis in Myocardial Infarction (TIMI) 0 flow i.e (no antegrade flow beyond the occlusion) of at least three months duration [1]. Incidence of coronary CTOs are reported to be as high as 20% in usual practice [1, 2].

Attempting revascularization with Percutaneous Coronary Intervention (PCI) for a chronic total occlusion of a coronary artery is a controversial topic. Continuing evolution of new techniques and devices have improved outcome of PCI to CTOs. Several large multi-center registries have reported a success rate of CTO PCI as high as 80% with acceptable complication rates from various centers all over the world [1, 2]. Nevertheless, there is no clear evidence which guide the interventional cardiologist to address all or most CTOs found in patients with coronary artery disease (CAD). The population affected is heterogeneous ranging from proximal left anterior descending artery (LAD) CTO presenting with significant angina, left ventricular (LV) dysfunction and with a large ischaemic viable myocardium of LAD territory to the patient presenting with technically challenging distal right coronary artery CTO with a small segment of ischaemic myocardium with dyspnoea and severe LV dysfunction [3].

Therefore CTO PCI should be reserved for selected patients with angina, poor quality of life and with significant area of viable ischaemic myocardium. It is important to discuss with the patient, regarding potential risks and the unclear clinical benefits prior to the procedure. There is high expectation regarding the procedural success

of CTO PCI and the safety, due to advanced new techniques and devices, and the newly introduced CTO guide wires, plaque modification tools, devices facilitating directed sub intimal tracking and reentry, retrograde CTO techniques and the “hybrid CTO algorithm” [4, 5]. The successful results of CTO PCI is influenced by patient factors, plaque characteristics, suitability of distal target vessel, availability of resources and the expertise of the operator. However, it is well established that Coronary artery bypass Surgery (CABG) is the gold standard in achieving complete revascularization which was clearly demonstrated in the SYNTAX trial [6, 7]. Patients who refuse CABG, either have to remain with medical management or receive revascularization with PCI. However, PCI has been recommended as a mode of revascularization in selected patients with CTOs in recent guidelines (Class 11a) [8]. The appropriate use criteria of American College of Cardiology (ACC) for stable CAD with CTOs have eliminated the separate criteria for revascularization of CTO lesions in 2017 and classified them under PCI to CTO or severe stenosis based on symptoms [8].

Case Scenario

We report a difficult case of a 58 year old man presenting to a paid hospital facility following a recent acute coronary syndrome (ACS) with NYHA Class III heart failure and CCS Class II-III angina of one month duration. He had a past history of a heart attack, diabetes mellitus, hypertension, dyslipidaemia and renal impairment. There was also a record of coronary angiography performed ten months ago demonstrating double



vessel coronary artery disease (DVCAD) with total occlusion of proximal LAD following an anterior myocardial infarction (MI). Nevertheless he had been continuing on medical management despite recommendation for revascularization. It was also reported that he had LV dysfunction with LV ejection fraction of 30%.

The clinical examination revealed evidence of congestive cardiac failure (CCF) with blood pressure of 100/80 and heart rate of 98 per minute. 2D echocardiogram demonstrated dilated left ventricle with preserved LV muscle mass and poor left ventricular ejection fraction(LVEF) of 30% with mild to moderate mitral regurgitation.

In this case several important problems were identified i.e. significant symptomology, LV dysfunction, poor quality of life with clinically significant large area of viable myocardium (LAD territory) requiring urgent revascularization. Furthermore, it was revealed that he had financial constraints forestalling optimal utilization of important supportive measures such as intra-aortic balloon pump (IABP), cardiac pacing, artificial ventilation and continuous renal replacement therapy (CRRT) in case of revascularization.

A consultative discussion was made with regard to the urgent need for revascularization either with PCI or CABG with the patient and his family. Having discussed with all parties concerned it was decided to go ahead with accessible resources to open the over ten months old LAD CTO with PCI. However, patient was informed that supportive devices were kept for a backup plan in case of unsuccessful revascularization with PCI.

Diagnostic coronary angiogram via right radial access confirmed moderate stenosis of distal left main coronary artery (LMCA) with total occlusion of proximal LAD with a tapering stump. (Figure: 1 & Figure: 2) There was slow retrograde flow via collaterals from right coronary artery (RCA). (Figure: 3) Left circumflex artery (LCx) was non dominant. Two obtuse marginal branches (OM) were proximally moderately narrowed with normal RCA.

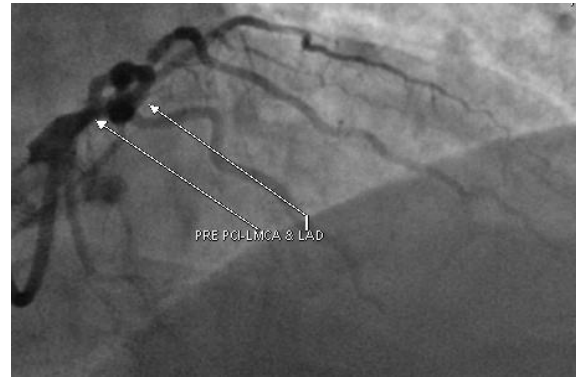


Figure 1- LCA injection AP Cranial view

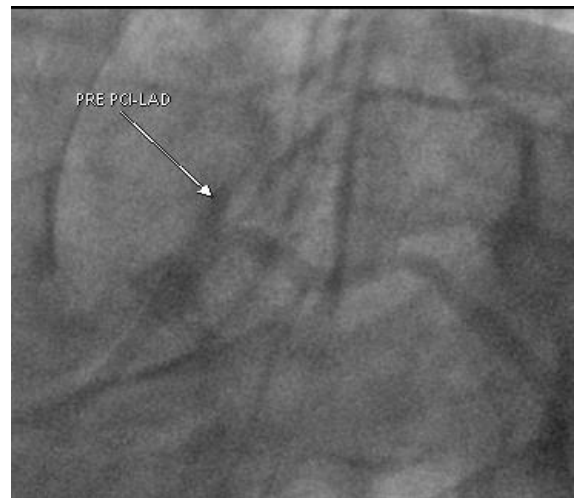


Figure 2- LCA injection LAO caudal view



Figure 3- RCA injection RAO view



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The diagnosis of double vessel CAD with significant distal LMCA disease was confirmed. Subsequent to coronary angiography PCI to LAD CTO was performed through the right radial approach. LMCA was cannulated with XB3 6F guiding catheter and LAD CTO lesion was successfully crossed with a 0.014" Miracle 6 guide wire with 2 x 12mm Mini Trek balloon support. Following angioplasty and preparation of the LAD lesion, the guide wire was exchanged to a 0.014" Cruiser HFJ guide wire. Having examined the LAD, it was decided to deploy a 3.5mm x 48mm long Drug Eluting Stent (DES) covering proximal LMCA to mid LAD. Subsequent to deployment of LMCA-LAD stent, LMCA was post dilated with a 4mm x 8mm Euphora balloon at 18 atms to achieve optimum results. Post procedure angiographic results confirmed excellent results with TIMI III flow in the LAD, LCx and branches. (Figure: 4 & 5)



Figure 4- LCA injection with AP cranial view

The moderate narrowing of proximal OM branches were left for medical management. The total volume of contrast used was less than double the eGFR (in ml) of this patient and total radiation time was less than 35 minutes for the procedure. The patient was observed for first 24 hours in the coronary care unit. He was free of complications. He was transferred to cardiac ward on day 2 and was fit for discharge on day 4 with usual per oral medications (aspirin 75mg nocte, clopidogrel 75mg nocte, atorvastatin 40mg nocte, captopril 6.25mg bd, carvedilol 3.125mg bd, frusemide 20mg mane and spironolactone 25mg vesper).



Figure 5- LCA injection with LAO caudal view

It was also found that his renal functions were recovering slowly. He was reviewed in 2 weeks and 4 weeks. He reported that he has improved in exercise tolerance and was free of chest pain. Clinical examination revealed improvement of congestive heart failure.

Case discussion

In this case scenario we identified several challenging factors with regard to revascularization of a LAD CTO. Firstly there is no doubt that CABG is the gold standard of treatment in achieving complete revascularization in double vessel CAD with distal LMCA stenosis and proximal LAD CTO. Calculated SYNTAX score 1 was 33.5 and SYNTAX score 2 and 4 year mortality is 26.6% for PCI and 8% for CABG, clearly favouring CABG as the choice of revascularization in a patient with proximal LAD CTO with double vessel CAD and LMCA involvement, complicated with renal impairment and poor LV systolic dysfunction. Since the patient refused surgery and opted for PCI, the risks and the benefits of PCI were discussed with patient and other relevant parties concerned and it was decided to proceed to treat his condition with PCI. The presence of a tapering stump of LAD without side branch at the end of the stump and without bridging collaterals favoured the PCI by the anterograde approach in this case. CTO duration of ten months, moderate to long length of lesion and doubtful distal target vessel were considered unfavourable for successful outcome of retrograde



approach. It was decided to proceed with antegrade approach due to the presence of a good LAD proximal stump and the absence of septal collaterals.

This case scenario illustrates several points:

1. Importance of assessment of viability of myocardium clinically with the history and evidence of preserved left ventricular muscle mass by 2D echo.
2. Impairment of renal function of a patient with poor EF and hypotension can be misleading due to pre renal hypoperfusion and in fact post procedurally, the patient may demonstrate improvement of renal function as in this case.
3. The risk of contrast nephropathy should be minimized in the presence of renal impairment. During PCI this could be achieved using diluted contrast with normal saline (diluted in 1:1 ratio) ideally with non iodinated iso-osmolar contrast, hydrating the patient adequately, reducing the number of views to minimum requirements and injecting of small quantities of contrast, (maximum volume being less than double the patient's eGFR in ml. as concluded by expert analysis).
4. Ante-grade wire approach to the CTO in the absence of good septal collaterals to reduce complications due to retrograde approach with potential risk of pericardial effusions.
5. Decision to revascularize the patient with CTO by PCI should be based on symptoms, viability of large ischaemic myocardium and quality of life.

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