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Case report

Calcified left main stenosis – is there a room for us interventionalists?

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Abstract We present a case of 79 years old gentleman admitted to our institution suffering from low effort angina with dilated left ventricle, moderate mitral regurgitation and severely decreased left ventricular ejection fraction (LVEF) of 15%. he had cholangiocarcinoma that has been scheduled for surgery. Coronary angiography revealed occluded right coronary artery in the middle segment and critical lesion of distal left main (LM) and significant stenosis of proximal left anterior descending (LAD) artery with extensive calcifications. Patient was denied surgery and underwent complex PCI of distal LM with mechanical circulatory support (MCS) using intravascular lithotripsy. Use of advanced calcium treatment techniques should be supplemented with intravascular imaging especially in LM lesions in order to assess the vessel, lesion preparation and result after stent implantation. MCS might provide useful hemodynamics support in complex PCI where prolonged balloon inflations and calcium treatments are used.

Kew words low ejection fraction, complex calcific lesion, mechanical circulatory support, intravascular lithotripsy

Case presentation

We here present a case of 79 years old gentleman admitted to our institution suffering from low effort angina in Canadian Cardiovascular Society (CCS) class III and New York Heart Association (NYHA) class II. He was previously treated for hypertension and diabetes on oral medications. He received aspirin, beta blocker, angiotensin converting enzyme (ACE) inhibitor, trimetazidine, furosemide and spironolactone. His estimated glomerular filtration rate was eGFR 100ml/min/m^2. Transthoracic echocardiography revealed dilated left ventricle 63/45mm, enlarged left atrium of 51mm, moderate mitral regurgitation and severely decreased left ventricular ejection fraction (LVEF) of 15%. His right heart systolic function was preserved with TAPSE of 19 but there was moderate tricuspid regurgitation with increased estimated right ventricular systolic pressure (RVSP) of 65mmHg. At the admission he reported being examined for cholangiocarcinoma (Klatskin type I) that has been scheduled for surgery.

His coronary angiography revealed occluded right coronary artery in the middle segment and critical lesion of distal left main (LM) and significant stenosis of the proximal left anterior descending (LAD) artery with extensive calcifications in both coronaries (Figure 1).

Patient underwent thorough evaluation by the institutional Heart team with SYNTAX score of 33 and SYNTAX II score estimating four years mortality of 63% with PCI and 30.6% with coronary bypass grafting (CABG), while surgical risk scores were Euroscore II 14.38% and STS score 2.5% mortality and 15.4% morbidity with surgery. Although surgical risk scores demonstrated lower mortality with surgery patient was denied surgery due to very low LVEF and presence of cancer.

Patient underwent PCI via right radial approach with transfemoral implantation of mechanical circulatory support (MCS) device iVAC 2L (PulseCath BVm Arnhem, The Netherlands). We used extra back up guiding catheter in 7 F size, wired both branches LAD and Cx and performed optical coherence tomography (OCT) using DragonFly Optis catheter (Abbott Vascular, Santa Clara, CA, US) in order to evaluate vessel size, plaque distribution and extent of calcifications. Recording from LAD demonstrated calcified nodule at distal LM protruding into LAD severely reducing lumen area, while pullback from Cx revealed mild calcifications with preserved ostial lumen and absence of plaque at the ostium of Cx (Figure 2). Initial plan was to use "provisional" strategy and to implant stent from LM to LAD. Predilatation was done using 2.5x12mm non-compliant balloon then Shockwave balloon 3.0x12mm (Shockwave Medical Inc., Santa Clara, CA, US) was used with four pulses in proximal LAD and LM. The control angiography revealed dissection extending towards Cx and we've changed initial strategy of "provisional" to two stent strategy with "culotte" stenting. First, we've implanted 2.75x18mm and 3.26mm DES in proximal to middle LAD then after Shockwave treatment of ostial Cx with two pulses we've

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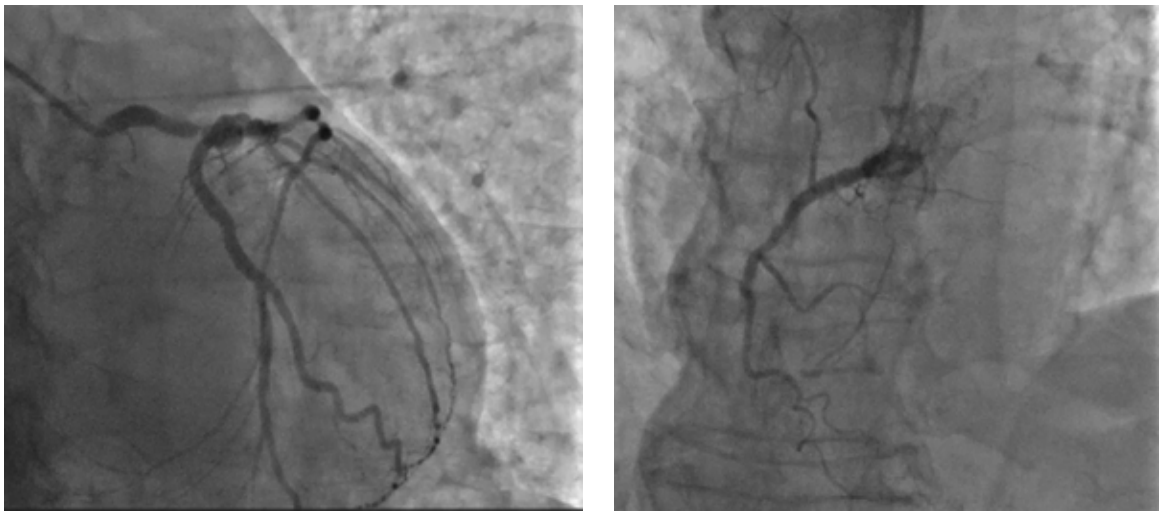

Figure 1. Coronary angiography of left and right coronary artery

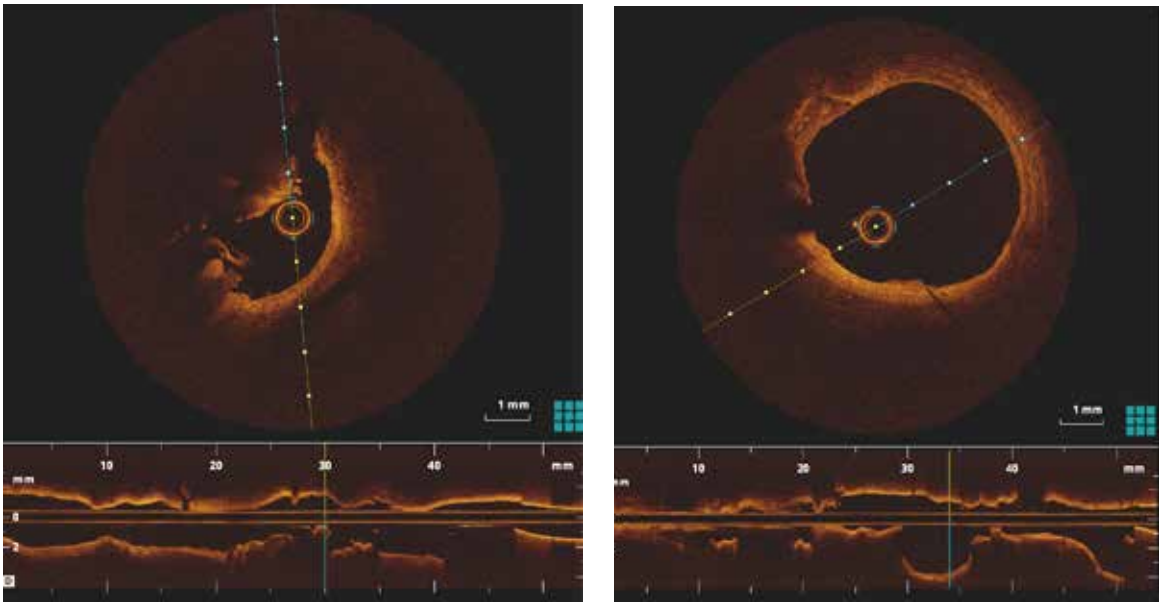

Figure 2. OCT pullback from LAD (left) and Cx artery (right)

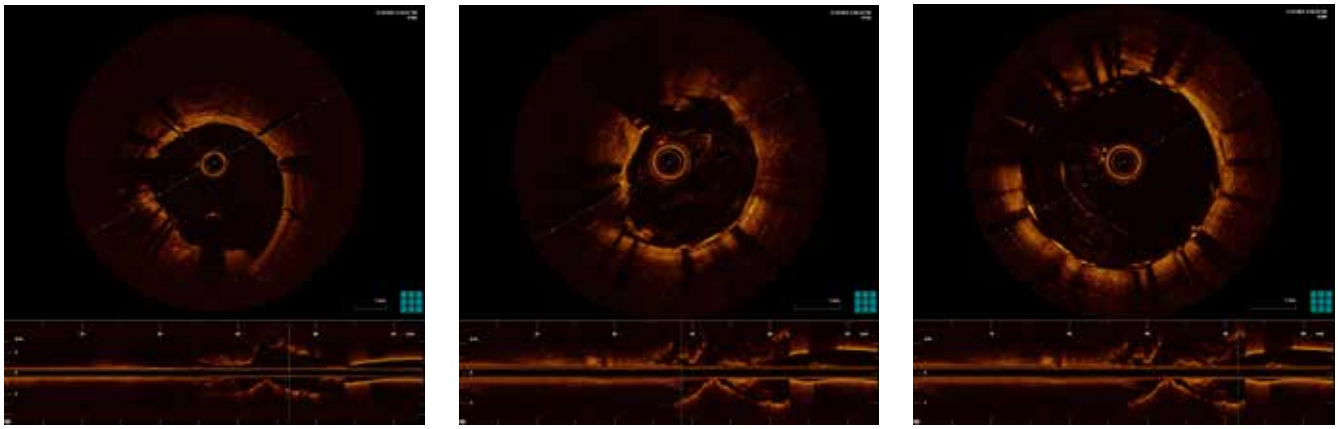

Figure 3. Final OCT run of the left LM, middle LAD, and Cx coronary artery

implanted 3.5x24mm DES from Cx to LM, then after proximal optimization treatment (POT) in LM with 4.5x6mm NC balloon, we've opened the strut towards LAD and implanted 3.5x34mm DES from LM towards LAD. After stent implantation, kissing balloon inflation was done using 3.5x15mm NC balloon in LAD and 3.0x15mm balloon in Cx with inflation up to 8 atm. Finally rePOT was done in LM using 5.0x12mm NC balloon with high pressure inflation (Figures 3 and 4).

Patient had an uneventful stay in hospital and was discharged two days later. He was seen in an office visit after six months free from angina and doing well in NYHA class II.

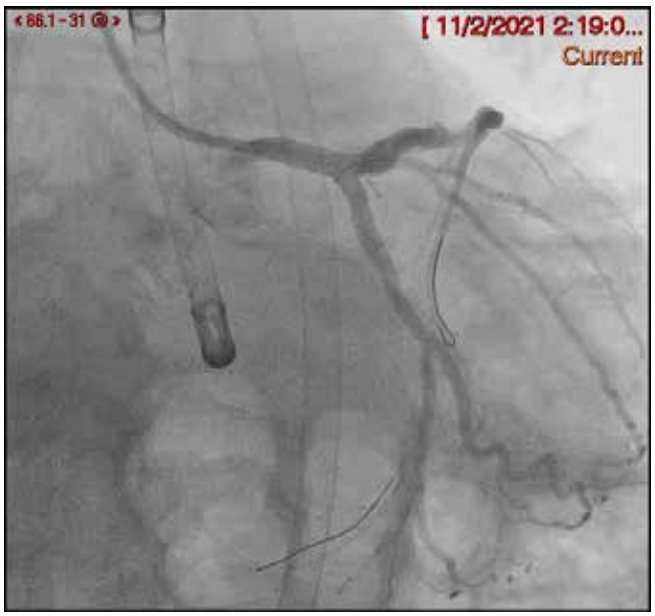

Figure 4. Final angiography of the left coronary artery

Discussion

Left main coronary artery supplies blood to almost two thirds of the heart in a right dominant system, while in left dominant system entire myocardium receives blood from the left coronary artery. Knowing this, atherosclerotic disease of LM jeopardizes a large myocardial territory and could be the cause of substantial mortality and morbidity[1]. Atherosclerosis develops mostly at arterial branching points and that applies to LM disease which is in around 80% of cases at the bifurcation with left anterior descending (LAD) and circumflex (Cx) artery[2].
Appropriate treatment for LM disease remains a matter of debate between interventional cardiologist and cardiac surgeons. Current European Society of Cardiology (ESC) guidelines suggest that in lesions with low anatomical complexity expressed as SYNTAX score below 22 percutaneous coronary intervention (PCI) can be equally effective option as coronary artery bypass grafting (CABG) in patients suitable for both types of revascularizations (3). On the other hand, recently published American Heart Association (AHA) guidelines on coronary revascularization state that CABG should be the first option for LM disease, while PCI can be a choice for selected patients with stable ischemic heart disease where both options are feasible[4]. In the largest meta-analysis comparing PCI and CABG patients with isolated LM disease there was no difference regarding five years mortality between PCI or CABG[5].
Due to prolonged life expectancy and development in medical treatment, severe coronary calcifications are more frequent findings in coronary angiographies. PCI can be very challenging in calcified lesions and is associated with increased rate of procedural complications and higher rate of adverse events due to inadequate lesion preparation, stent under-expansion and increased rates of stent thrombosis and re-stenosis[6]. In order to effectively treat calcified lesions several techniques have been developed like rotational atherectomy, orbital atherectomy and scoring or cutting balloons and their use is steadily rising in everyday practice. Intravascular lithotripsy (IVL) has been recently developed and has shown promising results in vast array of calcified lesions. However, LM calcified lesions, despite obvious challenges and added complexity in interventions, were frequently excluded from the registries[7]. There is a small registry of IVL in LM PCI from Salazar and associates that demonstrated feasibility of IVL use in LM stenosis. The study demonstrated significant reduction in diameter stenosis accompanied with achieving large minimal lumen diameters after PCI. The authors sent the word of caution regarding the prolonged inflation of IVL balloon in LM causing significant ischemia and suggested the abbreviated cycles of IVL treatment in order to reduce large myocardial territory ischemia[8].
In our case we did IVL using standard protocol that required full cycle of IVL pulses. However due to MCS with iVAC2L pump we achieved adequate lesion preparation with stable hemodynamics. Using OCT prior and after IVL treatment allowed vessel assessment before lesion preparation and the effects of calcified lesion treatment afterwards that can allow stent implantation in LM lesion that would not be compromised by stent underexpansion. Use of advanced calcium treatment techniques should be supplemented with intravascular imaging especially in LM lesions in order to assess the vessel, lesion preparation and result after stent implantation. In the future we expect IVL to be compared in a randomized fashion to other calcium treatments like non-compliant, high pressure or cutting balloons or mechanical atherectomy devices like rotational or orbital atherectomy.

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