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CASE REPORT

Use of Impella 2.5 device for hemodynamic support during a High Risk Unprotected Left main percutaneous coronary intervention

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Abstract:

The role of percutaneous interventions in complex coronary disease and complex patients has been steadily expanding over the recent years. Left main and multi-vessel coronary artery interventions post a unique set of challenges to interventional cardiologists; especially in elderly patients, patients with left ventricular dysfunction or renal insufficiency. This resulted in an ongoing need for a safe and effective circulatory device that is easy to insert and manage in order to reduce the risk of morbidity and mortality associated with these interventions. Here, we describe a case of multi-vessel intervention including the left main coronary artery in a patient with reduced ejection fraction and multiple occluded bypass grafts.

Keywords: Impella –hemodynamic support –high risk PCI – assist device

Case History:

A 69 years old male with hypertension, hyperlipidemia and coronary artery disease (CAD) with history of coronary artery bypass grafting (CABG) with left internal mammary artery (LIMA) to the left anterior descending artery (LAD) and reverse saphenous vein grafts (SVG) to the first diagonal artery and the first obtuse marginal (OM) artery presents with unstable angina 18 months after CABG. He was on 3 anti-angina agents and optimal medical therapy for CAD, there were no ECG changes and troponin levels were negative. Given his clinical presentation and past history, cardiac catheterization was performed. It showed 60-70% stenosis in the distal left main coronary artery (LMCA) (Photo 1), 50% ostial and 70% mid LAD stenoses, 90% stenosis in the proximal first diagonal, 80% ostial left circumflex artery (LCX) stenosis and a 70% stenosis in the second OM branch. The right coronary artery had mild to moderate disease. All bypass grafts were occluded except for SVG to the first diagonal. It was noticed that the native coronary arteries were small in caliber based on angiographic appearance and previous description in the CABG operative report. Left ventricular ejection fraction was moderately reduced at 40% with moderate global hypokinesis. Myocardial perfusion imaging showed ischemia along the LCX and distal LAD territory. The decision was made to proceed with multi-vessel percutaneous coronary intervention (PCI) with Impella® (Abiomed Inc, Danvers, MA, USA) hemodynamic support.

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Photo 1

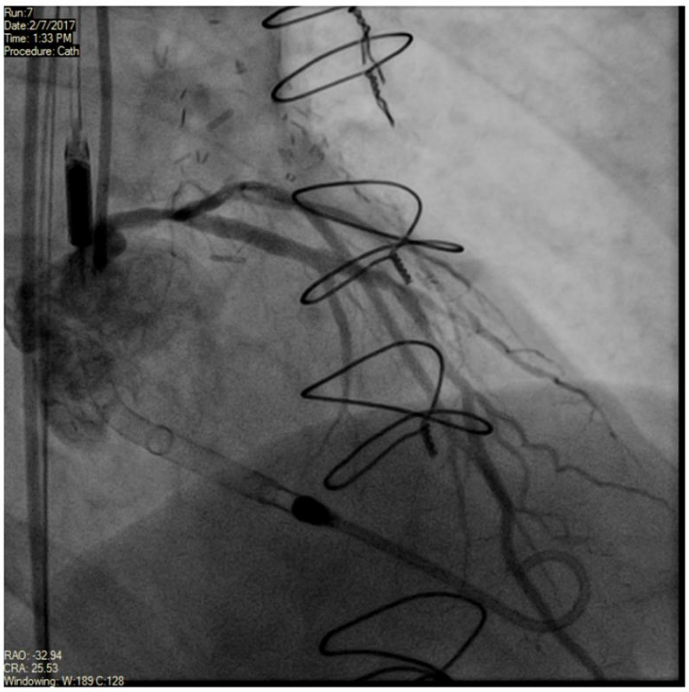
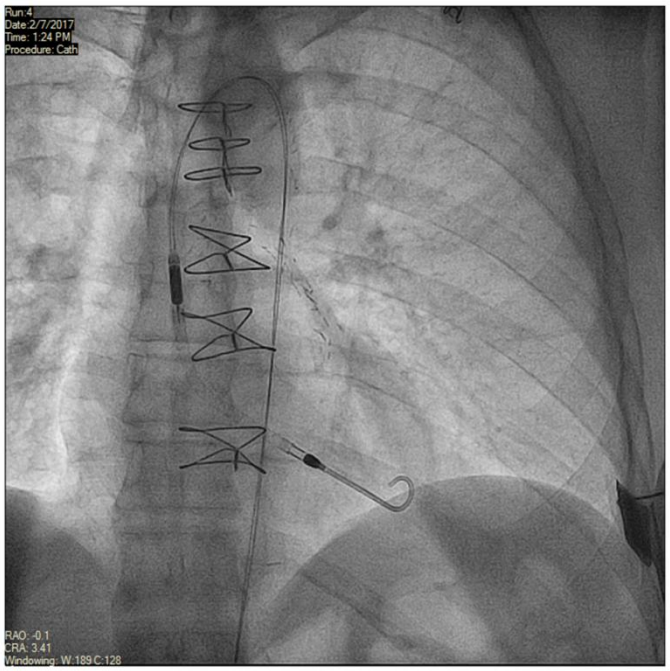


Photo 2



Right common femoral access was obtained and a pigtail catheter was used to obtain an abdominal aortogram with bilateral iliac angiograms. The size of the left iliac artery was adequate for Impella® 2.5 insertion. The Impella device was inserted via left common femoral access using a 13 French sheath and placement was confirmed both with fluoroscopy and console placement signal

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(Photo2). The device provided blood flow per minute. This flow rate was adequate for hemodynamic support for the patient's body surface area (1.77 m^2).

The LMCA was engaged with a 6 Fr Judkins Left 4.0 guiding catheter and the mid LAD lesion was crossed with a Marvel® guide wire (Boston Scientific Corp – Marlborough, MA, USA). The lesion was pre-dilated with a 2.0x15 mm compliant balloon and then a 2.25x32 mm Synergy® drug eluting stent (Boston Scientific Corp – Marlborough, MA, USA) was deployed. Post dilation was performed with a 2.5x20mm non-compliant balloon. The wire was left in place in the LAD and a second guide wire was used to cross the mid-LCX lesion. This lesion was pre-dilated with a 2.0x15 mm compliant balloon then a 2.5x24 mm Synergy® drug eluting stent was deployed and post-dilated with a 2.5x20 mm non-compliant balloon. The between 1.8 and 2.0 liters LMCA lesion was then pre-dilated with a 2.0x15 mm compliant balloon utilizing the wire into the LCX. There was a mild drop in blood pressure with balloon inflation but no change in Impella flow. A 2.5x20 mm drug eluting stent was deployed in the LMCA into the LCX. There was 70% residual ostial LAD stenosis after stent deployment. The LAD wire was then retracted and used to re-wire the LAD through the LMCA stent struts. The LMCA stent was post-dilated with a 2.75x15 mm non-compliant balloon. The ostial LAD was dilated with a 2.5x12 compliant balloon with 30% residual stenosis (Photo3).

The patient was transferred to the intensive care unit and the Impella catheter and sheath were removed with good haemostasis using manual pressure. He was discharged the next day in good condition. At one week and six-week outpatient follow-up visits, he had no residual angina.

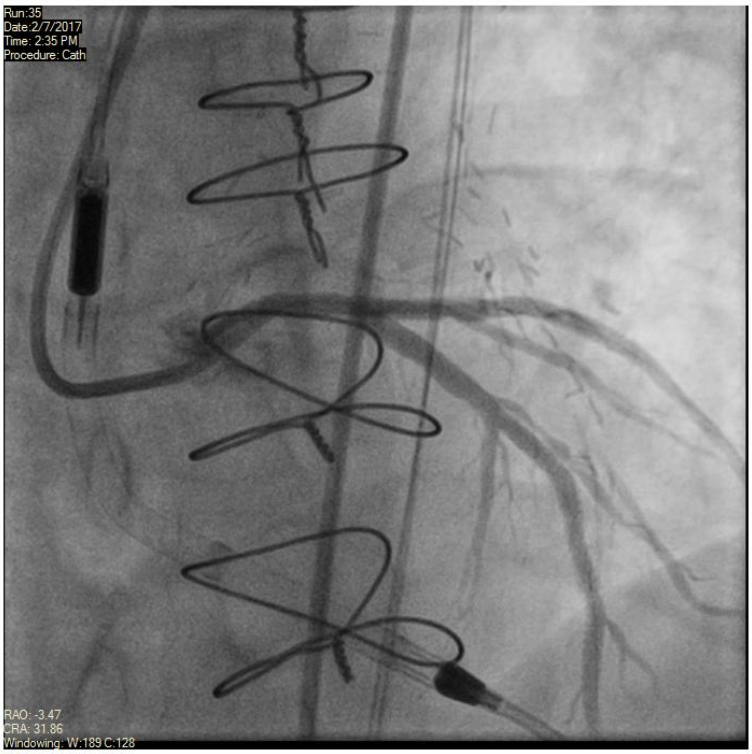

Photo 3

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Discussion:

Complete coronary revascularization in patients with multi-vessel CAD was associated with lower mortality, myocardial infarction and repeat revascularization compared to incomplete revascularization (1, 2). Although CABG remains the preferable revascularization strategy in such patients the role of percutaneous coronary intervention (PCI) has been expanding in the recent years. This is especially true in patients with severe co-morbidities, renal insufficiency, advanced age, reoperation or poor distal targets which make surgery a less attractive option(3). PCI in this patient population has several challenges both from a technical and logistical standpoint with longer procedure times, larger contrast volumes and hemodynamic compromise. The elective use of Intra-Aortic Balloon Pump (IABP), as the usual hemodynamic support device, in high risk PCI has not shown a significant and reproducible reduction in adverse cardiac outcomes in several studies (4,5).

The ideal cardiac support device for the cardiac catheterization laboratory provides effective support for both elective high-risk PCI, as well as cardiogenic shock. For elective high-risk patients, the goal is to maintain stable hemodynamics, provide more time for complex PCI by raising the patient's ischemic threshold to minimize myocardial cell damage from balloon inflation or coronary dissection; and provide prophylactic safety in case of complications (6).

Impella is a catheter mounted micro-axial flow pump capable of pumping blood from the left ventricle into the ascending aorta. The cannula is positioned across the aortic valve with the inlet portion in the left ventricle and the outlet portion in the aortic root. Impella 2.5 and Impella CP are placed percutaneously while Impella 5.0 requires surgical cut-down (these pumps provide up to 2.5 liters, 3.5 liters and 5 liters of flow per minute, respectively). The pump is powered and controlled by an external console(7). The pump motor diameter is 12 French (Fr) for Impella 2.5, 14 Fr for Impella CP and 21 Fr for Impella 5.0(8). We used Impella 2.5 device in our patient given the small size of the left iliac artery.

The safety of Impella 2.5 device use for high risk PCI was demonstrated by several studies showing no limb ischemia, valve trauma or aortic regurgitation (9, 10) and only a small incidence of device related bleeding.

In PROTECT-II trial, it was concluded that hemodynamic support with Impella compared with intra-aortic balloon pump during high risk PCI resulted in improved event free survival at 3 months follow-up(12).

Conclusion:

The use of Impella for hemodynamic support in high risk PCI is well described in the literature. This case report illustrates that PCI remains a valid option for patients who are at high risk after early multi-graft failure. This patient's option would have otherwise been unprotected high risk intervention or redo CABG with high potential graft failure. The Use of intravascular ultrasound would have been a reasonable step to take for accurate sizing of the LMCA.

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