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INTERNATIONAL JOURNAL OF ADVANCED RESEARCH (IJAR)

Article DOI: 10.21474/IJAR01/20770
DOI URL: http://dx.doi.org/10.21474/IJAR01/20770

RESEARCH ARTICLE

IMPELLA-SUPPORTED HIGH-RISK PCI AS AN ALTERNATIVE TO CABG IN A PATIENT WITH SEVERE LV DYSFUNCTION AND MULTIVESSEL DISEASE.

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Manuscript Info

Manuscript History
Received: 17 Febuary 2025
Final Accepted: 21 March 2025
Published: April 2025

Key words:-
High risk percutaneous coronary intervention, case report, rotablation, coronary artery bypass graft, dk crush technique, severely impaired lvef, impella

Abstract

A 78-year-old male with non-ST elevation myocardial infarction (NSTEMI) and severe left ventricular dysfunction (LVEF 25%) underwent Impella-supported high-risk percutaneous coronary intervention (PCI) for complex multivessel coronary artery disease. Coronary angiography performed via the right radial approach revealed significant disease in the left anterior descending artery (LAD), obtuse marginal branch (OM), and right coronary artery (RCA). Impella-assisted PCI to the left main and LAD using rotational atherectomy and a cutting balloon was successfully performed without complications.
This case highlights that Impella-supported high-risk PCI can serve as a viable alternative to coronary artery bypass grafting (CABG), demonstrating favorable short- and long-term outcomes, particularly in patients where individualized risk assessment and comorbidities complicate the choice of revascularization strategy.

Introduction:-

The demand for complex percutaneous coronary interventions (PCI) is increasing, particularly among frail patients with severely impaired left ventricular ejection fraction (LVEF) and complex coronary artery lesions who are considered unsuitable for surgical revascularization. Historically, these patients were often denied PCI due to the high risk of hemodynamic compromise and recurrent ischemia. However, they now represent a growing proportion of candidates for the procedure [1,2].

Mechanical circulatory support devices, such as the Impella, have broadened the scope of PCI by providing sufficient coronary and systemic perfusion during high-risk interventions [1,2]. Current guidelines support the use of high-risk PCI, especially in centers without on-site surgical backup, acknowledging the limitations of medical therapy alone in this patient population [3,4].

Here, we present a case of successful Impella-supported high-risk PCI performed in our cardiac catheterization laboratory.

Case Presentation:

A 78-year-old male with a history of type 2 diabetes mellitus, hypothyroidism, and stage 3 chronic kidney disease was admitted to the cardiology department with retrosternal chest pain that worsened with exertion. The patient was hemodynamically stable, with normal jugular venous pressure and heart sounds. A 12-lead ECG (Figure 1) revealed ST-segment depression in leads I, II, aVF, and V4–V6, along with mild ST-segment elevation in leads aVR and V1.

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Elevated troponin levels confirmed the diagnosis of non-ST elevation myocardial infarction (NSTEMI). The patient was initiated on medical therapy, including ramipril, bisoprolol, aspirin, ticagrelor, atorvastatin, glyceryl trinitrate spray, and omeprazole.

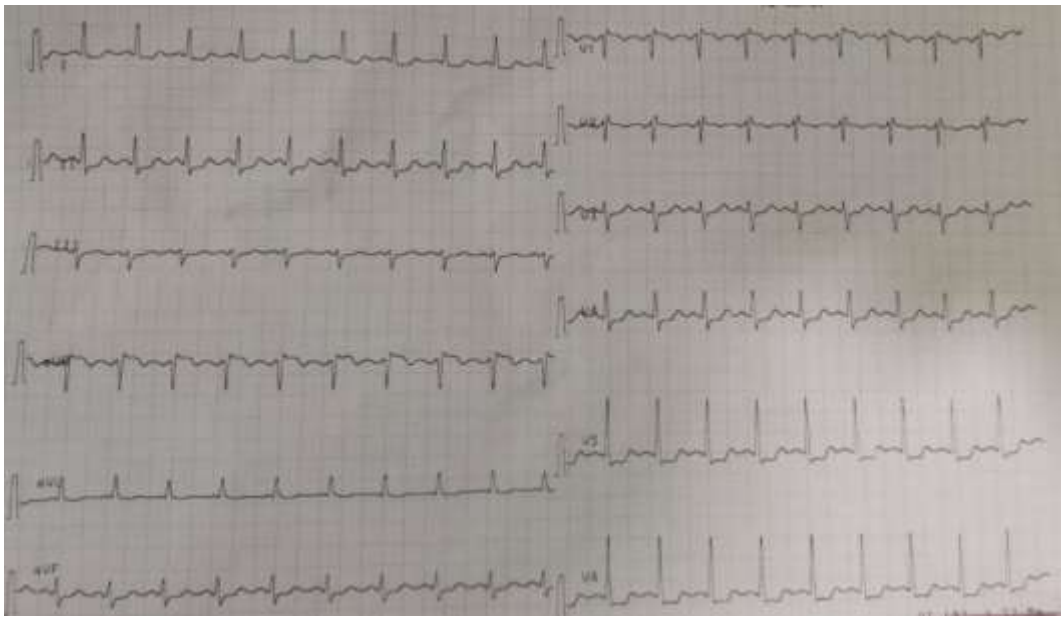

FIGURE 1: ECG findings on admission.

Initial transthoracic echocardiography (TTE) (Figure 2) revealed severely reduced left ventricular (LV) systolic function with an ejection fraction (LVEF) of 25%, along with regional wall motion abnormalities characterized by akinesis of the mid to apical inferoseptal, anterior, and inferior walls. Mild mitral regurgitation was noted, while right ventricular (RV) size and function were within normal limits. Based on these findings, dapagliflozin and eplerenone were added to the patient's medical regimen, and sacubitril/valsartan was initiated in place of ramipril. and sacubitril/valsartan was substituted for ramipril.

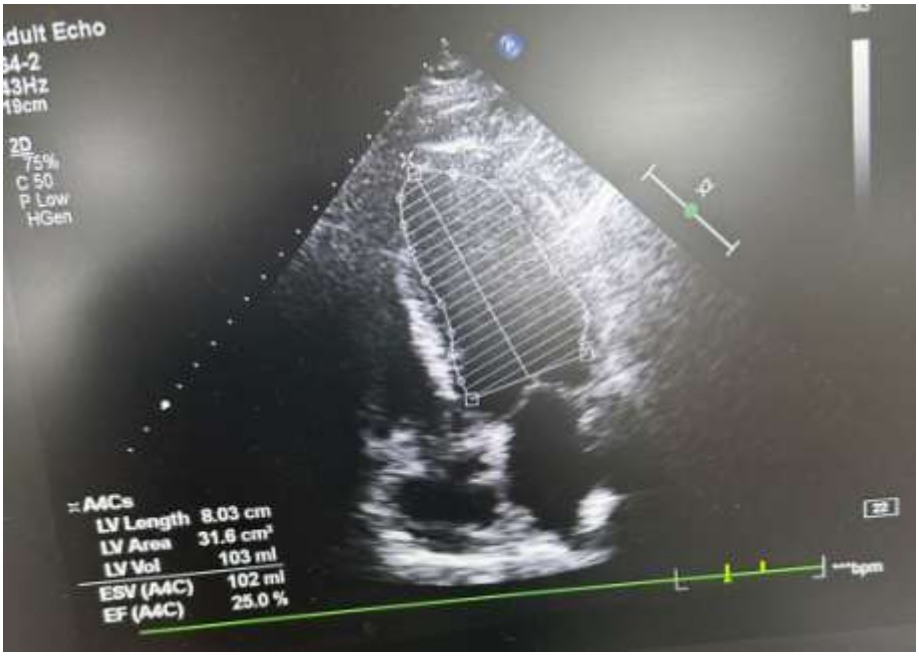

FIGURE 2: Initial transthoracic echocardiography

Coronary angiography revealed a non-significant plaque in the distal left main. The left anterior descending artery (LAD) was classified as Type III, with a 99% stenosis at the ostial to proximal segment, accompanied by severe calcification. The mid-LAD exhibited a 90% stenosis, also heavily calcified. The left circumflex artery (LCX) was non-dominant, with a 50% stenosis in its proximal segment. A major obtuse marginal (OM) branch showed a 70% stenosis in the proximal segment, with associated calcification (Figure 3).

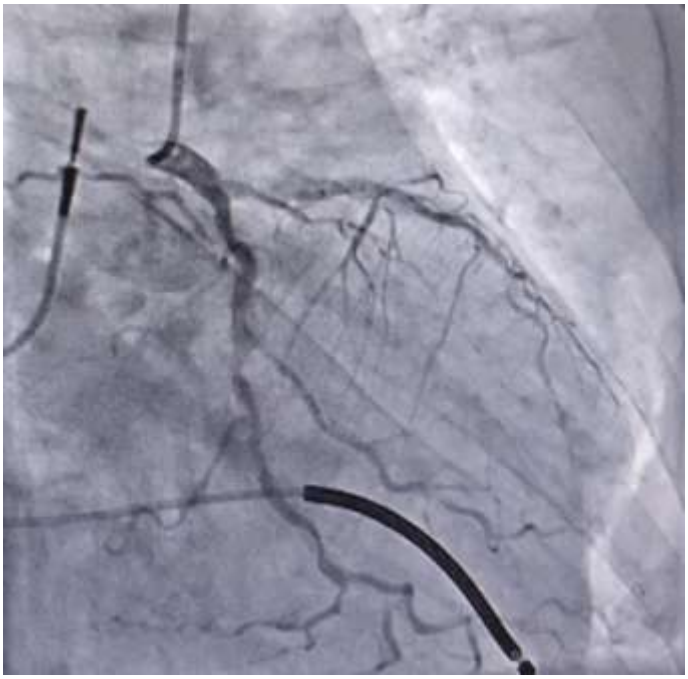

Figure 3: Coronary angiography of the left coronary system.

The right coronary artery (RCA) was dominant, with diffuse disease extending from the proximal to mid segments, showing a maximum stenosis of 80%. The distal RCA demonstrated a 90% stenosis. The posterior descending artery (PDA) and posterolateral ventricular (PLV) branch exhibited diffuse disease with a small vessel caliber (Figure 4).

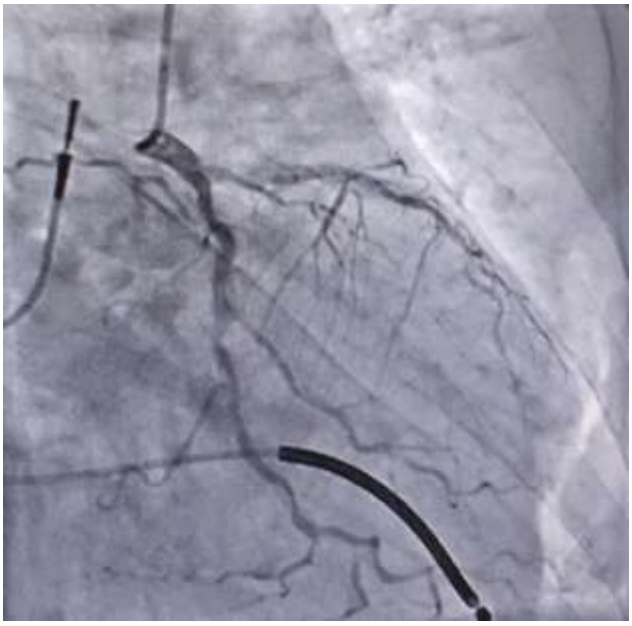

Figure 4: Coronary Angiography Of The Right Coronary Artery.

Given the patient's frailty, advanced age, and multiple comorbidities, the multidisciplinary team (MDT) comprising interventional cardiologists and cardiac surgeons concluded that complex Impella-supported high-risk percutaneous coronary intervention (PCI) was the most appropriate treatment strategy, as opposed to coronary artery bypass grafting (CABG).

To evaluate the feasibility of large-bore vascular access, a CT aortogram was performed. The scan demonstrated patent thoracic and abdominal aortas, iliac arteries, and common femoral arteries, with no evidence of obstructive plaque or significant tortuosity.

Under conscious sedation and ultrasound guidance, a team of interventional cardiologists and Impella specialists performed a complex PCI of the left main to the left anterior descending artery (LAD), supported by an Impella CP device. The procedure included rotational atherectomy and cutting balloon angioplasty. Ultrasound-guided insertion of a 14F Impella CP device was performed via the right femoral artery, with closure planned using a single ProGlide device. A multipurpose A (MPA) diagnostic catheter was placed in the right atrium to assess intracardiac pressures."

Following Impella insertion, a 7 Fr EBU 3.5 guide catheter was advanced via left femoral access. A Fielder FC wire with a SuperCross microcatheter was used to cross the lesion. Predilatation was performed using a 1.5 × 12 mm semi-compliant balloon at 12 atm, followed by a 2.5 × 12 mm semi-compliant balloon at 11 atm, and a 2.5 × 10 mm Wolverine scoring balloon at 20 atm.

Rotational atherectomy was then performed with a 1.25 mm burr at 180,000 rpm using the Rotapro system over a RotaWire. A 2.25 × 38 mm Synergy drug-eluting stent (DES) was deployed at 11 atm in the mid-to-distal left anterior descending artery (LAD), facilitated by a GuideLiner catheter. This was followed by deployment of a 2.75 × 48 mm Xience Xpedition DES at 12 atm in the proximal-to-mid LAD, overlapping the previously placed stent.

A 3.5 × 28 mm Xience Sierra DES was then deployed from the left main to the proximal LAD at 12 atm. Proximal optimization technique (POT) was performed using a 4.5 × 8 mm non-compliant balloon at 16 atm, and final post-dilatation was completed with a 3.5 × 12 mm non-compliant balloon at 22 atm. Optical coherence tomography (OCT) guidance was used to optimize the final result.

The Impella device was weaned off and safely removed on the table. The access sites were closed using a ProGlide closure device.

Immediate post-procedural vascular ultrasound and TTE showed no evidence of bleeding or effusion, and no intra- or post-operative arterial dissections were observed.

FIGURE 5: Angiographic images showing the Impella device and drug-eluting stents in the left main stem (LMS) to the left anterior descending artery (LAD) following rotational atherectomy and cutting balloon angioplasty.

The patient remained clinically stable and was discharged two days after the procedure. He has a scheduled follow-up appointment in the Cardiology clinic in three months for regular assessment of his LV function, after which a staged PCI with or without rotablation to the RCA will be considered.

Discussion.

This case report describes the successful management of an elderly, frail patient with multiple comorbidities who was admitted with a non-ST elevation myocardial infarction (NSTEMI) and found to have ischemic cardiomyopathy with severely calcified multivessel coronary artery disease (CAD). The case highlights the advantages of Impella-assisted complex percutaneous coronary intervention (PCI) over conservative medical therapy. The Impella device is increasingly used in high-risk PCI due to its ability to enhance hemodynamic stability by improving perfusion pressure and delivering up to 3.5 L/min of cardiac output [5,6].

To guide decisions regarding revascularization—including the appropriateness of PCI in inoperable patients—the European Society of Cardiology (ESC) guidelines recommend risk stratification using scoring systems such as SYNTAX I, SYNTAX II, and EuroSCORE [1,2]. The SYNTAX score, used by clinicians to evaluate the anatomical complexity of coronary artery disease (CAD), also serves as a predictor of major adverse cardiovascular and cerebrovascular events (MACCE) following either PCI or coronary artery bypass grafting (CABG). Higher SYNTAX scores are associated with more complex coronary disease and a less favorable prognosis.

The features that contribute to the utility of the Impella device in high-risk PCI are summarized in Table 2.

In relation to:	Criteria
The patient	Advanced age, heart failure, previous cardiac surgery, presence of valvular heart disease, diabetes, chronic obstructive pulmonary disease, chronic kidney disease, peripheral vascular disease
The hemodynamic state of the patient	High LV end-diastolic pressure, severely impaired cardiac output, anticipated long duration of ischemia, reduced mean arterial pressure, extensive areas of myocardial tissue at risk, ventricular arrhythmias
Anatomy of the coronary arteries	Multiple vessel disease, chronic total occlusion, severely calcified lesion/long lesions, complex lesions at bifurcations, one remaining vessel, unprotected left main vessel

Table 2: Established Criteria for Identifying High-Risk PCI

Conclusion:

This case highlights the importance of individualized risk assessment and multidisciplinary decision-making in selecting the optimal revascularization strategy for high-risk patients. Impella-supported PCI represents a promising alternative, offering the potential for favorable short- and long-term outcomes in this challenging patient population.

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