Case Report: Strategic Large-Bore Access and Impella Support for Complex High-Risk PCI After Recent Stroke and Myocardial Infarction

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Abstract

An 82-year-old male presented with a transient ischemic attack, acute myocardial infarction, and acute kidney injury, attributed to hemodynamic instability caused by sepsis from right foot cellulitis. Imaging revealed a chronic occlusion of the left middle cerebral artery M1 segment and severe triple-vessel coronary artery disease, including left main bifurcation involvement with double chronic total occlusions. The patient underwent successful Impella-assisted percutaneous coronary intervention to the left main bifurcation using the Culotte technique, along with revascularization of the proximal to middle left anterior descending artery and proximal left circumflex artery. Following antibiotic treatment, dual antiplatelet therapy, and Impella CP-assisted percutaneous coronary intervention, the patient showed marked improvement in hemodynamic status, neurological symptoms, and chest discomfort. This strategy successfully obviated the need for urgent coronary artery bypass grafting or veno-arterial extracorporeal membrane oxygenation.

Keywords: Impella, hemodynamic support, high-risk PCI, left main bifurcation, chronic total occlusion

Introduction

Patients with concomitant cerebrovascular and coronary artery disease exhibit heightened susceptibility to hemodynamic fluctuations, which can precipitate or exacerbate transient ischemic attacks (TIAs) and myocardial infarctions (MIs). The management of acute coronary syndromes complicated by concurrent neurologic events, septic hemodynamic compromise, and multivessel coronary artery disease represents a challenging clinical scenario. When combined with left main (LM) bifurcation disease and chronic total occlusions (CTO), early decision-making regarding optimal revascularization strategies becomes particularly complex due to hemodynamic and periprocedural risks. Older adults with high anatomical complexity, impaired physiological reserve, and acute kidney injury (AKI) face substantial procedural risk, whether treated with either coronary artery bypass grafting (CABG) or complex percutaneous

Received: Nov. 17, 2025; Accepted: May 22, 2026
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coronary intervention (PCI). Mechanical circulatory support, often utilized in complex high-risk indicated PCI as defined by the British Cardiovascular Intervention Society (BCIS CHIP-PCI) score, may provide an opportunity to stabilize hemodynamics, reduce ischemic burden, and facilitate controlled revascularization when conventional PCI is deemed unsafe.

We present an elderly patient who arrived with acute focal neurological deficits, septic hemodynamic compromise, and acute MI, subsequently found to have severe LM bifurcation disease with concurrent double CTOs. This case highlights the diagnostic complexity of overlapping TIA, AMI, and AKI, illustrating the clinical decision-making process that guided the choice of Impella-assisted PCI over CABG. It also underscores the importance of pre-procedural vascular access assessment, careful hemodynamic monitoring, and contemporary large-bore closure techniques in ensuring procedural safety and a successful recovery.

Case presentation

An 82-year-old man with hypertension presented to the emergency department with acute-onset aphasia and right arm weakness occurring 3 hours before arrival. He also reported redness, swelling and tenderness in his right foot. On arrival, he was delirious with a Glasgow Coma Scale score of E4V3M5 and was febrile at 38°C. Hypotension was noted (88/52 mmHg), while his heart rate (97 bpm), respiratory rate (18/min), and oxygen saturation (95% on room air) were otherwise stable.

A stroke code was immediately activated. Non-contrast brain computed tomography (CT) and perfusion CT excluded intracranial hemorrhage. However, a prolonged mean transit time accompanied by mildly reduced cerebral blood flow yet preserved blood volume in the left middle cerebral artery (MCA) territory suggested a chronic left MCA M1 occlusion. His neurological deficits almost completely resolved shortly after imaging, consistent with the diagnosis of TIA. Nonetheless, he developed acute chest pain afterward. Electrocardiography revealed ST-segment elevation in leads III and aVF with reciprocal depression in leads I and aVL, and ST-segment elevation in leads aVR and V1 with diffuse ST-segment depression, suggestive of an inferior–posterior ST-segment elevation myocardial infarction (STEMI) with possible left main coronary artery involvement (Figure 1).

Transthoracic echocardiography revealed a mildly reduced left ventricular ejection fraction (44%) with regional wall motion abnormalities involving the inferior, posterior and lateral walls, as well as the apex, along with mild-to-moderate aortic stenosis. Chest radiography showed cardiomegaly and mild pulmonary congestion (Figure 2). Laboratory studies were notable for leukocytosis (26.09 k/μL), AKI (creatinine 2.04 mg/dL, baseline 0.9 mg/dL), elevated high-sensitivity troponin T (37.66 ng/L) and lactate (2.68 mmol/L).

Given the working diagnosis of concurrent TIA and STEMI, initial conservative stabilization was initiated with cautious fluid resuscitation and low-dose norepinephrine support under strict surveillance of blood pressure, lactate clearance, and respiratory status. Dual antiplatelet therapy (Aspirin and clopidogrel) and unfractionated heparin were administered. Emergent coronary angiography revealed a complex LM Medina 0,1,1 bifurcation lesion, left anterior descending artery (LAD) 80% ostial stenosis, and diffuse proximal to middle LAD lesions with collateral branches supplying CTOs of both the distal left circumflex artery (LCx) and mid right coronary artery (RCA). The LCx had 80% ostial stenosis with distal CTO and collateral branches to RCA, and the RCA showed 50% proximal stenosis with a mid-vessel CTO and intracoronary collaterals (Figures 3 and 4). The SYNTAX score was 37.5.

The intricate clinical presentation was driven by dual organ ischemia (TIA and AMI) secondary to left MCA M1 and LM/LAD hypoperfusion, which was aggravated by septic hemodynamic

instability originating from right foot cellulitis. Facing an unprotected LM bifurcation disease with dual CTOs, the Heart Team engaged in a complex revascularization dilemma regarding the choice between CABG and mechanical circulatory support (MCS)–assisted PCI. Although CABG remains the Class I recommendation for left main and three-vessel disease, the patient's prohibitive surgical risk—driven by advanced age, recent neurological events, and active AKI (EuroSCORE II: 10.85%, BCIS CHIP score: 12)—challenged this conventional paradigm. PCI offered a more realistic strategy in terms of its minimal invasiveness, avoidance of endotracheal intubation, periprocedural hemodynamic stability, and favorable short-term recovery. When considering MCS for this high-risk PCI, Impella was favored over IABP

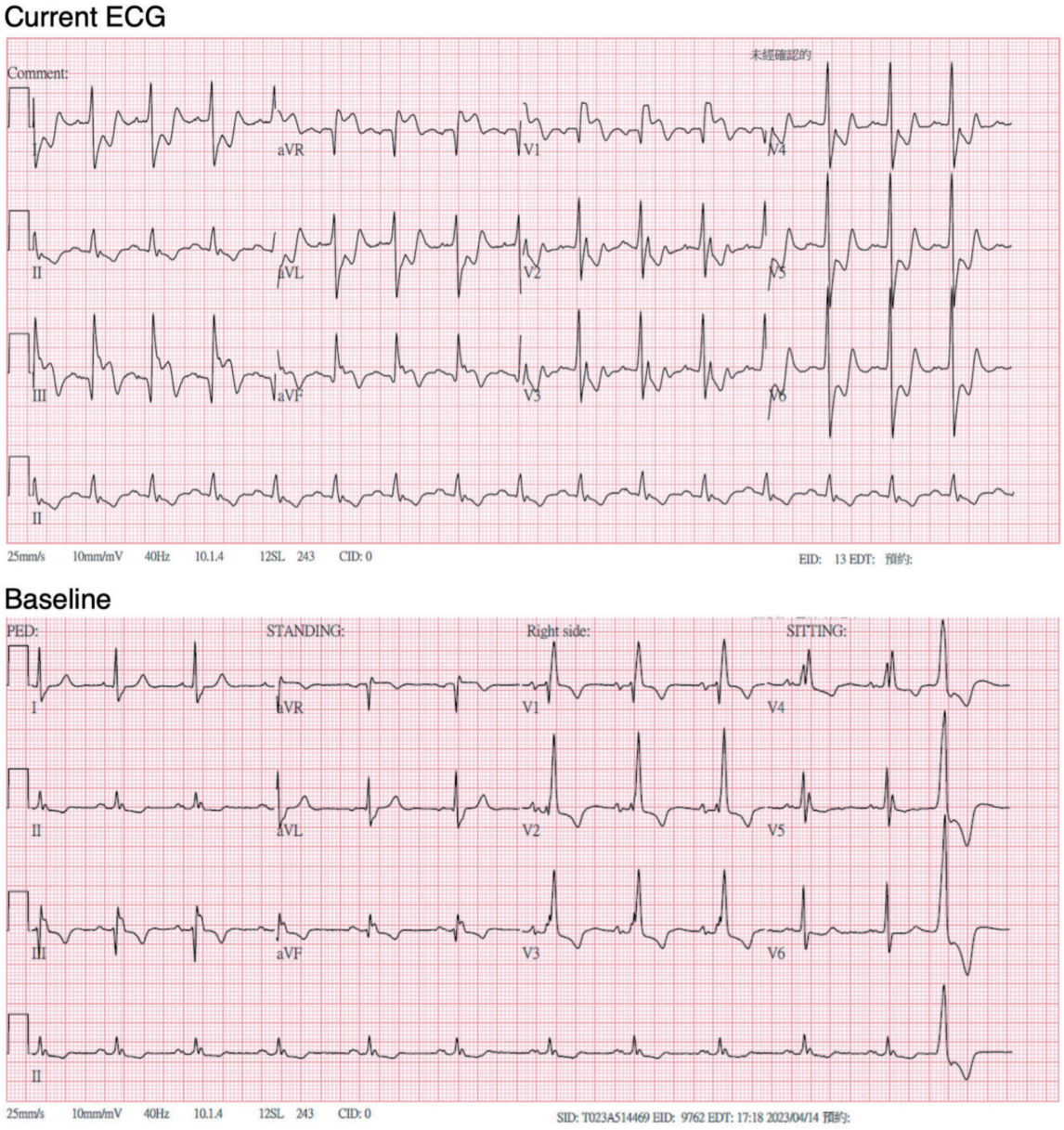

Figure 1. Electrocardiogram.

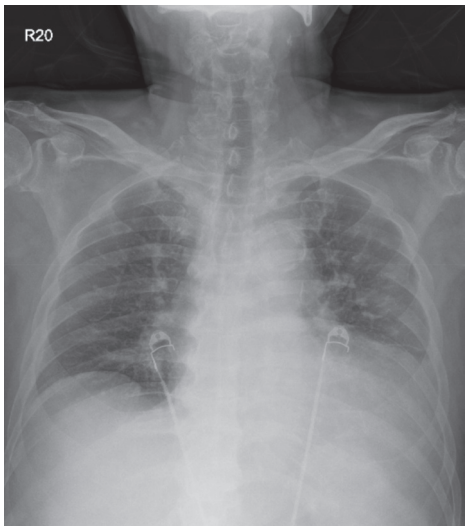

Figure 2. Chest X-ray.

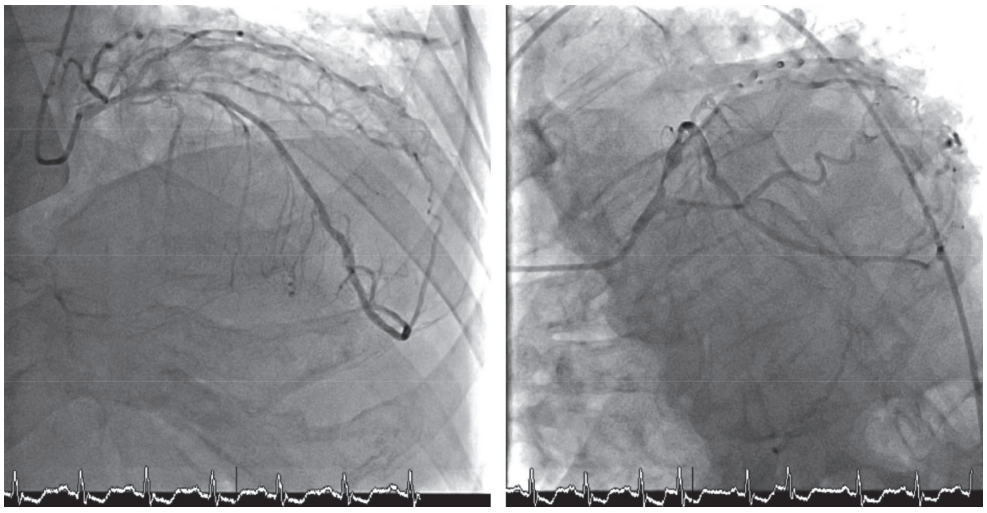

Figure 3. Diagnostic coronary angiography.

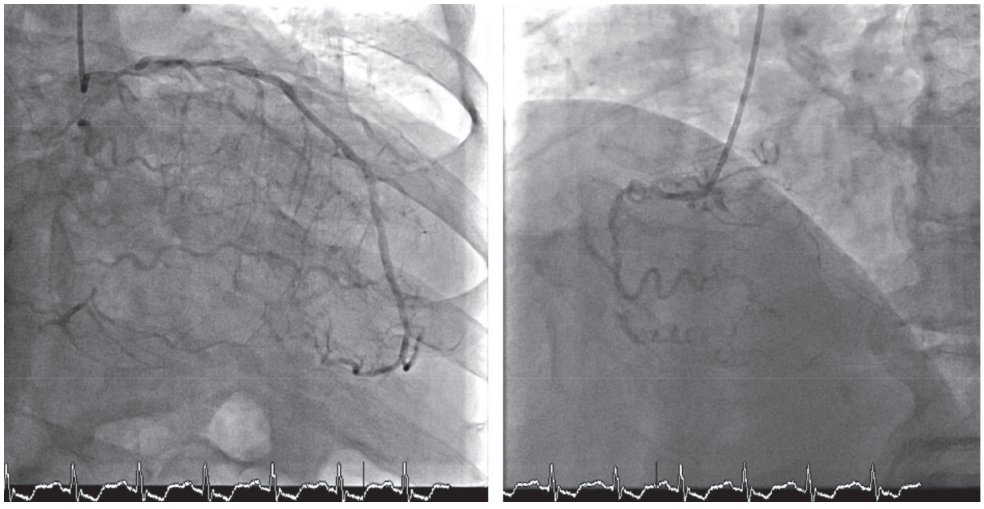

Figure 4. Diagnostic coronary angiography.

due to its superior hemodynamic support, and preferred over VA-ECMO because it provides physiological antegrade flow with less afterload burden. Ultimately, the Heart Team proceeded with Impella CP-assisted PCI over CABG, IABP, and VA-ECMO-assisted PCI.

Given the patient's AKI, a contrast-sparing approach using vascular duplex ultrasound was prioritized over CT for access planning, revealing bilateral peripheral artery disease, highlighted by severe left common femoral artery stenosis with calcified nodule (Figure 5). Contralaterally, a 6 Fr Terumo arterial sheath from the prior day's diagnostic angiography remained in situ in the right femoral artery. However, the right femoral artery was deemed unsuitable for Impella access due to a low puncture site within the right superficial femoral artery and an iatrogenic arteriovenous fistula identified during pre-procedural peripheral angiography assessment (Figure 6). Consequently, despite the plaque burden, large-bore access was successfully obtained via the left common femoral artery guided by contralateral injections and fluoroscopy (Figure 7), followed by the pre-deployment of the Perclose Proglide (Abbott Vascular, Santa Clara, CA) . The Impella Circulatory Support System CP (Abiomed, Danvers, MA) was then advanced into the left ventricle without complication. Baseline hemodynamics profile measured by pulmonary artery catheter demonstrated an elevated pulmonary artery wedge pressure (32 mmHg), pulmonary hypertension (68/22 mmHg; mean 43 mmHg), a low cardiac index (1.98 L/min/m^2), and a relatively low systemic vascular resistance index (2043 dyn•s/cm^5/m^2), consistent with mixed cardiogenic and septic shock. Following Impella insertion, the wedge pressure decreased to 23 mmHg, confirming robust unloading.

The left coronary artery was engaged using a Medtronic 8-French EBU 3.5 guiding catheter with side holes. A Terumo Runthrough Floppy guidewire (GW) was advanced into the obtuse marginal branch, and an ASAHI Sion Blue GW was placed in the distal LAD. Intravenous ultrasound (IVUS) demonstrated diffuse mixed fibrocalcific plaque and comparable proximal vessel diameters between the LAD and LCx. Given the severe plaque burden at the LCx ostium, a provisional stenting strategy was projected to carry an unacceptable risk of plaque shift or ostial occlusion, which would compromise future access for the planned LCx CTO intervention. Therefore, a two-stent Culotte technique was chosen. After treating the proximal-to-mid LAD with balloon angioplasty, drug eluting stent (DES), and drug eluting ballon (DEB) to diagonal branch, we proceeded to the LM bifurcation intervention. Both the proximal LAD and LCx were predilated with 3.0 mm balloons. A 3.0 × 23 mm DES was deployed from the LM into the LCx, followed by a 3.0 × 28 mm DES from the LM into the LAD (Figure 8), along with sequential proximal optimization technique (POT), rewiring, kissing balloon inflation, and a final re-POT. The patient was successfully weaned off Impella in the catheterization laboratory without difficulty. Wedge pressure remained stable at 25 mmHg at the end of the procedure, with a total procedural time of 166 minutes. He remained hemodynamically stable throughout the intervention, reported no peri-procedural chest discomfort, and experienced no vascular access complications after closure using a hybrid strategy with Perclose Proglide and Angio-Seal Closure Device (Terumo Interventional Systems, Somerset, NJ). His renal function demonstrated progressive improvement prior to discharge. Fever and right foot cellulitis resolved with a 5-day antibiotic course. The patient spent 5 days in the cardiac intensive care unit, completing a total hospitalization of 10 days, and was discharged home in excellent clinical condition without neurological or cardiovascular sequelae.

Discussion

In patients with complex high-risk LM bifurcation lesions complicated by acute MI, recent ischemic stroke, and AKI, the choice

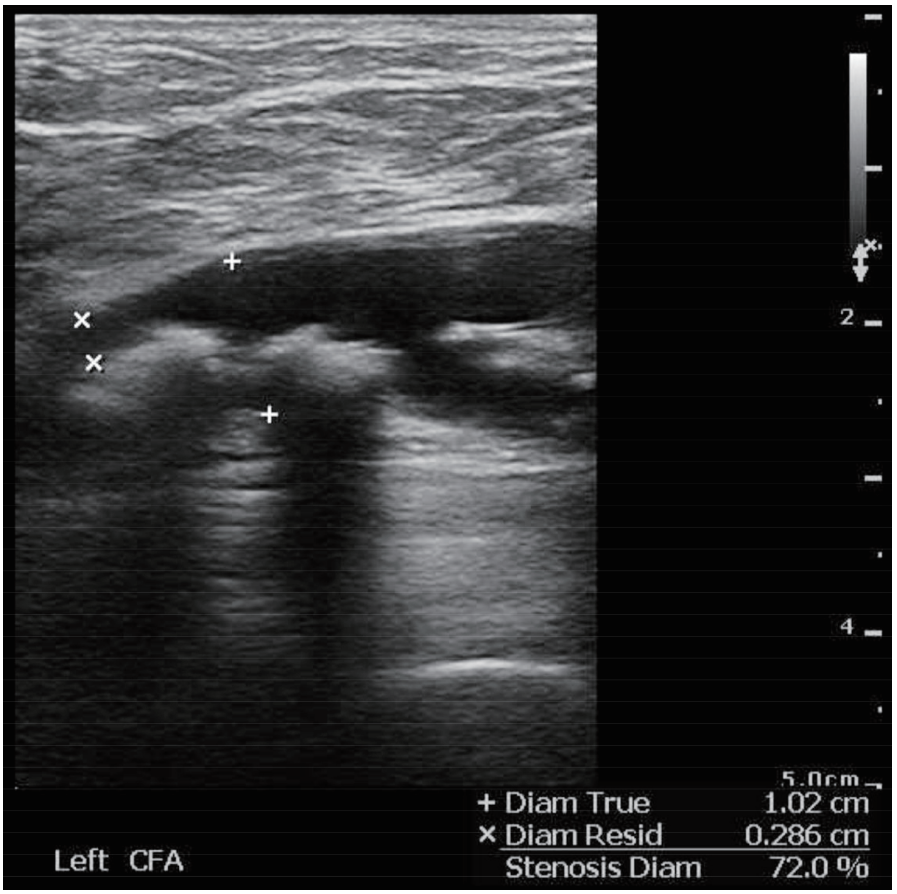

Figure 5. Left common femoral artery severe stenosis with calcified nodule.

Figure 6. Low puncture site of right femoral arterial sheath and iatrogenic AV fistula.

Figure 7. Contralateral injections and fluoroscopic guided puncture.

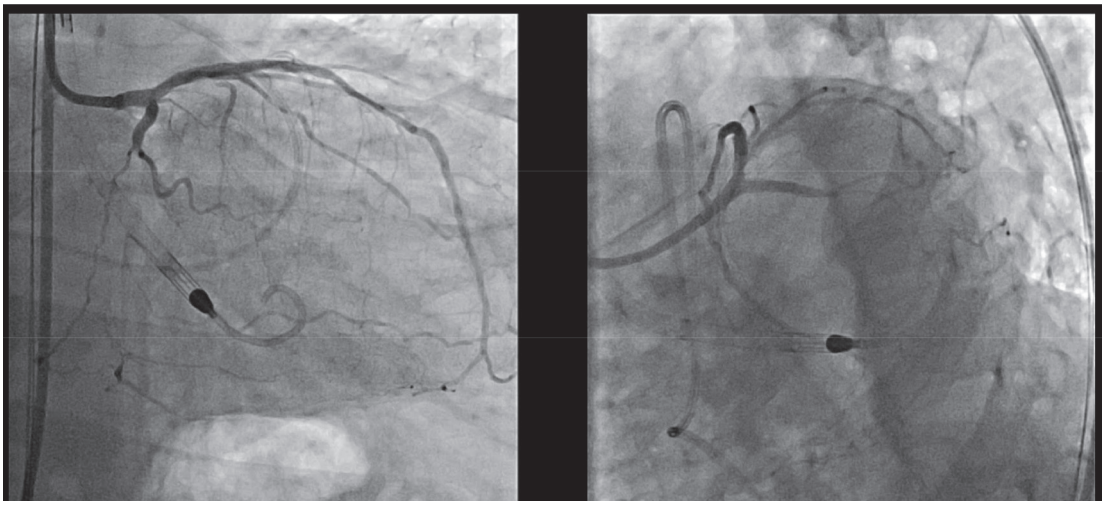

Figure 8. Final angiography.

between CABG and PCI with MCS must be meticulously individualized. While CABG remains a Class I indication for acute coronary syndrome involving left main and multivessel disease[1], it carries a higher risk of periprocedural stroke especially in the first 30 days post-procedure[2], and an elevated risk of worsening AKI during left main coronary artery revascularization compared to PCI[3].

As for MCS assisted PCI, Impella CP-assisted PCI offers a less invasive approach performed only under local anesthesia, with superior short-term hemodynamic stability and faster recovery, albeit with risks of access-site complications and renal impairment. In a comparative analysis, Impella provides physiological antegrade flow with less left ventricular afterload burden and is associated with lower in-hospital and medium-term mortality than VA-ECMO[4]. Furthermore, the PROTECT III study demonstrated that contemporary Impella support achieves a significant reduction in long-term major adverse cardiac and cerebrovascular events compared to traditional IABP[5], while the landmark DanGer Shock trial established a definitive 180-day survival benefit for Impella in infarct-related cardiogenic shock[6], solidifying its role as a life-saving tool during high risk PCI for complex ACS. Overall, PCI, especially with Impella support, may be preferable for patients with prohibitive surgical risks, as observational data suggest acceptable short-term outcomes

in high-risk populations[7], particularly as our patient presented with advanced age, mild to moderate aortic stenosis, mildly reduced ejection fraction, recent stroke, AKI, and an active infection complicated by mixed shock. However, randomized evidence for Impella CP in this multi-comorbid context is limited, and complication rates (bleeding, limb ischemia) remain a concern.

Regarding large-bore access closure strategies, lessons from TAVR have fundamentally reshaped our clinical approach. While the CHOICE-CLOSURE trial showed that the MANTA plug-based device achieves shorter time to hemostasis, it carries a significantly higher risk of vascular complications than dual-ProGlide suture-based technique[8]. In contrast, the hybrid strategy has emerged as a superior alternative. Supported by the ACCESS-TAVI trial and our randomized comparative trial[9,10], the hybrid approach (suture combined with a plug) significantly minimizes vascular complications, device failure, and additional vascular closure device use, while maintaining comparable bleeding rates to suture-only techniques. These findings support that the use of a hybrid closure strategy is favorable for large-bore femoral access hemostasis in contemporary clinical practice.

Conclusion

High-risk PCI in patients with a recent stroke and acute MI remains a significant clinical challenge, requiring meticulous procedural planning and individualized risk assessment. Careful preparation for large-bore vascular access—utilizing tools such as pre-procedural CT or duplex imaging, contralateral injection, and fluoroscopic or ultrasound-guided puncture—can substantially minimize access-site complications. The use of Impella CP provides crucial hemodynamic support during complex high-risk indicated PCI (CHIP-PCI), facilitating procedural safety, maintaining stability, and reducing both patient discomfort and peri-procedural complications.

Abbreviations

TIA: transient ischemic attack
MI: myocardial infarction
AKI: acute kidney injury
CTO: chronic total occlusion
STEMI: ST-segment elevation myocardial infarction
NSTE-ACS: non-ST-segment elevation acute coronary syndrome
PCI: percutaneous coronary intervention
CABG: coronary artery bypass graft
VA-ECMO: veno-arterial extracorporeal membrane oxygenation
CT: computed tomography
IVUS: intravascular ultrasound
DES: drug-eluting stent
DEB: drug-eluting balloon
RCA: right coronary artery
LM: left main artery
LAD: left anterior descending artery
LCx: left circumflex artery
MCA: middle cerebral artery

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