Case Report

Five-Year Follow-up After Percutaneous Management of a 40-Year-Old Man in Shock Treated by Percutaneous Coronary Intervention and MitraClip

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*Structural Heart Unit, Cardiology Division, Department of Medicine, University Hospital of Geneva, Geneva, Switzerland***ABSTRACT**

Acute coronary syndromes complicated by cardiogenic shock are associated with high mortality, and patients are definitely considered at high procedural risk. We present here the 5-year success of full percutaneous management of a young patient in cardiogenic shock with acute and chronic coronary artery disease as well as significant mitral regurgitation. Whereas the benefit of culprit lesion coronary revascularization is well established, evidence supporting chronic total occlusion revascularization in the acute setting remains poor. Percutaneous management of acute mitral regurgitation with cardiogenic shock is a viable option in patients with recurrent pulmonary edema.

RÉSUMÉ

Les syndromes coronariens aigus compliqués d'un choc cardiogène sont associés à une mortalité élevée, et les patients sont clairement considérés comme présentant un risque interventionnel élevé. Nous présentons ici un cas de succès à 5 ans, de la prise en charge percutanée complète d'un jeune patient en état de choc cardiogène avec une coronaropathie aiguë et chronique ainsi qu'une régurgitation mitrale sévère. Alors que le bénéfice de la revascularisation coronarienne de la lésion coupable est reconnu, l'évidence en faveur d'une revascularisation de l'occlusion totale chronique en phase aiguë reste à établir. L'approche percutanée de la régurgitation mitrale aiguë avec choc cardiogène est une option viable chez les patients présentant un œdème pulmonaire récurrent.

The proportion of patients younger than 50 years old admitted for acute myocardial infarction varies from 5% to 20% with very limited data regarding their outcomes.¹ However, in the overall population, acute coronary syndrome complicated by cardiogenic shock is associated with high mortality, and patients are definitely considered at high procedural risk for both percutaneous and surgical management.

Case

A 40-year-old active smoker was admitted to the emergency department with worsening dyspnea over a few days. He rapidly developed cardiogenic shock (CS) and needed mechanical ventilation. An electrocardiogram showed a diminished progression of the R wave in the precordial leads, and transthoracic echocardiography showed 20% of left

ventricular ejection fraction (LVEF) and at least moderate mitral regurgitation (MR).

The coronary angiogram showed severe coronary artery disease with a chronic total occlusion (CTO) of the left anterior descending artery (LAD), a subocclusion of the dominant circumflex artery, and significant stenosis of the left main stem (Fig. 1). Emergency extracorporeal membrane oxygenation (ECMO) was inserted for hemodynamic support. After heart-team assessment, we favored prompt revascularization of the dominant circumflex artery and left main by percutaneous coronary intervention (PCI), considering the CS with severely reduced LVEF and the unfavorable distal coronary vascular bed for coronary artery bypass grafting, especially in the LAD territory. We implanted 2 drug-eluting stents and inserted an intra-aortic balloon pump at the end of the procedure.

As the hemodynamic parameters did not improve 12 hours later, but the anterior wall seemed to gain contractility with dobutamine when assessed by transoesophageal echocardiography, we performed an antegrade recanalization of the LAD CTO. After successful myocardial revascularization, we were able to withdraw the hemodynamic supports and dobutamine at day 4. The LVEF remained at 25%.

Subsequently, the patient developed recurrent acute pulmonary edema (PE), and ventilator weaning failed, requiring tracheostomy. Transoesophageal echocardiography

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Novel Teaching Points

- Mechanical circulatory support allows performing high-risk PCI during CS.
- Evidence supporting CTO as well as culprit lesion revascularization in STEMI patients with CS remains poor and should be discussed as part of a heart-team approach.
- MitraClip is a viable option in high-surgical risk patients with repetitive acute PE, failure of ventilator weaning, and low LVEF.

showed moderate-to-severe MR (Fig. 1) with localized P2 prolapsus and chordal rupture.

Mitral valve repair using MitraClip (Abbott Vascular, Santa Clara, CA) was performed, the alternative being conventional surgery or the implantation of a left ventricular (LV) assistance device as a bridge to heart transplantation. Conventional surgery was considered to be too high risk (LVEF severely decreased).

After successful single clipping of A2-P2 (Fig. 1), the patient was weaned from ventilatory support the next day without further episodes of acute PE. The patient left the intensive-care unit at day 3 and was discharged from the hospital at day 10 post MitraClip. Overall, the patient was hospitalized for 52 days. At 5-year follow-up, LVEF was 35% (Fig. 2). Transthoracic echocardiography showed mild MR with a transmitral mean gradient of 2.7 mm Hg. The patient had a functional class 1. He exercised 1 hour daily. He has never been rehospitalized and was removed from the transplant list. At 3-year follow-up, a coronary angiogram showed no in-stent restenosis.

Discussion

The case of this young patient in CS reports a 5-year success of full percutaneous management in the setting of acute and chronic coronary artery disease as well as significant MR. In a meta-analysis, patients in CS post MI showed a 33% higher survival rate with ECMO compared to an intra-aortic balloon pump.² We chose ECMO, but an Impella CP (Abiomed Europe GmbH, Aachen, Germany) heart pump might have been an alternative.

Figure 1. (A, B) Coronary angiogram showing a significant stenosis of the left main stem (short arrow), a chronic total occlusion of the proximal part of the left anterior descending artery with ipsilateral filling through microchannels (long arrow), and a subocclusion of the mid-part of the circumflex artery (arrowhead in A). (C) Coronary angiogram after staged percutaneous coronary interventions of the left main stem, the left anterior descending artery, and the circumflex arteries. Transesophageal echocardiography showing moderate to severe (proximal isovelocity radius of 0.76 cm) and trace mitral regurgitation, respectively (D) before and (E) after A2-P2 MitraClip insertion. (F) Mild anterograde transvalvular mitral mean gradient (4 mm Hg) directly after MitraClip insertion with a heart rate of 98 beats/min. GP_{max}, max pressure gradient; GP_{moy}, mean pressure gradient; ITV, time velocity integral; V_{max}, maximal velocity; V_{moy}, mean velocity.

Figure 2. Left ventricular ejection fraction (LVEF), left ventricular end diastolic and systolic diameter (LVEDD and LVESD), and mitral regurgitation (MR) grade evolution before and after MitraClip insertion, up to 5 years of follow-up. Numbers on the y-axis on the left are in percent for LVEF and millimeters for LVEDD and LVESD, whereas numbers on the right represent MR grade.

The concomitant presence of a CTO as a non-infarct-related artery in ST-elevation myocardial infarction (STEMI) complicated by CS is frequent and associated with increased mortality when compared to patients without CTO.³ No randomized trial has assessed CTO revascularization in the context of CS. The randomized Evaluating Xience and Left Ventricular Function in Percutaneous Coronary Intervention on Occlusions After ST-Elevation Myocardial Infarction (EXPLORE)-trial showed no difference in 303 STEMI patients without CS but concurrent CTO in terms of LVEF evolution (primary endpoint) and a composite endpoint including cardiac death, myocardial infarction, and coronary artery bypass grafting (secondary endpoint) at 4 months between a CTO revascularization group and a culprit lesion treatment-only group.⁴ Even though mortality was greater at 30 days among the multivessel PCI group of the Culprit Lesion Only PCI Versus Multivessel PCI in Cardiogenic Shock (CULPRIT-SHOCK) trial (including 24% of CTO) in comparison to the culprit lesion-only PCI group, the mortality did not differ significantly at 1 year (56.9% vs 50.0%, respectively). In our case, we decided to revascularize the CTO due to documented contractility gain with dobutamine, and this strategy led to prompt mechanical and vasopressor support withdrawal.

Independently of the initial clinical presentation, the long-term impact of CTO revascularization on clinical endpoints is still debated, as no large randomized trial has shown a benefit in mortality, myocardial infarction, or repeat revascularization (Supplemental Table S1). Recently, the prospective multi-center Evaluation of the XIENCE PRIME LL and XIENCE Nano Everolimus Eluting Coronary Stent Coronary Stents, Performance, and Technique in Chronic Total Occlusions (EXPERT-CTO) trial reported long-term safety and efficacy of CTO revascularization at up to 4-year follow-up with a clinically indicated target lesion revascularization of 11.3% using new-generation drug-eluting stents.⁵ Our case shows a

favorable long-term outcome of a CTO revascularization with no in-stent restenosis at 3 years and no symptoms at 5 years.

Due to recurrent acute PE with failure of ventilatory weaning, MR treatment was needed. After multidisciplinary discussion, the patient was deemed inoperable (25% LVEF and decompensated heart failure), and the localized posterior leaflet prolapse offered a favorable anatomy for bail-out MitraClip therapy. Percutaneous treatment of acute MR has become an interesting option in the current era of transcatheter valve therapy, but it is still largely underrepresented in MitraClip registries. Case reports and small case series report favorable outcomes, yet they are limited to short- and mid-term follow-up. In the national Spanish MitraClip registry, 5 patients (2.7% of the cohort) including 3 with CS were treated in an acute setting. One patient died at 1 week, whereas the other 4 had favorable outcomes at a median follow-up time of 317 days.⁶ The extremely rapid favorable hemodynamic evolution after the procedure of our patient, as well as the good clinical outcome at 5 years post MitraClip implantation, supports treatment of MR even earlier in these very sick patients with repetitive ventilatory weaning failure. Large coaptation gaps are not uncommon in the acute setting and might preclude a percutaneous procedure. The recent XTR MitraClip device with longer arms than the NTR MitraClip may overcome such anatomic challenges.⁷

In conclusion, we report favorable long-term success of acute full percutaneous coronary and valvular management in a young patient with a very poor initial prognosis.

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Disclosures

The authors have no conflicts of interest to disclose.

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Supplementary Material

To access the supplementary material accompanying this article, visit *CJC Open* at <https://www.cjopen.ca/> and at <https://doi.org/10.1016/j.cjco.2020.06.007>.