

Lower extremity artery thromboembolism during removal of Impella after repair for ventricular septal rupture: A case report

SAGE Open Medical Case Reports
Volume 12: 1–3
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DOI: 10.1177/2050313X241260228
journals.sagepub.com/home/sco



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Abstract

Although the anticoagulant complications of Impella are well known, the timing of heparin administration when using Impella immediately after open heart surgery has not been established. We report a case of a 59-year-old man with Impella-assisted repair of a ventricular septal perforation after acute myocardial infarction who developed thromboembolism of the lower extremity arteries after removal of Impella.

Keywords

Myocardial infarction, ventricular septal rupture, Impella, thromboembolism

Date received: 29 December 2023; accepted: 22 May 2024

Introduction

Ventricular septal rupture (VSR) is a fatal mechanical complication secondary to acute myocardial infarction (AMI).¹ Although there have been reports that perioperative Impella support has been effective in improving the outcome, Impella is associated with bleeding and thromboembolic complications, and the timing of anticoagulant initiation, especially in the postoperative period, has not been established.²

Case presentation

The patient was a healthy 59-year-old man with no medical history. The day after he complained of sudden chest pain, he was rushed to his previous hospital. An electrocardiogram revealed a suspected acute coronary syndrome, and the patient was transferred to our hospital for treatment. Coronary angiography revealed occlusion of the posterior descending branch of the right coronary artery (RPDA) and stenosis of the left anterior descending artery (LAD), and a diagnosis of AMI was made. The emergency percutaneous coronary intervention was performed for RPDA occlusion. In the days following PCI, blood pressure dropped to approximately 80 mmHg, oxygen saturation dropped to the 93%

range, creatinine level was 1.5–2.0 mg/dl, and liver function was good, but radiographs showed progressive pulmonary edema. Four days after PCI, echocardiography revealed a left-to-right shunt with VSR near the left ventricular apex (see Supplemental material Figure 1). An Impella CP (Abiomed Inc, Danvers, MA, USA) was immediately inserted through the right femoral artery and the patient was intubated. After Impella insertion, P4-5 support produced a right-left shunt, so Impella was controlled at P2-3. This support produced a flow of approximately 1.5 L/min, and blood pressure improved to 100 mmHg. However, the next day's radiographs showed no improvement in the pulmonary edema, and the P/F ratio was approximately 150, indicating the need for early surgery.

The day after the Impella was implanted, surgery was performed. The procedure consisted of VSR repair using the

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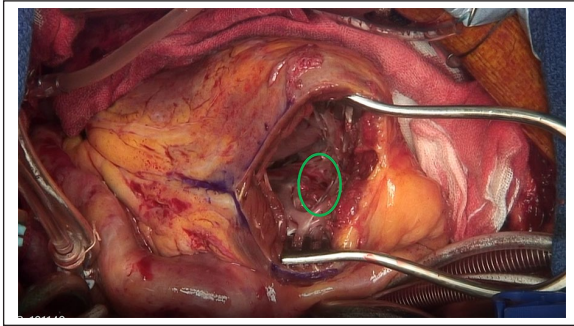


Figure 1. Through the left ventricular incision, a ventricular septal rupture hole was observed in the ventricular septum closer to the apex (circle).

Daggett procedure¹ (Figure 1) and coronary artery bypass of the left internal thoracic artery to the LAD artery. During cardioplegic arrest, Impella was operated on in surgical mode and adjusted at P6-7 after withdrawal of cardiopulmonary bypass. Heparin administration into the purge solution resumed 6 h after surgery. The systemic dose of heparin was controlled so that the activated clotting time was 150–200 s. Impella was at P6-7 and was delivering a blood flow of about 2.5–2.8 L/min, the rotation level gradually decreased and Impella was removed on the second postoperative day. Immediately after removal, the blood was flushed out for a few seconds. However, a few minutes later, the arterial pulsation in the right lower extremity disappeared, which led to suspicion of thromboembolism, and angiography was performed. The results showed an image of blood flow interruption in the right superficial femoral artery (Figure 2). An emergency thrombectomy was performed using a 5.5F Fogarty balloon catheter (Edwards Lifesciences, Irvine, CA, USA), and about 10 g of fresh thrombus was removed, and blood flow was restored to the right lower extremity.

The patient was weaned from the ventilator 1 week postoperatively. The patient underwent rehabilitation and was discharged home on the 18th postoperative day. Postoperative echocardiography showed no evidence of residual shunt and good cardiac function with a left ventricular ejection fraction of 65%.

Discussion

Although VSR is a lethal complication after AMI,¹ in recent years, perioperative use of Impella for left ventricular unloading and systemic circulatory support has demonstrated excellent results.^{2,3} However, complications such as bleeding and thromboembolism are often problematic. A meta-analysis of 17 studies involving 3,933 patients with cardiogenic shock supported by Impella reported major bleeding in 15.2% of patients.⁴ A Japanese registry of 593 cases reported that thrombotic complications from Impella accounted for 0.7% of all cases and were less common than those from hemolysis (10.8%) and hemorrhage/hematoma



Figure 2. Angiography showed that the superficial femoral artery (SFA) was occluded from the origin.

(7.6%).⁵ There have been very few reports of thrombotic complications, with only a few case reports.^{6,7}

When Impella is used after cardiac surgery, there is no established protocol for when to start heparin administration. Griffith et al.⁸ RECOVER I Trial reported that in 16 patients treated with Impella 5.0 or LD for cardiogenic shock after cardiac surgery, 7 patients required reoperation for postoperative bleeding. None of the patients developed thrombotic complications. In their protocol, systemic administration of heparin was started when postoperative drain bleeding was less than 100 ml/h and controlled to achieve a partial thromboplastin time of 40–50 s. The risk of bleeding may be increased by their protocol. However, it is also important to be vigilant for thromboembolism. There has been a case report of thrombi floating in the descending aorta in patients using Impella, even when heparin was being used.⁹

In our patient, postoperative drain bleeding was minimal, but heparin infusion was administered 6 h after the end of surgery. This was because the procedure involved a left ventricular incision and there was a strong concern about bleeding. There was an option to start heparin earlier in consideration of thrombus formation. The embolism seen after the removal of the Impella was probably caused by a thrombus attached to the shaft of the Impella. The presence of a thrombus should have been confirmed by echocardiography and computed tomography at the time of removal. In addition to flushing the blood out, the peripheral side of the artery should have been blocked at the time of removal to prevent the thrombus from flowing downstream. The indication for Impella in this case was also controversial. VSR was considered a good indication for Impella as well as cardiogenic shock.^{2,3} However, it was reported that better postoperative outcomes for VSR repair were achieved 1–2 weeks after Impella placement.^{3,10} The reason for early surgery after Impella placement, in this case, was that several days

had passed since the onset of VSR, the inflammation was thought to have resolved, and the pulmonary edema had not improved on x-ray the day after Impella placement. Although the optimal timing for Impella weaning has not been established in previous reports,^{11,12} it is believed that P2-3 can be weaned if sufficient cardiac output is achieved.

Conclusion

We experienced a rare case of thromboembolism of the lower extremity after perioperative use of Impella for VSR repair. Perioperative circulatory support with Impella was effective, and patients recovered well after emergency thrombectomy.

Acknowledgements

This paper was written without the help of anyone other than the co-authors.

Author contributions

Y.I. was responsible for the treatment, data collection, interpretation, and writing the paper; Y.Y. was responsible for the treatment, data interpretation, and overall supervision of the study. Other co-authors were responsible for the treatment.

Declaration of conflicting interests

The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

Funding

The author(s) received no financial support for the research, authorship, and/or publication of this article.

Ethics approval

Our institution does not require ethical approval for reporting individual cases or case series.

Informed consent

Written informed consent was obtained from the patient(s) for their anonymized information to be published in this article.

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Supplemental material

Supplemental material for this article is available online.

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