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Image of the Issue

Safe Exchange of a Transfemoral Impella Pump

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ABSTRACT

Mechanical circulatory support with the Impella pump is established in many centers treating patients with cardiogenic shock. While Impella pumps usually run very stable, it may still be possible that one needs to remove the pump for using the same vascular access for different reasons. Unfortunately, until now it had been nearly impossible to remove the pump while preserving arterial access without severe bleeding.
Here we describe a prototypical approach of exchanging an Impella pump in a 47-year-old female supported with veno-arterial ECMO for cardiogenic shock from myocarditis. The dysfunctional Impella pump was safely removed and replaced by a new one through the same arterial access site. Continuation of active LV unloading resolved pulmonary edema, and the patient was finally bridged to ventricular assist device surgery with favorable outcome. In general, the described approach is applicable for virtually all large-bore devices with arterial access.

A 47-year-old female was transferred to our center with progressive cardiogenic shock. For predominant left ventricular (LV) failure with massive pulmonary edema an Impella CP® pump was implanted via right femoral access. During implantation cardiac arrest from electromechanical dissociation occurred. Veno-arterial extracorporeal membrane oxygenation (VA-ECMO) was initiated under continued cardiopulmonary resuscitation via left femoral access, and Impella implantation completed. While the patient still required catecholamines, Impella pump flow continuously declined despite adequate volume management and effective anticoagulation with heparin suggesting pump dysfunction. Progressive distension of the apulsatile LV, pulmonary edema and central aortic hypoxemia demonstrated that active LV and pulmonary unloading was critically required. As both femoral arteries were already occupied by ECMO and Impella devices and therapeutic anticoagulation was in effect, we aimed to exchange the dysfunctional Impella through the same arterial access. Published techniques in merely Impella-supported patients are rather complex either due to extensive wiring [1] or sheath replacement maneuvers [2], both with a remaining risk for bleeding. We thus employed a novel technique for Impella exchange maintaining the same arterial access with minimized risk of bleeding.

The left radial artery was punctured under ultrasound guidance (Fig. 1A), a 6F 16 cm slender radial sheath was inserted and a 260 cm 0.035″ guide wire was forwarded to the right iliac artery proximal to the Impella insertion site (Figs. 1A, 2A). A peripheral angioplasty balloon appropriately sized to occlude the vessel was positioned in the right iliac artery via this wire (Figs. 1A, 2A). The dysfunctional Impella was

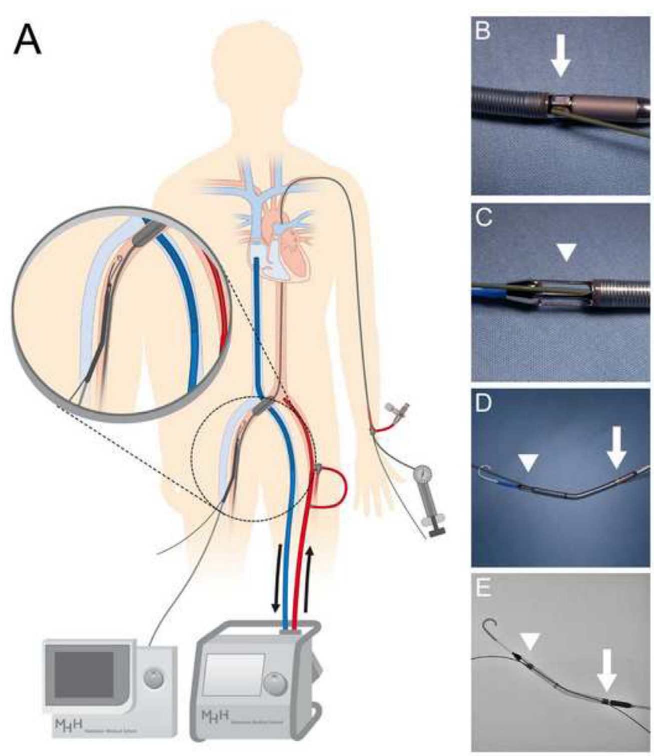

Fig. 1. Concept of the Impella exchange technique. The scheme illustrates the technique maintaining the same arterial access (A). The Impella pump was retrogradely rewired via the outflow (B, arrow) and the inflow (C, arrowhead) of the device with a 0.035″ guide wire. Macroscopic (D) and fluoroscopic images (E) show the resulting configuration.

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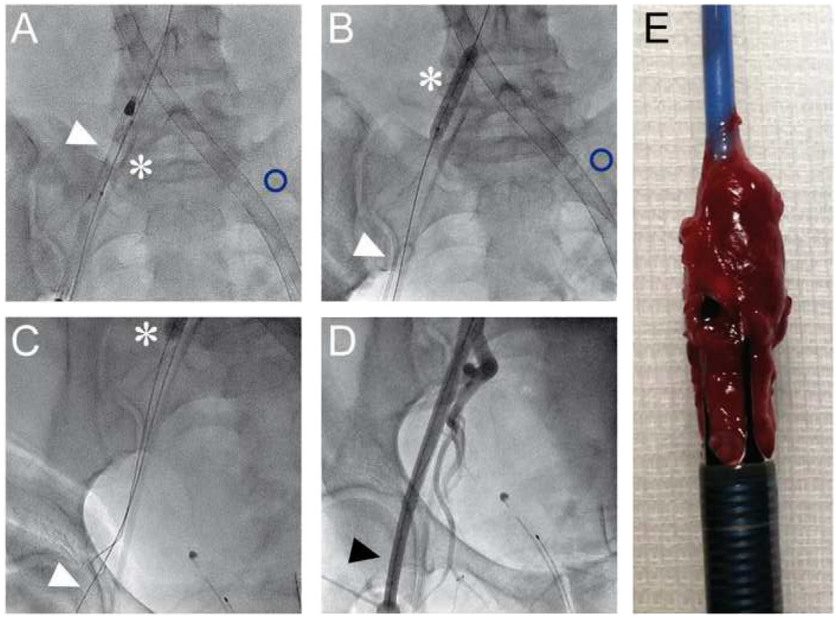

Fig. 2. Application of the novel technique in a patient with refractory cardiogenic shock. Via left radial access, a 260 cm guide wire (asterisk) was forwarded to the right femoral artery close to the dysfunctional Impella microaxial pump (A, arrowhead). After pullback of the dysfunctional Impella towards its permanent sheath (B, arrowhead), an angioplasty balloon was inflated (B, asterisk). Now the sheath was retracted and the Impella retracted until the Impeller housing became accessible to insert a 0.035″ guide wire. Now the Impella was extracted with the wire securing the femoral arterial access (C). Finally, a new Impella CP was implanted over the wire through the intact right iliac artery (D, black arrowhead), with only minimal bleeding despite full anticoagulation. Macroscopic evaluation of the removed Impella revealed obstruction of the inflow as the reason of pump dysfunction (E). Reestablished active LV unloading by the new Impella resulted in resolution of pulmonary edema and hypoxemia.

retracted towards the permanent Impella sheath, and the angioplasty balloon was inflated proximal to the Impella to stop antegrade blood flow towards the right femoral artery (Fig. 2B). This maneuver allowed for retracting the permanent sheath and to further pull back the Impella until the impeller housing just became accessible (Fig. 2B). A 145 cm 0.035″ guide wire was engaged via the now extracorporeal impeller housing through the pump to exit at the still intravascular pump inlet into the iliac artery (Figs. 1B–D, 2D). Now, with the blood flow being stopped by the balloon, the Impella pump could be easily removed over the wire with only minimal bleeding. A new insertion sheath was placed via this guide wire (Fig. 2C), which finally allowed for implanting a new Impella CP via the same femoral arterial access (Fig. 2D). With reestablished active LV unloading by the new Impella, pulmonary edema and hypoxemia resolved. Myocardial biopsy results demonstrated fulminant myocarditis with massive lymphocytic infiltration, but despite immunosuppressive therapy and mechanical circulatory support cardiac function did not recover. The patient underwent permanent ventricular assist device implantation and was finally discharged for rehabilitation.

In conclusion, this novel technique enables rapid and safe exchange of an Impella pump through the same arterial access without relevant bleeding. This elegant solution, which may also be applied with other large-bore extracorporeal devices, increases safety in high-risk cardiogenic shock patients, who are prone to bleeding and in whom arterial access sites are often limited.

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