

CASE REPORT

Pop the balloon: rapid switch from Intra-aortic balloon pump to alternate device

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600 Gresham Drive, Norfolk, VA 23507,
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Email: docbaran@gmail.com**Abstract**

When a patient with an intra-aortic balloon pump needs different support, it is simple to use a stiff 0.018-inch interventional wire (360 cm) to exchange the balloon for a new sheath. This allows the team to start with a balloon and then switch if the support is not sufficient.

KEYWORDS

balloon pump, exchange, wire

1 | INTRODUCTION

With the explosion of percutaneous mechanical circulatory support devices which are available, the interventional cardiologist has many choices to support patients with cardiogenic shock patients. If a patient has an intra-aortic balloon pump (IAB), but needs different support, it has been a dilemma about what to do with the IAB. Often, such patients are not ideal for manual hemostasis, and it is challenging to keep both the IAB and another device. A case is described where the IAB of a patient with significant peripheral arterial disease was switched to an alternate device with a peripheral guidewire and a standard vascular sheath. This simple technique allows rapid exchange from IAB to a sheath, allowing a multitude of subsequent devices or closure devices to be deployed. Given the low cost of the IAB, and its ubiquity, this approach allows a 'balloon-first' strategy without compromising vascular access.

Cardiogenic shock is associated with significant rates of morbidity and mortality; the Intra-aortic balloon pump (IABP) is the most commonly employed mechanical circulatory support device for cardiogenic shock refractory to medical management.¹ Despite the IABP Shock II trial,² the IABP remains a mainstay of therapy given its low cost and ubiquity. Previously, the IABP was used in conjunction with vasoactive medications to conservatively manage patients

with cardiogenic shock^{1,3}; however, the development of more robust systems of mechanical circulatory support (MCS) such as Impella or extracorporeal membrane oxygenation (ECMO) has created a new paradigm for hemodynamic support of the patient in cardiogenic shock in the last decade.³⁻⁵ A recent review of the literature failed to identify any literature sources on the technical aspects of switching an IABP to a higher level of MCS, which is surprising given the explosion of new studies detailing use of Impella or ECMO when CS persists despite concurrent IABP use.

As part of an ongoing discussion on the practical considerations of escalating care from IABP to Impella or ECMO, a patient case is presented that illustrates the technical challenges of transitioning between support modalities, with a step-step tutorial on conversion. This technique has not yet been described in the literature.

2 | CASE REPORT

A 58-year-old woman with history of hypertension, hyperlipidemia, chronic kidney disease stage 3b, and peripheral vascular disease was transported to the emergency department following 72 h of worsening shortness of breath and generalized abdominal pain. On arrival, her EKG revealed anterior

Q waves with residual ST-segment elevation in the precordial leads. The patient was intubated secondary to onset of respiratory distress and taken for emergent angiography. Access could not be obtained in the right femoral artery due to severe vascular disease but was possible from the left femoral artery. Coronary angiography revealed 90% occlusion of the left anterior descending (LAD) artery and an IABP was placed without a sheath via the left femoral artery. PCI was attempted of the LAD but was unsuccessful. The patient was stabilized with inotropes and pressors in the intensive care unit until it was possible to transfer to our tertiary center for consideration

of mechanical circulatory support or coronary artery bypass grafting. An echocardiogram performed immediately prior to transfer revealed a left ventricular ejection fraction of 27%.

On arrival in the tertiary center, the patient manifested worsening shock (Society for Cardiac Angiography and Intervention Stage D), and the team decided to implant an Impella CP (Danvers, Massachusetts). Given the occlusion of the right common femoral artery, it was imperative to use the existing left femoral artery access. Anticoagulation was continued throughout the procedure to exchange the IABP to an Impella catheter.

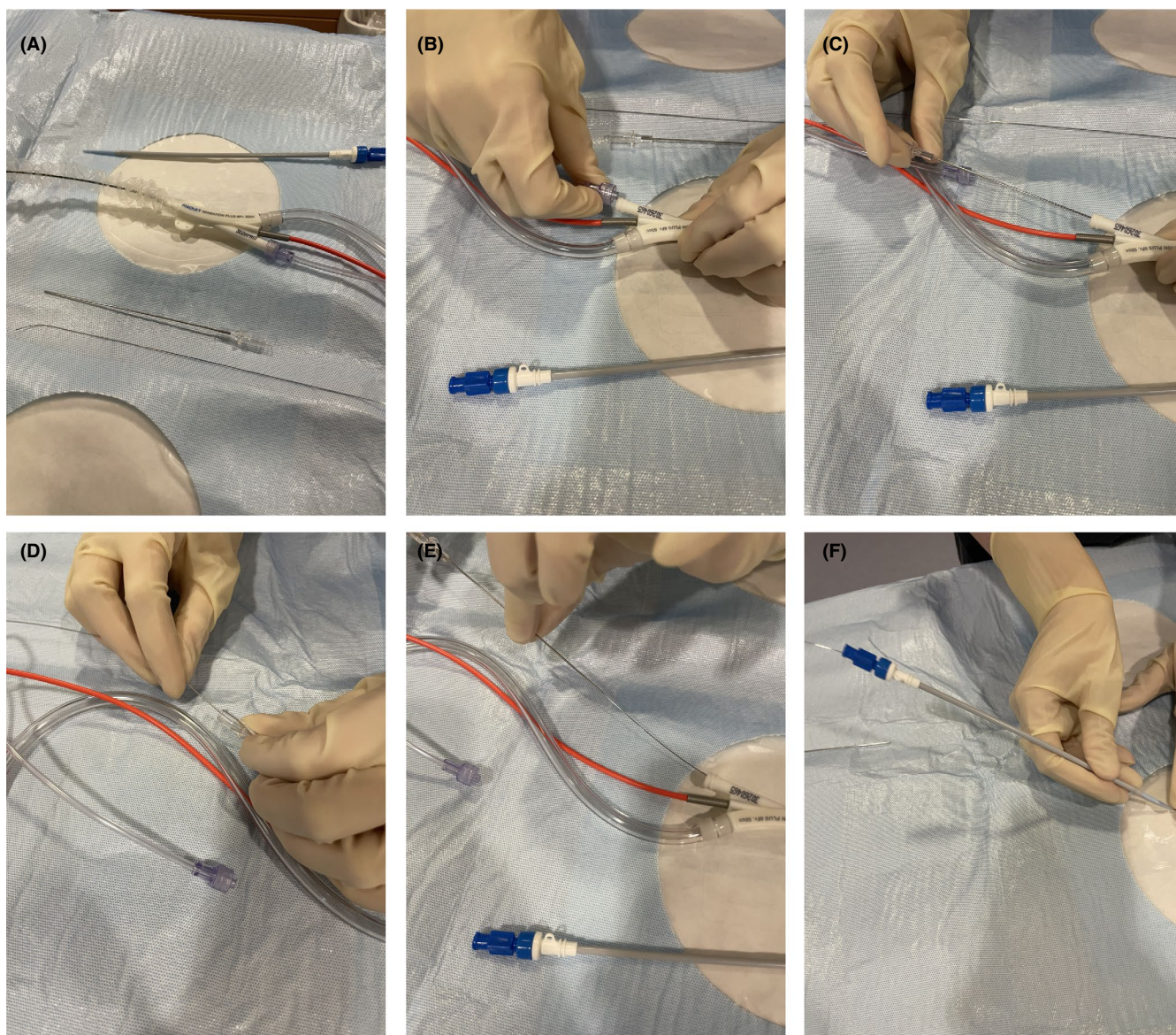


FIGURE 1 Panel A: The figure shows the items needed to perform the switch. From the top, are the sheath, the existing balloon pump catheter, the wire introducer, and the 0.025" or 0.018" wire. Panel B: First step illustrated. Unscrew the Luer lock of the flush line from the balloon pump after sterile preparation the existing catheter. Panel C: Place the wire introducer into the balloon pump catheter where the flush line was unscrewed. Panel D: Place the 0.025" or 0.018" wire into the wire introducer and advance into the balloon pump catheter until the wire exits the catheter. Panel E: Remove the wire introducer and then remove the balloon catheter while advancing the wire. Hold pressure at the arteriotomy site to prevent bleeding. Panel F: Advance new sheath of similar size to balloon pump over wire and remove wire and dilator

3 | CONVERSION OF IABP TO IMPELLA, ECMO, OR OTHER DEVICE

All intra-aortic balloon pumps regardless of manufacturer have a central blood lumen, which is typically connected to an arterial pressure line. This lumen is too narrow to accommodate a standard 0.035-inch J-wire. To exchange an IABP for a sheath, we recommend the following steps as illustrated in Figure 1, Panels A–F.

Sterilely prep the entire length of the IABP catheter from the the pressure tubing to the entrance site in the skin (arteriotomy site).

Obtain a stiff 0.018-inch stiff peripheral guidewire such as Steel Core (Abbott) or Platinum Plus (Boston Scientific) of exchange length (360 cm) (Panel A). Disconnect the blood lumen from the sterilely prepped pressure tubing (Panel B). Blood will slowly ooze from this site.

Use a wire straightener (long blunt needle used to introduce coronary wires into the Touhy-Borst valve) and place it into the blood lumen of the IABP (Panel C). Advance the 0.018-inch wire via the straightener into the IABP catheter blood lumen (Panel D). Advance wire under fluoroscopy so that the wire exits the IABP catheter and enters the ascending aorta.

At this point, use a scissors or scalpel to cut the helium gas line and, if present, the fiber optic line to make it easier to remove the IABP.

Advance the stiff wire while removing the IABP catheter (using fluoroscopy to confirm wire remains in the thorax). When the IABP is removed from the femoral artery, hold occlusive arterial pressure at the exit site to maintain hemostasis (Panel E).

The next step requires a vascular sheath of at least the same diameter as the IABP. Most IABP catheters are 7.5 Fr or 8 Fr, so an 8 or 8.5 French sheath will be appropriate for most cases.

Use caution not to kink the wire with excessive force or pressure on the groin exit site. Have an assistant advance an 8 or 8.5 French sheath over the 0.018" wire; it will help to advance the wire together with the sheath at the time of insertion and to verify wire location (thorax or upper abdomen) by fluoroscopy (Panel F).

Next, remove wire and dilator and flush the new arterial sheath. Now, the operator can choose any option including sheath angiography, use of a closure device, or exchange for an alternate device or cannula.

4 | DISCUSSION

A simple method is presented to solve a common catheterization laboratory dilemma. A patient has an IABP, but needs that femoral access site converted into a larger device, or the clinician

desires to 'post-close' the arteriotomy with a closure device. The technique described works well with a variety of peripheral guide wires and is most easily performed with fluoroscopy. However, once the operator is familiar with the technique, it can be considered for bedside applications with advance planning, although live fluoroscopic imaging is always preferred.

In this case, the IABP was inserted without a sheath, but even when a sheath is present, the described technique may be reasonable. Sometimes, the previously inflated IABP catheter will not pull through a vascular sheath, or pulling may damage the sheath or lead to its removal. Therefore, the exchange technique is valuable to avoid this risk.

5 | CONCLUSION

With the management of cardiogenic shock continuously evolving, the interventional cardiologist must be prepared for ever-changing scenarios. Often, these patients are coagulopathic and critically ill, and it is not always possible to remove a catheter, or obtain contralateral femoral access for a 'device upgrade'. The method illustrated allows for simple exchange of an existing IABP catheter with a variety of commonly available tools while maintaining safety and hemostasis.

ACKNOWLEDGMENT

Published with written consent of the patient.

CONFLICT OF INTEREST

None declared.

AUTHOR CONTRIBUTION

AL: co-wrote the manuscript and edited the content. KS: co-wrote the manuscript and edited the content. DB: co-wrote the manuscript and conceived of the report.

ETHICAL APPROVAL

Given de-identification, the report was exempted from institutional review board review.

DATA AVAILABILITY STATEMENT

Data sharing is not applicable to this article as no new data were created or analyzed in this study.

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How to cite this article: Long A, Stelling K, Baran DA. Pop the balloon: rapid switch from Intra-aortic balloon pump to alternate device. *Clin Case Rep*. 2021;9:e04614. <https://doi.org/10.1002/ccr3.4614>