JACC: CASE REPORTS VOL. 2, NO. 12, 2020

EDITORIAL COMMENT

Impella 2.5 Insertion

Which Artery to Access When Femoral Is not an Option?*

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Transcutaneous left ventricular assist devices have been used for hemodynamic support in the setting of cardiogenic shock, or prophylactically before high-risk percutaneous coronary interventions (PCI). Impella 2.5 (Abiomed Inc., Danvers, Massachusetts) is a miniaturized, catheter-based, rotary blood pump that is placed retrogradely across the aortic valve and which can provide up to 2.5 l/min forward flow from the left ventricle to the ascending aorta (1). Since the introduction of Impella 2.5 in 2004, several studies have described its beneficial role in unloading the left ventricle and improving cardiac output, as well as augmenting coronary perfusion in the setting of cardiogenic shock and during high-risk PCI (2–6). PROTECT I (A Prospective Feasibility Trial Investigating the Use of IMPELLA RECOVER LP 2.5 System in Patients Undergoing High Risk PCI) demonstrated feasibility and overall safety of Impella 2.5, which, when used during high-risk PCI, prevented intraprocedural hemodynamic compromise (defined as mean arterial blood pressure <60 mm Hg for >10 min) (7). The role of Impella 2.5 in patients with cardiogenic shock after acute myocardial infarction was evaluated in the Impella-EUROSHOCK-registry (8). Placement of Impella 2.5 in the setting of cardiogenic shock was found to be feasible and resulted in improved serum lactate levels, suggesting improved organ perfusion. No significant improvement in mortality has been reported.

Impella 2.5 is usually inserted percutaneously through a 13-F femoral sheath. Other arterial sites of insertion have been used in the presence of significant iliofemoral arterial disease that precludes femoral access. The axillary artery can typically accommodate the insertion of large sheaths (up to 18-F), and it is infrequently affected by atherosclerotic disease (9). Furthermore, the presence of collateral circulation decreases the likelihood of periprocedural limb ischemia. As a result, axillary access is usually the alternative approach for the insertion of Impella 2.5 in the absence of a suitable aorto-iliac-femoral arterial axis (10–13). However, concerns about potential nerve damage and inability to achieve good hemostasis due to lack of compressibility of the arteriotomy site against bony structures have been raised.

In this issue of *JACC: Case Reports*, Karami et al. (14) describe the successful placement of Impella 2.5 using the brachial artery as an alternative access site when femoral access is not feasible. Impella 2.5 was uneventfully inserted and removed in 2 patients, 1 undergoing high-risk PCI and the other experiencing cardiogenic shock after acute myocardial infarction. Pre-procedural Duplex ultrasound of the upper limb of the first patient revealed a brachial artery diameter of at least 4 mm. Pre-procedural imaging assessing the brachial artery diameter of the second patient was not reported. The 13-F (4.33 mm) arterial sheath of Impella 2.5 was inserted following serial dilations of the brachial arteriotomy. No vascular or other complications were reported peri-procedurally in either of the patients. Impella 2.5 prevented hemodynamic compromise of the first patient during PCI to the left main coronary artery, and it helped the second patient transiently recover from cardiogenic shock, before he died due to multiorgan failure.

Although using the brachial artery (as an alternative to femoral) for the insertion of Impella 2.5 was

*Editorials published in *JACC: Case Reports* reflect the views of the authors and do not necessarily represent the views of *JACC: Case Reports* or the American College of Cardiology.

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The author attests they are in compliance with human studies committees and animal welfare regulations of the authors' institutions and Food and Drug Administration guidelines, including patient consent where appropriate. For more information, visit the *JACC: Case Reports* author instructions page.

ISSN 2666-0849 https://doi.org/10.1016/j.jaccas.2020.07.052

successful in the 2 patients presented (14), the generalizability of this approach requires further investigation in larger studies. The diameter of the brachial artery is 3.9 ± 0.5 mm when assessed by ultrasound, and it varies depending on patient demographic characteristics (15). Whether the 4.33 mm (13-F) arterial sheath of Impella 2.5 can be safely inserted, without increasing the risk of periprocedural limb ischemia or other vascular complications, must be carefully assessed by pre-procedural evaluation of the brachial artery. Duplex ultrasound, computed tomography angiogram, or peripheral angiography under fluoroscopy can be used for that purpose.

In addition to the limited studies evaluating the nonfemoral insertion of Impella 2.5, there are rapidly growing data supporting the transaxillary insertion of large-bore devices, including the transcatheter aortic valve replacement (TAVR) delivery system (16–18). A recent study of >3,600 patients who underwent TAVR reported a success rate with the transaxillary approach of 97.3% (18). The number of transaxillary TAVRs doubled over the 3 years of the study and represented one-half of the TAVRs during the last quarter of 2017. Thirty-day mortality was lower (5.3% vs. 8.4%; $p < 0.01$) and intensive care unit and hospital stay were shorter compared with the transapical or transaortic approaches. Stroke rates were 6.3%, whereas the major vascular complication rate was 2.5%. Whether brachial access is as successful as axillary access for the insertion of large-bore devices and whether it is associated with fewer neurological and bleeding complications must be answered by large prospective studies. Furthermore, as experience with transaxillary insertion of large-bore devices increases and the technique is being optimized (19), another question that arises is whether the axillary approach has now equal or better outcomes compared with the femoral approach and whether it can be used even in the setting of intact iliofemoral arteries (16,17).

In conclusion, insertion of Impella 2.5 using brachial arterial access is feasible in patients with unfavorable iliofemoral anatomy. An individualized approach with preprocedural evaluation of the brachial artery diameter should be followed. Large studies are needed to determine feasibility of the brachial approach in the general population and evaluate complication rates compared with the axillary approach, which is currently the most popular insertion site of large-bore devices in the setting of a hostile iliofemoral environment.

AUTHOR RELATIONSHIP WITH INDUSTRY

Dr. Koutroumpakis has reported that he has no relationships relevant to the contents of this paper to disclose.

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KEY WORDS cardiac assist devices, hemodynamics, percutaneous coronary intervention