Transesophageal guided left atrial positioning of a percutaneous ventricular assist device

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In the setting of myocardial infarction, cardiogenic shock remains a leading cause of acute mortality.\textsuperscript{1} Percutaneous insertion of IABP and open chest insertion of left ventricular assist devices (LVADs) in setting of cardiogenic shock and myocardial infarction has been a temporizing measure prior to surgical or percutaneous revascularization; and in other instances, provides hemodynamic support to allow for the delayed recovery of revascularized myocardium.\textsuperscript{3,4} In 2001, Schuler et al. published initial data on the use of percutaneous left atrial to femoral bypass (pVAD, Tandem Heart).\textsuperscript{5} Tandem Heart (Cardiac Assist, Pittsburgh, PA) is a low-speed centrifugal continuous flow pump that was shown to provide 4.0 L/min of assisted cardiac output in setting of peri-infarct cardiogenic shock. Implantation of the Tandem Heart uses standard transseptal puncture techniques to access the left atrium, and in the latter study, position of the venous inflow cannula was confirmed by manual dye injection under fluoroscopy.\textsuperscript{5}

Transesophageal technique is routinely used at our institution, in assisting percutaneous deployment of atrial septal closure devices, percutaneous mitral valve clips and LAA occlusion devices.\textsuperscript{2,5,6,8} Here, we present a case of deployment of a pVAD into the left atrium with guidance by transesophageal echocardiogram.

Case report

A 47-year-old man with history of multiple myocardial infarctions and ischemic cardiomyopathy presented with cardiogenic shock in setting of inferior MI. IABP had been inserted at time of PCI and stenting of the RCA. Patient remained in cardiogenic shock several days after revascularization, and his course was further complicated by incessant polymorphic ventricular tachycardia. He was transferred to Emory University Hospital, for placement of percutaneous VAD, and further evaluation for possible cardiac transplant. TEE was utilized to guide various steps in placement of the venous cannula in the left atrium. Standard biatrial views were utilized during puncture across the fossa ovale with modified Ross needle. Most important, left atrial images in coaxial views were used to aid in the localization of the tip of the venous cannula. Figure 1 shows how the tip was initially in contact with the left atrial wall, which would have compromised the suction mechanism of the pVAD. Optimal position in the left atrium was achieved under TEE guidance by pulling back and anteriorly rotating the venous cannula (Figures 2 and 3); color Doppler then demonstrated the suction mechanism through the holes of the venous cannula tip (Figures 4 and 5). The patient’s hemodynamics improved over the next week allowing for initiation of ACE inhibitor and beta-blocker regimen and successful weaning from the pVAD.

Discussion

Echocardiography plays an important role today in the catheterization laboratory. It provides guidance for the safe and successful percutaneous deployment of multiple new devices by our interventional colleagues. Cardiogenic shock in the setting of myocardial infarction continues to represent a high proportion of immediate mortality in this patient population, despite ongoing advances in thrombolytics, PCI, and medical management of AMI. pVAD represents...
a next step in supporting patients in cardiogenic shock. This case demonstrates the utility of TEE in guiding the deployment and positioning of the pVAD’s venous cannula in left atrium. Recent study of the Tandem Heart in setting of AMI and cardiogenic shock showed improved outcome in comparison to IABP. Additionally, the results of the REMATCH trial show clear survival benefit for end-stage heart failure patients who received an LVAD and we will likely see the application of pVAD in this patient population in the near future. TEE then will have a pivotal role, and efforts at standardizing and reporting of optimal TEE views should be undertaken with this patient cohort.

Supplementary material

Supplementary data associated with this article can be found in the online version.

References