

Multimodal Imaging of a Transcatheter Aortic Valve Implantation Within an Isolated Heart

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NOVEL IMAGING OF FUNCTIONAL CARDIAC ANATOMY is possible in isolated heart preparations when a clear perfusate is used; which, in turn, provides important insights into the device-tissue interface of implanted devices such as transcatheter valves. The implantation of a transcatheter aortic valve (TAV) (CoreValve System, Medtronic, Inc., Mounds View, Minnesota) within an isolated human heart was performed using echocardiography, fluoroscopy, and direct visualization to compare imaging modalities for better understanding of the implantation procedure (Fig. 1, Online Video 1).

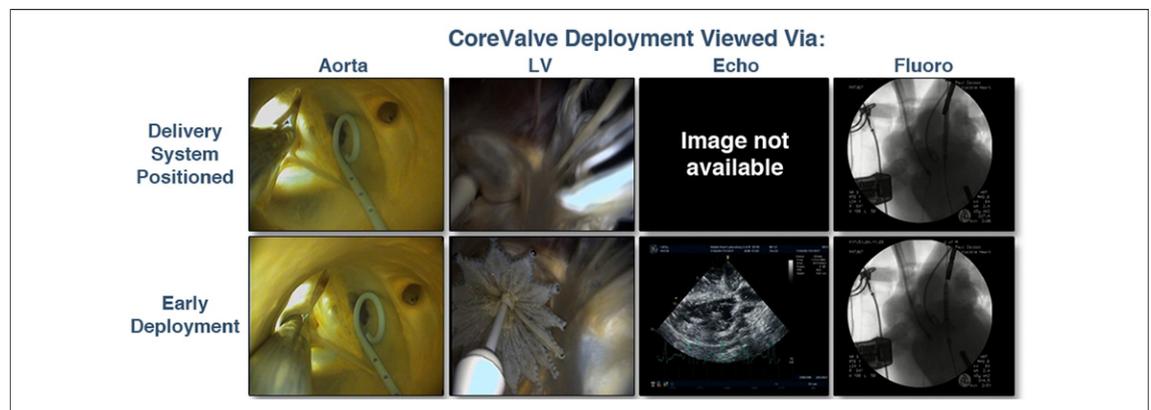
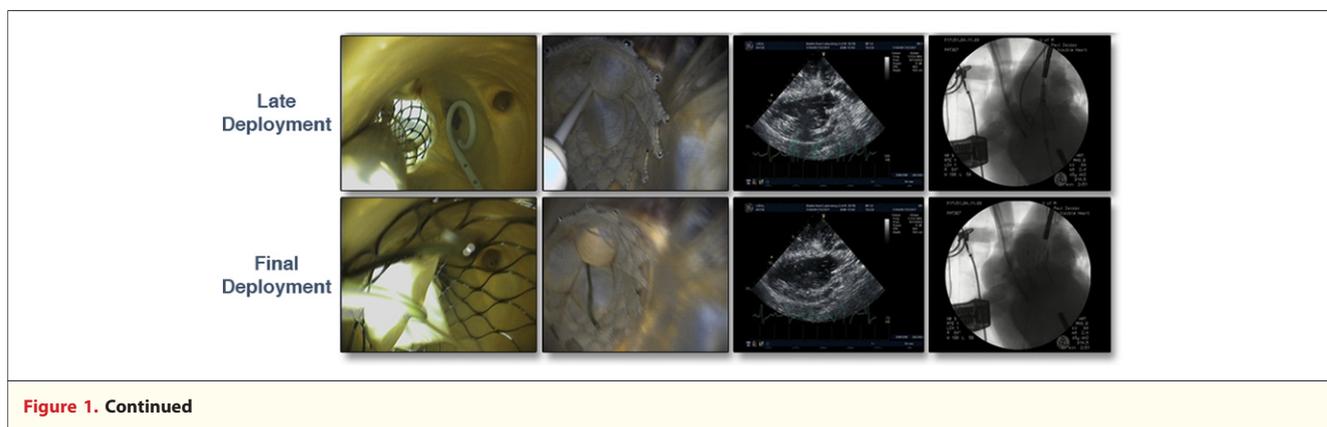


Figure 1. CoreValve Deployment Sequence

The implantation of a transcatheter aortic valve within an isolated human heart is shown using simultaneously captured endoscopic footage from the aorta, left ventricle (LV), echocardiography (Echo), and fluoroscopy (Fluoro). This heart had an intrinsic rhythm and could sustain function in a 4-chamber working mode, with baseline systolic and diastolic LV pressures of 83/12 mm Hg. The dimensions of the aortic root at the basal attachment of the valve leaflets were 25×29 mm, as measured by echocardiography. A 29 mm CoreValve prosthesis (Medtronic, Inc.) was chosen for implantation. Initially, a guidewire was positioned retrograde across the native aortic valve and into the LV. The delivery system was then placed over the guidewire and advanced until the transcatheter aortic valve (TAV) was properly positioned (Delivery System Positioned). The delivery system was unsheathed until the inflow portion of the TAV frame was partially expanded, and any required minor adjustments to location were made (Early Deployment). The delivery system was then unsheathed until the leaflets of the TAV were functioning and an angiography was performed to assess device position, function, and coronary flow (Late Deployment). The TAV was then fully unsheathed and deployed (Final Deployment). A final angiography on the deployed TAV was performed and endoscopic images were obtained of the functioning valve. The entire procedure can be viewed in [Online Video 1](#). Continued on next page



Endoscopic cameras (IplexFX, Olympus Corporation, Tokyo, Japan) were placed within the ascending aorta and left ventricle of a human donor heart (LifeSource, St. Paul, Minnesota) that was deemed not viable for transplantation. The heart was reanimated and perfused with a clear Krebs-Henseleit buffer according to previously described methodologies (1). Epicardial echo measurements were performed using a transthoracic probe (Vivid *i*, GE Healthcare, Waukesha, Wisconsin). These images have tremendous educational value for patients, clinicians, and design engineers.

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