Commentary: Transcatheter aortic valve–in–transcatheter aortic valve replacement—Are we learning more and knowing less?

Gaetano Paone, MD, MHSA, and Adam B. Greenbaum, MD

From the Structural Heart and Valve Center, Division of Cardiothoracic Surgery, Emory University School of Medicine, Atlanta, Ga.

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Address for reprints: Gaetano Paone, MD, MHSA, Structural Heart and Valve Center, Division of Cardiothoracic Surgery, Emory University Midtown Hospital, Medical Office Tower, 6th Floor, 550 Peachtree St NE, Atlanta, GA 30308 (E-mail: gpaone313@gmail.com).

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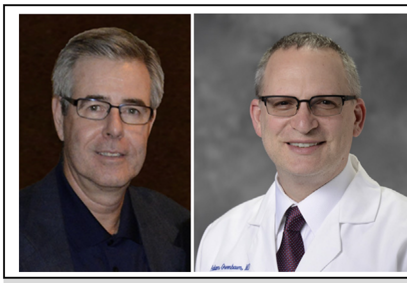

Gaetano Paone, MD, MHSA (*left*), and Adam B. Greenbaum, MD (*right*)

Central Message

Understanding the hemodynamic properties across various potential TAV-in-TAV configurations will be essential to optimizing the performance and the durability of future TAV-in-TAV replacements.

See Article page 565.

With both Edwards Sapien 3 (Edwards Lifesciences, Irvine, Calif) and Medtronic CoreValve Evolut R (Medtronic, Minneapolis, Minn) valves now commercially available for use in low-risk patients, transcatheter aortic valve replacement will quickly become the procedure of choice for virtually every patient with severe aortic stenosis, independent of age, risk, or valve pathology (save for endocarditis). As its use increases in those with longer life expectancy, some valves will inevitably fail. On the heels of previous studies in which their group evaluated the hemodynamic properties of transcatheter valves placed both as isolated implants[1] and inside bioprosthetic surgical valves,[2] in this issue of the *Journal*, Hatoum and colleagues[3] report the flow characteristics across 6 specific simulated transcatheter aortic valve–in–transcatheter aortic valve configurations of 23-mm Edwards Sapien 3 and 23-mm and 26-mm CoreValve prostheses.

Their sophisticated study of hemodynamic performance and flow disturbance demonstrates a range of transvalvular gradients, effective valve areas, regurgitant fractions, shear stresses, and pinwheeling indices. A 26-mm CoreValve placed inside a 23-mm Sapien 3 valve appears to perform best; however, no single configuration provides ideal flow properties for all the measured parameters.

Understanding how devices of specific size and design will interact is no doubt of value. Not every patient will receive a 26-mm CoreValve placed inside a 23-mm Sapien 3 valve, however, and certainly not within a uniform outflow conduit performing under fixed conditions that simulate the circulation but nonetheless are nonphysiologic. Flow within the aortic root is dependent on factors beyond the specific valve-in-valve configuration, including, among others, the relative size, height, and compliance of the coronary sinuses and the sinotubular junction. The process of positioning one valve inside another under variable clinical conditions cannot be as predictable and precise as when doing bench work. And, as Hatoum and colleagues[3] note, the risk of acute coronary obstruction as well as a potential need for future coronary access are additional anatomic considerations for both the initial valve choice and the replacement device. Furthermore, future device designs are in development and inevitable.

The value then of this article is clearly not in identifying a single preferred valve-in-valve combination. Rather, Hatoum and colleagues[3] demonstrate significant hemodynamic properties with distinguishable associated patterns of flow turbulence, which will vary across various potential combinations of valve design and size. Importantly, these unique flow characteristics may variably predispose to leaflet thrombosis and premature valve failure, and they should therefore be among the factors considered when choosing an appropriate treatment strategy for a failed transcatheter aortic valve replacement valve, although not the only ones.

The longer-term durability of transcatheter aortic valve replacement valves, currently uncertain—and speculative at best—will be central to any proposed treatment algorithm for aortic stenosis, particularly if transcatheter aortic valve–in–transcatheter aortic valve replacement is to become, as Hatoum and colleagues[3] suggest, "the plausible future therapy" and procedure of choice for younger low-risk patients. Controlled mechanical flow studies of different transcatheter aortic valve–in–transcatheter aortic valve implantations such as those presented here, together with advances in imaging and predictive anatomical modeling, perhaps with 3-dimensional printing and some forthcoming iteration of artificial intelligence, may well inform a future paradigm of not valve-specific, but patient-specific decision making. For now, however, it seems that the more we learn, the less we know.

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