Commentary: On-X and St Jude Medical mechanical prostheses—A paradoxic concept; they are equal but different!

Francesco Formica, MD,[a,b] Stefano D'Alessandro, MD, FECTS,[c] and Umberto Benedetto, MD[d]

From the [a]Mechanical Circulatory Support Program, Cardiac Surgery Unit, San Gerardo Hospital, Monza, Italy; [b]Department of Medicine and Surgery, University of Milano-Bicocca, Monza, Italy; [c]Cardiac Surgery Unit, Cardio-thoracic-vascular Department, San Gerardo Hospital, Monza, Italy; and [d]Bristol Heart Institute, University of Bristol, Bristol, United Kingdom.

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Address for reprints: Francesco Formica, MD, Clinica Cardiochirurgica, Ospedale San Gerardo, ASST Monza Via G.B. Pergolesi 33, 20052, Monza (MB), Italy (E-mail: francesco_formica@fastwebnet.it).

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Left-right: Francesco Formica, MD, Stefano D'Alessandro, MD, FECTS, and Umberto Benedetto, MD

Central Message

In vitro assessment studies of turbulence of mechanical prostheses give important notions about potential blood damage. Translating these notions into the clinical practice requires more studies.

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During the last decade, we have witnessed a progressive change in aortic valve replacement strategies. New generations of biological valves, including the sutureless prosthesis, and transcatheter aortic valve implantation techniques have reduced the percentage of mechanical prosthesis implanted. Moreover, the emergence of valve-in-valve therapy, the high durability of biological valves, and patients' reluctance to undergo lifelong anticoagulation therapy are pushing toward to the implantation of tissue valves in patients younger than 70 years. Although in the last years there was a trend toward a dramatic reduction of mechanical prosthesis implantation, from 60% to 25%,[1] the current guidelines still recommend a mechanical prosthesis for aortic valve replacement in patients younger than 65 years.[2]

Recent studies have reported superb long-term survival and excellent freedoms from reoperation, thromboembolism, bleeding, endocarditis, structural valve deterioration, major cerebrovascular events[1,3] with the St Jude Medical (SJM; Abbott Laboratories, Abbott Park, Ill) mechanical prosthesis and excellent results in terms of freedom from major cerebrovascular events under low-intensity warfarin therapy in patients receiving the On-X prosthesis (CryoLife Inc, Kennesaw, Ga).[4-6] In this issue of the *Journal*, Hatoum and colleagues[7] have reported a sophisticated and elegant in vitro study aiming to assess the turbulence of On-X and SJM prostheses. Hatoum and colleagues[7] analyzed the particle image velocity, the vorticity dynamics, and the Reynold shear stress to assess blood damage in vitro. They reported a smaller pressure gradient and a higher effective orifice area of the On-X valve relative to the SJM valve, and they were able to observe oscillation of the leaflets in the On-X valve at the peak of systole, which translates into increased shear stress and turbulence but does not relate to clinical hemolysis.[8] Sizes 21, 23, and 25 represent about 75% of mechanical prosthesis implanted for aortic valve replacement[1,3,4]; in this study, however, the assessments of turbulence for 21 and 25 sizes are missing. The measures of tissue annular diameter and internal diameter are higher for the On-X valve than for the SJM valve for the size 23 valve studied and also for both 21 and 25 sizes. In these latter cases, the parameters regarding the in vitro turbulence assessment might favor one prosthesis relative to the other. Moreover, the test was set at an ideal cardiac output of 5 L/min, heart rate of 60 beats/min, and pressure of 120/80 mm Hg. Because of different flows across the leaflet, we can expect different results with different hemodynamic conditions. On the basis of the turbulence assessment in the On-X valve, Hatoum and colleagues[7] stated that such parameters do not represent a proof favoring a lower intensity warfarin therapy. From the point of view of the in vitro study, this assertion is of paramount importance in decision-making of prosthesis choosing. Considering the clinical impact, however, the On-X valve may represent an evolution in terms of extremely low thromboembolism risk with a lower target international normalized ratio. Obviously, the excellent long-term (>30 years results) of the SJM must not be absolutely ignored. More effort should be expended to investigate the issues discussed here to avoid falling into the paradoxical concept: these prostheses are *structurally different but functionally equal*.

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