Editor’s Perspective

Transcatheter Aortic Valve Replacement and Stroke

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The evaluation of any therapy includes an assessment of benefits and risks. For percutaneous coronary interventions, death and myocardial infarction are typically selected as the 2 hard end points for describing adverse events. Stroke may be observed during percutaneous coronary intervention and be a direct result of the procedure. Fortunately, as percutaneous coronary intervention has matured, rates of stroke are <1%. Accordingly, few efforts have been directed toward lowering this event rate further.

For transcatheter aortic valve replacement (TAVR), rates of stroke are substantially higher than percutaneous coronary interventions, and in the Placement of Aortic Transcatheter Valves (PARTNER) B trial, the rate at 1 year among TAVR patients was double that of patients assigned to medical therapy alone. From a patient standpoint, stroke is among the most feared complications of patients undergoing TAVR, often more so than death. Furthermore, when high-risk patients treated by TAVR using the Sapien system were compared with those treated by surgical aortic valve replacement (PARTNER A), the rate of any stroke at 30 days with TAVR clearly exceed that of surgical aortic valve replacement, 5.5% versus 2.4%, \( P=0.04 \). Importantly, the rate of major stroke was also higher with TAVR, 3.8% versus 2.1%, \( P=0.2 \). A detailed analysis of strokes in the PARTNER A trial demonstrated that 51% of strokes were procedure related with 38% occurring within 2 days of the procedure.

The above findings caused some clinicians to pause after the initial presentation of the PARTNER data. But if we come forward to present day, follow-up data from the same trial have demonstrated that the risk of stroke or TIA was similar between those randomized to TAVR versus surgical aortic valve replacement (15.9% in the TAVR group versus 14.7% in the surgical aortic valve replacement group, \( P=0.35 \)) at 5 years.

Fortunately, rates of stroke have improved over time. Nevertheless, this problem is still a significant concern. In a recent publication of a TAVR registry with 12,182 patients, the rate of stroke at 1 year was 4.1%. Interestingly, aside from male sex, no other baseline or procedural feature evaluated was related to an increased incidence of stroke.

The mechanism for stroke in TAVR is thought to be showing of atheroemboli or calcific material during balloon predilation, valve positioning, or valve implantation. Although there was some initial thought that a significant fraction of stroke was a direct result of the catheter system traversing the aortic arch, based on an initial finding of excess stroke in transfemoral versus transaortic TAVR, this relationship has not been borne out by other studies. Accordingly, current thinking suggests that with contemporary approaches, atheroemboli arise from the aortic root and not the arch.

There is still significant work to be done with regard to TAVR-related stroke. Decreasing the risk of stroke in the future may be achieved in many ways including improving risk prediction, valve system technology, and periprocedural medical therapy, and possibly, the development of embolic protection devices.

Risk prediction for neurological events in TAVR could aid in patient selection and in patient counseling before the procedure. Important predictors of early strokes are small aortic valve areas, atrial fibrillation, and balloon postdilation during the procedure, whereas late strokes are mostly influenced by chronic atrial fibrillation, previous cerebrovascular disease, and a transapical approach. After stroke, patients exhibit significant morbidity and mortality, and if stroke does occur, it is the strongest predictor of mortality in routine practice.

The fact that balloon postdilation is a major factor in the development of stroke leads to the conclusion that improved TAVR devices and delivery systems may decrease the risk of stroke as TAVR technology improves. Postdilation should be avoided when possible, balancing the risk of stroke with the risk of even mild aortic regurgitation.

There seems to be no relationship between the device used for TAVR and the incidence of stroke. The Edwards and CoreValve (Medtronic) systems are the most extensively evaluated valves for TAVR thus far, with important differences in design, deliverability, and deployment technique. A recent pooled analysis, however, suggests similar risks of stroke between the valve types. However, improvements in valve technology that lessen the need for postdilation will likely have a large effect in preventing stroke.

There is also a growing interest in ancillary embolic protection devices to reduce the risk of stroke with TAVR. Several different devices have been developed and are part of clinical testing programs, with mixed results thus far. In a histopathologic analysis, Mieghe et al demonstrated that 75% of embolic protection devices retrieved after TAVR contained embolic debris. The significance of silent cerebral embolism on prognosis, however, remains uncertain.

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The risk of stroke has declined over the years as there have been improvements in patient selection, operator experience, and valve system technology. A multilevel approach for the prevention of strokes includes improved interventional techniques, embolic protection devices, antithrombotic treatment, close monitoring, and aggressive management of modifiable risk factors. Technology advances notwithstanding, reducing the risk of stroke is one of the keys to continue to improve the safety of TAVR and makes it reasonable to transition TAVR to lower risk patients.

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References
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