“Not in my brain”: The use of embolic protection devices to prevent brain embolization during cardiovascular procedures

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Disclosures: Author has nothing to disclose with regard to commercial support.

Received for publication May 28, 2018; revisions received May 28, 2018; accepted for publication May 30, 2018; available ahead of print July 11, 2018.

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J Thorac Cardiovasc Surg 2018;156:e205-6

0022-5223/\$36.00

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<https://doi.org/10.1016/j.jtcvs.2018.05.114>

Brain “bright lesions” in dw-MRI (arrows).

Central Message

The prevention of brain embolization during cardiovascular procedures is of paramount importance.

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In this issue of the *Journal*, Ranganath and colleagues¹ creatively used cerebral embolic protection devices (EPDs) routinely used during carotid stenting to prevent embolization to the brain during the removal of an Impella (Abiomed, Danvers, Mass) device that had been used without anticoagulation. The devices captured thromboembolic material, and the patient recovered with no neurologic complications. The medical literature is full of procedures and treatments that have a logical and thoughtful foundation, but their implementation has been associated with increased risk or has been difficult to demonstrate that they achieved their proposed objective. Prophylactic procedures aimed to prevent complications should demonstrate effectiveness, and their implementation should be associated with low risk. There are no more important prophylactic procedures than those aimed to the prevention of clinical or radiologic strokes during cardiovascular procedures.

Clinical strokes after cardiovascular procedures are fortunately rare, but the majority of patients have clinical silent strokes detected on diffusion-weighted magnetic resonance imaging (dw-MRI) of the brain.² dw-MRI of the brain typically demonstrates 1 to 5 small (1-3 mm) bright lesions in 8% to more than 90% of patients after cardiovascular procedures (Figure 1).² These lesions represent acute ischemia and may progress to irreversible infarct and tissue loss, although some of them disappear after a few months.²⁻⁵ Clinical strokes after cardiac surgery, coronary interventions, or transcatheter valve and aortic procedures not only decrease survival but also worsen quality of life. Even patients who experience clinical silent strokes (“bright lesions” on dw-MRI) have poor long-term outcomes with an increased incidence of cognitive dysfunction, dementia, and memory loss.²⁻⁵

Several attempts have been made to prevent embolic strokes during cardiac surgery and other cardiovascular procedures. In a recent Cardiothoracic Surgical Trials Network–sponsored clinical trial (clinicaltrials.gov

Identifier: NCT02389894), the use of cerebral EPD failed to demonstrate a decreased number of clinical or radiologic strokes after isolated surgical aortic valve replacement or combined aortic valve replacement and coronary artery bypass graft surgery.⁶ The study demonstrated that although EDP captured embolic material in 74% to 99% of the patients, only 5% of patients have clinically apparent strokes even with a rigorous stroke adjudication process. Meanwhile, at least 70% of the patients had new “bright lesions” on dw-MRI, and their incidence was not different between the study and control groups. Similar observations have been made by studies that examined the use of EPD during transcatheter aortic valve replacement: Although EPDs captured embolic material in 99% of the patients, the rate of clinical and radiologic strokes was similar among the groups.⁷ In some studies, the placement of these devices has been associated with an increased risk of complications because they require manipulation of the inside walls of diseased aortic and carotid vessels.⁸ Likewise, EPDs during carotid stenting are associated with fewer lesions in dw-MRI, but the majority of the lesions are not associated with transient ischemic attacks or with minor or major strokes.⁵

Cerebral EPDs have a thoughtful and logical foundation, and their implementation during cardiovascular procedures is associated with low risk, but the effectiveness to reduce clinical or radiologic strokes has not been conclusively demonstrated even when they capture embolic material. Thus, we cannot assume that the presence of thromboembolic material in the EPDs prevented a clinical or radiologic stroke in the current case report.¹ It is likely that this patient had “bright lesions” on dw-MRI if one had been performed

FIGURE 1. Diffusion-weighted magnetic resonance imaging of the brain showing multiple embolic lesions (bright lesions, *arrows*) after surgical aortic valve replacement.

and may even have had a clinical stroke if a rigorous examination had been performed by a neurologist. Should the EPD have been used? There are no conclusive data to support its use during any cardiovascular procedures and even less during Impella removal. Yet, these “bright lesions” on dw-MRI are unlikely to make anybody any brighter because their volume is correlated with worse neuropsychologic and cognitive outcomes.^{6,7,9} Do you want them in your brain? I don’t. Cerebral EPDs may not be the solution, but pursuing reduction of brain embolization is of paramount importance because survival is considered an expected outcome, and we and the society focus on quality of life outcomes as the definition of success after cardiovascular procedures.

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