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RESEARCH LETTER

Novel Neuroimaging Evidence of Brain Lesions Following Transcatheter Aortic Valve Replacement

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Transcatheter aortic valve replacement (TAVR) is anticipated to expand to younger low-risk patients. Brain lesions post-TAVR remain a source of concern. Small ischemic lesions are frequently detected de novo on diffusion-weighted magnetic resonance imaging (MRI) and assumed to be attributable to embolism of calcific and thrombotic fragments.[1] A recent retrospective study has reported new susceptibility-weighted imaging (SWI) lesions in patients after surgical implantation of heart valves,[2] suggesting the hitherto overlooked possibility of microbleeds following TAVR, because SWI sequences are regarded as the most sensitive MR technique for detection of brain microbleeds but not used in TAVR studies.[3] We reported the preliminary observations of new SWI lesions on serial MRI following TAVR.

MRI was performed using a 3.0-Tesla system (Discovery MR750, General Electric, USA). The protocol consisted of standardized conventional diffusion-weighted-MRI, T_2-FLAIR (fluid-attenuated recovery inversion), and SWI parameters with a slice thickness of 2, 5, and 1 mm, respectively. A senior neuroradiologist (S.L) masked to clinical information reviewed the number, size, and location of lesions. SWI lesions were defined as round or ovoid black lesions that were small in size (diameter, 1–10 mm) with at least half of the lesion surrounded by brain parenchyma. Hyper-intense lesions were categorized as ischemic in origin after independent consideration of FLAIR and diffusion-weighted-MRI images. Previous scans were compared to confirm new lesions. Prospective neurological and cognitive assessments were conducted during index hospitalization before and after TAVR using a combination of tests recommended by the Neurologic Academic Research Consortium.[4] The study was approved by the institutional review board and written informed consent was obtained. Data of this study are available from the corresponding author upon request. Descriptive analyses are provided because of the small sample size. Continuous variables are presented as median (interquartile range [IQR]) and categorical variables as percentages. Correlation between continuous variables was tested using the Spearman Rand correlation coefficient.

We enrolled 23 patients (6 [26.1%] women) with a median age of 70.0 (IQR, 67.0–76.0) years. All patients remained alive with stable bioprosthetic valve performance.

Brain MRI was performed 1 day before and 6 days after TAVR. Baseline hemorrhagic lesions were found in 9 patients, including 13 lesions of microbleeds and 1 subdural hemorrhage. Following TAVR, new SWI lesions (diameter 1.2–4.1 mm) were detected in all 23 patients (total 120; range, 1–17 per patient; median

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4.0 [IQR, 2.0–7.0], Figure), and women tended to have a greater number of new SWI lesions per patient (9.0 [IQR, 3.5–12.5] versus 4.0 [IQR, 1.5–5.5]). Baseline infarcts were identified in 7 patients. One patient was unable to finish diffusion-weighted-MRI post-TAVR because of non-compliance and a total of 86 new

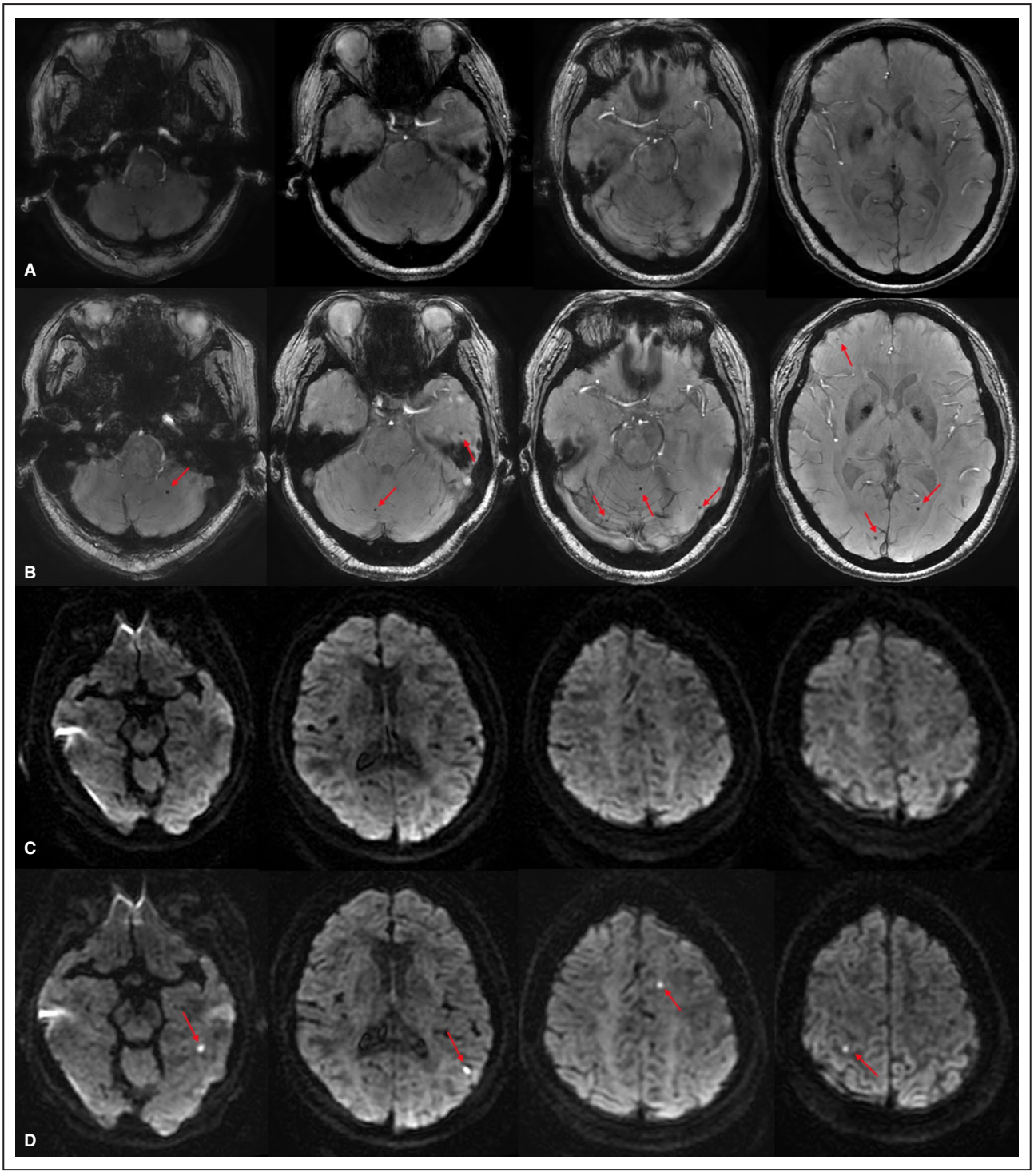

Figure. Differential locations of new brain susceptibility-weighted imaging lesions and infarcts following transcatheter aortic valve replacement.
A and **B**, New susceptibility-weighted imaging lesions (red arrows) at different locations observed 6 days after transcatheter aortic valve replacement (some lesions are not shown in their best plane of view because of the limitations of still images). **A**, Serves as baseline reference. **C** and **D**, New ischemic lesions (red arrows) at different locations in the same patient demonstrated with diffusion-weighted-MRI. **C**, Serves as baseline reference.

ischemic lesions (diameter 1.3–7.2 mm) were detected in 17 of the remaining 22 patients (77.3%) with fewer ischemic lesions than SWI lesions per patient (2.5 [IQR, 0.8–4.5] versus 4.0 [IQR, 2.0–7.0], Figure). The number of new SWI/ischemic lesions was not associated with the number of baseline hemorrhagic/ischemic lesions (P=0.97, P=0.86), but there was a positive correlation of the number of new SWI and ischemic lesions (r_s=0.5, P=0.01). New SWI lesions were observed at the gray and white matter junction (n=87, 72.5%), cerebellum (n=20, 16.7%), brain stem (n=4, 3.3%), basal ganglia (n=7, 5.8%), and centrum ovale (n=2, 1.7%), while ischemic infarcts were observed at the gray and white matter junction (n=58, 67.4%), centrum ovale (n=10, 11.6%), cerebellum (n=10, 11.6%), and basal ganglia (n=8, 9.3%). Overall, the left frontal lobe was the most common location for both new SWI and ischemic lesions.

There was no clinical stroke or transient ischemic attack detected after TAVR. Cognitive assessments remained stable in the majority of patients although 4 demonstrated declines in 1 to 2 tests.

Nine patients underwent follow-up MRI at a median of 89 (IQR, 45–201) days following TAVR. SWI lesions detected on day 6 showed no change in 6 patients, while 3 (33.3%) showed progressive change with an additional new SWI lesion compared with the post-procedural MRI scan. Ischemic lesions remained stable in 4 of 9 patients (44.4%) and receded in others (encephalomalacia, n=3; size reduction, n=1; undetectable, n=5).

This study presents novel evidence about a previously overlooked type of brain lesion after TAVR. Although intra-patient spatial overlap may limit the determination of some lesions, we demonstrated that new SWI lesions can be identified in all patients after TAVR and seem to be more prevalent than ischemic lesions. SWI lesions had a different topological distribution of the brain from ischemic lesions. SWI lesions after TAVR remained unchanged during follow-up (with moderate progression in some patients) whilst ischemic lesions frequently resolved. If the underlying entity is microbleeds, it is noteworthy that brain microbleeds have been associated with cerebrovascular events and even increased mortality.[5] Our findings suggest the need of further evaluation on micro-hemorrhagic events post-TAVR and possible clinical sequalae, as patient management (eg, antithrombotic therapy) might need improvements.

ARTICLE INFORMATION

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Disclosures

None.

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