

Bilateral Simultaneous Middle Cerebral Artery Mechanical Thrombectomy for Periprocedural Transcatheter Aortic Valve Implantation Stroke: A Case Report

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J Clin Interv Radiol ISVIR 2023;7:190–193.

Abstract

Mechanical thrombectomy has been described as the prompt procedure for emergent large vessel occlusion strokes resulting from cardioembolic events, arterial lesion-to-artery embolism, or from in situ atherosclerosis. This is the first reported case of an elderly woman who presented with bilateral paresis, progressive drowsiness, and dysarthria due to bilateral middle cerebral arterial occlusion, originating from the aortic valve, after transcatheter aortic valve implantation, leading to stroke. Despite intravenous thrombolysis being begun for this patient, it proved ineffective and she underwent mechanical thrombectomy, which led to complete revascularization of bilateral middle cerebral arteries following which she completely recovered without any deficits.

Keywords

- mechanical thrombectomy
- TAVI
- acute ischemic stroke

Introduction

Stroke following transcatheter aortic valve implantation (TAVI) is a known entity that can occur within or after 24 hours of the procedure. The incidence of 30-day periprocedural stroke is 1.4 to 1.9%.^{1,2} Acute ischemic stroke occurs due to various factors influencing the condition during the procedure. Diagnosis of acute ischemia is very crucial to preserve the neurological functions. Computed tomography (CT) angio-

gram is very effective and an accurate imaging technique in detecting the arterial occlusion. Though intravenous (IV) thrombolysis can recanalize the intracranial arteries effectively, it attains lower modified treatment in cerebral infarction score 3 (TICI3) reperfusion rate than mechanical thrombectomy (MT).³ MT is offered as the first line of management in large-vessel occlusion within window period that can be undoubtedly detected on imaging. As per our knowledge, bilateral MT post-TAVI stroke has not been reported till date.

article published online
October 14, 2022

DOI <https://doi.org/10.1055/s-0042-1757579>.
ISSN 2457-0214.

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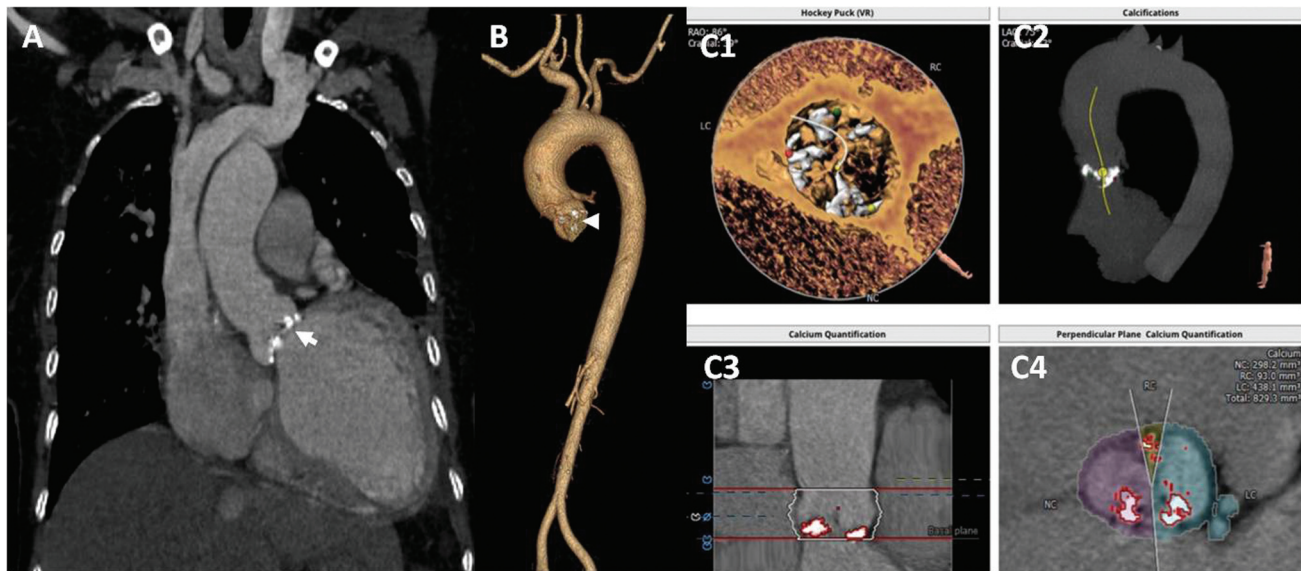


Fig. 1 Coronal section computed tomography angiogram and volume rendering image of aorta showing severe aortic valve calcifications (small arrow in A and arrowhead in B). Quantifications of aortic valve calcifications (C1–C4).

Case Report

A 65-year-old lady with severe aortic stenosis underwent TAVI under general anesthesia. Aortic valve calcification was reformatted on CT and further quantified before the procedure (►Fig. 1A–C). Aortic valve replacement was uneventful during the procedure. Balloon-assisted valve 20 × 40 mm Mammoth was used and Myval 24.5 mm device was placed (►Fig. 2A–D) following balloon predilatation. Half an hour post-procedure following extubation, patient was found drowsy and was not responding to commands. On examination, the power on the right side was 0/5 and 2/5 on the left side with aphasia. In suspicion of stroke, immediate plain CT and CT angiogram were performed. National Institute of Health Stroke Scale (NIHSS) score was 21.

Plain brain showed evolving hyperacute infarct involving the left caudate nucleus with CT ASPECTS score of 8/10 on left

and 10/10 on right side (►Fig. 3A). There was no intracranial bleed. CT angiogram and digital subtraction angiogram revealed cutoff of proximal M1 segment of bilateral middle cerebral arteries, suggesting complete occlusion (►Fig. 3B–D). IV thrombolysis done immediately showed no clinical or neurological improvement in next 30 minutes. Under local anesthesia, patient underwent emergent MT of both middle cerebral arteries simultaneously using 4 × 40 mm Solitaire stent and CAT 6 distal aspiration catheter to remove the embolic material in first pass (Solumbra technique). TIC13 recanalization was achieved on both sides and on close-up evaluation embolized material was found to have native aortic valve fragments (►Fig. 3E–F). Patient showed dramatic improvement in sensorium and started moving all four limbs and was discharged in the next 4 days without any deficits. Patient is asymptomatic and is on regular follow-up for the last 1 year with modified Rankin Scale of 0.

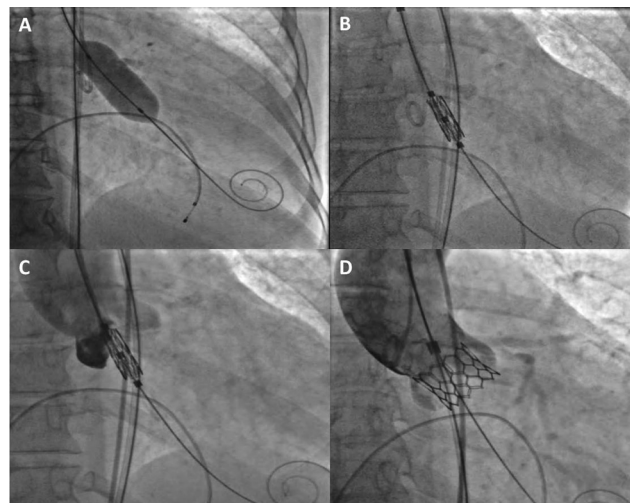


Fig. 2 Digital subtraction angiograms showing successfully deployed balloon-assisted aortic valve placement (A–D).

Discussion

Aortic stenosis, seen in elderly, is defined as obstruction to the flow of blood across the aortic valve. This can be treated through endovascular technique or surgically. Transcatheter aortic valve replacement is the standard treatment of choice at present for aortic stenosis.⁴ One of the major complications includes stroke. The rate of incidence of stroke is much higher in surgically treated aortic stenosis than TAVI.⁵ Stroke after TAVI can be acute, occurring within 24 hours, subacute between past 24 hours and 30 days post-procedure and late occurring after a month following procedure.⁶ Patients with acute stroke in the immediate postoperative period may present with focal neurological deficits like facial asymmetry, limb weakness, slurring of speech or aphasia, limb ataxia, sudden onset blurring of vision or preferential gaze towards one side, and altered sensorium. These symptoms are impossible to detect or delay in the clinical diagnosis if there is

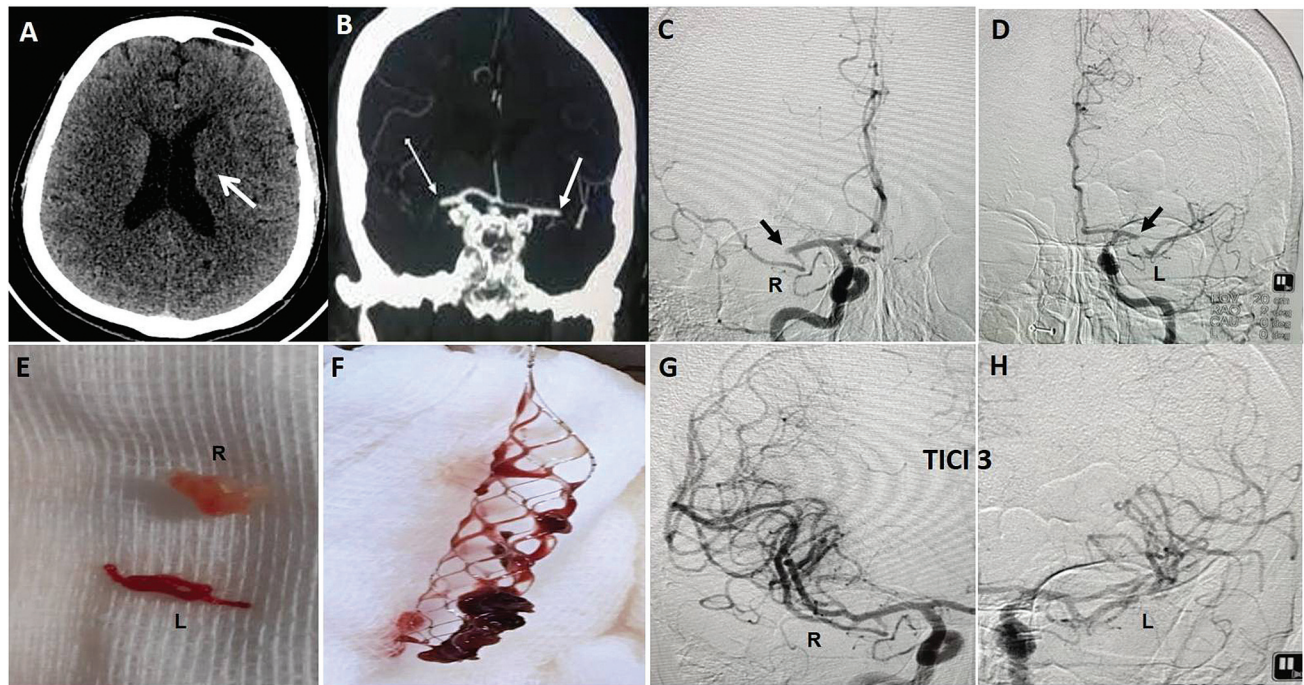


Fig. 3 Plain computed tomography (CT) brain shows hyperacute infarct in left basal ganglia (arrow) with aspect score of 7/10 on left side and 10/10 on right side (A). CT angiogram and diagnostic digital subtraction angiogram show complete cutoff of M1 segment of bilateral middle cerebral arteries (arrows) (B–D). Mechanical thrombectomy using 6 × 20 stentriever retrieved fleshy firm tissue from both the middle cerebral arteries (E and F) resulting in treatment in cerebral infarction score 3 (TICI3) recanalization (G and H).

use of general anesthesia or sedation. Extubating the patient from general anesthesia as soon as possible makes it easier to detect symptoms.

Patient-related early stroke predictors include history of prior stroke, female gender, chronic kidney disease, peripheral vascular disease, low basal metabolic index, angina, and prior atrial fibrillation. Procedure-related predictors include aortic valve annulus size, pure aortic stenosis, constitution of calcified aorta valve and aortic wall, manipulation with large delivery catheter, time taken in cath lab, time of delivery of catheter in patients' body, rapid pacing during valvuloplasty, balloon pre- and postdilatation, and valve repositioning.⁷ According to SOLVE-TAVI trial, use of self-expandable valves showed a lower stroke rate as compared to balloon-expandable valves.⁸ In our patient, female gender and heavily calcified aortic valve aortic valves were the risk factors. Apart from these, use of balloon-expandable valve preceded by balloon predilatation was the most probable cause for the embolic stroke.

Mechanism of acute ischemic stroke in these patients is the endothelial damage resulting from manipulation of the catheters that in turn cause activation of platelets and coagulation cascade leading to thrombus formation.⁶ The thrombus formed gets dislodged into the intracranial arteries that can produce stroke.

Embolus can be red blood cell (RBC)-rich clot that appears hyperdense on CT and shows blooming on susceptibility-weighted images. However, fibrin-rich clot does not show blooming on gradient sequence. Calcified thrombus may also be seen in calcified aortic stenosis, carotid atherosclerotic disease, and mitral valvular calcification. In TAVI patients, the native aortic valve calcification causes calcified throm-

bus.⁹ Fibrin is the commonest tissue debris causing occlusion in patients where balloon-expandable and oversized valves are used. Air emboli during the procedure is a rare but a known cause. Unfortunately, we could not send the retrieved clot for histopathology in our case.

Though diffusion weighted imaging is the gold standard in detecting acute infarcts, recent surgery is a challenging situation for magnetic resonance imaging. While plain CT helps in detecting any intracranial bleed, CT angiogram detects the site of occlusion if any.

Our patient had bilateral large vessel occlusion involving proximal middle cerebral arteries secondary to embolization of native aortic valve fragments presented clinically within half an hour of procedure for which bilateral MT was offered. IV tissue plasminogen activator (tPA) can be administered, however, of lesser benefit as the major cause is nonthrombotic emboli in these patients. Also, bleeding from the TAVI access site is one of the complications due to which tPA should be used cautiously depending on the patient.¹ There is no data published till date on bilateral MT in periprocedural TAVI stroke patients.

MT is suitable for patients with symptom onset less than 6 hours, NIHSS more than 6, small infarct core volume, ASPECT Score of 6 to 10, good collaterals, and remarkable penumbra to core mismatch.¹⁰ MT is more useful and efficient than IV thrombolytic therapy for documented large vessel occlusion in acute settings.¹ Improvement in neurological condition can be noticed on table soon after the thrombus is removed. Stent retriever is used for the removal of the embolus. In case of calcified thrombus, constant radial force is necessary during the stent retrieval in order to remove the thrombus.⁹ Clots occluding intracranial arteries

may be RBC rich (red clot), fibrin rich (white clot), or mixed. Clot arising from cardi-embolic source is generally RBC rich and responds very well to IV thrombolysis and stentriever MT; however, fibrin-rich clots, which are mostly from atherosclerotic origin, are poor responders to IV thrombolysis as well as for MT from stentriever. Contact aspiration with large bore aspiration catheter or combination of stentriever and contact aspiration techniques are superior in achieving complete recanalization of the arteries.¹¹

Measures for the prevention of stroke include unfractionated heparin during TAVI, procedural modifications, and using cerebral embolic protection devices. Antiplatelets are added in atrial fibrillation patients. Anticoagulant therapies would reduce the rates of late strokes. Transfemoral access is preferred for TAVI procedure as it would also be used for MT if necessary.⁷

Conclusion

Intracranial arterial embolization due to debris dislodging into the carotid arteries causes early stroke following TAVI. IV tPA alone may not be effective in all cases. MT has a higher rate of reperfusion and is the treatment of choice for emergent large vessel occlusions. Large-vessel occlusion can occur following TAVI and MT should be offered in such circumstances. Availability of neurointerventional expertise in the same center where TAVI is performed can salvage many periprocedural strokes if identified at the earliest and treatment initiated immediately.

Conflict of Interest
None declared.

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