CASE REPORT

Young Paradoxical Stroke Treated Successfully with Mechanical Thrombectomy Using Solitaire and Transcatheter Closure of Patent Foramen Oval

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Summary

Paradoxical embolization is the mechanism for patent foramen ovale (PFO)-associated cryptogenic stroke and transcatheter closure of PFO may prevent recurrent ischemic stroke. Mechanical thrombectomy is promising to treat acute ischemic stroke due to high rates of reperfusion and reduced intracranial hemorrhage complications. We report the case of a 27-year-old woman with a massive cerebral infarction but no evidence for any atherosclerosis, who received an urgent mechanical thrombectomy with a Solitaire device. In order to ascertain the etiology of stroke, transcranial Doppler (TCD) and transesophageal echocardiograph (TEE) were conducted. TCD showed severe right-to-left shunting (shower effect) after Valsalva maneuver and bubble test and TEE identified a PFO. Therefore, the patient had suffered a paradoxical stroke associated with PFO. After two weeks of the stroke onset, transcatheter PFO closure with Cardio-O-Fix occluder was also performed successfully. During 1-year of follow-up, no recurrence of stroke occurred. Our case demonstrates that mechanical thrombectomy using a Solitaire device and transcatheter PFO closure can be safely and successfully performed to treat acute paradoxical stroke and prevent its recurrence.

Key words: Cryptogenic stroke, Solitaire device, Cardio-O-Fix occluder

P atent foramen ovale (PFO) is considered as a crucial risk factor for cryptogenic stroke (CS) in young patients.1,2) The mechanism to explain the relationship between CS and PFO is paradoxical embolism through a PFO.3) Transcatheter PFO closure is safe and seems to protect against recurrent strokes in patients with paradoxical embolism.4,5) In recent years, mechanical thrombectomy has emerged to treat acute ischemic stroke and shown significant technical advances, even when chemical thrombolysis is not possible because of the potential risk of hemorrhagic complications.6,7) We report herein a young patient with paradoxical stroke, who was successfully treated with mechanical thrombectomy and transcatheter PFO closure, but also prevented the recurrence of ischemic stroke.

Case Report

A 27-year-old woman with a normal body mass index (23.4 kg/m²) was admitted to department of neurology with left-sided limb weakness of 8 hours duration. There was no history of atherosclerosis risk factors such as hypertension, diabetes, hyperlipidemia or smoking. An initial neurologic examination revealed limb weakness on the left side. Electrocardiography was normal. Brain magnetic resonance imaging showed acute infarction in the right frontal, temporal, and insular regions as well as basal ganglia (Figure 1). Cerebral angiography showed thrombi and severe stenosis (90%) of M1 segment of the right middle cerebral artery (Figure 2A). Subsequently, emergent mechanical thrombectomy was performed. A microcatheter was navigated across the stenosis of M1 to the M2 portion of the right MCA using a 0.014 inch microwire. After removing the microwire, a Solitaire (4 × 20 mm) retriever stent was then introduced through the microcatheter and fully deployed across the entire stenosis segment (Figure 2B). Five minutes after deployment, the Solitaire stent was retrieved during compression of the right common carotid artery. Recanalization of the right middle cerebral artery was achieved with capturing of the thrombus. A final angiogram revealed complete recanalization without residual stenosis (Figure 2C). Her neurologic symptoms resolved after the thrombectomy and she was treated with aspirin (100 mg/day) and clopidogrel (75 mg/day).

Her coagulation profiles were normal and antiphospholipid antibodies screening was negative. Furthermore, carotid ultrasound did not detect any abnormalities and cardiac rhythm monitoring did not document atrial fibrillation. Therefore, paradoxical embolism was suspected. Although Doppler ultrasound of the lower limbs veins did
not reveal deep venous thrombosis, transcranial Doppler (TCD), and transesophageal echocardiograph (TEE) were performed to ascertain the etiology of stroke. TCD demonstrated severe right-to-left shunting (shower effect, > 25 microbubbles) after Valsalva maneuver and bubble test (Figure 3). TEE with saline contrast infusion identified a 1.9 mm of tunnel-sharped PFO without an atrial septal aneurysm (Figure 4). Also, the Risk of Paradoxical Embolism (RoPE) score was 10, suggesting that the young patient was more likely to have a PFO-attributable CS. Thus, the patient had suffered a paradoxical stroke due to PFO and was qualified for a transcatheter PFO closure.

After two weeks of the stroke onset, the patient was referred to the cardiovascular department. The procedure of PFO closure was performed under X-ray and transthoracic echocardiographic monitoring. After insertion of the right femoral vein sheath, unfractionated heparin 5000 U was administered. A 0.035” Super Stiff guidewire was advanced into the left atrium through the open foramen ovale and positioned in the upper left pulmonary vein. The 9 French, 80 cm transseptal delivery system was advanced into the left atrium over the stiff wire. The Cardio-O-Fix 18/25 mm PFO Occluder (Starway Medical Technology, Beijing, China) was introduced through the delivery sheath and the left atrial disk was released by pushing it out on the left atrial side and then the delivery sheath was withdrawn to release the right atrial disk. The correct position was seen in transthoracic echocardiography. On the next day, complete PFO closure was confirmed in contrast TCD (Figure 5). The patient was discharged 2 days later on 100 mg/day of aspirin and 75 mg/day of clopidogrel for 6 months. There was no recurrence of stroke noted at the 12 months follow-up and no right-to-left shunting was detected in contrast TCD.

Discussion

Ischemic stroke has been considered a relatively rare event in young adults and only 5-10% of ischemic stroke may occur below the age of 45 years. Moreover, the etiologies of stroke in young patients are different from those in elderly patients and paradoxical embolism may be more frequent in younger patients. PFO has been recognized as an important risk factor for paradoxical systemic embolization and related to increased risk of CS in patients because of right-to-left-shunting.

There is no conclusive consensus as to the optimal way to treat patients with paradoxical embolism and prevent recurrence of ischemic stroke. Therapeutic options demonstrated benefit for adult acute ischemic stroke include intravenous fibrinolysis with tissue plasminogen ac-

Figure 1. Magnetic resonance imaging shows acute infarction in the right frontal, temporal, and insular regions as well as basal ganglia.

Figure 2. Cerebral angiography and mechanical thrombectomy. A: Pre-operative cerebral angiography shows thrombi and severe stenosis (90%) of M1 segment of the right middle cerebral artery. B: Solitaire (4 × 20 mm) stent retriever deployed fully across the entire stenosis segment. C: Final angiography shows complete recanalization without residual stenosis.
Figure 3. Transcranial Doppler bubble test shows severe right-to-left shunting (shower effect) after Valsalva maneuver.

Figure 4. Transesophageal echocardiography with color Doppler reveals an opened patent foramen ovale. LA indicates left atrium; and RA, right atrium.

Figure 5. Post-PFO closure, transcranial Doppler bubble test demonstrates no right-to-left shunting.

tivator (tPA) within 4.5 hours of symptoms onset and mechanical thrombectomy. The Solitaire device is a new generation device approved for mechanical thrombectomy, which is a self-expanding stent retriever and restores blood flow in patients with ischemic stroke due to intracranial artery occlusion. Recent studies showed that the Solitaire stent retriever was associated with high rates of reperfusion and favorable clinical outcomes, including reduced intracranial hemorrhage complications and improved final disability outcome. However, the risks and benefits of mechanical thrombectomy are still in evaluation.

In addition, transcatheter PFO closure with the Amplatzer device has been proved to be safe and has had a high rate of success. A large meta-analysis of observational studies has shown transcatheter PFO closure to be more effective than medical therapy for prevention of recurrent paradoxical emboli, in particular in patients with complete closure. Although three randomized controlled trials in the past few years failed to demonstrate that transcatheter PFO closure was superior to medical therapy, a sub-analysis of the RESPECT study reported that patients with a substantial PFO shunt may benefit from the Amplatzer device. Furthermore, the current recommendations on the management of patients with CS & PFO suggest that transcatheter PFO closure could be offered for patients at high risk of recurrent embolic event such as patients with atrial septal aneurysm, long PFO tunnel, substantial right-to-left shunt, eustachian valve, chiari network as well as hypercoagulable state. Therefore, there was reasonable evidence to perform a transcatheter PFO closure in the young stroke patient because of a substantial right-to-left shunt.

To the best of our knowledge, this is the first case report to describe the use of mechanical thrombectomy and PFO closure for young ischemic stroke. In the case, there was no evidence for any atherosclerosis and cardiac arrhythmias, and thus the sudden onset of ischemic stroke suggested to be a CS owing to a paradoxical embolism. In our experience, mechanical thrombectomy using Solitaire and transcatheter PFO closure may be feasible and effective in the treatment of acute embolic stroke and prevention of recurrence.

Conclusions

Mechanical thrombectomy using a Solitaire device and transcatheter PFO closure can be safely and successfully performed to treat acute paradoxical stroke and prevent its recurrence.

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Disclosures

Conflict of interest: The authors declare that they have no conflict of interest.

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