Int J Clin Exp Med 2017;10(8):12880-12888
www.ijcem.com /ISSN:1940-5901/IJCEM0056330

Case Report

Impact of stent implantation on cognitive function of patient with middle cerebral artery stenosis: one case analysis

Guohu Weng[1*], Bo Zhou[4*], Shaoshi Chen[1], Hua Yang[2], Zhengxin Huang[3], Shixiong Huang[5]

Departments of [1]Neurology, [2]Internal Medicine, [3]Cardiology, Hainan Provincial Hospital of TCM, Haikou, Hainan, China; [4]Department of Intensive Care Unit, The First Affiliated Hospital of Human University of Chinese Medicine, Changsha, Hunan, China; [5]Department of Neurology, People's Hospital of Hainan Province, Haikou, Hainan, China. [*]Co-first authors.

Received April 27, 2017; Accepted July 6, 2017; Epub August 15, 2017; Published August 30, 2017

Abstract: This study reported the treatment process of a case of middle cerebral artery (MCA) stenosis patient with cognitive impairment, aiming to investigate the impact of stent implantation on the postoperative cognitive function of the patient with MCA stenosis. A MCA stenosis patient received stent implantation and was further treated by low molecular heparin, clopidogrel, and aspirin postoperatively. No new infarction focus was found by MR+DWI after surgery. The patient discharged on the 3rd day after operation and kept on antithrombotic therapy. The cognitive function was improved after 1 month. Stent implantation is safe and efficient to MCA stenosis patient, while its long-term effect still needs further verification. Cognitive function was improved after encephalic blood reperfusion.

Keywords: Middle cerebral artery, stenosis, stent, cognitive function

Introduction

Stroke is one of the major causes of death and disability in the world [1]. Middle cerebral artery (MCA) plays an important role in primary atherosclerotic especially in Asian [2]. Atherosclerosis of the MCA may cause stenosis, plaque shedding, and chronic occlusion, which may lead to severe complications and predicts a poor prognosis, including cognitive disorder. Symptomatic MCA stenosis is a general cause of ischemic stroke.

Atherosclerosis appears more commonly in intracranial artery instead of extracranial artery from melanoderm and Asian Compared with Caucasian [3]. At present, except positive drug therapy, interventional therapy became one of the important methods for intracranial artery stenosis. Several studies have reported the safety and effectiveness of interventional therapy [4]. The application of interventional therapy in symptomatic MCA M1 segment stenosis shows high risk. This study reported a related case to discuss the treatment.

Case presentation

Clinical information

A 44-year-old male suffered from poor left limb activity, combined with left side facial paralysis and cognitive impairment for 1 day. He received brain MRI+DWI examination and was found acute cerebral infarction and cerebral hemorrhage in right frontal, temporal, insular lobes (**Figure 1**). The facial paralysis and poor limb activity were alleviated after treated by antiplatelet, plaque stabilization, and neurotrophy. Next, the patient reviewed brain MRI after 3 months and was showed no new infarction (**Figure 2**). Neck CTA exhibited that R-MCA severe stenosis (90%) (**Figure 3**). The patient showed no history of diabetes, hypertension, or heart disease. Physical examination demonstrated clear consciousness, calculation power and memory deterioration, symmetric nasolabial groove, myodynamia at degree 5^-, finger-to-nose test and rombergism (+). MMSE scale evaluation was 25 points. TCCD indicated

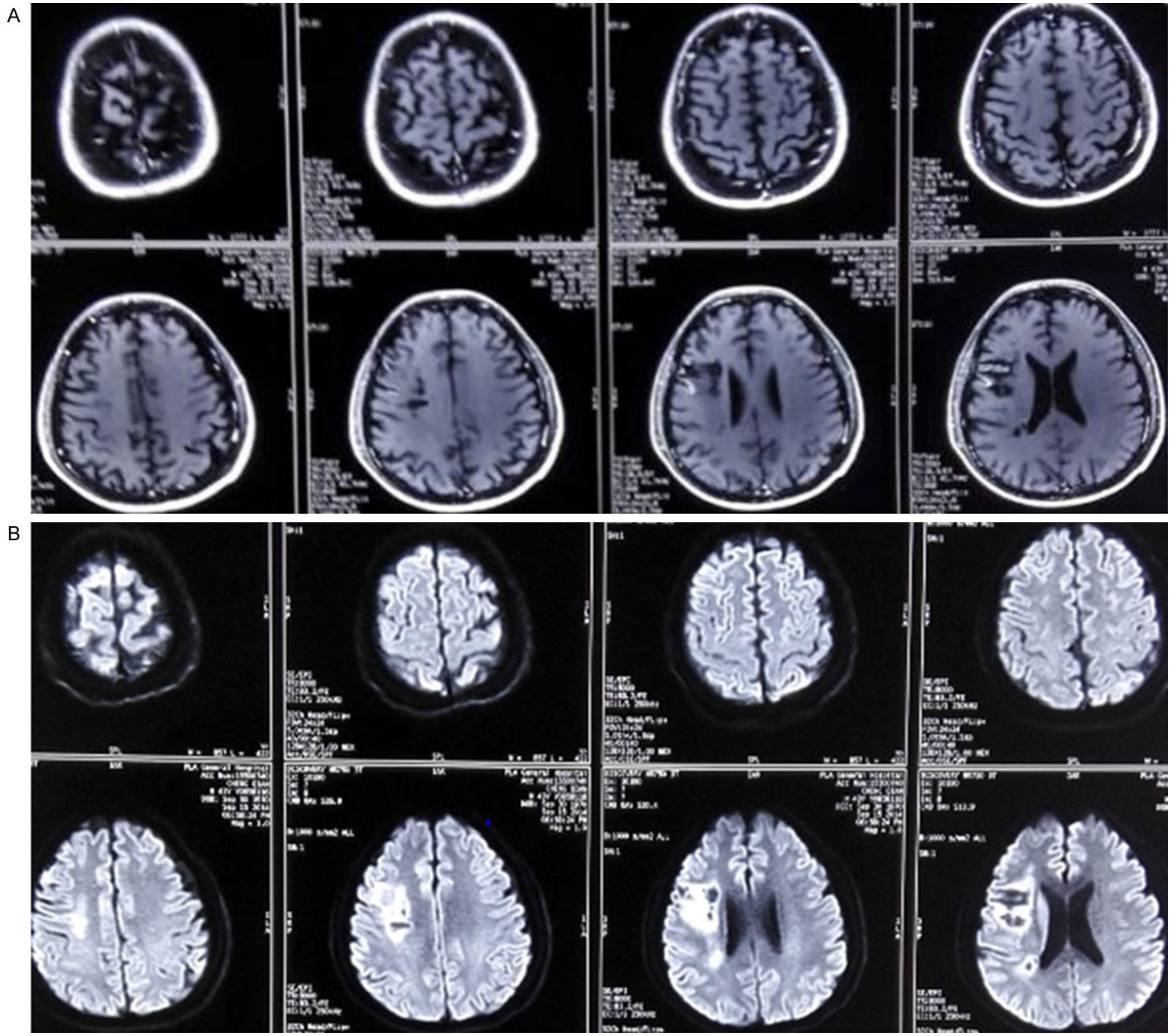

Figure 1. Cerebral MRI examination (A. T1; B. DWI).

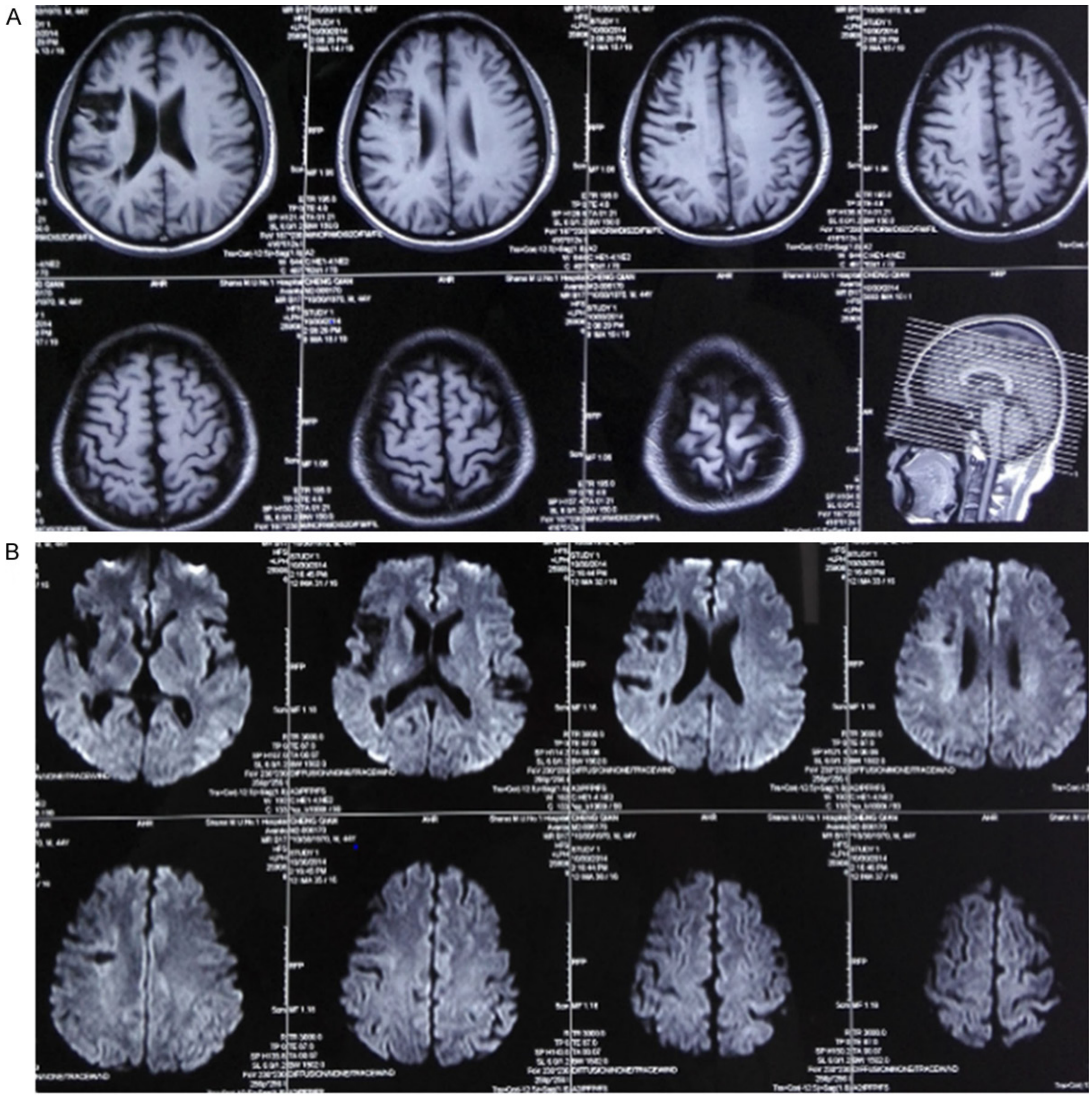

Figure 2. Cerebral MRI examination review (A. T1; B. DWI).

R-MCA stenosis at middle to severe degree. Velocity of blood flow was 218 cm/s. Brain CT suggested old cerebral infarction in right frontal, temporal, insular lobes (**Figure 4**). Brain CTP presented MTT time extension in cortex of right temporal and frontal lobes. Blood routine, biochemistry, and coagulation were normal. The blood pressure was 110/80 mmHg.

Treatment

The patient received 0.1 g aspirin, 75 mg clopidogrel, and 20 mg Lipitor for three days before MCA stent implantation. For MCA stent implantation, the patient was treated by general anesthesia. Then the 6F arterial catheter was put into the right femoral artery by Seldinger technique to make the whole body heparinization. Radiography verified the severe stenosis in right MCA. Echelon microtubule was put through the stenosis part in M1 segment assisted by PILOT 150 microguide wire. Next, the microguide wire was placed in M3 segment of MCA and the microtubule was removed. Gateway saccule at 2.5 × 9 mm was sent to the stenosis part along the microguide wire and expanded at 6 atm. After removing the saccule, radiography showed stenosis improvement.

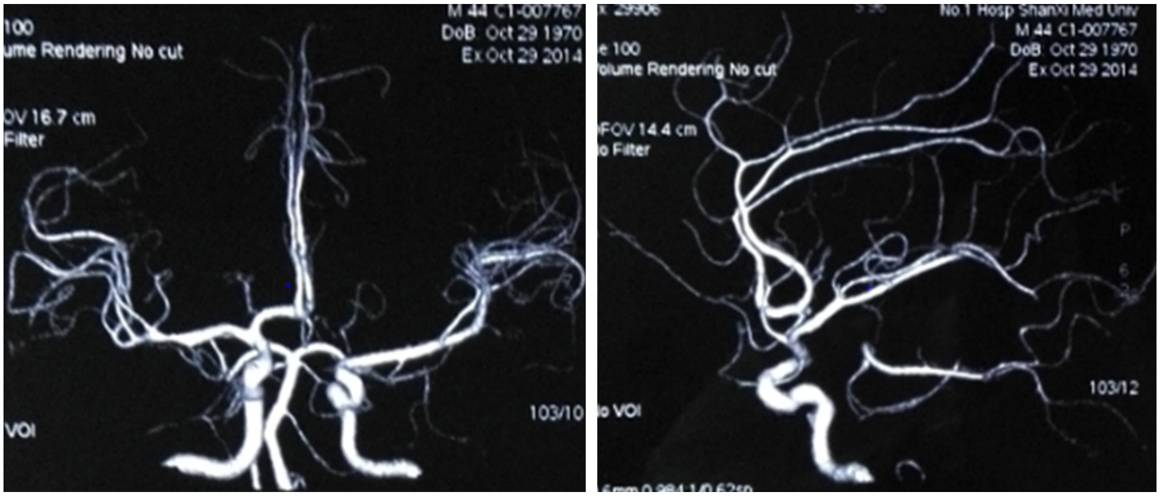

Figure 3. Cerebrovascular CTA.

Next, the Wingspn auto-expansion stent at 3.0 × 9 mm was sent to the stenosis part and confirmed by radiography. Reexamination demonstrated that stenosis in M1 segment was significantly improved and the distal blood supply was better (**Figure 5**). At last, the guide wire and catheter were withdrawn, and the puncture site was closed by arterial closure. Intraoperative blood pressure was maintained at 110/70 mm. After operation, the myodynamia was degree 5 on right side and 5^{-} on left side. The muscular tension was normal. The patient received low molecular heparin subcutaneous injection q12h for two days, clopidogrel, aspirin, and urapidil to keep the blood pressure at 100-120/60-80 mmHg.

Outcomes

Brain CTP reexamination showed the MTT in the cortex of right temporal and frontal lobes was obviously improved compared with preoperation (**Figure 6**). TCCD revealed the blood flow was unobstructed after stent implantation (mild stenosis), and the velocity was 103 cm/s. Cerebral MR+DWI suggested the old cerebral infarction in right frontal, temporal, insular lobes (**Figure 7**). Physical examination demonstrated clear consciousness, calculation power and memory deterioration, symmetric nasolabial groove, myodynamia at degree 5^{-}, finger-to-nose test and rombergism (+). One-month follow-up exhibited the memory and calculation power was markedly improved, and the MMSE score was 30 points.

Discussion

Intracranial atherosclerotic stenosis is one of the main causes of acute stroke or transient ischemic attack (TIA) [5]. In North America, the incidence of cerebral apoplexy caused by intracranial atherosclerosis was 8-10%. However, it was 30-50% in Asia [6]. Stroke caused by intracranial artery stenosis is featured as high incidence rate and recurrence rate, especially in patients with severe stenosis suffered from TIA or stroke.

At present, there are three main treatment methods for intracranial artery stenosis, including drug therapy, surgery, and endovascular interventional treatment. Warfarin and aspirin in the treatment of symptomatic intracranial arterial stenosis (WASID) study showed the one-year recurrence rate of severe intracranial arterial stenosis induced TIA and cerebral apoplexy were 14% and 23%, respectively. The SSYLVIA study demonstrated that the restenosis rate of ≥50% was 32.4% at 6 months [7]. Severe intracranial arterial stenosis (70-90%) patients suffered from new clinical symptom can benefit from endovascular treatment. As the restenosis is associated with the angle of the lesion, we did not observe restenosis in this case.

Wingspan stent is the only stent approved to be used in intracranial arterial stenosis. It is generally agreed to show a good efficacy and safety in the short term after operation [8]. Stenting and intensive medical prevention of

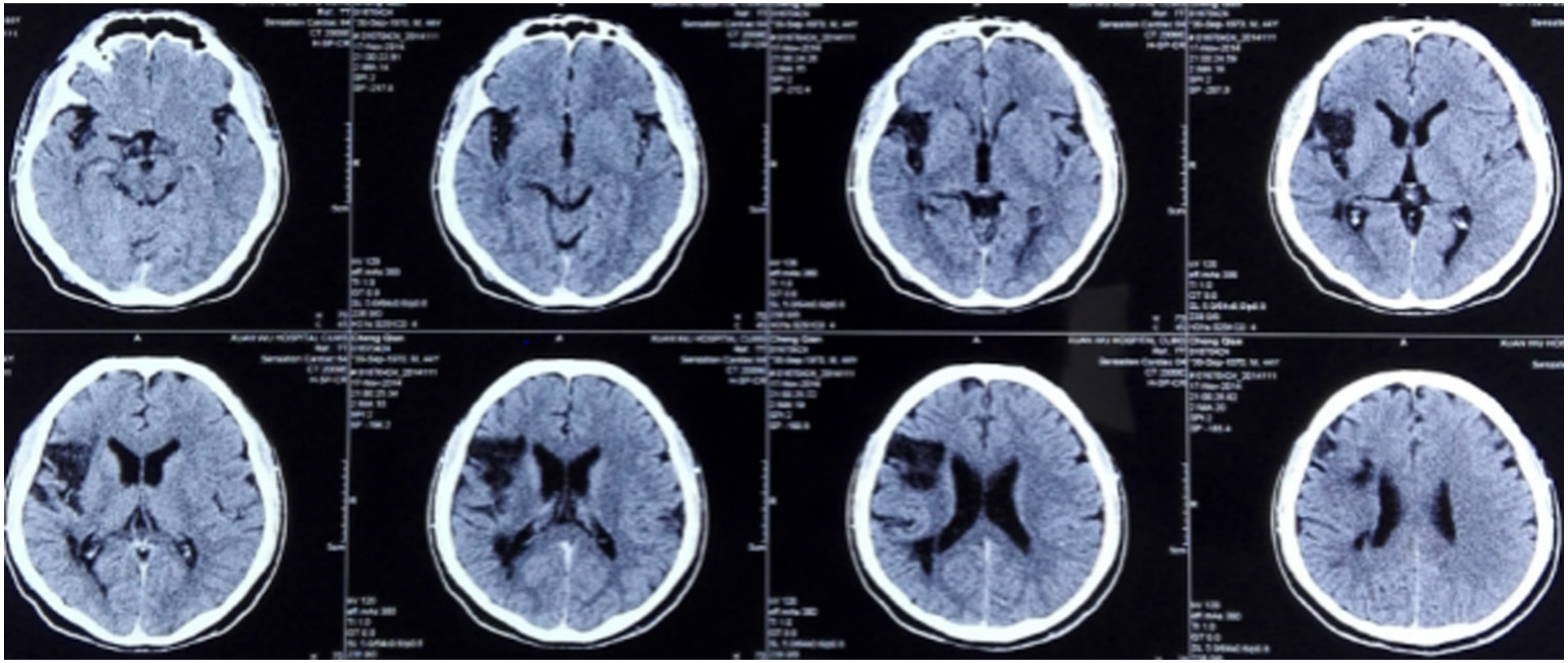

Figure 4. Brain CT.

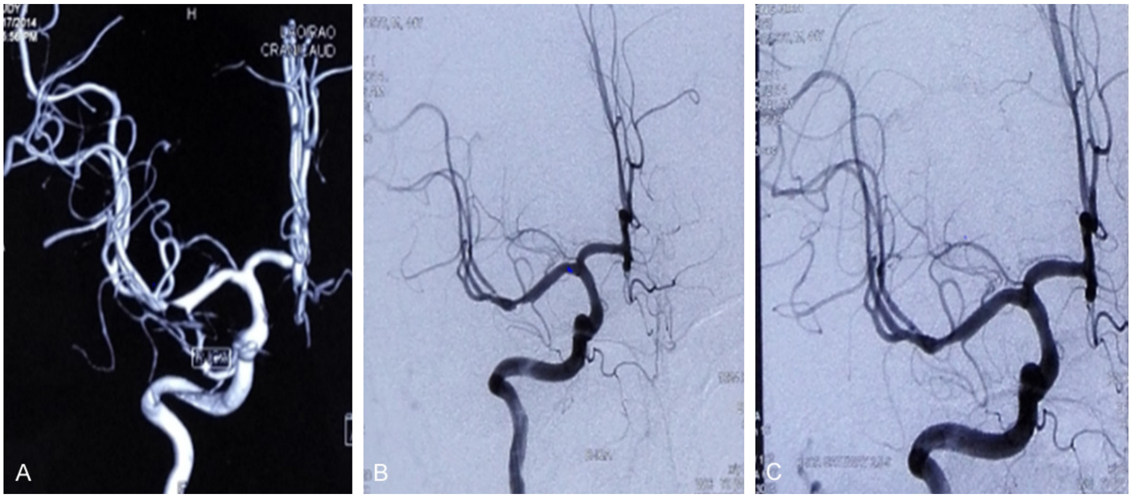

Figure 5. Right MCA stent implantation (A. Preoperative 3D image; B. Preoperative radiography; C. Postoperative radiography).

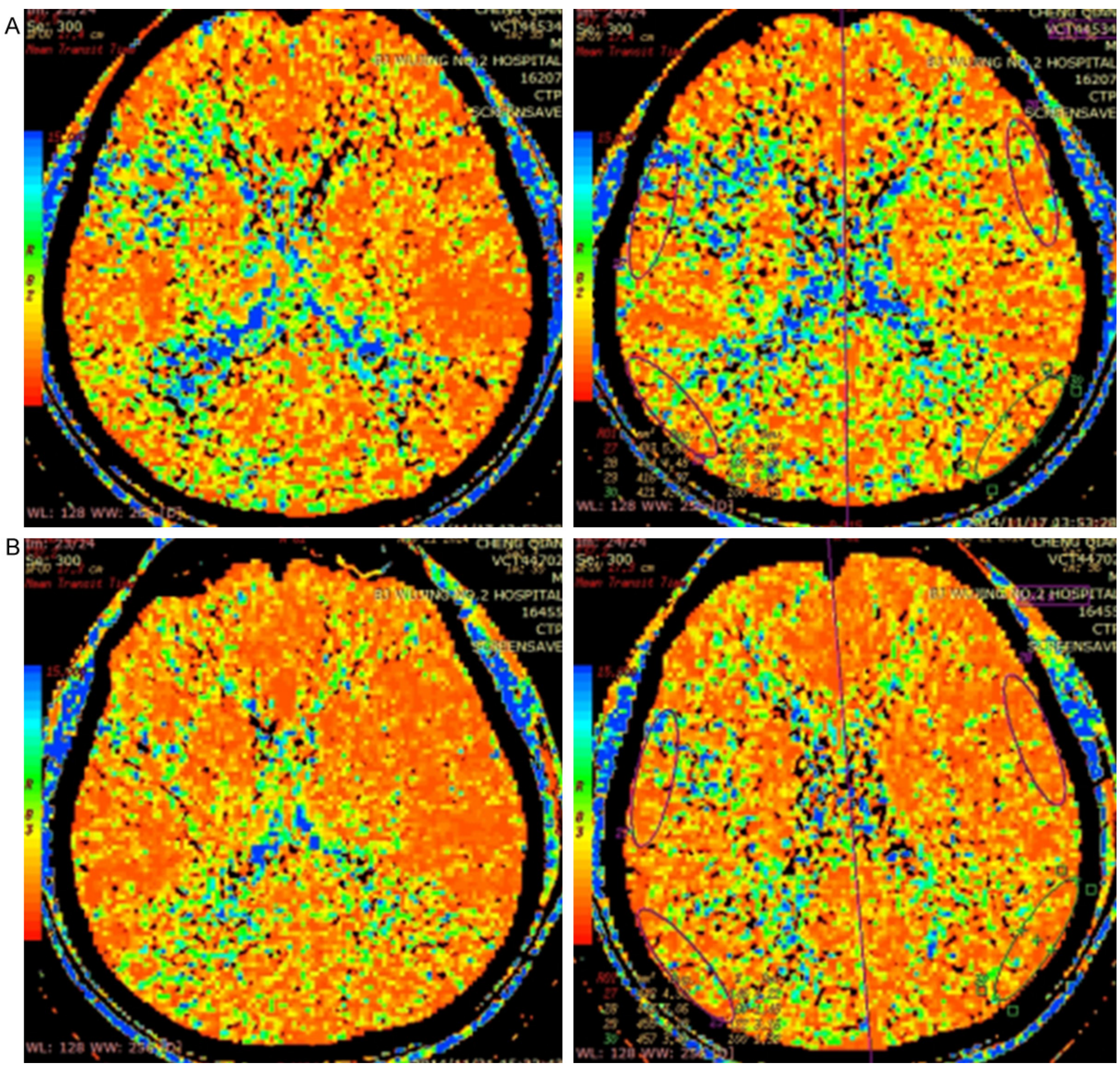

Figure 6. Brain CTP (A. Pre-operation; B. Post-operation).

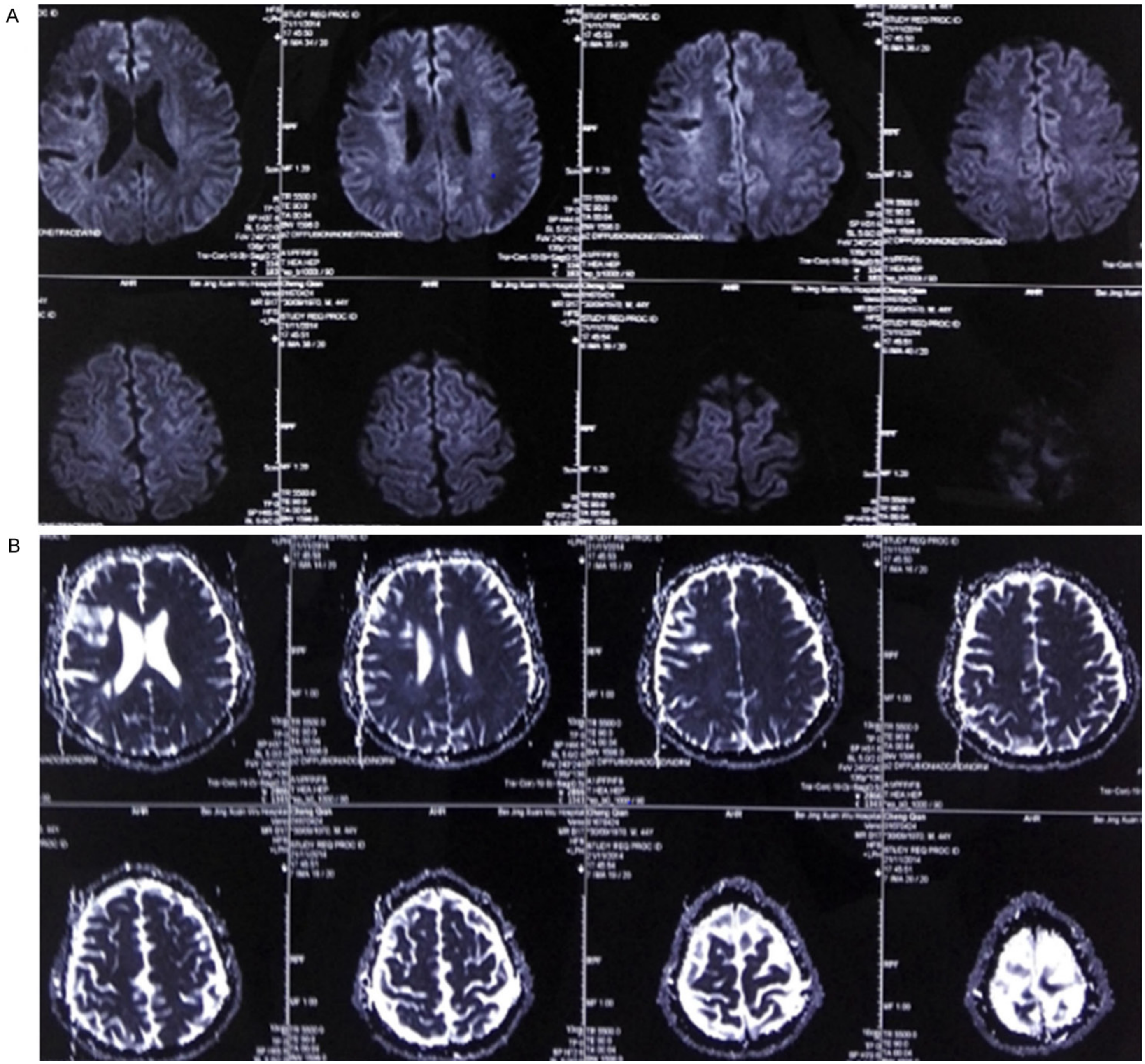
A
B

Figure 7. Postoperative cerebral MRI (A. DWI; B. ADC).

recurrent stroke in intracranial arterial stenosis (SAMMPRIS) suggested that the efficacy of intensive medical group was better than that of stent group [9]. At present, the long-term follow-up of SAMMPRIS trial still supported the abovementioned results [10], which leading to wide spread controversy. Recently, a single-central prospective study in China adopted 100 cases of symptomatic severe intracranial arterial stenosis to perform Wingspan stent implantation. It selected WASID study as control and affirmed the effect of Winspan stent, while considered that the random study between drugs and stent should be applied [11]. We adopted several small-scale multi-center studies to investigate the role of Wingspan stent system in symptomatic intracranial atherosclerotic stenosis and also verified its efficacy and safety [12]. Thus, we thought there are several defects of experimental design to cause the high complication rate in endovascular treatment from SAMMPRIS study, such as the time window of patients enrolling and the inclusion criteria. Moreover, since single-center patient selection can represent the complication rate of Wingspan stent system [13], a multi-center CASSISS study was performed to explore the safety and efficacy of Wingspan stent, such as death, vascular events, and hemorrhagic events. Vessel tortuosity will enhance the technical difficulty and increase the risks. Some researchers revealed that the stent could not arrive at the suitable position due to the tortuous artery pathway [14]. In this case, we selected microguide wire to assist the precise positioning of the stent. This method not only reduced the bumped tunica intimae, but also shortened the procedure time.

After intracranial arterial stenosis, the changes of cerebral hemodynamics could be divided into two stages. In stage 1 as compensatory period, the chronic stenosis of vascular diameter decreases blood supply of brain tissue. Moreover, it expanded the distal blood vessel to maintain normal cerebral blood flow though the feedback regulation of neuroendocrine. In stage 2 as decompensation period, the perfusion pressure further reduces that exceeds the threshold of cerebrovascular self-correcting, leading to the reduction of cerebral blood flow and eventually hypoperfusion. Long-term cerebral hypoperfusion may result in nerve cells energy metabolism disorder, which could impair cognitive function to different degrees [15]. We observed the patient cognitive function improved at one month after stent implantation, which was similar with pervious report [16]. As brain perfusion pressure elevation was the most direct changes after stent implantation, we speculated that perfusion pressure insufficiency may be one of the causes of vascular cognitive disorder. It was also reported that the cognitive function was impaired in severe carotid arterial stenosis patients treated by stent implantation [17]. Therefore, perfusion pressure insufficiency may be only a starting factor, while its specific mechanism in affecting cognitive function is still unclear. There is still lack of large-scale trial to investigate the occurrence rate of cognitive disorder in patients suffered from MCA stenosis. More in-depth exploration is needed to further clarify the impact of stent implantation on cognitive function of patients with MCA stenosis.

Disclosure of conflict of interest

None.

Address correspondence to: Shixiong Huang, Department of Neurology, People's Hospital of Hainan Province, Haikou, Hainan, China. Tel: +86-898-68642104; Fax: +86-898-68642104; E-mail: hsxw-013@163.com

References

[1] Donnan GA, Fisher M, Macleod M, Davis SM. Stroke. Lancet 2008; 371: 1612-1623.
[2] Li H, Wong KS. Racial distribution of intracranial and extracranial atherosclerosis. J Clin Neurosci 2003; 10: 30-34.
[3] Wang Y, Zhao X, Liu L, Soo YO, Pu Y, Pan Y, Wang Y, Zou X, Leung TW, Cai Y, Bai Q, Wu Y, Wang C, Pan X, Luo B, Wong KS; CICAS Study Group. Prevalence and outcomes of symptomatic intracranial large artery stenoses and occlusions in China: the Chinese intracranial atherosclerosis (CICAS) study. Stroke 2014; 45: 663-669.
[4] Zaidat OO, Wolfe T, Hussain SI, Lynch JR, Gupta R, Delap J, Torbey MT, Fitzsimmons BF. Interventional acute ischemic stroke therapy with

intracranial self-expanding stent. Stroke 2008; 39: 2392-2395.
[5] Arenillas JF. Intracranial atherosclerosis: current concepts. Stroke 2011; 42: S20-23.
[6] Sacco RL, Kargman DE, Gu Q, Zamanillo MC. Race-ethnicity and determinants of intracranial atherosclerotic cerebral infarction. The Northern Manhattan stroke study. Stroke 1995; 26: 14-20.
[7] Investigators SS. Stenting of symptomatic atherosclerotic lesions in the vertebral or intracranial arteries (SSYLVIA): study results. Stroke 2004; 35: 1388-1392.
[8] Zhao T, Zhu WY, Xiong XY, Li J, Wang L, Ding HY, Wei F, Zhou Y, Gong ZL, Cheng SY, Liu Y, Shuai J, Yang QW. Safety and efficacy of wingspan stenting for severe symptomatic atherosclerotic stenosis of the middle cerebral artery: analysis of 278 continuous cases. J Stroke Cerebrovasc Dis 2016; 25: 2368-2372.
[9] Chimowitz MI, Lynn MJ, Derdeyn CP, Turan TN, Fiorella D, Lane BF, Janis LS, Lutsep HL, Barnwell SL, Waters MF, Hoh BL, Hourihane JM, Levy EI, Alexandrov AV, Harrigan MR, Chiu D, Klucznik RP, Clark JM, McDougall CG, Johnson MD, Pride GL Jr, Torbey MT, Zaidat OO, Rumboldt Z, Cloft HJ; SAMMPRIS Trial Investigators. Stenting versus aggressive medical therapy for intracranial arterial stenosis. N Engl J Med 2011; 365: 993-1003.
[10] Derdeyn CP, Chimowitz MI, Lynn MJ, Fiorella D, Turan TN, Janis LS, Montgomery J, Nizam A, Lane BF, Lutsep HL, Barnwell SL, Waters MF, Hoh BL, Hourihane JM, Levy EI, Alexandrov AV, Harrigan MR, Chiu D, Klucznik RP, Clark JM, McDougall CG, Johnson MD, Pride GL Jr, Lynch JR, Zaidat OO, Rumboldt Z, Cloft HJ; Stenting, Aggressive Medical Management for Preventing Recurrent Stroke in Intracranial Stenosis Trial Investigators. Aggressive medical treatment with or without stenting in high-risk patients with intracranial artery stenosis (SAMMPRIS): the final results of a randomised trial. Lancet 2014; 383: 333-341.
[11] Jiang WJ, Yu W, Du B, Gao F, Cui LY. Outcome of patients with ≥70% symptomatic intracranial stenosis after wingspan stenting. Stroke 2011; 42: 1971-1975.
[12] Ueda T, Hatakeyama T, Kohno K, Kumon Y, Sakaki S. Endovascular treatment for acute thrombotic occlusion of the middle cerebral artery: local intra-arterial thrombolysis combined with percutaneous transluminal angioplasty. Neuroradiology 1997; 39: 99-104.
[13] Zaidat OO, Klucznik R, Alexander MJ, Chaloupka J, Lutsep H, Barnwell S, Mawad M, Lane B, Lynn MJ, Chimowitz M; NIH Multi-center Wingspan Intracranial Stent Registry Study Group. The NIH registry on use of the wingspan stent for symptomatic 70-99% intracranial arterial stenosis. Neurology 2008; 70: 1518-1524.
[14] Kim JK, Ahn JY, Lee BH, Chung YS, Chung SS, Kim OJ, Kim WC, Joo JY. Elective stenting for symptomatic middle cerebral artery stenosis presenting as transient ischaemic deficits or stroke attacks: short term arteriographical and clinical outcome. J Neurol Neurosurg Psychiatry 2004; 75: 847-851.
[15] Ghogawala Z, Westerveld M, Amin-Hanjani S. Cognitive outcomes after carotid revascularization: the role of cerebral emboli and hypoperfusion. Neurosurgery 2008; 62: 385-395; discussion 393-385.
[16] Yan Y, Liang L, Yuan Y, Chen T, Shen Y, Zhong C. Influence of stent-assisted angioplasty on cognitive function and affective disorder in elderly patients with symptomatic vertebrobasilar artery stenosis. Med Sci Monit 2014; 20: 1129-1136.
[17] Bertog SC, Grunwald IQ, Kuhn AL, Franke J, Vaskelyte L, Hofmann I, Id D, Hornung M, Sievert H. Complications during carotid artery stenting. J Cardiovasc Surg (Torino) 2013; 54: 67-82.