

**CEREBRAL HEMORRHAGE AND CEREBRAL
INFARCTION IN 30 CASES OF ADULT MOYAMOYA
DISEASE: COMPARISON BETWEEN CONSERVATIVE
THERAPY AND SUPERFICIAL TEMPORAL
ARTERY-MIDDLE CEREBRAL ARTERY ANASTOMOSIS**

HIROFUMI OYAMA, AKIRA KITO, HIDEKI MAKI, KENICHI HATTORI,
TOMOYUKI NODA and KENTARO WADA

Department of Neurosurgery, Ogaki Municipal Hospital, Ogaki, Japan

ABSTRACT

To clarify the effect of surgery on the prevention cerebral hemorrhage in adult moyamoya disease, we compared postoperative courses between superficial temporal artery-middle cerebral artery (STA-MCA) anastomosis and conservative therapy. The study subjects were 30 adults with moyamoya disease. Unilateral STA-MCA anastomosis was conducted in 7 of these 30 cases, and bilateral STA-MCA anastomosis was conducted in 8 of these 30 cases. Therefore, anastomosis was performed in a total of 23 sides. The postoperative clinical course was observed for more than 5 years after the STA-MCA anastomosis.

Cerebral hemorrhage occurred after operation in 2 sides (8.7%) among the 23 sides that received STA-MCA anastomosis. On the contrary, hemorrhage occurred during conservative therapy in 5 sides (13.5%) among 37 non-operation sides (no significance in χ^2 test). Cerebral infarction occurred in 3 sides (13%) among 23 sides treated with STA-MCA anastomosis. However, the infarction occurred in 2 sides (5.4%) among the 37 non-operation sides (no significance in χ^2 test).

Cerebral hemorrhage tended to occur less frequently after STA-MCA anastomosis, and bypass surgery was suggested to have some beneficial effect in preventing cerebral hemorrhage in adult moyamoya disease. However, it was revealed that STA-MCA anastomosis exacerbated the brain ischemia. Therefore, strict management is mandatory in the perioperative period.

Key Words: Moyamoya disease, STA-MCA anastomosis, Intracerebral hemorrhage, Adult, Cerebral infarction

INTRODUCTION

Cerebral hemorrhage is a major problem in adult moyamoya disease along with cerebral infarction. Superficial temporal artery-middle cerebral artery (STA-MCA) anastomosis has been attempted for the prevention of cerebral hemorrhage; however, its effectiveness is unclear. To clarify the effect of operation on the prevention of cerebral hemorrhage in adult moyamoya

Received: November 24, 2011; accepted: August 22, 2012

Corresponding author: Hirofumi Oyama, MD.

Department of Neurosurgery, Ogaki Municipal Hospital,

Minaminokawa-cho 4-86, Ogaki, Gifu 503-8502, Japan

Phone: 0584-81-3341; Fax: 0584-75-5715; E-mail: oya3776@arrow.ocn.ne.jp

disease, we compared postoperative courses between STA-MCA anastomosis and conservative therapy.

SUBJECTS AND METHODS

The study subjects were 30 adults with moyamoya disease. The onset was TIA in 6 cases, cerebral infarction in 5 cases, cerebral hemorrhage in 8 cases, intraventricular hemorrhage in 4 cases, convulsion in 3 cases, depression in 1 case, and other symptoms in 3 cases.

Unilateral STA-MCA anastomosis was performed for 7 of these 30 cases. Bilateral STA-MCA anastomosis was conducted for 8 cases, and therefore, anastomosis was performed on a total of 23 sides. The postoperative clinical course was observed for more than 5 years after STA-MCA anastomosis.

RESULTS

Cerebral hemorrhage occurred after the operation in 2 sides (8.7%) among 23 sides treated with STA-MCA anastomosis. (Table 1) These 2 patients had shown cerebral hemorrhage (1 case) and intraventricular hemorrhage (1 case) at the onset. On the contrary, hemorrhage occurred during conservative therapy in 5 sides (13.5%) among 37 non-operation sides (no significance in χ^2 test). These 5 patients had shown cerebral hemorrhage (2 cases), intraventricular hemorrhage (2 cases) and transient ischemic attack (TIA) (1 case) at the onset.

Cerebral infarction occurred in 3 sides (13%) among 23 sides treated with STA-MCA anastomosis. (Table 2) These 3 patients had shown cerebral infarction (1 case), cerebral hemorrhage (1 case) and convulsion (1 case) at the onset. On the contrary, infarction occurred in 2 sides (5.4%) among 37 non-operation sides (no statistical significance in χ^2 test). These 2 patients

Table 1 Cerebral hemorrhage in the side of STA-MCA anastomosis and the non-operation side. Cerebral hemorrhage happened after operation in 2 sides (8.7%) among 23 sides of STA-MCA anastomosis. On the contrary, hemorrhage occurred during conservative therapy in 5 sides (13.5%) among 37 non-operation sides (no significance in χ^2 test).

	cerebral hemorrhage (+)	cerebral hemorrhage (-)	total
bypass side	2	21	23
non-bypass side	5	32	37

Table 2 Cerebral infarction in the side of STA-MCA anastomosis and the non-operation side. Cerebral infarction occurred in 3 sides (13%) among 23 sides of STA-MCA anastomosis. On the contrary, infarction developed in 2 sides (5.4%) among 37 non-operation sides (no significance in χ^2 test).

	cerebral infarction (+)	cerebral infarction (-)	total
bypass side	3	20	23
non-bypass side	2	35	37

had shown TIA (1 case) and convulsion (1 case) at the onset.

The STA-MCA anastomosis operation was performed for 3 out of 6 patients with TIA. For one among the 3 patients operated on, TIA disappeared. Another patient suffered from chronic subdural hematoma in the operated side.

REPRESENTATIVE CASE

The patient was a 42-year-old female, who suffered from left hemiparesis and became comatose when she was 17 years old. Brain CT scan revealed ventricular hemorrhage, and cerebral angiography showed moyamoya disease. She was later treated with ventricular drainage and a ventriculo-peritoneal shunt. An STA-MCA anastomosis operation was performed on both sides 6 months after the first attack, and she had been in an independent condition thereafter.

The second attack happened 25 years after the first one. She presented with nausea, dizziness and right hemiparesis, and suffered from incomplete right hemiparesis and conjugate deviation to the left side upon admission. Brain CT scan showed left putaminal hemorrhage. (Fig. 1) Cerebral angiography revealed that the collateral flow via STA-MCA anastomosis and middle meningeal artery was poor on the left side, compared with the right side. (Fig. 2) The moyamoya vessels developed more prominently on the left side than the right side. She was treated conservatively and eventually walked independently, but marked aphasia remained.

This case seems to show that poor revascularization and remaining moyamoya vessel are related with cerebral hemorrhage. It is suggested that decreasing the moyamoya vessels by adequate revascularization will be effective for preventing cerebral hemorrhage in the future.

DISCUSSION

In bypass surgery for moyamoya disease, rebleeding was less likely to occur in patients who had undergone bypass or some other revascularization surgery.¹⁾ The rebleeding rate was



Fig. 1 Brain CT scan 2 days after second admission. It showed left putaminal hemorrhage.

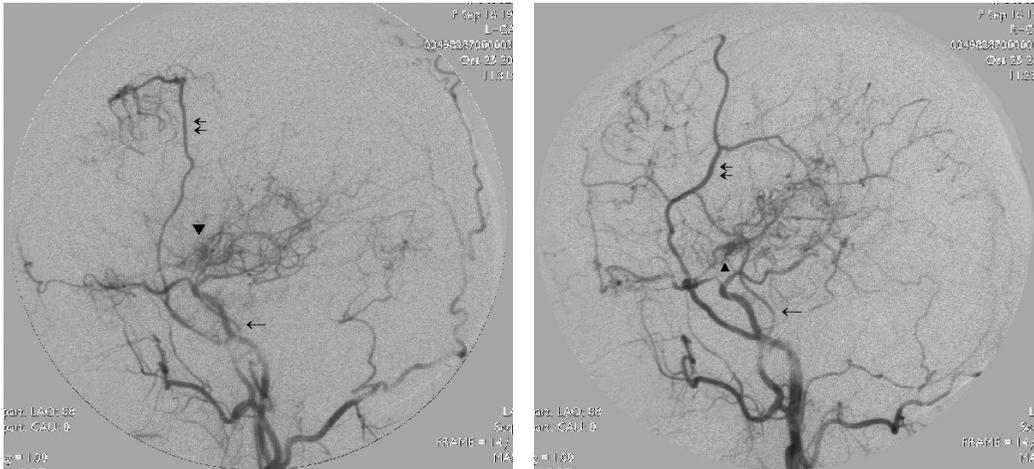


Fig. 2 Cerebral angiography 5 days after second attack. Left cerebral angiography (A, lateral view) and right cerebral angiography (B, lateral view).

They revealed that collateral flow via STA-MCA anastomosis (arrow) and middle meningeal artery (double arrow) was poor on the left side, compared with the right side. The moyamoya vessels (arrowhead) developed more prominently on left side than right side.

19.1% in the bypass surgery group in contrast to 28.3% in the conservative treatment group (no significance).²⁾ Rebleeding was observed in 12.5% of patients who underwent bypass surgery and in 38.5% of patients who did not (no significance).³⁾ In the current series, cerebral hemorrhage occurred in 8.7% of STA-MCA anastomosis sides in contrast to 13.5% of non-operation sides. Cerebral hemorrhage tended to occur less frequently after STA-MCA anastomosis and bypass surgery was suggested to have some beneficial effect in preventing cerebral hemorrhage in adult moyamoya disease.

However, it was revealed that STA-MCA anastomosis caused poor results for those with brain ischemia. Cerebral infarction occurred in 3 sides (13%) among 23 sides treated with STA-MCA anastomosis. On the contrary, infarction occurred in 2 sides (5.4%) among 37 non-operation sides. It was reported that the risk of infarction after revascularization was 1.8%.¹⁾ Another report mentioned that 20% of patients presented with an ischemic event during the follow-up period after encephalo-duro-arterio-synangiosis.⁴⁾ Strict management is mandatory to prevent ischemic events in the perioperative period.

REFERENCES

- 1) Kuroda S, Nakayama N, Ishikawa T, Hokin K, Kamiyama H, Iwasaki Y. Treatment strategies and long-term prognosis in moyamoya disease. *Surg Cereb Stroke (Jpn)*, 2008; 36: 361–366.
- 2) Fujii K, Ikezaki K, Irikura K, Miyasaka Y, Fukui M. The efficacy of bypass surgery for the patients with hemorrhagic moyamoya disease. *Clin Neurol Neurosurg*, 1997; 99 Suppl 2: S194–195.
- 3) Yoshida Y, Yoshimoto T, Shirane R, Sakurai Y. Clinical course, surgical management, and long-term outcome of moyamoya patients with rebleeding after an episode of intracerebral hemorrhage: An extensive follow-up study. *Stroke*, 1999; 30: 2272–2276.
- 4) Kawaguchi S, Okuno S, Sakaki T. Effect of direct arterial bypass on the prevention of future stroke in patients with the hemorrhagic variety of moyamoya disease. *J Neurosurg*, 2000; 93: 397–401.