

Uneven Cerebral Hemodynamics in the Acute Stage after STA-MCA Bypass for Adult-onset Moyamoya Disease: Possible Involvement of Focal Hyperperfusion and Ispilateral Remote Ischemia Caused by the Watershed Shift Phenomenon

Miki Fujimura MD, PhD; Teiji Tominaga MD, PhD Department of Neurosurgery, Kohnan Hospital, Sendai, Japan Department of Neurosurgery, Tohoku University, Sendai, Japan

Introduction

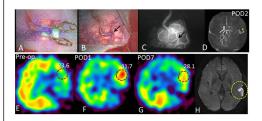
Superficial temporal artery-middle cerebral artery (STA-MCA) bypass is generally performed as the preferable surgical treatment for moyamoya disease (MMD). Cerebral hyperperfusion (CHP) syndrome and ischemia are potential complications during the acute stage after revascularization for MMD, and their managements are contradictory to each other.

Of the 172 consecutive surgeries performed for MMD under a standardized protocol {postoperative prophylactic intensive blood pressure control (systolic blood pressure < 130 mmHg)}, we herein present two cases of adult-onset MMD, which manifested the simultaneous occurrence of HPS and cerebral infarction after STA-MCA anastomosis. This rare association may indicate a limitation in the current perioperative management protocol, suggesting the necessity for further evaluations of the underlying pathology during the early perioperative period of revascularization surgery for MMD.

Methods

We retrospectively investigated the incidence of the simultaneous occurrence of CHP and infarction on the same hemisphere after direct revascularization surgery for MMD.

Figure 1



onstrated apparent patent bypass (c). D: Post-operative MR angiography showing a patent left STA-MCA bypass risk) 2 days after surgery. Empopral profile of ²²³-IMP-SPECT images before surgery (E), 1 day after surgery (F), and 7 days after surgery (G). Intitative local (BC values are shown as dotted circles. Pre-operative SPECT showing decreased CBF in the left

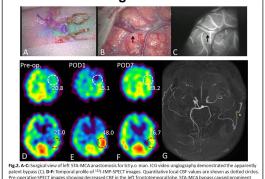
Results

Of the 172 consecutive direct revascularization surgeries performed for MMD, we encountered two adult cases (1.1%) manifesting the simultaneous occurrence of symptomatic CHP and remote infarction on the operated hemisphere in the acute stage. Case-1 (Figure 1): A 47-year-old man initially presenting with infarction developed CHP syndrome (fluctuating aphasia) two days after left STA-MCA bypass, as assessed by quantitative single-photon emission computed tomography (SPECT). Although blood pressure lowering ameliorated his symptoms, he developed cerebral infarction at a remote area on the operated hemisphere in the acute stage.

Results (Continued)

Case-2 (Figure 2): Another 63-year-old man, who initially had progressing stroke, presented with aphasia due to focal CHP in the left temporal lobe associated with acute infarction at the tip of the left frontal lobe one day after left STA-MCA anastomosis, when SPECT showed a paradoxical decrease in cerebral blood flow (CBF) in the left frontal lobe despite a marked increase in CBF at the site of anastomosis. Symptoms were ameliorated in both patients with the normalization of CBF, and there were no further cerebrovascular events during the follow-up period.

Figure 2



Conclusions

Patients with MMD temporarily represent uneven cerebral hemodynamics in the acute stage after STA-MCA bypass.

Although the incidence is relatively low, CHP and cerebral infarction could occur simultaneously not only due to blood pressure lowering against CHP, but also to the 'watershed shift' phenomenon, which needs to be elucidated in future studies.

Learning Objectives

By the conclusion of this session, participants should be able to know uneven cerebral hemodynamics in the acute stage after direct revascularization for adult-onset moyamoya disease.

References

Fujimura M, Kaneta T, Mugikura S, et al. Temporary neurologic deterioration due to cerebral hyperperfusion after superficial temporal artery-middle cerebral artery anastomosis in patients with adult-onset moyamoya disease. Surg Neurol 67: 273-282, 2007.

Fujimura M, Shimizu H, Inoue T, et al. Significance of focal cerebral hyperperfusion as a cause of transient neurologic deterioration after EC-IC bypass for moyamoya disease: Comparative study with non-moyamoya patients using 123I-IMP SPECT. Neurosurgery 68: 957-965, 2011.

Fujimura M, Inoue T, Shimizu H, et al. Efficacy of prophylactic blood pressure lowering according to a standardized postoperative management protocol to prevent symptomatic cerebral hyperperfusion after direct revascularization surgery for moyamoya disease. Cerebrovasc Dis 33: 436-445, 2012.

Fujimura M, Niizuma K, Inoue T, et al. Minocycline prevents focal neurological deterioration due to cerebral hyperperfusion after extracranial-intracranial bypass for moyamoya disease. Neurosurgery 74:163-170, 2014.

Hayashi T, Shirane R, Fujimura M, Tominaga T. Postoperative neurological deterioration in pediatric moyamoya disease: watershed shift and hyperperfusion. J Neurosurg Pediatr 6: 73-81, 2010.

Tu XC, Fujimura M, Rashad S, et al. Uneven cerebral hemodynamic change as a cause of neurological deterioration in the acute stage after direct revascularization for moyamoya disease: Cerebral hyperperfusion and remote ischemia caused by the 'watershed shift'. Neurosurg Rev 40:507-512, 2017.