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# Angiography of Encephalomyosynangiosis and Superficial Temporal Artery to Middle Cerebral Artery Anastomosis in Moyamoya Disease

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**Summary:** The authors present an angiographic follow-up of anastomotic surgery (extra- to intracranial) in a 33-year-old woman with moyamoya disease. The bypass was superficial-temporal to middle-cerebral, with placement of muscle tissue over the open craniotomy; the bypass eventually regressed.

**Index terms:** Moyamoya disease; Cerebral angiography; Arteries, stenosis

Brain revascularization procedures for the treatment of moyamoya disease have included superficial temporal artery (STA) to middle cerebral artery (MCA) anastomosis, encephalomyosynangiosis (EMS), encephaloduroarteriosynangiosis (EDAS), and encephalomyoarteriosynangiosis (EMAS). We describe the angiographic changes observed over 6 years following STA-MCA anastomosis combined with EMS in a case of moyamoya disease.

## Case Report

This 33-year-old, right-handed woman of French descent experienced (March 1981) the sudden onset of speech impairment associated with mild left arm numbness and weakness, followed by frequent episodes of transient worsening of her neurologic deficits. Her past history was significant for the use of oral contraceptives and heavy cigarette smoking. Physical examination revealed that the patient was dysarthric and stuttered. There was increased tone in the left limbs associated with a mild left hemiparesis. Sensory exam disclosed decreased stereognosis and graphesthesia on the left side of her body. A left hemianopsia was also present. The patient was investigated by a computed tomographic (CT) scan of the brain that showed a recent right temporal lobe infarction and an old left inferior parietal infarction associated with moderate ventricular and sulcal dilatation. Cerebral angiogram (Fig. 1) suggested bilateral moyamoya disease. In May 1982, a right STA anastomosis to a frontal branch of the right MCA was performed. At the same time, the right temporal

muscle was placed over the surface of the brain and the craniotomy bone flap was left out. The patient had an uneventful postoperative course with immediate resolution of her transient ischemic attacks. Follow-up cerebral angiograms were performed in October 1983 (Fig. 2), January 1988 (Fig. 3A), and October 1988 (Fig. 3B). Ten years postoperatively, the patient has remained asymptomatic.

## Discussion

In moyamoya disease, there is a propensity towards the formation of extensive parenchymal, leptomeningeal, and transdural collaterals (1–3). The success of brain revascularization procedures such as EMS or EDAS is related to such a driving force. Collateral circulation following EMS seems to appear as early as 2 to 3 months following the operation (4); however, in certain cases of rapidly progressing neurologic deficits or very frequent transient ischemic attacks, EMS may not provide adequate revascularization in due time to prevent an ischemic cerebrovascular accident. In such cases, STA-MCA anastomosis provides an immediate increase in blood supply to the brain and favorable results have been reported (1, 5, 6, 7). Nakagawa et al (5) concluded that STA-MCA anastomosis with EMS promoted more extensive neovascularization than a simple STA-MCA bypass or EMS alone. According to these authors, STA-MCA anastomosis without EMS did not promote long-lasting filling of the MCA, presumably due to progression of the occlusive process with involvement of the recipient artery. In our patient, the initial increase in caliber of all STA branches, as seen in the Figure 2, was followed by a decrease in caliber of the anastomosed anterior branch and continued enlargement of the STA posterior branch that supplies the EMS (Figs. 3A and 3B). These changes appear to be related to

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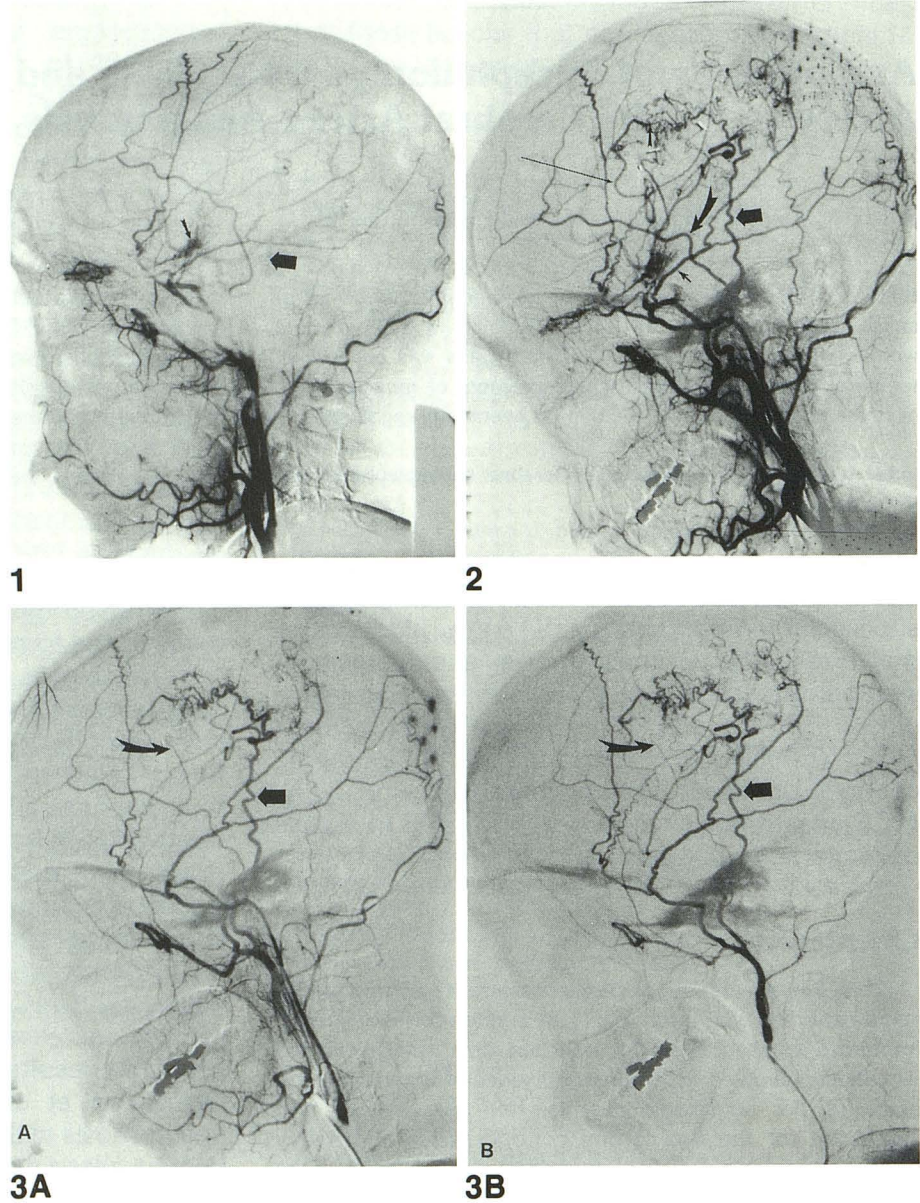
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Fig. 1. Preoperative right common carotid angiogram demonstrates right internal carotid artery occlusion. Severe stenotic segment is noted just above the ophthalmic artery origin. Extensive basal and early leptomeningeal collateral formation is evident (*medium arrow*). Note the small caliber of the posterior branch of the superficial temporal artery which will supply the EMS (*wide arrow*).

Fig. 2. Right common carotid angiogram demonstrates the patency of the STA-MCA anastomosis (*medium straight arrow*) filling the frontal branch of the middle cerebral artery (*long thin arrow*). The muscle flap fed by a posterior branch of the STA (*wide arrow*) has developed collaterals to the MCA, filling its posterior trunk and adjacent branches. Note the caliber increase of this STA branch feeding the EMS and to a lesser degree, the anterior branch (*curved arrow*) which supplies the bypass. There is also enlargement of the middle meningeal artery (*small arrow*) and its branches.

Fig. 3. *A* (January 1988) and *B* (October 1988): Selective right external carotid angiograms demonstrate patency of the STA-MCA bypass and collaterals from the muscle flap. Note the decreasing caliber of the anterior branch of the STA to the bypass (*curved arrow*) compared to the prior exam (Fig. 2) and from *A* to *B*. Posterior STA branch (*wide arrow*) that supplies the EMS has continued to enlarge, as compared with Fig. 2.



the pari passu development of abundant collateral circulation from muscle and scalp, thus demonstrating the long-term effectiveness of EMS, while the STA-MCA anastomosis appeared to provide immediate perfusion of the ischemic brain and prompt resolution of symptoms.

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