Direct Anastomotic Bypass for Cerebrovascular Moyamoya Disease

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Abstract

Therapeutic result and pitfalls in the surgical treatment of cerebrovascular moyamoya disease are evaluated. During the recent 15 years, 268 patients with moyamoya disease have been treated in our clinic. Among them, 238 patients showed ischemic symptoms. Superficial temporal artery to middle cerebral artery anastomoses combined with temporal muscle grafting (encephalo-myo-synangiosis) were performed for most of the cases. Complete remission and clinical improvement were obtained in 34.0% and 64.2% of the patients, respectively. Symptomatic aggravation due to ischemic complication followed the operation in five patients (1.9%). Normocapnic control during general anesthesia with sufficient hydration is essential to avoid perioperative ischemic complications. Omental graft was performed in 16 patients. In 13 patients, omental graft was performed for the progressing ischemia in the posterior cerebral artery or anterior cerebral artery distribution. In the other three patients, omental graft was used for marked brain atrophy.

Key words: moyamoya disease, superficial temporal artery-middle cerebral artery anastomosis, encephalo-myo-synangiosis, omentum

Introduction

In some patients with moyamoya disease, de novo collaterals can be formed simply by placing vascularized tissue upon the cerebral surface. By using this peculiar feature, several procedures of indirect non-anastomotic bypass have been reported. Indirect bypass procedures include encephalo-duro-arterio-synangiosis (EDAS), that is a transposition of the superficial temporal artery (STA), encephalo-myo-synangiosis (EMS) (temporal muscle graft), and combinations of these. Omental graft is also classified as an indirect bypass. During the recent 15 years we have treated 268 patients with moyamoya disease chiefly by STA-middle cerebral artery (MCA) anastomoses with or without EMS. Therapeutic result and pitfalls in the surgical treatment of cerebrovascular moyamoya disease are evaluated.

Summary of the Patients

During the recent 15 years, 268 patients with moyamoya disease have been treated in our clinic. Among them, 238 patients showed ischemic symptoms. STA-MCA anastomoses combined with temporal muscle grafting were performed for most cases. Omental graft was performed in 16 patients. In 13 patients, omental graft was performed for the progressing ischemia in the posterior (PCA) or anterior cerebral artery (ACA) distribution. In the other three patients, omental graft was used for marked brain atrophy or for those without appropriate STA as donor artery.

Complete remission and clinical improvement were obtained in 91 patients (34.0%) and 172 patients (64.2%), respectively. Symptomatic aggravation due to ischemic complication followed the operation in five patients (1.9%). Infarct were observed in the remote zone apart from the operative field or on the contralateral side.

Discussion

Indirect bypass maneuvers have the benefit of being technically easy to perform. However, some patients have been reported to be refractory to these indirect procedures. Although technical training is required, the therapeutic results of the direct bypass
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procedures have been shown to be superior to those of the indirect bypass. Therefore, it is not of significance to compare between the direct and the indirect bypass. The direct bypass is recommended if technically feasible. In spite of these preceding reports indicating the better surgical results of the direct bypass, several indirect procedures with minor modification to the original EDAS or EMS have been described as if they are fascinating newly-developed procedures. The choice of the operative maneuvers should depend on the technical feasibility and on the location of the ischemic brain. Because the diameters of recipient arteries are very narrow in some patients, and the occlusive lesions are not confined to the circle of Willis, the extent of filling through the STA-MCA anastomosis varies from extensive to localized. Thus, we make it a rule to combine the direct bypass and the indirect bypass. After the STA-MCA anastomosis was completed, dura was closed with the temporal muscle flap as a graft. This is called EMS. Extensive craniotomy and dural opening enhanced the chance of developing de novo transdural anastomoses. Preservation of the middle meningeal artery is also essential for this purpose. Blood flow is compromised chiefly in the borderzone areas between cerebral arteries. Focal reduction of blood flow follows after the administration of acetazolamide. These reverse steal phenomena suggest a risk of hypercapnea during general anesthesia. Since the risk of hypocapnea is a well-known fact in moyamoya disease, anesthesiologists tend to maintain higher level of arterial CO2 tension during general anesthesia. However, hypercapnea can be a potential risk inducing cerebral ischemia by the reverse steal.

When patients suffer from ischemic symptoms in the ACA or PCA distribution, a third operation is required. The paucity of recipient arteries in these distributions makes the revascularization more difficult than in the MCA distribution. Because most patients have already been treated with STA-MCA anastomoses on both sides, symptoms such as episodes of blindness, or transient motor weakness in the lower extremities subsided with antiplatelet therapy. Among the 268 patients treated during these 15 years, the third operation was required only in 13 patients (this accounts 4.9% of our series). We believe that, if both hemispheres are irrigated sufficiently through STA-MCA anastomoses, the risk of completed stroke is quite low. According to our experience more conservative attitude is recommended for the indication of the third operation.

References


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