A Comparative Study of Risk Factors and the Occurrence Rate of Coronary Atherosclerosis in Extra- and Intracranial Atherosclerotic Lesions

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Background: The risk factors and epidemiology of extracranial and intracranial atherosclerotic lesions may be different. We evaluated the importance of perioperative management of coronary atherosclerotic lesions in carotid endarterectomy (CEA) or carotid artery stenting (CAS) for extracranial cervical carotid artery stenosis and superior temporal artery (STA)–middle cerebral artery (MCA) bypass for intracranial severe MCA stenosis/occlusion. *Methods:* The medical records of patients who underwent cerebrovascular surgery at Aizu Chuo Hospital between January 2000 and September 2010 were retrospectively analyzed. Preoperative cardiovascular screening was performed for all patients to prevent perioperative ischemic heart disease–related complications. The number of patients requiring preoperative treatment of the coronary artery was compared. *Results:* A total of 320 patients underwent surgery for cervical carotid stenosis (IC group; 259 patients with CEA and 61 patients with CAS), and 92 patients underwent STA–MCA bypass for MCA stenosis/occlusion (MC group). Treatment for coronary lesions was required in 35 of 320 patients (10.9%) in the IC group and 14 of 92 patients (15.2%) in the MC group. Surgery was safely performed in both groups without any ischemic heart disease–related complications during the perioperative period. *Conclusions:* This study shows the importance of perioperative management of coronary atherosclerotic lesions for STA–MCA bypass, similar to that for CEA/CAS. **Key Words:** Carotid artery stenting—carotid endarterectomy—coronary atherosclerosis—extracranial atherosclerosis—intracranial atherosclerosis—superior temporal artery–middle cerebral artery bypass.
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Extracranial and intracranial atherosclerotic lesions have different risk factors and epidemiologies. In particular, extracranial atherosclerotic lesions are common among whites and intracranial atherosclerotic lesions are common among Asians and African Americans.[1] Extracranial and intracranial atherosclerotic lesions also have differences in their pathogenesis and histopathologic characteristics.

Extracranial atherosclerotic lesions caused by cervical carotid arteriosclerosis are often associated with cardiac coronary artery atherosclerosis, and both diseases have similar histopathologic characteristics.[2] In contrast, intracranial atherosclerotic lesions are rarely associated with coronary atherosclerosis.[3] Ischemic heart disease has been emphasized as a perioperative complication in the treatment of cervical carotid stenotic lesions,[4] but has no equivalent importance in surgery for lesions in major intracranial arteries.[5]

The present study compared patients with intracranial and extracranial atherosclerotic lesions to evaluate the associated risk of coronary lesion complications in the perioperative management, and verify the importance of coronary lesion management in such cases. The patients

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had cervical carotid stenosis treated by carotid endarterectomy (CEA) or carotid artery stenting (CAS), or middle cerebral artery (MCA) severe stenosis or occlusion treated by superficial temporal artery (STA)–MCA bypass.

Methods

Study Population

We retrospectively analyzed the medical records of patients who underwent cerebrovascular surgery (CEA or CAS for cervical carotid stenosis and STA–MCA bypass for MCA severe stenosis or occlusion) at Aizu Chuo Hospital between January 2000 and September 2010 to identify the risk factors and frequency of patients requiring preoperative coronary artery treatment.

Preoperative Cardiovascular Treatment

Cardiovascular screening was performed for all patients before cerebrovascular surgery to identify coronary atherosclerotic disease. Specifically, echocardiography and Holter monitoring were performed for all patients. We consulted the cardiology department and performed treadmill stress electrocardiography and coronary digital subtraction angiography as recommended. If the cardiology department judged the subject to have a high risk for coronary lesions, we performed percutaneous coronary intervention or coronary artery bypass grafting before the surgery for atherosclerotic vascular disease. Most of the detected coronary atherosclerotic lesions were asymptomatic. Generally, significant (≥95%) diameter stenosis in any of the 3 major coronary arteries was indicated for preoperative treatment. Continuous intravenous administration of a coronary vasodilator (nicorandil) was performed before surgery in patients who were at high risk of developing perioperative ischemic heart disease–related complications.

Surgery for Cranial Atherosclerotic Lesions

Patients with symptomatic cervical carotid stenosis of ≥50% and asymptomatic stenosis of ≥80% were considered for cerebrovascular surgery based on the findings of various randomized, controlled studies. Characteristics of carotid plaque findings on ultrasonography or magnetic resonance imaging (MRI) were not considered in the inclusion criteria for surgery. CEA was the first choice for the surgical treatment. CAS was selected for high position carotid plaque extending distally to the height of the C2 vertebral body based on the difficulty of the surgical approach. In addition, CAS was the first choice of treatment for restenosis after CEA. Characteristics of carotid plaque findings on ultrasonography or MRI were not considered in the selection of CEA or CAS. CEA was performed under general anesthesia, and CAS was performed under local anesthesia. Patients with symptomatic severe stenosis or occlusion of the MCA were considered for surgery if the extent of the cerebral infarction was limited and localized, with reduced cerebral blood flow and cerebrovascular reserve capacity in the MCA area. STA–MCA bypass was performed under general anesthesia. The presence of ischemic heart disease was not considered in the indications for surgery in any patient.

Statistical Analysis

Mean age was compared using the Student t test. The rate of male patients was compared with the Pearson Chi-square test. Rates of patients with underlying diseases and of patients who underwent coronary treatment were compared with the Pearson Chi-square test. All statistical analyses were carried out using JMP software (version 9.0.2; SAS Institute Inc, Cary, NC), and $P < .05$ was considered to be statistically significant.

Results

A total of 320 patients underwent surgery for cervical carotid stenosis (IC group; 259 patients with CEA and 61 patients with CAS), and 92 patients underwent STA–MCA bypass for MCA occlusion or severe stenosis (MC group). The backgrounds of the subjects and previous or underlying diseases are shown in Table 1. The number of male patients, mean age, and previous or underlying ischemic heart disease were significantly higher in the IC group. There was no significant difference between the 2 groups with regard to other previous or underlying diseases.

Preoperative coronary treatment was performed in 35 of 320 patients (10.9%) in the IC group and 14 of 92 patients (15.2%) in the MC group (Table 2). Surgery for coronary lesions could be safely performed in all patients without perioperative ischemic heart disease–related complications.

Sixty-two patients in the IC group and 5 patients in the MC group had previously undergone treatment for coronary atherosclerotic lesions, and 12 of 62 patients in the IC group and 2 of 5 patients in the MC group required retreatment for coronary artery stenosis based on the preoperative screening. Twenty-three patients in the IC group and 12 patients in the MC group received initial treatment for coronary atherosclerotic lesions identified on preoperative screening. The totals of patients with previous and perioperative treatment for coronary atherosclerotic lesion was 85 (26.6%) in the IC group and 17 (18.5%) in the MC group (Table 3), indicating a greater tendency in the IC group compared with the MC group, but the difference was not statistically significant.

Discussion

The present study indicates the importance of managing ischemic heart disease (atherosclerotic coronary

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