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Local fibrinolysis for cardioembolic occlusion of the internal carotid artery

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Abstract. *Background.* Although favorable results of local fibrinolysis for occlusion of the middle cerebral artery have been reported, there is still poor or sometimes fatal outcome in patients with occlusion of the internal carotid artery. The purpose of this study is to disclose the role of local fibrinolysis for cardiogenic embolic occlusion of the internal carotid artery.

Methods. Ten patients (eight men and two women with an average age of 62 years), who were admitted within 3 h of ictus, with cardioembolic occlusion of the internal carotid artery were treated with local fibrinolysis within 6 h of onset.

Results. Complete or partial recanalization was obtained in two patients. Distal shift of the embolus without recanalization was observed in four patients. No apparent angiographic change was obtained in four patients. Outcome was one good recovery, six severe disability and three deaths.

Conclusion. At present, local fibrinolysis has no place in the treatment for cardioembolic occlusion of the internal carotid artery even in the ultra-acute stage.

Key words: embolism, endovascular surgery, heart disease, recanalization.

Introduction

Fibrinolytic treatment for embolic occlusion of the cerebral arteries aims for rapid restoration of the blood flow, thus protecting brain tissue from infarction or minimizing the infarcted brain. To date, favorable results of transcatheter fibrinolysis have been reported [1]. Although good outcome was mostly obtained in patients with occlusion of the middle cerebral artery [2–5], there is still poor or sometimes fatal outcome in patients with occlusion of the internal carotid artery, especially when the lenticulostriate arteries are involved [5–7]. We report our preliminary results and discuss the efficacy of this treatment modality.

Materials and Methods

There were eight men and two women, aged 45–72 years with an average age of 62 years. Etiology was cardioembolism in all cases. Locations of the emboli are shown in Fig. 1. No patient had atherosclerotic disease at the cervical carotid bifurcation. Etiologies of the cardioembolism were nonvalvular atrial fibrillation (four patients),

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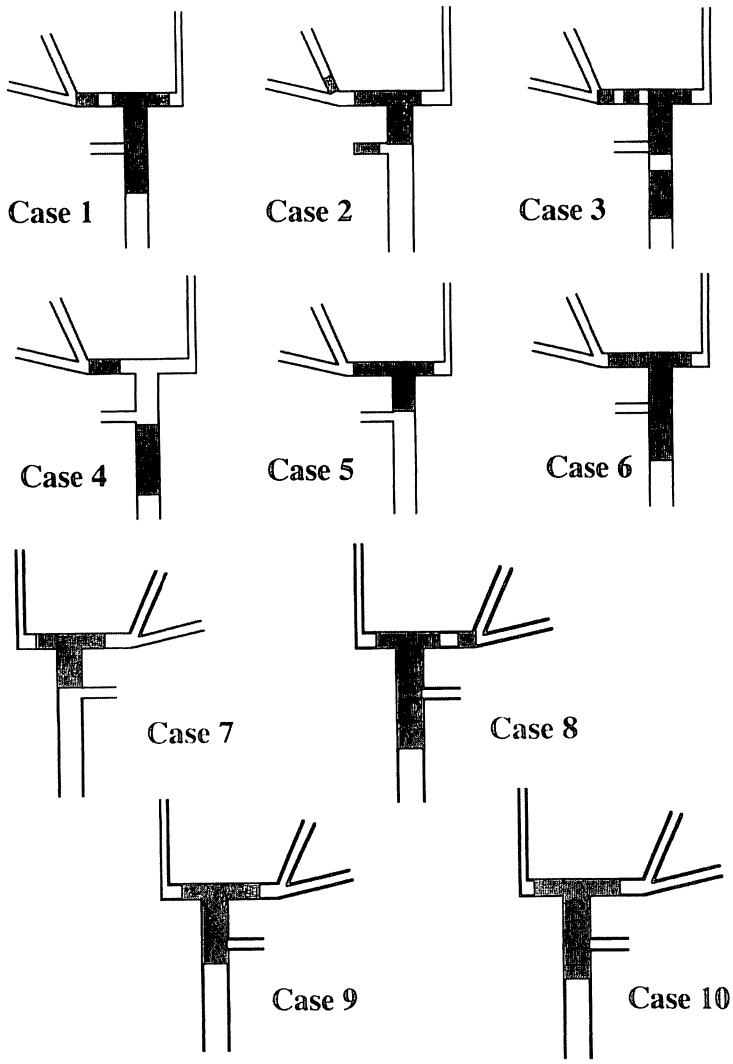

Fig. 1. Locations of the emboli in the internal carotid arteries.

valve diseases (four patients), idiopathic hypertrophic cardiomyopathy (one patient) and myocardial infarction (one patient).

Indication of local fibrinolysis was: 1) no fresh hematoma or infarction on X-ray computed tomography (CT); 2) admission within 3 h of ictus; and 3) severe neurological deficits. Endpoints of the treatment were when: 1) clinical improvement or angiographic recanalization was obtained; 2) the time elapsed from the onset exceeded over 6 h; 3) the extravasation of the contrast was observed on fluoroscopy; or 4) the total dosage of the fibrinolytic agent reached the upper limits.

Fibrinolytic agents were either urokinase (UK) or tissue plasminogen activator (t-PA), with upper limits of dosage of 480 and 1,200 k units, respectively. The fibrinolytic agents were administered locally through a microcatheter. Time elapsed from the onset to admission varied from 0.5 to 3 h, with an average of 1.5 h. The average time from admission to starting the intervention was 1.5 h.

Results

Recanalization means restoration of the blood flow. Distal migration of the embolus without restoration of the blood flow was discriminated from recanalization. Complete recanalization was obtained only in one patient while partial recanalization was noted in one patient. Distal shift of the embolus without recanalization was observed in four patients. No apparent angiographic change was obtained in four patients. Increased attenuation on postintervention CT was noted in three patients. Outcome was one good recovery, six severe disability and three deaths.

Discussion

Although Zeumer et al. [8] reported favorable outcome of local fibrinolysis for embolic occlusion of the internal carotid artery, most patients might have poor or fatal outcome. Favorable outcome with local fibrinolysis even after several hours of ictus may be attributable to less severe ischemia due to collateral flow [6]. Reported recanalization rates and outcome were as follows: 20% (2/10 cases) complete recanalization, 60% partial recanalization, and 20% no change with 20% good recovery and 80% severely disabled [5]; 87.5% (7/8 cases) recanalization and 12.5% partial recanalization with 25% complete symptom resolution, 50% partial resolution and 25% no change [1]. Complete recanalization does not mean clinical improvement. Sasaki et al. [5] reported that 8/10 patients showed complete or partial recanalization but no patient improved.

Our results were worse than these reports. Our poor results can be attributed to either failure of recanalization or infarction after reperfusion. Failure of recanalization is related to: 1) the size of the embolus, 2) nature of the embolus and 3) technique of local fibrinolysis. Infarction after reperfusion is related to: 4) timing of fibrinolysis, 5) involvement of the lenticulostriate arteries, and 6) distal migration of the embolus.

1. Size of the embolus

It is a common experience that the embolus in the internal carotid artery is larger than that in the middle cerebral artery. The embolus originating from the heart may be larger than that originating from the carotid plaque, which is theoretically smaller than the carotid lumen and may lodge in the middle cerebral artery [2].

2. Nature of the embolus

The emboli in the heart were thought to be fibrin and erythrocyte rich (red thrombus), which might be larger than platelet-fibrin rich thrombus (white thrombus). In artery to artery embolism in the middle cerebral artery stenosis, the embolus is an unorganized fibrin-platelet embolus [9], which is essentially different from the organized fibrin-erythrocyte rich embolus from the heart.

3. Fibrinolytic techniques

We administered fibrinolytic agents to places proximal to the embolus, within the embolus, distal to the embolus, deliberately. The fibrinolytic technique that we employed was hand injection and not the continuous injection using the infusion syringe pump. We do not think these two methods make significant difference in the recanalization rate.

4. Timing of recanalization

If intervention can induce recanalization sufficiently early to allow a clinical improvement, prognosis of the patients may become better than the natural course. However, recanalization may harm the cerebral tissue when the ischemia had been already irreversible.

5. Ischemia in the lenticulostriate artery territory

Even if there is no embolus in the middle cerebral artery, the saddle-type embolus located at the distal carotid bifurcation blocks the flow in the middle cerebral artery, causing the cortical ischemia and ischemia in the lenticulostriate arteries. Patients with ischemia in this territory are at high risk of hemorrhage during fibrinolysis because the walls of the lenticulostriate arteries are so fragile due to prolonged ischemia [6].

6. Distal migration of the embolus

When fibrinolysis of the embolus in the internal carotid artery is successful, there is a possibility of the distal migration of the fragmented emboli, causing occlusion of the middle cerebral artery. In this situation, further trial to lyse the distal embolus is indicated. However, the brain tissue of the middle cerebral artery territory has already suffered from profound ischemia and neurological recovery is less likely.

Conclusions

At present, local fibrinolysis has no place in the treatment modalities for embolic occlusion of the internal carotid artery even if the patient reaches medical attention

in the ultra-acute stage. However, we think that further careful study is necessary to conclude the real efficacy and limitation of this treatment.

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