Early Recanalization Rates and Clinical Outcomes in Patients With Tandem Internal Carotid Artery/Middle Cerebral Artery Occlusion and Isolated Middle Cerebral Artery Occlusion

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Background—Patients with isolated middle cerebral artery (MCA) and tandem MCA/internal carotid artery (ICA) obstruction have similar presenting symptoms and stroke severity. We aimed to investigate early recanalization of MCA and clinical outcomes in patients with tandem ICA/MCA obstructions and isolated MCA occlusion.

Methods—Patients with MCA occlusion on pretreatment transcranial Doppler were treated with intravenous tissue plasminogen activator. ICA lesions were detected with carotid duplex. Early neurological improvement (ENI) was defined by reduction of National Institutes of Health Stroke Scale (NIHSS) /H11350 10 points or total NIHSS /H11349 3 points. Good outcome at 3 months was a modified Rankin score of /H11349 2.

Results—Among 104 patients, 31% had tandem lesions and 69% had isolated MCA occlusions. Complete recanalization rate was 39% in isolated MCA occlusion group and 9% in tandem group (P /H11005 0.002). ENI at 24 hours occurred in 46% of the isolated MCA occlusion group and in 25% of the tandem group (P /H11005 0.045). Good outcome was achieved by 30% and 39% respective patients (NS).

Conclusion—The tandem lesion group showed lower early recanalization rate and ENI rate than the isolated MCA occlusion group. Despite this, good outcomes were similar in both groups. (Stroke. 2005;36:869-871.)

Key Words: middle cerebral artery occlusion ■ outcome ■ stroke, acute ■ thrombolysis ■ ultrasonography, Doppler, trnscranial

A quarter of patients with middle cerebral artery (MCA) occlusions have concomitant internal carotid artery (ICA) occlusion, and up to 50% of patients with ICA occlusion have a proximal MCA occlusion.1,2 Patients with tandem ICA/MCA lesions have similar clinical presentations and neurological severity compared with isolated MCA occlusion.1 Patients with tandem ICA/MCA occlusions had better outcomes if MCA recanalization occurred on time regardless of whether ICA remained occluded or not.2 It remains uncertain how often an early recanalization of MCA occurs in patients with tandem lesions.

We thought to investigate early recanalization of MCA and clinical outcomes in patients treated with systemic thrombolysis for tandem ICA/MCA lesions and isolated MCA occlusion.

Patients and Methods
This is a retrospective analysis of the CLOTBUST collaboration databank that includes patients with acute MCA occlusions treated with intravenous tissue plasminogen activator (tPA).3

A sonographer performed transcranial Doppler (TCD) with a 2-MHz device (Ez-Dop, DWL; PMD 100, Spencer Technologies; Multigon, 500 mol/L, Multigon Industries). MCA occlusion and recanalization were identified using previously validated criteria before and during the first 2 hours after tPA bolus.3 Before tPA bolus, we also performed carotid duplex (Sonosite 180 Plus), and previously validated diagnostic criteria for ICA occlusion were applied.4

Tandem ICA/MCA lesions (tandem group) were defined as hemodynamically significant ICA obstruction (70% to 100% obstruction) with MCA occlusion, and isolated MCA occlusion was diagnosed when patients had abnormal TIBI (Thrombolysis In Brain Ischemia) flow grades without evidence of significant ICA obstruction on carotid duplex ultrasound and TCD.

Neurological deficit was measured with the National Institutes of Health Stroke Scale (NIHSS) before, 30, 60, 90, and 120 minutes, and 24 hours after bolus. Modified Rankin scale (mRS) scores were obtained at 90 days after onset by a stroke neurologist blind to TCD findings. Early neurological improvement (ENI) was defined as reduction of NIHSS by /H11350 10 or decrease of total NIHSS to /H11349 4 within 24 hours after bolus.5 Good outcome was defined by mRS /H11349 2.

Stroke subtype was determined using Trial of Org 10172 in Acute Stroke Treatment (TOAST) classification system definitions:6 large...
artery atherosclerosis (LVA), cardioembolic (CE), lacunar (LA), other determined etiology (OE), and undetermined etiology (UE).

We used $\chi^2$ test, Mann–Whitney $U$ test, and $t$ test to compare groups. $P < 0.05$ was considered significant.

**Results**

A total of 104 patients were included in our study. Seventy-two (69%) patients had isolated MCA occlusion and 32 (31%) patients had tandem lesions. Their demographic data and clinical parameters are summarized in the Table. Stroke subtypes in the isolated MCA group were: LVA 8.5%; CE 5.3%; LA 1%; and UE 37% of patients. In patients with tandem lesion, stroke subtypes were: LVA 62%; CE 22%; OE 6%; and UE 9% of patients.

Complete recanalization rate increased with time after bolus in the isolated lesion group. It occurred in 26.4% of the isolated lesion group and 9.4% of the tandem group at 90 minutes after bolus ($P=0.05$) and at 2 hours in 38.9% and 9.4%, respectively ($P=0.002$; Figure 1). Complete recanalization rate was different according to the stroke subtype: LVA 14.4% and CE 39.1% ($P=0.02$).

ENI was achieved in 46% of the isolated lesion group and in 25% of the tandem group ($P=0.045$; Table), and the median NIHSS score reduction was different between the 2 groups at 2 hours and 24 hours after bolus ($P=0.002$ and $P=0.05$, respectively; Figure 2). Good outcomes were similar in the 2 groups.

**Discussion**

Our results showed that early complete recanalization and ENI are more common with the isolated lesion group compared with the tandem group despite similar baseline characteristics. MCA recanalization rate was lower with tandem than with isolated lesions in other studies at >24 hours after onset. In our study, the isolated lesion group had faster and higher complete recanalization rate than the tandem group during the first 2 hours. Recanalization rate increased with time in the isolated lesion group but not in the tandem group. Recanalization was less frequent with LVA than with CE subtype. Our patients may have had more chance to achieve complete recanalization because they had TCD monitoring during the first 2 hours. A direct comparison of our study with previous studies is not possible because previous studies did not report early recanalization rates. The low MCA recanalization rate in the tandem group may be attributed to the large amount of thrombus if ICA is obstructed. ICA lesion may cause hypoperfusion and reduce the delivery of tPA to the thrombus in the MCA.

Although the isolated lesion group had more reduction of NIHSS scores and higher ENI rate compared with the tandem group, good outcomes were similar between the 2 groups in our study. ENI predicts good outcomes. However, late ICA recanalization, partial MCA recanalization, collateral flow improvement with time, delayed recovery after slow and partial recanalization, or small sample size in the tandem group may attribute to our findings. Large numbers of patients are needed to confirm this trend in 90-day outcome. In conclusion, early complete recanalization of MCA and ENI are less frequent in the tandem group than in the isolated lesion group. Despite this, 30% of the tandem group achieved good outcome. The tandem ICA/MCA obstruction should not be used as an exclusion from standard tPA therapy within the therapeutic window. The tandem lesion group may require more aggressive intervention to obtain adequate reperfusion.

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References


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