Immediately balloon-expandable stent placement of underlying stenosis after initial intraarterial thrombolysis in acute middle cerebral arterial stroke

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Purpose

To determine the feasibility and efficacy of stenting and angioplasty in acute stage of symptomatic atherosclerosis using balloon-expandible stent (BES), we conducted a retrospective review of 12 cases if acute middle cerebral artery (MCA) who treated by BES for early reobstruction of MCA after intraarterial thrombolysis (IAT).
Methods and Materials

Between May 2009 and March 2010, twelve consecutive patients (average age, 58.3 years; age range, 37-77 years) with acute obstruction of MCA underwent cerebral revascularization with a combination of balloon-expandable stent (BES) placement immediately after interarterial thrombolysis.

Inclusion criteria of this study were the followings: 1) MCA stroke symptoms with onset within 6 hours before treatment; 2) CT or MR exclusion of hemorrhage; and 3) atherosclerotic-related MCA obstruction confirmed by intra-arterial digital substraction angiography (DSA) and treated by deployment of coronary stent due to reobstruction after IA thrombolysis. Finally, 12 patients were eventually included in this study.

All of these patients were initially evaluated by stroke team neurologists and imaging with CT/MR. Time to treatment, urokinase dose, duration of the procedure, recanalization rates, and symptomatic hemorrhage were analyzed. Clinical outcome measures were assessed on admission and at discharge (National Institutes of Health stroke scores [NIHSS]), and at 3 months after treatment (modified Rankin scales [mRS]).
Results

- Clinical characteristics

The mean age of the 12 patients (9 men and 3 women), was 59.4 years (range, 37-78 years). The clinical characteristics of the 12 patients are summarized in Figure 1. The median NIHSS score was 8.6 (range, 4-18; SD 3.6) on admission. The median time between the onset of neurologic symptoms and endovascular intervention was 236 minutes (90min to 350min), and median duration of IA therapy was 62 minutes(range, 50-75min).

- Prestenting procedure

Angiographic occlusion sites were located in the MCA (n = 10) and combined lesions of distal internal carotid artery and MCA (N = 2). All patients underwent the IA thrombolysis with urokinase and mechanical clot disruption with microcatheter and microguide wire. Urokinase dose was 100,000 - 200,000 U (median, 141,000 U). After IA thrombolysis and mechanical clot disruption, angiograms showed the underling stenosis of MCA at the occlusion site in all patients. Percutaneous angioplasty was performed in 5 of 12 patients. These patients were occurred the reobstruction of MCA after 10 - 20 minutes

- Angioplasty and Stenting

Intracranial stent placement was performed in each of the 12 lesions. In 5 of 12 lesions, both stent placement and angioplasty were performed. Patients who had attempted recanalization with angioplasty before stent placement did not have repeat angioplasty after stent placement.

- Poststenting

Technical success of intracranial stent was achieved in all patients. Recanalization (TICI grade II or III) was in all patients. TICI grade III occurred in 11 patients (91.7%), and TICI grade II occurred in one patients (8.3%). No procedure-related complications such as vessel rupture or dissection were observed. No acute hemorrhage (either intraparenchymal or subarachnoid) on postprocedural CT scan obtained within 24 hours of the procedure. One patient had the hemorrhagic transformation in core area of infarction on MR scan within 72 hours of the procedure.

- Clinical outcomes

Two in-hospital deaths occurred; one with hemorrhagic transformation due to progression of stroke and withdrawal of care at the family's request and one secondary to respiratory failure by the aspiration pneumonia.
At discharge (10/12), the median NIHSS score was 2.4 (range, 0-5). The NIHSS score of all patients was improved. In aspect of neurologic improvement, 7 of 10 patients achieved a #4-point reduction of admission score; 3 patients achieve 3-point reduction. At the 3-month follow-up, the functional outcome was excellent (mRS, 0 or 1) in 6 (60%) of the 10 patients, good (mRS, 2) in 1 patient, and poor (mRS, 3-5) in 2 patients.

- Reobstruction

Two patients underwent early reobstruction due to in-stent thrombosis within 48 hours of the procedure. These patients were heavy smokers. These patients underwent the IA therapy such as urokinase infusion, mechanical clot disruption with microcatheter and microguide wire, and angioplasty, but did not achieved in recanalization of MCA. Of these patients, one patient was performed the bypass surgery due to poor collateral flow and young patient and one was performed the conservative treatment due to good collateral flow.

Follow-up study at 6 months for restenosis was completed in 8 patients. Angiographic follow-up in 6 patients revealed stenosis a mean 31% ± 0.23 SD. No definite restenosis (>50%) was seen on CT angiography and Doppler study, therefore indicating no restenosis in our study patients (0/8).
### Table 1: Clinical and Imaging Characteristics and Outcome in 21 Patients

<table>
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<tr>
<th>Patient ID</th>
<th>NHSS at admission</th>
<th>Onset time (min)</th>
<th>Time to IAT (min)</th>
<th>Duration of procedure (min)</th>
<th>Urokinase dose (U)</th>
<th>Angioplasty (mm)</th>
<th>Stent grade</th>
<th>Symptomatic hemorrhage</th>
<th>NIHSS at discharge</th>
<th>mRS at 3 Months</th>
<th>Clinical Outcome</th>
<th>Comorbidities</th>
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**Fig. 0:** Fig 1. Clinical characteristic of patients

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Fig. 0: 37 years old man with smoking history of 15 packyears developed Rt side weakness and dysarthria. (A) Initial intracranial angiogram in frontal projection shows thrombosis of and delayed flow of Lt MCA. (B) After IA thrombolysis and angioplasty using 2*15mm balloon, the vessel caliber is improved and flow is increased. (C) 20 min-delayed angiography shows restenosis of Lt MCA. Post stent-deployment angiography shows focal luminal irregularity with good patency. (D) Follow up angiography after 1 week shows complete reobstruction of Lt MCA. Bypass surgery was performed but had no effect.

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Fig. 0: Fig 3. 58 years old man with alcohol history developed mental change.
(A) Initial angiogram in frontal projection shows complete obstruction of Rt MCA(M1).
(B) Angiogram after IA thrombolysis shows underlying stenosis of Rt MCA. (C) 20min-
delayed angiogram shows reobstruction of Rt MCA. (D) Post stent- deployment
angiography shows good patency. (E) Follow up angiogram after 2 months shows good
patency and normal range of flow.

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Conclusion

In this study, BES deployment is safe and effective in patients with immediately reocclusion after IAT. A high rate of recanalization, low rate of symptomatic hemorrhage, and excellent functional outcome can be achieved.


Personal Information

Hyun Kyung Lee, Hyo-Sung Kwak, Seung-Bae Hwang, Gyung-Ho Chung

Department of Radiology, Chonbuk National University Hospital and Medical School,
634-18, Keumam-Dong, Jeonju, Jeonbuk, 561-712, South Korea