Clopidogrel Load for Emboli Reduction in Patients With Symptomatic Carotid Stenosis Undergoing Urgent Carotid Endarterectomy

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Background and Purpose—Microembolic signals (MES) on transcranial Doppler are an independent risk factor for recurrent stroke in patients with extracranial symptomatic/asymptomatic carotid artery stenosis (CARAS). Clopidogrel load (300 mg) combined with dual antiplatelet therapy has been shown to reduce MES in patients with symptomatic CARAS. We sought to determine feasibility of clopidogrel load in decreasing asymptomatic embolization in patients with symptomatic CARAS undergoing urgent carotid endarterectomy within the first 2 weeks from the index event.

Subjects and Methods—Consecutive patients with symptomatic CARAS (70%–99%) and presence of MES on 1-hour baseline (<24 hours from the index event) transcranial Doppler monitoring of ipsilateral middle cerebral artery were treated with clopidogrel load followed by clopidogrel (75 mg) ± aspirin (100 mg) during the elapsed time period between hospital admission and urgent carotid endarterectomy at 3 tertiary-care stroke centers. Repeat 1-hour transcranial Doppler monitoring was performed the day before surgery. Bleeding complications during surgery and recurrent strokes or transient ischemic attacks during the first month of ictus were prospectively recorded.

Results—A total of 11 symptomatic CARAS patients (mean age, 66 ± 7 years; 73% men; 64% acute ischemic strokes) were treated with clopidogrel load followed by dual (67%) or single (33%) antiplatelet therapy. MES count was significantly reduced between baseline (median count, 8 MES/h; interquartile range, 6–19) and repeat transcranial Doppler monitoring (0 MES/h; interquartile range, 0–3; \( P = 0.003 \)). No bleeding complications, recurrent strokes, or transient ischemic attacks were documented.

Conclusions—Our pilot observational study provides preliminary nonrandomized data regarding the potential efficacy of clopidogrel load to reduce asymptomatic embolization in patients with symptomatic CARAS before urgent carotid endarterectomy. (Stroke. 2012;43:00-00.)

Key Words: clopidogrel load ■ emboli reduction ■ urgent carotid endarterectomy ■ carotid artery stenosis
2. MES detected in ipsilateral to symptomatic CARAS middle cerebral artery in baseline 1-hour TCD monitoring (<24 hours).
3. Emergent CEA performed for revascularization of symptomatic CARAS within 2 weeks from stroke onset.
4. Repeat 1-hour TCD monitoring performed 1 day before CEA.
5. Absence of other potential sources of embolism (eg, cardiac sources, aortic arch atheroma)

Demographic characteristics and stroke risk factors were recorded as previously described. Stroke severity on hospital admission and at discharge was evaluated using the National Institutes of Health Stroke Scale score. Patients with absent temporal artery windows, symptomatic carotid artery occlusion, and prehospital functional disability (defined as modified Rankin Scale score of >2) were excluded from additional evaluation.

TCD monitoring of the M1-middle cerebral artery ipsilateral to the symptomatic CARAS was performed at 50 to 60 mm depth using previously described methodology with motion-mode TCD (PMD-ST3, Spencer Technologies or SONARA, VIASYS Healthcare) equipped by a 2-MHz transducer that was stabilized by a head frame. Standard TCD settings were set according to the International Consensus Criteria: 4 to 5 mm sample volume and 4 to 5 seconds sweep speed. Experienced sonographers at each center (G.T., A.K., C.K., K.V., I.H., A.V.A.) reviewed the TCD recordings in real-time to identify the presence of MES according to International Consensus Criteria on MES detection (Figure 1).

Bleeding complications during surgery and recurrent acute ischemic stroke/transient ischemic attacks during the first month following the index event were prospectively documented. Patients were treated with single antiplatelet therapy (aspirin 81–325 mg or clopidogrel 75 mg) following CEA. Functional status at 3 months was evaluated using modified Rankin Scale score.

The present study was approved by the Ethics Committee/Institutional Review Board of our institutions, where clopidogrel load (300 mg) is used as standard of care in addition to aspirin for patients who have large artery atherosclerotic (LAA) stroke mechanism and are scheduled to undergo urgent extra- or intracranial revascularization procedure. Data were collected under Institutional Review Board-approved protocol that captured all pretreatment variables, treatments, and outcomes among consecutive stroke patients admitted to our institutions as part of ongoing research and quality/outcomes improvement processes. All patients signed standard informed consent forms for carotid endarterectomy and were informed about potential bleeding risks. Given that this was a pilot/standard of care observational study, no a priori stopping rules were implemented. Serious adverse events were reported by local investigators and there was no independent data safety and monitoring board.

**Statistical Analyses**
Continuous variables with normal and skewed distribution are presented as mean (SD) or as median (interquartile range [IQR]). The difference in frequency of embolization between baseline and repeat TCD monitoring was evaluated using Wilcoxon rank-sum test given the skewness in MES distribution.

**Results**
A total of 11 symptomatic CARAS patients (mean age, 66±7 years; 73% men; 64% acute ischemic stroke) were treated with clopidogrel load followed by dual (67%) or single (33%) antiplatelet therapy during the study period (Table). The

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<tr>
<th>Table. Baseline Characteristics of the Study Population (n=11)</th>
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<tr>
<td><strong>Baseline Characteristic</strong></td>
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<tr>
<td>Mean age, y (SD)</td>
</tr>
<tr>
<td>Male</td>
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<tr>
<td>Index event</td>
</tr>
<tr>
<td>AIS</td>
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<tr>
<td>TIA</td>
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<td>Hypertension</td>
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<td>Current smoking</td>
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<td>Stroke before index event</td>
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<td>Median admission NIHSS score (range)</td>
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<td>Median elapsed time between admission and CEA, d (range)</td>
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AIS indicates acute ischemic stroke; TIA, transient ischemic attack; NIHSS, National Institutes of Health Stroke Scale; CEA, carotid endarterectomy.
Our findings are consistent with European and Asian randomized clinical trials evaluating the safety and efficacy of clopidogrel load followed by dual antiplatelet therapy in patients with symptomatic CARAS or symptomatic extra- or intracranial LAA. The reduction of MES detection at day 7 following aggressive antiplatelet therapy was 67% in the Asian6 and 54%5 in the European study. We documented a similar 54% reduction at repeat TCD monitoring performed at a median of 6 days (range, 4–9) from symptom onset. Our findings are also in line with the observations of a single-center study, indicating that the addition of clopidogrel to aspirin before CEA resulted in a 10-fold reduction in the relative risk of those patients having >20 emboli in the postoperative period.11 Notably, no increase in bleeding complications or blood transfusions during or after CEA was noted in patients treated with dual antiplatelet therapy.11 However, substantial methodological differences between our and the former study11 need to be acknowledged, including the fact that clopidogrel load was not used, and both symptomatic and asymptomatic CARAS patients were included.11 In addition, dual antiplatelet therapy was administered only the night before CEA.11

Our study has limitations, including the observational design and the absence of central reading of TCD recordings. Moreover, our findings should be interpreted with caution given the nonrandomized setting of our study and the absence of independent data safety and monitoring board for evaluation of potential serious adverse events. In addition, as we describe in our methodology, we implemented no prespecified stopping rules, and no formal sample size estimation was performed before study initiation. Finally, dual antiplatelet therapy following clopidogrel load was administered in 2 of the 3 participating centers (Alexandroupolis and Alabama), whereas in the remaining center (Bochum), patients were treated with antiplatelet monotherapy (clopidogrel 75 mg) after clopidogrel load because of the fear of bleeding complications.

In conclusion, our pilot observational study provides preliminary nonrandomized data regarding the potential efficacy of clopidogrel load to reduce asymptomatic embolization in patients with symptomatic CARAS before urgent CEA. The present findings are subject of a larger ongoing multicenter study investigating whether clopidogrel load followed by dual antiplatelet therapy is associated with lower risk of recurrent stroke in patients with symptomatic CARAS scheduled to undergo urgent CEA.

### Sources of Funding

None.

### Disclosures

None.

### References


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