Self-Expandable Stents in the Treatment of Acute Ischemic Stroke Refractory to Current Thrombectomy Devices

Italo Linfante, MD, FAHA; Edgar A. Samaniego, MD; Philipp Geisbüsch, MD; Guilherme Dabus, MD

Background and Purpose—Vessel recanalization is a strong predictor of good outcome in acute ischemic strokes (AIS) secondary to large vessel occlusions. We report our single-center experience with self-expandable stents in the treatment of AIS.

Methods—The stroke database of Baptist Cardiac and Vascular Institute in Miami was retrospectively reviewed from August of 2008 to September of 2010. All cases of AIS in which a self-expandable stent was deployed as acute endovascular intervention were included in the analysis. Criteria for intervention were the onset of neurological symptoms due to AIS, a National Institute of Health Stroke Scale score ≥4 at presentation, stroke attributable to a large vessel occlusion, and failure of arterial thrombolysis or mechanical thrombectomy or both. Good outcome was defined as a modified Rankin Scale score ≤2 at 1 month from hospital discharge.

Results—Nineteen patients with AIS who underwent stenting were identified. Median National Institute of Health Stroke Scale score on admission was 19. Six Enterprise and 13 Wingspan stents were deployed. Recanalization was achieved in 95% occlusions (63% thrombolysis in myocardial infarction grade 3 and 32% thrombolysis in myocardial infarction grade 2). Good clinical outcome was achieved in 42%. No intraprocedural complications occurred and all stents were successfully deployed. Symptomatic intracerebral hemorrhage occurred in 3 (16%) patients, 2 of whom died.

Conclusions—Use of self-expandable stents in AIS appears to be safe and may be considered when currently available thrombectomy devices and/or intraarterial thrombolysis fail. (Stroke. 2011;42:2636-2638.)

Key Words: acute ischemic stroke ■ self-expandable stents ■ stenting ■ thrombectomy ■ thrombolysis

Recanalization is a strong predictor of good outcome in cerebral ischemia secondary to large vessel occlusion. Recanalization rates with Food and Drug Administration-approved thrombectomy devices such as the Concentric Thrombus Retriever (Concentric Medical) and the Penumbra System (Penumbra) have been reported to range between 63% and 82%. Recent experience with the use of self-expanding stents (SES) for flow restoration of acute ischemic stroke (AIS) secondary to intracranial large vessel occlusion suggests that this approach can be safe and feasible. We report our single-center experience with SES in the treatment of AIS.

Materials and Methods

After obtaining Institutional Review Board approval, stroke cases at Baptist Cardiac and Vascular Institute, which occurred between August 2008 and September 2010, were retrospectively reviewed. All cases of AIS in which a stent was deployed as acute endovascular intervention were included in the analysis.

Criteria for intervention were the onset of neurological symptoms attributable to an acute ischemic stroke with a National Institute of Health Stroke Scale score ≥4, stroke attributable to a large vessel occlusion, and failure or contraindication to intra-arterial thrombolysis or mechanical thrombectomy (or both). Patients who presented beyond 6 hours from symptom onset were considered for treatment if the brain computed tomography perfusion demonstrated a mismatch of more than one-third of the middle cerebral artery territory between the cerebral blood flow and cerebral blood volume images. Enterprise Vascular Reconstruction Device (Cordis Corporation) and Wingspan (Boston Scientific) SES are used at our institution. The off-label use of these stents for vessel recanalization in AIS, procedural complications, and adverse events were notified to the Institutional Review Board and manufactures. Every intervention was performed with written consent from the patients or their legal representative.

Outcomes were assessed at follow-up clinic visits or by a structured telephone interview. Good outcome was defined as a modified Rankin Scale (mRS) score ≤2 at 1 month from hospital discharge. Recanalization of the target vessel and of the distal circulation was assessed using the thrombolysis in myocardial infarction grading system by a physician not involved with the procedure and blinded from the clinical outcome. If chemical thrombolysis was not effective, then mechanical thrombectomy was attempted with the Merci Retriever or the Penumbra system (or both). If minimal or no recanalization was achieved, or if anatomic variations prevented the use of thrombectomy devices, then angioplasty and stenting were performed. If the patient was not using aspirin and clopidogrel, then intra-arterial abciximab was infused immediately before or after the stent deployment (0.25 mg/kg).

A head computed tomography was performed within 24 hours of the procedure to detect hemorrhagic transformation. Spontaneous intracerebral hemorrhage was defined as a 4-point deterioration from
the preprocedure National Institute of Health Stroke Scale score combined with a space-occupying brain hematoma.6

Results

Nineteen patients with AIS who underwent stenting were identified. Demographic characteristics and clinical outcomes are described in Table 1. The median National Institute of Health Stroke Scale score at admission was 19 (range, 6–28).

All patients were treated with chemical thrombolysis or mechanical thrombectomy (or both), except for 2 patients who presented beyond 3 hours and had evidence of atherosclerotic changes in angiography and were directly stented. Six Enterprise and 13 Wingspan stents were deployed. In all the procedures, intra-arterial GIIb/IIIa inhibitors were administered to ensure stent patency.

Twelve (63%) lesions achieved thrombolysis in myocardial infarction grade 3 flow (complete perfusion), 6 (32%) had thrombolysis in myocardial infarction grade 2 flow (partial reperfusion), and 1 (5%) had thrombolysis in myocardial infarction grade 1 flow (penetration without reperfusion) after angioplasty and stenting. No intraprocedural complications occurred and spontaneous intracerebral hemorrhage was observed in 3 (16%) patients, 2 of whom died.

Eight (42%) patients had a good outcome and 12 (63%) patients achieved a mRS score ≤3. Five patients (26%) died (mRS score, 6), 1 patient had moderate severe disability (mRS score, 4), and 4 patients had moderate disability (mRS score, 3). One patient moved out of the country and was lost during follow-up.

Discussion

In our experience, angioplasty and stenting in AIS secondary to large vessel occlusion resulted in 95% thrombolysis in myocardial infarction grade 2 or 3 flow. This selected cohort of patients, with otherwise poor prognoses, achieved a mRS score of ≤2 in 42% and mRS score ≤3 in 63%. Other studies have shown a 100% successful deployment of SES in AIS (Table 2), with only 2 cases of transitory stent occlusion in which intra-arterial glycoprotein IIb/IIIa inhibitors had to be administered.8,9

The rate of spontaneous intracerebral hemorrhage (16%) in our cohort was higher than other studies that have reported rates between 0% and 11%.4,7–9 These previous studies did not administer intra-arterial glycoprotein IIb/IIIa inhibitors in all their patients, as in our experience (Table 2). Based on these observations, intraprocedural glycoprotein IIb/IIIa inhibitors may only be used as a salvatory intervention in case of acute in-stent thrombosis8,9 and may not be administered routinely during stent deployment.

The Wingspan stent system was approved by the Food and Drug Administration for endovascular treatment of intracranial atherosclerosis and appears as a natural choice for revascularization in AIS. Nevertheless, the more navigable SES Enterprise was successfully deployed in 2 cases in which cerebrovasculature tortuosity limited the use of Wingspan.4,10
Table 2. Self-Expandable Stents in Acute Ischemic Stroke

<table>
<thead>
<tr>
<th>Study</th>
<th>Sample Size</th>
<th>Study Type</th>
<th>Median Age, Y</th>
<th>Mean NIHSS</th>
<th>TPA, n (%</th>
<th>IV, n (%</th>
<th>Successful Stent Deployment, %</th>
<th>TIMI and/or TICI, n (%)</th>
<th>Stent Occlusion, n (%)</th>
<th>Overall Mortality, n (%)</th>
<th>Clinical Outcome, %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Levy et al (2007)</td>
<td>18</td>
<td>Retrospective Multicenter</td>
<td>75</td>
<td>18</td>
<td>10 (56)</td>
<td>5</td>
<td>Neuroform (16)</td>
<td>Wingspan (3)</td>
<td>100</td>
<td>79 (TICI/TIMI 2/3)</td>
<td>2 (11)</td>
</tr>
<tr>
<td>Zaidat et al (2008)</td>
<td>9</td>
<td>Retrospective Single center</td>
<td>69</td>
<td>17</td>
<td>6 (67)</td>
<td>1</td>
<td>Neuroform (4)</td>
<td>Wingspan (5)</td>
<td>89</td>
<td>89 (TICI/TIMI 2/3)</td>
<td>None</td>
</tr>
<tr>
<td>Brekenfeld et al (2009)</td>
<td>12</td>
<td>Retrospective Single center</td>
<td>63</td>
<td>14</td>
<td>1 (8)</td>
<td>None</td>
<td>Wingspan (14)</td>
<td>100</td>
<td>92 (TIMI 2/3)</td>
<td>None</td>
<td>1</td>
</tr>
<tr>
<td>Levy et al (2009) SARS</td>
<td>20</td>
<td>Prospective</td>
<td>63</td>
<td>13</td>
<td>None</td>
<td>3</td>
<td>Wingspan (17)</td>
<td>100</td>
<td>100 (TIMI 2/3)</td>
<td>1 (5)</td>
<td>0</td>
</tr>
<tr>
<td>Mocco et al (2010)</td>
<td>20</td>
<td>Retrospective Multicenter</td>
<td>62</td>
<td>17</td>
<td>11 (55)</td>
<td>10</td>
<td>Enterprise (20)</td>
<td>100</td>
<td>100 (TIMI 2/3)</td>
<td>2 (10)</td>
<td>0</td>
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<tr>
<td>BCVI</td>
<td>19</td>
<td>Retrospective Single center</td>
<td>65</td>
<td>19</td>
<td>19 (100)</td>
<td>8</td>
<td>Wingspan (13)</td>
<td>Enterprise (6)</td>
<td>100</td>
<td>95 (TIMI 2/3)</td>
<td>3 (18)</td>
</tr>
</tbody>
</table>

BCVI indicates Baptist Cardiac and Vascular Institute; GP, glycoprotein; IV, intravenous; mRS, modified Rankin Scale; NIHSS, National Institutes of Health Stroke Scale; SARIS, stent-assisted recanalization in acute ischemic stroke; sICH, symptomatic intracranial hemorrhage; TICI, thrombolysis in cerebral ischemia; TIMI, thrombolysis in myocardial ischemia; TPA, tissue plasminogen activator.

*SARIS is a 2-center, prospective, single-arm trial, but results were reported only from a single center (University of Buffalo).

This single-center retrospective study has all the limitations intrinsic to this type of case series. Certainly, a structured prospective study with predetermined inclusion criteria would bypass the study limitations. In summary, deployment of SES in AIS is an alternative for recanalization of large intracranial vessels in patients in whom other currently available devices failed.

Disclosures

I.L. is a consultant for Codman Neurovascular and Concentric Medical.

References

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Stroke. 2011;42:2636-2638; originally published online June 30, 2011;
doi: 10.1161/STROKEAHA.111.618389
Stroke is published by the American Heart Association, 7272 Greenville Avenue, Dallas, TX 75231
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Print ISSN: 0039-2499. Online ISSN: 1524-4628

The online version of this article, along with updated information and services, is located on the World Wide Web at:
http://stroke.ahajournals.org/content/42/9/2636