Technical Note

Emergent stent placement following intra-arterial thrombolysis for the treatment of acute basilar artery occlusion

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ABSTRACT

Acute basilar artery occlusion (BAO) is a condition producing high rates of morbidity and mortality. Intravenous thrombolysis or intra-arterial thrombolysis are therapeutic options; however, the clinical outcomes remain poor. The purpose of the present study was to evaluate feasibility, safety, and efficacy of emergency stent placement following intra-arterial thrombolysis for patients with acute BAO. Thirty-six consecutive patients were treated for acute BAO using intra-arterial therapy from September 2004 to October 2009. Nine patients, with a Glasgow Coma Scale (GCS) score ranging from 8 to 12, underwent emergency stent placement following inadequate revascularization after thrombolysis. Neurological status prior to treatment was evaluated using the GCS score. Modified Rankin Scale (mRS) scores at 90 days post-treatment were used to assess functional outcome and we reviewed clinical records for frequency of procedure-related complications. Stents were deployed at the target lesion in all patients. Successful revascularization was achieved in eight of nine (88.9%) patients (residual stenosis <50%). The median GCS score prior to thrombolysis was 9 (range: 6–12) and prior to stent placement was 10 (range: 8–12). Four patients (44.4%) achieved good outcomes as determined by the mRS scale (0–2 at 90 days). Mortality was 33.3% in all procedures with one patient (11.1%) experiencing acute intrastent thrombus formation. No patient developed symptomatic intracerebral hemorrhage. Data from our small case series demonstrates that emergency stent placement following intra-arterial thrombolysis is a feasible treatment for patients with acute BAO and may reduce mortality and prevent re-occlusion of the basilar artery.

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Thirty-six consecutive patients with acute BAO were treated with intra-arterial thrombolytic therapy from September 2004 to October 2009. Among the 36 patients who underwent thrombolysis, nine (Glasgow Coma Scale [GCS] score, 8–12) received emergency stent placement following inadequate revascularization (residual stenosis 70–99%) with thrombolysis. Neurologists estimated neurological status prior to thrombolysis and stent placement using the GCS score. In all patients, the cause of BAO was considered to be atherothrombosis. Informed consent was obtained from each patient or family member prior to treatment.

2.2. Endovascular procedure

Diagnostic cerebral angiography was performed with a 5-French (Fr) catheter using a transfemoral approach prior to all intra-arterial thrombolysis treatments. Following identification of the occluded vessel, the diagnostic catheter was exchanged for a 6-Fr guide catheter (Envoy; Cordis, Miami Lakes, FL, USA), which was placed in the dominant vertebral artery proximal to the lesion. An infusion microcatheter (Prowler; Cordis) was advanced to the proximal region of the lesion using a microguidewire (Transcend; Meditech, Westwood, MA, USA) for landmarking. The microcatheter, with the microguidewire attached, was moved frequently through the clot to mechanically disrupt the thrombus. Intra-arterial thrombolytic therapy was administered through the microcatheter using urokinase (10,000 U/mL in saline) and infused manually at a rate of 20,000 U per minute. The maximum dose administered was 1,000,000 U. Infusion was discontinued when an activated clotting time of >250 s. A 0.014-inch [0.356-mm] exchange length microwire was inserted into the stenotic portion of the vessel and advanced to the distal segment of the posterior cerebral artery. Stents were sized to target vessel diameter and advanced to the site of stenosis. Prior to inflation, positioning of the balloon-expandable stent was confirmed using angiography. Subsequently, balloons of the stents were slowly inflated over 30 s to enable sufficient contact between the stents and vessel walls. Results were evaluated immediately using angiography. Balloons were dilated again if necessary. The procedure was considered complete if residual stenosis was less than 50% and no distal embolism of the peripheral branches were observed. The types of balloon stents used were as follows: Driver (Medtronic AVE; Minneapolis, MN, USA) in six patients, Apollo (MicroPort Medical Company, Shanghai, China) in one patient, and Coroflex (B. BRAUN, Melsungen, Germany) in two patients. The diameters of the implanted stents were 2.0 mm to 3.0 mm, and their lengths were 8 mm to 13 mm.

2.3. Clinical and radiological follow-up

Patients were transferred to the neurointensive care unit for overnight observation in the event of vascular or nonvascular adverse reactions following treatment. TCD examination was performed to evaluate hemodynamics following stenting. Clinical and radiological follow-ups were scheduled 3 months after the procedure and then annually. For imaging follow-up, we performed TCD to evaluate stent patency due to availability and non-invasiveness. Clinical outcomes at 90 days were classified using the modified Rankin Scale (mRS) score.

3. Results

Patient characteristics and clinical results are presented in Table 1. Among the nine patients (six men and three women) who underwent emergency stent placement following inadequate revascularization for thrombolysis, the median age was 63 years (range, 35–72 years). Stents were deployed at the occlusion site in all patients. Successful revascularization was also achieved in eight of nine (88.9%) patients (residual stenosis <50%). The median time from stroke onset to treatment was 5.5 hours (3.0–11.5 hours), with a median procedure time of 150 minutes (95–240 minutes). The median GCS score prior to thrombolysis was 9 (range: 6–12), and before stent placement was 10 (range: 8–12). Four patients (44.4%) achieved good outcomes (mRS score of 0–2 at 90 days); however, mortality was 33.3%. One patient (11.1%) experienced formation of acute intrastent thrombus following the procedure and was monitored by TCD. Angioplasty was performed at the target occlusion site; however, we were unable to achieve revascularization. The patients clinical condition deteriorated resulting in death. No symptomatic intracerebral hemorrhage was observed.

Table 1

<table>
<thead>
<tr>
<th>Patient no.</th>
<th>Age (years)</th>
<th>Sex</th>
<th>Time to treatment (hours)</th>
<th>GCS score before thrombolysis</th>
<th>GCS score before stenting</th>
<th>UK × 10⁻³ U Procedure time (min)</th>
<th>Prestenosis/poststenosis (%)</th>
<th>90 day mRS</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>63</td>
<td>M</td>
<td>6.5</td>
<td>7</td>
<td>10</td>
<td>90</td>
<td>145</td>
<td>90/20</td>
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<td>2</td>
<td>72</td>
<td>F</td>
<td>4.8</td>
<td>12</td>
<td>12</td>
<td>80</td>
<td>120</td>
<td>75/0</td>
</tr>
<tr>
<td>3</td>
<td>35</td>
<td>M</td>
<td>3.0</td>
<td>11</td>
<td>12</td>
<td>80</td>
<td>120</td>
<td>75/0</td>
</tr>
<tr>
<td>4</td>
<td>66</td>
<td>F</td>
<td>5.5</td>
<td>8</td>
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<tr>
<td>5</td>
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<tr>
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<td>71</td>
<td>F</td>
<td>11.5</td>
<td>9</td>
<td>9</td>
<td>50</td>
<td>125</td>
<td>95/10</td>
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<td>M</td>
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<td>8</td>
<td>40</td>
<td>180</td>
<td>99/10</td>
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</table>

F = female, GCS = Glasgow Coma Scale, M = male, mRS = modified Rankin Scale scores, UK = urokinase.
4. Discussion

Acute BAO is an infrequent type of acute stroke, often associated with high morbidity and mortality even when treated with antiplatelet agents and systemic anticoagulation. Intravenous thrombolysis or intra-arterial thrombolysis has been shown to result in improved clinical outcomes in patients with acute ischemic stroke. Nevertheless, thrombolysis alone may be less effective for treating proximal artery occlusions, particularly if there are significant atherosclerotic changes in the occluded vessel. Furthermore, residual high-grade stenosis usually remains following revascularization and often causes re-occlusion associated with poor clinical outcomes. A strong relationship exists between revascularization and improved clinical outcomes. If initial treatment is not able to re-establish sufficient flow, the outcome will almost inevitably be death. According to a systematic analysis by Lindsberg et al., the likelihood of a good clinical outcome was negligible (2%) without revascularization. Prolonged infusion of thrombolytic agents in patients resistant to thrombolysis, such as those with firm clots or atherothrombotic occlusions, may lead to lower rates of revascularization and increased risks for hemorrhagic complications. In patients with acute ischemic stroke from BAO, effective interventions to decrease morbidity and improve clinical outcomes have yet been established. In the present study, stent placement at the site of target occlusion was always achieved. Successful revascularization was achieved in eight of nine (88.9%) patients, suggesting feasibility of emergent stent placement following intra-arterial thrombolysis in patients with acute BAO. Percutaneous transluminal angioplasty (PTA) for acute BAO was not performed in the present study. PTA is able to immediately restore blood flow in the stenotic or occlusive artery by dissolving the clot or dilating the atherosclerotic stenosis. However, there are potential risks from balloon PTA for acute BAO, including atherosclerotic plaque or emboli shedding, dissection of the endangium, vasospasm, or re-occlusion. Therefore, stent usage is advantageous in order to in preventing restenosis and re-occlusion.

In addition to the present study, few reports of intracranial stent placement for acute BAO are potential risks from balloon PTA for acute BAO, including atherosclerotic plaque or emboli shedding, dissection of the endangium, vasospasm, or re-occlusion. Therefore, stent usage is advantageous in order to in preventing restenosis and re-occlusion.

We acknowledge limitations with the present study. In our study, we used the GCS score to estimate neurological status. This is an useful measure, although not the “gold standard”. An inherent selection bias of patients determined for revascularization is present in our patient cohort. Although a limited sample size, the data suggests that emergent stent placement in the presence of BAO is technically feasible and warrants further study. More data are required to evaluate the indications for emergent stent placement and its impact on the clinical outcome of patients with various phenotypes.

Acknowledgement

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References