Synchronous Carotid Endarterectomy and Retrograde Endovascular Treatment of Brachiocephalic or Common Carotid Artery Stenosis

F. Grego,* P. Frigatti, S. Lepidi, S. Bonvini, P. Amista and G. P. Deriu

Division of Vascular Surgery, Department of Medical and Surgical Sciences, School of Medicine, University of Padova, Via Giustiniani, 2, Padova 35100, Italy

Objectives. To retrospectively evaluate the safety and the long-term results of retrograde brachiocephalic and common carotid angioplasty and stenting (AS) performed for >70% stenosis synchronously with the carotid endarterectomy (CEA).

Patients. Sixteen patients operated between April 1999 and March 2002

Results. 14/16 procedures were successful. There was no neurological morbidity or mortality. Per-operative angiography showed the optimal stent positioning and patency of both proximal and distal arteries in all patients. In the follow-up, all patients showed patency of the treated vessels without restenosis and the absence of any cerebrovascular symptoms.

Conclusion. Intra-operative retrograde AS combined with CEA is an effective, safe and durable alternative to conventional surgery when a tandem significant proximal lesion is identified in a patient with an high grade carotid stenosis.

Key Words: Extracranial cerebrovascular disease; Brachiocephalic and carotid artery stenting; Carotid endarterectomy.

Introduction

When there are high-grade stenoses in the brachiocephalic or common carotid arteries associated with a significant tandem lesion in the internal carotid artery, it can be difficult to determine which is the truly symptomatic lesion and whether those symptoms are embolic or haemodynamic. In the latter case, symptoms may be caused by the additional effect of the two lesions.1,2 Opinions vary as to whether, when and how such proximal lesions should be repaired prior to carotid endarterectomy (CEA). One basic principle of vascular surgery suggests that it is a mistake to treat a distal lesion without correcting first a proximal tight stenosis of the inflow.3,4 The promising results of percutaneous endovascular treatment of isolated supra-aortic lesions5,6 has lead some units to treat tandem lesions by means of intra-operative retrograde angioplasty and stenting (AS) combined with CEA.7 The aim of this study was to retrospectively evaluate our results with this technique.

Material and Methods

Between April 1999 and March 2002, 16 patients were considered for simultaneous CEA and AS of innominate (6 patients) or proximal common carotid (10 patients) for significant stenosis (>70%) in both areas (Tables 1 and 2).8 Surgery was based upon duplex-scan, cerebral CT or MR, angio-CT or angio-MR and digital subtraction angiography (DSA) of the supra-aortic trunks. Two patients presented with carotid territory transient ischaemic attacks (TIA), six with otherwise unexplained non-focal cerebral symptoms (syncope, loss of balance, vertigo, blurring of vision and dizziness) and eight were asymptomatic.

All procedures were performed in the surgical suite using a portable digital Fluoroscope (Eurocolumbus, Milano, Italy), under general anesthesia, continuous EEG monitoring and systemic heparinisation. After a radio-opaque reference meter positioning, the carotid bifurcation was exposed. A common carotid retrograde puncture was performed using a 16 G needle, at the proximal end of the subsequent arteriotomy. An hydrophilic 0.035 Terumo guide wire was pushed through the lesion under fluoroscopic control and an 8 F short sheath introduced. Using 5–07 ml of non-ionic iodated dye, the preliminary DSA allowed to
verify and confirm the preoperative artery measurements and to mark the reference points on the monitor using the radiopaque meter as a reference.

The common carotid artery was clamped distally to the sheath entry point in order to block any dislodged fragments from the lesion during AS procedures. The stent was quickly advanced into the lesion, released and dilated appropriately. The stent was considered well positioned when it appeared to lean 1–2 mm into the aortic arch. After angiographic control, the internal and external carotid artery were clamped, the sheath was removed and the common carotid clamp repositioned proximally to the sheath entry point. Following the arteriotomy, the temporary release of the common carotid clamp allowed a vigorous blood flush, to ensure elimination of possible plaque fragments detached during AS procedures. Immediately after the flush, the proximal common carotid ‘stump’ was filled with heparinised saline solution to avoid any possible apposition of platelets and thrombus between the meshes of the stent, during the few minutes (∼5 min.) necessary to complete the plaque removal. As previously described,9 a shunt (Pruitt-Inahara, 550, medium) was introduced after the plaque removal.

Table 1. Demographic characteristics and risk factors (16 pts).

<table>
<thead>
<tr>
<th>Risk factor</th>
<th>No. of patients</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male</td>
<td>14</td>
</tr>
<tr>
<td>Smoking</td>
<td>15</td>
</tr>
<tr>
<td>Hypertension</td>
<td>15</td>
</tr>
<tr>
<td>Diabetes</td>
<td>4</td>
</tr>
<tr>
<td>CAD</td>
<td>8</td>
</tr>
<tr>
<td>RI</td>
<td>0</td>
</tr>
<tr>
<td>COPD</td>
<td>5</td>
</tr>
</tbody>
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Risk factors were defined and graded according to the SVS/ISCVS recommended criteria.9 Risk factors grade 0 are reported. CAD, coronary artery disease; RI, renal insufficiency; COPD, chronic obstructive pulmonary disease.

Table 2. Site of proximal lesions.

<table>
<thead>
<tr>
<th>Lesion</th>
<th>No. of patients</th>
</tr>
</thead>
<tbody>
<tr>
<td>Left CCA</td>
<td>7</td>
</tr>
<tr>
<td>Brachiocephalic trunk</td>
<td>6*</td>
</tr>
<tr>
<td>Right CCA</td>
<td>3</td>
</tr>
</tbody>
</table>

*Two converted procedures.
to maintain brain perfusion during the PTFE patch closure (Fig. 1). At the end of the procedure, a DSA was performed to verify the proximal and distal sites of intervention.

All patients underwent postoperative neurological evaluations and duplex scanning. All patients were prescribed Aspirin (100 mg/day) or Ticlopidine (250 mg/day) starting from the second postoperative day. The follow-up was regularly scheduled, and consisted of clinical and duplex scan examinations at 1, 3, 6, 12 months and yearly thereafter, as well as MR angiographic imaging at 12 and 24 months.

**Results**

Technical success was achieved in 14 patients. In two symptomatic patients, the innominate lesion could not be crossed with the guidewire. After the failure of the transfemoral approach, the original intent-to-treat procedure was successfully converted to an aorto-carotid bypass (sternotomy) followed by bifurcation endarterectomy during the same procedure. EEG abnormalities were not observed at any time during carotid artery clamping. Fifteen balloon expandable stents were used (two in one single patient). Stent sizes ranged from 2.6 to 4 cm in length, 8 to 9 mm in diameter for the common carotid artery and 9–11 mm for the brachiocephalic trunk. Stents included 4 Palmaz (9–12 × 3), 3 Corinthian (8 × 3), (Cordis, Johnson & Johnson Gateway, USA), 6 Jostent (9 × 2.6), (Jomed, Helsingborg, Sweden), 2 Megalink (9 × 2.8 overexpanded to 10 mm), (Guidant, Indianapolis, IN, USA).

Post-procedural angiography showed the optimal stent positioning and patency of both proximal and distal treated lesions in all patients (Fig. 2). There was no 30-day neurological morbidity or mortality. The average volume of contrast medium injected in each procedure was 30 ml. At follow-up, all treated vessels were patent without restenosis and there were no focal
cerebrovascular symptoms. Two patients presenting preoperative non-focal symptoms, showed a postoperative remission of symptoms that appeared again in the long-term follow-up.

Discussion

Direct brachiocephalic reconstruction via thoracotomy or sternotomy produced good early and long-term results. However, an extra-anatomical approach is significant less morbidity and safer. Despite its theoretical and practical advantages, there are few reports on combined brachiocephalic AS and CEA. In a series of 44 patients proximal carotid lesion was treated by balloon angioplasty and the lack of stenting after angioplasty may explain the less satisfactory long-term results. Recently good long-term results were reported in seven patients presenting carotid tandem lesions and undergoing a combined AS and endarterectomy, using a similar approach to the one presented in this paper. The present study shows how the presence of the stent in the proximal artery did not interfere with the insertion and functioning of the shunt. In four patients not included in this series, preoperative angio-MR scan showed a stenosis but was not confirmed by the intraoperative DSA (Fig. 3) and only CEA was performed. We, therefore, believe that DSA is the gold standard for these patients. In conclusion, the present report confirms that intraoperative retrograde AS simultaneous with CEA is an effective, safe and durable alternative to conventional surgery of a significant proximal lesion associated with a high grade stenosis of the carotid bifurcation.

References