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Case report
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Threatening of cerebrovascular insufficiency within surgery of carotid artery restenosis

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Abstract: Surgical intervention for extracranial carotid artery stenosis remains a major potential therapeutic modality for the prevention of stroke. Nevertheless, every kind of surgical technique for carotid entarterectomy (CEA) has its specific complications, compromising the final surgical result. The authors report about a 70-year old man, suffering from recurrent transient ischemic attacks by suspected internal carotid artery (ICA) re-stenosis, 11 and 13 years after CEA with patch angioplasty. In relation to neurological symptomatic and angiographic appearance of ICA re-stenosis an open surgery of the left ICA was preferred. Intraoperatively the old patch material was such vulnerable that it was not possible to maintain the continuity of ECA and ICA or CCA and ICA. Consequently reconstruction and replacement of ICA and ECA with 6 mm Gore-Tex grafts was performed. Follow-up three years after surgery showed no symptoms of insufficient brain metabolism as well as a good flow within the grafts. Patch angioplasty by CEA seems to be favourable to reduce the risk of early ICA re-stenosis but for all that there are other accompanying problems, which can compromise utility of patch technique. For this the authors prefer a patient adapted surgical treatment, based not only on so far not significant data but moreover on personal experience.
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1 Introduction

Open revascularization of symptomatic carotid artery (CA) stenosis can be performed optionally with or without patch technique [1]. Recently published articles report better

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prognosis concerning the rate of re-stenosis using patch angioplasty by carotid endarterectomy (CEA) in comparison to primary closure [2]. Nevertheless, pseudoaneurysms (Fig. 1) even imposed with infection after patch angioplasty [3] occur as twice as often as after primary closure [4]. Moreover the risk of infection or even prion transmission using different biological patch material cannot be entirely neglected [5]. Whatever procedure inside of primary patch angioplasty later on can be technically more demanding [6] or troublesome, as well.

Fig. 1 Pseudoaneurysm of the right CA in another patient, 12 years after CEA using venous patch. The pulsating tumour developed within two years.

We report on surgical option within intervention in a case of progressive CA re-stenosis with aneurysmatic dilatation distal to the stenosis after primary patch angioplasty.

2 Case report

2.1 Medical history

A 70-year-old man was suffering from recurrent transient ischemic attacks by suspected internal carotid artery (ICA) re-stenosis. He already was operated on an ipsilateral nearly 13 years ago and on a contralateral symptomatic ICA stenosis 11 years ago. At that time a venous patch angioplasty was performed on the both sides.

2.2 Neuroimaging

Digital subtraction angiography was performed to assess grade and extension of the ICA re-stenosis. As one result a stenosis of more than 90% of the left common carotid artery (CCA) with atherosclerotic changes of the left carotid bulb and proximal ICA as well as post-stenotic dilatation after patch angioplasty was documented. Additionally pronounced irregularities of the right sided ICA were revealed (Fig. 2). Moreover, both vertebral arteries (VA) were occluded and the posterior circulation was only supplied via the right posterior communicating artery.

To evaluate cerebral hemodynamics with regard to alternative brain revascularization with extra-intracranial arterial bypass [7] a single photon emission computed tomography with 99TCM before and after administration of acetazolamide was performed, which

revealed no impairment of brain perfusion capacity.

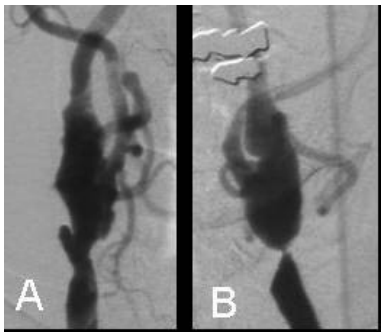

Fig. 2 Preoperative digital subtraction angiography revealed a re-stenosis of above 90% of the left common carotid artery and a post-stenotic dilatation (B). The right sided ICA showed extensive irregularities (A).

2.3 Surgical intervention

In relation to multifocal occlusive vascular lesions and angiographic appearance of ICA re-stenosis, we preferred an open surgery. Bifurcation of the left CA was dissected under general anaesthesia with continuous transcranial Doppler monitoring of ipsilateral middle cerebral artery and electroencephalography (EEG).

During this procedure the old patched area of the CA was found extremely vulnerable and irregular wall of the CA was fixed within tight adhesion of surrounding tissue. Consequently, there was no way for free dissecting of the CA for suggested CEA. Moreover, the distal part of ICA behind the re-stenosis showed extensive wall irregularities, which made it difficult for any direct manipulation on the vessel.

Due to vulnerability of the distal portion of ECA and ICA it was not possible to maintain the continuity of both arteries.

As a result, there was excessive bleeding from distal portion of the both arteries, which dramatically retracted cranially. Especially the ICA disappeared fully in skull base. Bleeding control of ICA and ECA was possible after insertion and inflation of Fogarty balloon-catheter (3F) in each artery.

At this time we decided to reconstruct and replace the ICA and ECA with 6 mm Gore-Tex grafts.

It was necessary to remove and reinsert the Fogarty balloon-catheters into the distal portion of the carotid branches passing these first through the 6 mm Gore-Tex grafts needed for ICA and ECA. For brain protection, barbiturates were administered up to continuous “burst suppression” in EEG.

The exposure of the brain arteries was done by gentle traction of the Fogarty balloon-catheters. Rescued reconstruction of the ECA and ICA was done using 6 mm Gore-Tex graft for each artery.

The first Gore-Tex graft was interpositioned between ICA distally and CCA proximally both using end to end anastomoses in microsurgical technique. The second graft was anastomosed end to end with ECA distally and end to side with CCA proximally (Fig. 3). Orthograd flow within all connected vessels was documented with intra-operative micro-Doppler probe (16 MHz).

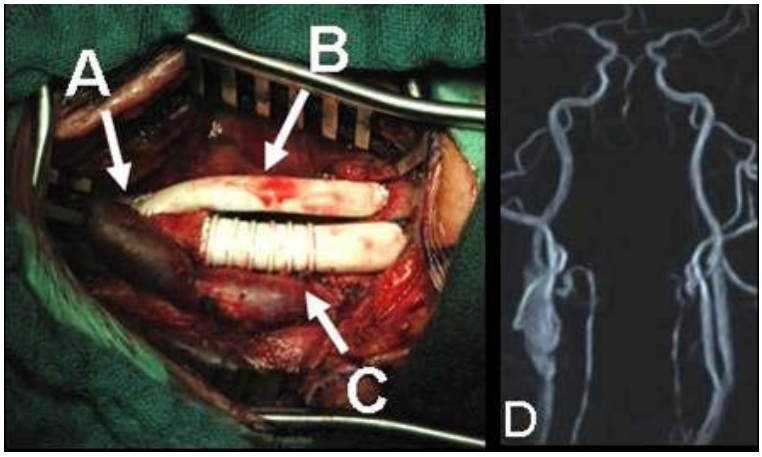

Fig. 3 Intraoperative view after reconstruction of ICA (C) with end-to-end anastomosis and ECA (B) with end-to-side anastomosis to ACC (A) with Gore-Tex graft. Follow-up MR-angiography three years after surgery revealed regular filling of the left CA territory in contrast to irregularities of right sided CA (D).

2.4 Follow-up

In the first days after surgical intervention the patient showed a weakness of the right side of the body and mild aphasia, but the symptoms disappeared completely within the next two weeks.

Three years later, neuroimaging showed good functioning of the Gore-Tex grafts on the left side without any irregularities. The right sided ICA re-stenosis with dilatation was actual asymptomatic (Fig. 3D).

Clinically there were no symptoms of compromising of the brain hemodynamics at al.

3 Discussion

Since introduction of CEA by de Bakey and published by Eastcott [8] open revascularization of a stenotic CA has been performed by different techniques. Each technique, whether primary closure or different patch techniques, can be generally used, but with respect to accepted morbidity rate. Benefit of CEA as revealed by the two great multicenter studies [9, 10] depends on the perioperative morbidity and mortality and an uneventful long term follow-up. Since now there is no agreement, which kind of surgical procedure should be preferred and therefore the personal experience of the surgeon seems to be

the main factor for outcome [11]. With approximately three decades and within some hundreds of CEA's, we used primary surgical closure of CA and only in less than 5% of all cases patch technique was necessary. In our opinion, using of microsurgical technique, intraoperative neuromonitoring and blood flow measurement contributes the omission of any patch techniques. Patching can probably confine developing of re-stenosis, even though without significance [12, 13], but there should be some other problems (pseudo-aneurysms, infections or prion-transmissions, scaring), which can compromise suitability of a patch [14, 15].

We gained experience with such a patient by the occurrence of bi-lateral ICA stenosis, 11 and 13 years after CEA with patch angioplasty, respectively, and by both VA occlusion. Open revascularization of the symptomatic ICA re-stenosis of the left side could be solved only with completely rebuilding of CCA, ICA and ECA, using a Gore-Tex graft. This rescued interdisciplinary surgical intervention was in the end successful and in spite of multifocal occlusive disorders the appropriate restoration of brain hemodynamics was set up.

In conclusion, patch angioplasty by CEA seems to be favourable to some extent for occurring at the rate of CA re-stenosis. However, accompanying problems can compromise the utility of patch techniques. We experienced different outcomes in patch angioplasty at the patient with multifocal cerebrovascular disorders. The only rescued fully reconstruction of the CCA, ICA and ECA in the described case using a Gore-Tex graft could maintain cerebral hemodynamics properly.

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