

## CASE REPORT

# Iatrogenic Carotid Artery Pseudoaneurysm Treated by an Autologous Vein-covered Stent

Y. Van Nieuwenhove\*<sup>1</sup>, P. Van den Brande<sup>1</sup>, F. van Tussenbroek<sup>2</sup>, E. Debing<sup>1</sup>, K. von Kemp<sup>1</sup>

*Department of Vascular Surgery<sup>1</sup> and Department of Radiology<sup>2</sup>, Academic Hospital, Vrije Universiteit Brussel, Brussels, Belgium*

### Introduction

Carotid artery endarterectomy has been proven to be beneficial<sup>1</sup> and cost-effective in the prevention of ischaemic stroke due to carotid artery disease,<sup>2</sup> and therefore the procedure is recognised as the "gold standard." The application of endovascular treatment in carotid artery disease is debated because of the high incidence of neurological complications.<sup>3</sup> Nevertheless, patients who might benefit from these endovascular techniques are those who have received extensive cervical surgery and irradiation for head and neck tumours. The incidence of haemodynamically significant carotid lesions and stroke in these patients is 17% and 6.3%, respectively, representing a significantly higher risk when compared to a population with carotid atherosclerosis.<sup>4</sup>

### Case Report and Technique

A 67-year-old man was admitted with a history of repeated syncope. Computed tomographic (CT) imaging of the brain did not demonstrate any ischaemic lesions, but a cerebral SPECT scan revealed important bilateral cortical hypoperfusion. Arterial digital subtraction angiography showed a severe (95%) left internal carotid artery (ICA) stenosis (Fig. 1) and an

occlusion of the right ICA. These arterial lesions, together with important reduction of the vertebral artery blood flow, were considered the probable cause of the symptoms. The patient was a smoker with hypercholesterolaemia. Furthermore, 9 years prior to presentation a tonsillar carcinoma had been treated with neck surgery and radiotherapy, producing massive neck tissue scarring and reduced mobility of the head.

Three weeks after diagnosis, an endovascular balloon dilatation and stenting of the left ICA was carried out under general anaesthesia. Direct supraclavicular percutaneous access to the left common carotid artery was chosen. A 7-French introducer (Cordis, Roden, The Netherlands) was inserted and 5000 IU of heparin were administered intravenously. A peroperative angiogram showed a thrombosis of the left ICA at the site of the known high grade stenosis. This thrombotic occlusion occurred in the 3-week interval between diagnostic work-up and surgery, and occurred without worsening of the initial neurologic symptoms. Successful thrombolysis was first obtained by local intra-arterial administration of 100 000 IU of urokinase. The stenosis was then dilated with a 3 × 20 mm balloon (Opta 5®, Cordis, Roden, The Netherlands) and a stent (Palmaz P 154, Johnson & Johnson, New Jersey, U.S.A.) was introduced into the ICA and expanded with the same balloon. A control angiogram was satisfactory and after removal of the introducer, careful manual compression over the puncture site was applied for 45 min. The patient was awakened immediately after the procedure and a neurological examination was normal. The patient was discharged on the third post-operative day. A few days after discharge the patient

\*Address for correspondence: Y. Van Nieuwenhove, Department of Vascular Surgery, Academic Hospital, Vrije Universiteit Brussel, Laarbeeklaan 101, B-1090 Brussels, Belgium.

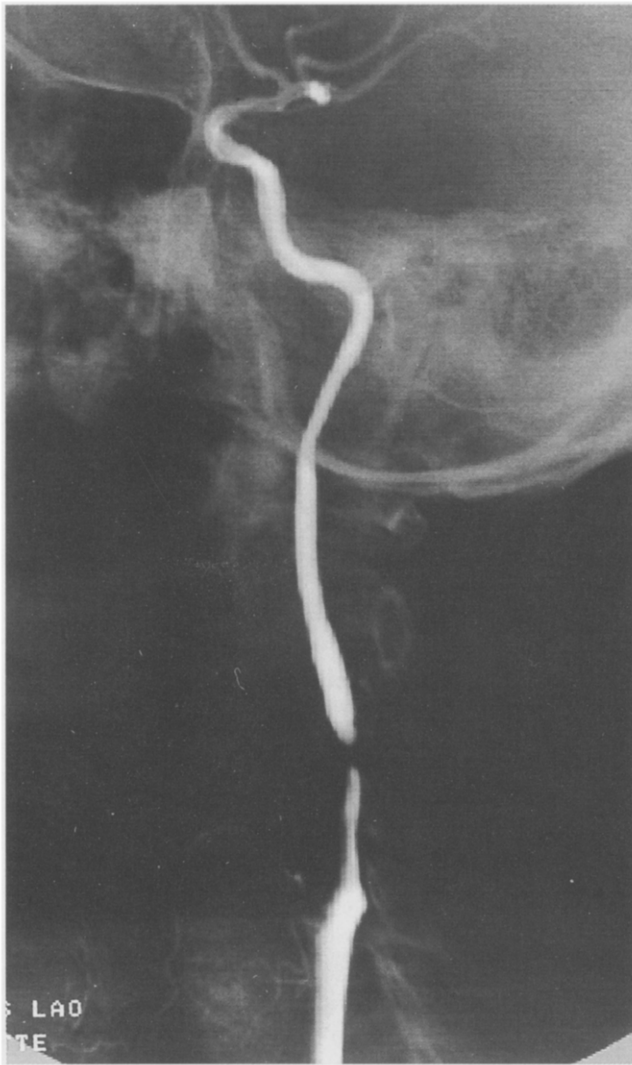


Fig. 1. Preoperative intra-arterial digital subtraction angiography of the left carotid artery. There is a high grade stenosis (95%) of the internal and an occlusion of the external carotid artery.

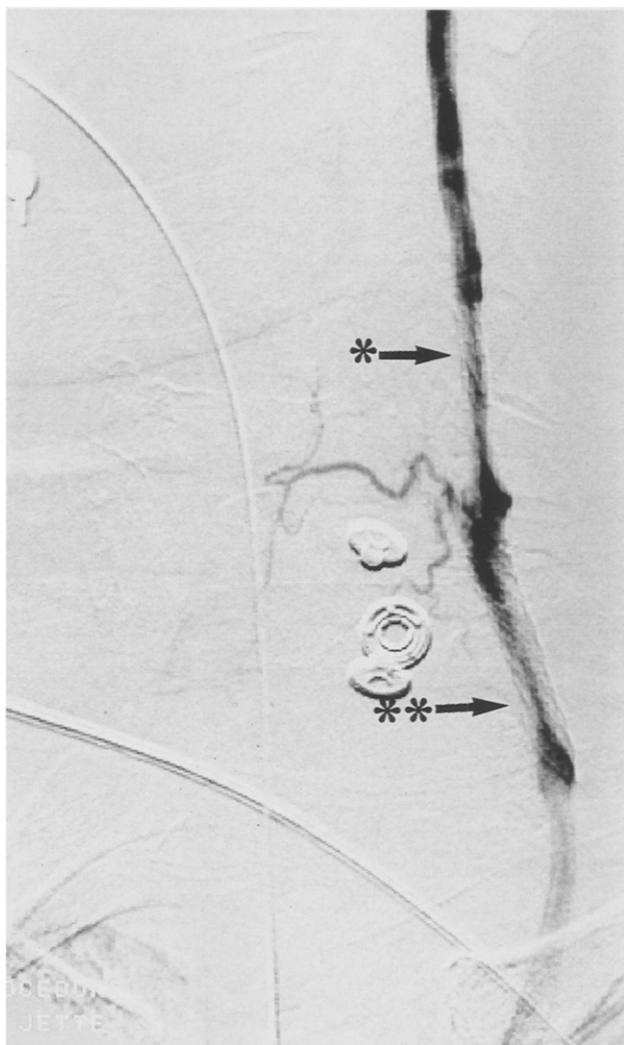
started to experience progressive dysphagia and hoarseness. A CT scan of the neck at 1 month revealed a large contrast filled mass next to the left common carotid artery (Fig. 2). Digital subtraction angiography confirmed the diagnosis of a large pseudo-aneurysm originating from the previous puncture site in the common carotid artery (Fig. 3). Clinically, no mass was felt in the neck, no bruit was heard and there were no signs of any local sepsis. An endovascular approach was further preferred to treat this complication. Under general anaesthesia, the right common femoral artery was surgically dissected and a 14F introducer (Cook, Denmark) was inserted in retrograde fashion. A 2 cm long piece of proximal greater saphenous vein was removed through the same surgical approach and further stitched to a stent (Palmaz



Fig. 2. CT scanning of the neck region, 1 month after endovascular dilation and stenting of the left internal carotid stenosis using the direct common carotid approach. The patient's hoarseness and dysphagia resulted from a large pseudoaneurysm (arrow) next to the left common carotid artery.



Fig. 3. Intra-arterial digital subtraction angiography of the left carotid artery showing the stent in the internal carotid (\*) and a common carotid artery pseudoaneurysm (\*\*).



**Fig. 4.** Intra-arterial digital subtraction angiography of the left carotid artery after the treatment of the pseudoaneurysm. The stenting and dilatation of the internal carotid stenosis is satisfactory (\*) and there is a complete exclusion of the pseudoaneurysm by the autologous vein-covered stent (\*\*).

P 394, Johnson & Johnson, New Jersey, U.S.A.) with 7-0 polypropylene sutures. This self-made autologous vein-covered stent was mounted on a 7 × 40 dilatation balloon (Smash®, Schneider, Bülach, Switzerland) and introduced to the level of the leak in the left common carotid artery over a guidewire (Naviguide®, Meditech, Sterlørse, Denmark). After inflation of the balloon and expansion of the covered stent, arteriography showed closure of the leak and exclusion of the pseudoaneurysm. The patient's recovery was uneventful. One month after this second procedure, angiography demonstrated exclusion of the aneurysm (Fig. 4). The haematoma remained present on CT scanning at 2 months but the patient no longer complained of hoarseness and his dysphagia had progressively diminished.

## Discussion

In our surgical and radiological departments the indications for the endovascular treatment of internal carotid disease are limited to symptomatic restenosis after CEA and to carotid stenosis in patients presenting with a hostile neck. The incidence of haemodynamically significant carotid stenoses and stroke in these patients is 17% and 6.3%, respectively, and has been attributed to the postradiotherapy tissue scarring.<sup>4</sup> Open surgery in irradiated tissues has been reported to be technically difficult<sup>5</sup> and to interfere with successful wound healing<sup>6</sup> and is therefore believed to be a contraindication. However, more recently carotid surgery has been carried out in these irradiated patients without significantly increasing morbidity,<sup>7</sup> using carotid endarterectomy in most cases or arterial carotid bypass to avoid an arterial anastomosis in irradiated tissue. Because of our previous successful experience with percutaneous angioplasty through a direct common carotid puncture we decided to use this technique in this patient. Although this procedure was performed without technical difficulties, the patient developed a carotid artery pseudoaneurysm. We feel the post-radiotherapy scarring might be partly responsible for the persistence of the puncture hole in the carotid artery, because of lack of elasticity of the tissues and impaired wound healing. Because the contraindication for open surgery remained valid, the endovascular use of a covered stent through the right femoral artery seemed the obvious solution to treat this complication. A covered stent had to be made by ourselves because covered stents with a sufficiently long delivery catheter to reach the common carotid artery from the femoral artery were not available at that time. The use of Dacron® or polytetrafluoroethylene covered stents has been reported in the endovascular management of abdominal aortic aneurysms, pseudoaneurysms and traumatic arteriovenous fistulas.<sup>8</sup> However, long-term patency results are not available and an experimental study in swine described low short-term patency because of an inflammatory reaction in the carotid arteries to Dacron®.<sup>9</sup> We therefore preferred to use autologous vein as covering material for the stent. This material has been described for the repair of iliac artery-ureteral fistula<sup>10</sup> and also in the management of one carotid artery pseudoaneurysm.<sup>8</sup> A 14F introducer required surgical exposure of the common femoral artery, having the greater saphenous vein readily accessible. In conclusion, when treating stenoses of the carotid artery using endovascular techniques the transfemoral route might be preferred, and direct puncture of the common

carotid artery, through irradiated tissues, avoided. Nevertheless, when direct puncture of the common carotid artery is chosen, and when a pseudoaneurysm develops, it can be successfully treated with a covered stent. When an appropriate covered stent is unavailable, it can be constructed by covering the stent with autologous vein.

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