Percutaneous Transluminal Angioplasty of the Cavernous Carotid Artery for Recurrent Ischemia

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Endarterectomy is usually the treatment of choice in patients presenting with transient ischemic attack and significant atheromatous disease in the region of the carotid bifurcation [1]. Treatment options are less certain in patients with disease distal to that part of the internal carotid artery that is surgically accessible. Symptomatic patients for whom medical therapy is inadequate may require extracranial-intracranial arterial anastomosis or carotid ligation [2, 3].

With the rapid growth of arterial angioplasty since introduction of the balloon catheter by Grüntzig, the possibility of angioplasty of the intracranial carotid artery has arisen as an alternative mode of therapy [4]. We present a case of successful dilatation of a cavernous carotid artery stenosis for treatment of recurrent transient cerebral ischemia.

Case Report

A 69-year-old woman with adult-onset diabetes first presented after two episodes of difficulty in speaking and right-arm weakness with paresthesias, each lasting 15 min. The first episode had occurred 3 days before admission; the second, on the day of admission. Physical examination was normal except for minimal right-arm weakness and sensory loss in the right arm and hand. Noninvasive testing revealed a significant flow abnormality at the origin of the left internal carotid artery. Carotid angiography demonstrated 90% stenosis of the left internal carotid artery just distal to its origin. There were no other abnormalities more distad, and no significant abnormalities were detected on the right. The patient underwent left carotid endarterectomy and had no postoperative problems except persistence of the minimal right-hand and -arm weakness and sensory loss. She was discharged on aspirin.

Four years later, she experienced a nearly identical episode of speech arrest and right-upper-extremity weakness lasting 1 hr. Examination on this admission revealed minimal right-hand and -arm weakness with slight sensory loss. Direct noninvasive testing of the carotid bifurcation, including B-scan sonography and Doppler study, was normal. Oculoplethysmography revealed a significantly lower ophthalmic artery pressure on the left. This study was interpreted as suggesting disease in the intracranial part of the internal carotid artery. Bilateral carotid angiography showed a normal left carotid bifurcation but a focal high-grade stenosis in the cavernous portion of the left internal carotid artery, the residual lumen measuring 1.5 mm (figs. 1A and 1B). This area had been normal at the time of the original angiographic study 4 years earlier.

Heparin therapy was instituted. On hospital days 4 and 6, she had hour-long episodes identical to that which had precipitated her admission. Various treatment options were considered, including surgical anastomosis, carotid occlusion by ligation or with a detachable balloon, and balloon angioplasty. It was decided to manage the patient conservatively, and administration of Coumadin was begun on hospital day 10. On day 17, just before planned discharge and with a prothrombin time of 23.5/12.5 sec, she experienced another episode of right-sided weakness and speech arrest lasting about 30 min. The risk, uncertainties, and alternatives to balloon angioplasty were again discussed with the patient and her family, and she decided in its favor.

She was started on constant heparin infusion at the rate of 1100 U/hr. The left internal carotid artery was catheterized selectively with a 5 French Becton-Dickinson catheter via the femoral artery. Using a 220-mm exchange wire, this was replaced with an 8 French introducing catheter, which remained in place at the origin of the internal carotid artery for the remainder of the procedure. Through this catheter a Meditech coronary balloon dilatation unit (4.5 French, 0.5-cm tip, 3.5-mm outer balloon, 2-cm balloon length) was introduced. The catheter is 135 mm long and contains a 165-mm-long, 0.15-mm-diam steerable guide wire with a soft tip. Under fluoroscopic guidance, this entire unit was advanced out the end of the introducing catheter into the internal carotid artery. With the guide wire leading, the balloon tip was advanced across the site of stenosis, and the balloon was inflated for three 30-sec periods. The patient remained alert and experienced no discomfort. The dilatation catheter was removed and contrast medium was injected through the introducing catheter. This revealed satisfactory dilatation at the site of stenosis (figs. 1C and 1D), but sequential filming over the next 30 min documented partial reexpansion of the compressed plaque (figs. 1E and 1F).

After this procedure, the patient was discharged on Coumadin. She was to be readmitted 1 month later for follow-up angiography. Three days before the scheduled admission, she developed progressive abdominal pain and, on admission, was found to have retroperitoneal hemorrhage. Coumadin was discontinued, and she was treated with transfusions and vitamin K. Because of this complication and the fact that she had no symptoms of ischemia, her physicians elected to discontinue Coumadin therapy without repeating carotid angiography because it would not alter management. One year after balloon angioplasty she takes one aspirin every other day and remains free of symptoms.

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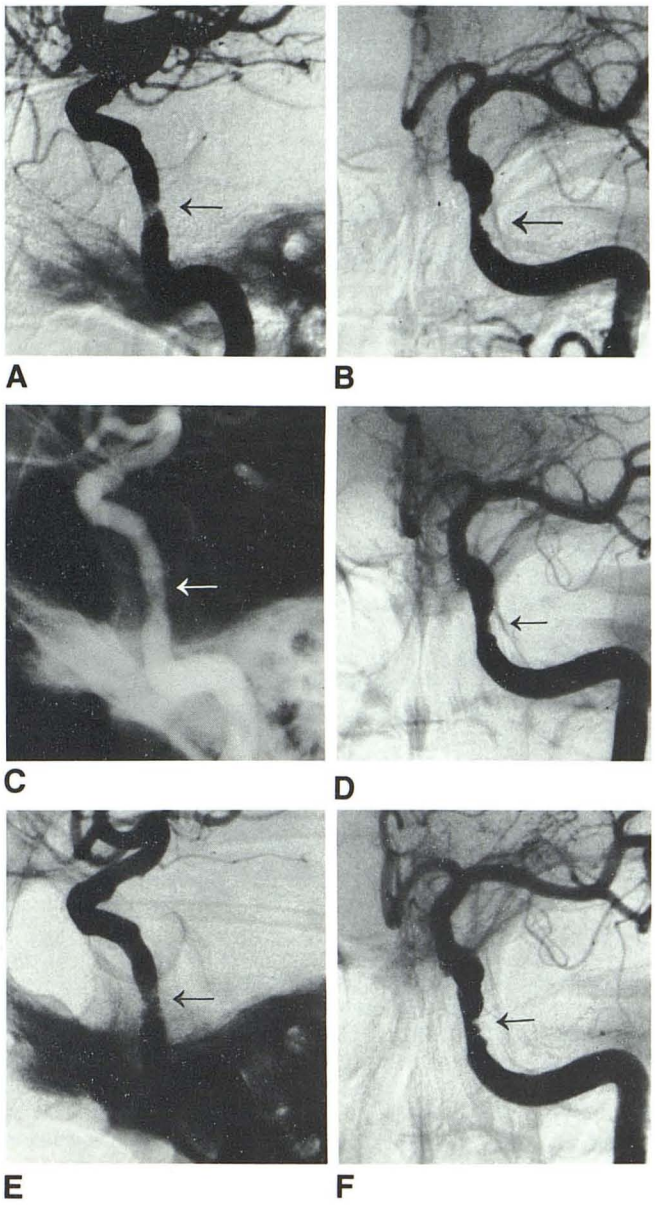

Fig. 1.—**A** and **B**, Admission arteriograms (lateral and anteroposterior views, respectively): Focal, high-grade stenosis in cavernous part of left internal carotid artery (*arrows*). Postprocedure arteriograms: Lateral view (**C**), obtained immediately after dilatation, shows significant widening of stenotic lumen (*arrow*). No xeroradiography was taken, hence no subtracted image could be produced. Anteroposterior view (**D**), obtained several minutes later, shows irregularity along lateral wall of carotid artery at site of dilatation (*arrow*). **E** and **F**, Postoperative arteriograms (lateral and anteroposterior views, respectively) obtained 30 min after dilatation: Partial restenosis of left internal carotid artery at disease site (*arrows*).

Discussion

Percutaneous transluminal angioplasty is now a widely accepted method of treating atherosclerotic vascular disease in most of the arterial system, especially the coronary, renal, iliac, and femoral arteries. The procedure works best if carried out in medium-size vessels with focal disease, a situation that is common in the carotid and vertebral systems, but the risk of embolization during this procedure has inhibited work in these vessels. Moreover, the low morbidity and mortality of carotid endarterectomy in skilled hands tends to discourage development of an alternative procedure posing uncertain risks. Lack of a suitable animal model for experimental work poses an additional problem.

There have been only scattered reports of balloon dilatation in the carotid and vertebral systems [5–9]. Most of these have involved treatment of patients with fibromuscular disease or with focal disease in the posterior circulation. Although these procedures have been considered successful and have caused no complications, their numbers are few, and most patients have not undergone subsequent angiography to assess long-term results. Prerequisites for transluminal dilatation of the artery are substantial experience by the angiographer and careful selection of patients [7–8]. It is generally believed that localized, smooth, nonulcerated plaques are best suited to dilatation and that embolization most often occurs when there is debris within the ulcerated plaque [7]. The lesion in our patient was slightly irregular but did not appear ulcerated.

The partial restenosis 30 min after the initial normal follow-up film in our patient is disturbing and difficult to explain. The patient was markedly anticoagulated in order to reduce the risk of embolization during the procedure, and there could have been hemorrhage into or beneath the plaque. Alternatively, there may have been partial reexpansion of a compressed soft plaque. While her benign neurologic course makes it difficult to consider, repeat angiography would be necessary to assess the long-term results of her balloon angioplasty of the carotid artery.

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