Case reports

Percutaneous revascularization of coexisting severe carotid and coronary artery disease: a case report

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Following the NASCET and ACAS trials, the use of carotid endarterectomy for the treatment of carotid artery stenosis has become widespread. However, in high-risk patients, the perioperative morbidity and mortality have reached 18%. In such populations, a percutaneous approach including coronary angioplasty and stenting of the carotid lesion could be an option worth exploring.

In this report we discuss a case that is representative of our experience with the simultaneous treatment of critical carotid and coronary stenosis. A 74-year-old patient with advanced coronary artery disease and severe bilateral carotid pathology was submitted to coronary angioplasty and stenting of the carotid lesions.

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Introduction

The North American Symptomatic Carotid Endarterectomy Trial (NASCET) and the Asymptomatic Carotid Atherosclerosis Study (ACAS) have shown that carotid endarterectomy, performed by a highly skilled surgeon, is superior to medical therapy for the prevention of cerebrovascular accidents, both in symptomatic and asymptomatic patients with severe carotid artery stenosis[1-3].

In spite of the fact that it has some limitations, in recent years this procedure has become widespread. In order to identify the correct role of carotid endarterectomy in the treatment of carotid disease it is necessary to fully understand the characteristics of the patient populations considered in the above mentioned trials. It has now become clear that the NASCET and ACAS patients belonged to low-risk populations only.

In NASCET, the risk of stroke or death was 5.8%; however, in higher-risk patients, particularly those with associated severe coronary artery disease, the perioperative morbidity and mortality associated with this procedure have been reported to reach 18%[1]. Furthermore, there are independent predictors of an adverse post-carotid endarterectomy outcome, such as previous ipsilateral carotid endarterectomy, contralateral occlusion and associated coronary artery disease[4]. Overall, in this particular type of patients, the treatment of one lesion (regardless of whether carotid endarterectomy or coronary artery bypass graft is performed first) is associated with an increased complication rate, including myocardial infarction and/or stroke[5-9].

The numerous advantages of carotid artery stenting including the absence of general anesthesia, of cardiopulmonary bypass and above all, the possibility of continuous and simple neurological monitoring, have been proven by the encouraging results obtained when this technique was used for the treatment of severe carotid artery stenosis, especially in high-risk patients[10-13].

Herein we describe a case of the use of simultaneous treatment of critical carotid and coronary artery stenosis in a patient with advanced coronary artery disease and severe bilateral carotid lesions.

Case report

The patient was a 74-year-old male with a history of hypertension and hypercholesterolemia. In 1984 he underwent cardiac surgery for unstable angina, receiving four coronary artery bypass grafts (mammary internal artery for the interventricular anterior coronary artery and saphenous vein grafts for the right coronary artery, the obtuse marginal and first diagonal branch).

He remained asymptomatic until some months ago when he was admitted into a suburban center because of unstable angina.

The patient was transferred to our institution because of prolonged clinical instability and he promptly underwent a coronary angiography that revealed: proximal occlusions of the interventricular, anterior coronary artery, and of the right coronary artery, an occlusion of the second tract of the circumflex coronary artery and an occlusion of the saphenous vein graft on the first diagonal and marginal branches with preserved function of the internal mammary artery graft on the interventricular anterior coronary artery and of the saphenous vein graft on the right coronary artery. On the basis of clinical and electrocardiographic data, a tight stenosis of the proximal interventricular posterior coronary artery was considered the culprit lesion.

In view of previous evidence of bilateral carotid artery disease at carotid artery duplex ultrasound (anamnestically reported), the patient, although clinically asymptomatic, was also submitted to carotid angiography during the same diagnostic procedure. Carotid angiography confirmed the presence of a subocclusive lesion of the right internal carotid artery (Fig. 1) and of an ostial occlusion of the left internal carotid artery (Fig. 2). We planned to perform carotid and coronary stenting in a single session. Owing to the patient's unstable cardiovascular status, computed tomographic neurological evaluation was omitted.

Preoperative treatment included acetylsalicylic acid (325 mg daily) and ticlopidine (250 mg twice daily) administered for 2 days before the procedure. A bolus of 5000 IU of heparin was administered after cannulation of the vessel. His neurological status was constantly monitored before and during the procedure.

The patient's blood pressure and heart rate were monitored during the procedure and, if required, atropine or metaraminol was administered.

The percutaneous access was through the femoral artery, and coronary angioplasty and stenting of the proximal interventricular posterior coronary artery was performed according to standard technique[14]. Angiographic results were positive.

An 8F MP guiding catheter (Cordis, Johnson & Johnson, Miami, FL, USA) was then advanced deeply into the common carotid artery, with the tip just proximal to the segment to be treated and angiographic images, providing evidence of subocclusive concentric stenosis of the right internal carotid artery, were recorded.

The stenosis was crossed with the same guidewire used for coronary procedures (0.014 BMW, Guidant, Tenecula, CA, USA) and predilated with a low-profile coronary balloon (2.0 × 20 mm SeaJet Nycomed, Amersham, Norway) inflated at a low pressure (3 atm), for 5 s (Fig. 3). Then the guidewire was retrieved and the neurological protective device (Angioguard, Cordis, Johnson & Johnson) advanced. The filter was opened 5 cm distally to the lesion and a second dilation of the stenosis, using a larger balloon (3.0 × 20 mm SeaJet Nycomed) inflated at a pressure of 6 atm, was performed (Fig. 4). Then, an autoexpandable stent (Carotid Wallstent Monorail 0.014, 7.0 × 40 mm, Schneider, Boston Scientific, Natick, MA, USA) was advanced on the wire of the system and released in such a way that it covered the whole lesion. The residual stenosis was dilated using a coronary angioplasty balloon (Maxxum 5.0 × 20 mm, Scimed, Boston Scientific) inflated at 12 atm for 5 s (Fig. 5). The final outcome was satisfactory. A 0.5 mg e.v. bolus of atropine was administered for prophylaxis.

The post-stent angiogram did not reveal any residual stenosis or stent deformation and showed a significant global improvement in the right cerebral blood flow.

There were no complications during and immediately after the procedure. The patient was transferred to the coronary care unit where he was monitored for 24 hours without any complications.

Coronary and carotid procedures were completed in 93 min. The carotid vessel was totally occluded for only 10 s.

Figure 1. *Subocclusion of the right internal carotid artery* (single arrow).

Figure 2. *Ostial occlusion of the left internal carotid artery* (single arrow).

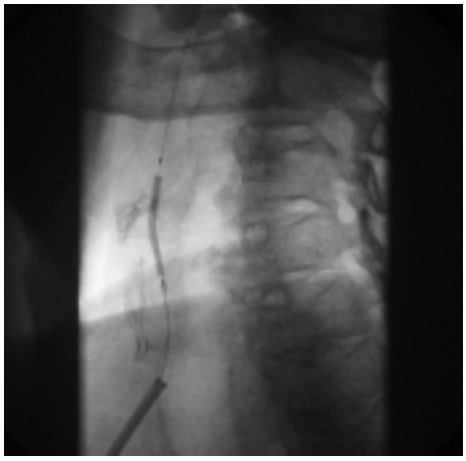

Figure 3. *Predilation, using a coronary balloon at low pressure, of the tight lesion of the right internal carotid artery.*

Figure 4. *Percutaneous transluminal angioplasty of the right internal carotid artery with the Angioguard protection system. Coronary balloon SeaJet 3.0 × 20 mm* (arrows) *and neurological protection system, Angioguard* (single arrow).

Figure 5. *Stenting (Carotid Wallstent 70 × 40 mm) over-dilation (Maxxum 5.0 × 20 mm) of the right internal carotid artery.*

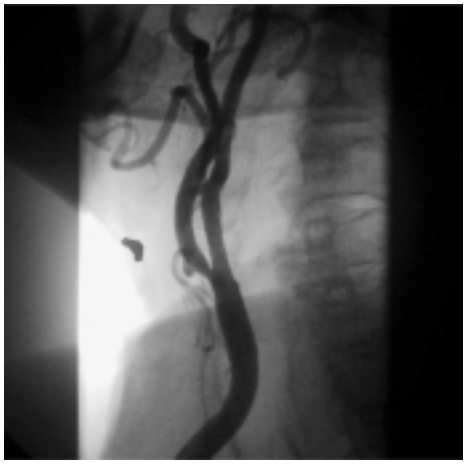

Figure 6. *The final results are rather satisfactory.*

During hospitalization neither recurrent ischemic events nor neurological complications were observed; on the second postoperative day the patient was submitted to carotid artery duplex ultrasound that confirmed the positive outcome of carotid stenting.

He was discharged 3 days after the procedure and scheduled to take ticlopidine for 1 month and aspirin indefinitely. During the 30-day follow-up period, neither recurrent cardiac or cerebral ischemic events nor neurological complications occurred.

Discussion

This case is an example of the combined resolution of complex coronary and carotid pathology in a single operative session. The operative time and economic expenses are limited, patient discomfort is minimal, the hospital stay is short and results are satisfactory.

Indications to the percutaneous approach relate to the high risk associated with conventional procedures. Our patient, presenting with tight stenosis and contralateral occlusion of the internal carotid arteries, faced a poor prognosis with both medical and surgical therapies (38% risk of ipsilateral stroke at 2 years with medical therapy and 14.3% risk of perioperative stroke and death in case of a surgical approach)[15]; moreover, the presence of coronary artery disease further increased the overall risk of adverse events. Our results correspond with those reported by previous studies which demonstrated the safety and efficacy of carotid artery stenting as an alternative to surgery. Immediate results are positive and the degree of restenosis and the incidence of adverse events are low, even in patients with combined carotid and coronary pathology[16,17] and in those with advanced bilateral carotid disease[18].

Major limitations of carotid angioplasty are still penalized by negligible risk for distal, intracerebral em-

bolization of plaque fragment or clot, with a rate comparable to that following carotid endarterectomy. The risk of cerebral accidents is even higher in elderly patients with tight stenosis (> 90%). This was the case in our patient. Therefore the need for a brain protection device was mandatory.

For the prevention of cerebral embolization, the most popular and extensively reported device[15] is presently the GuardWire Plus Temporary Occlusion & Aspiration System (PercuSurge Inc., Sunnyvale, CA, USA). This consists of a balloon incorporated into a 0.014'' nitinol hypotube and occluding the internal carotid artery during the stenting procedure. In our case, the coexisting occlusion of the contralateral internal carotid artery could nevertheless have compromised an efficient collateral flow support during the inflation of the PercuSurge balloon thus resulting in cerebral microinfarcts or major clinical events.

To avoid these complications we chose the Angioguard (emboli capture guidewire) system, a filter protective device that traps detached particles without interrupting the blood flow to the brain and which is particularly useful in case of contralateral occlusion.

The main disadvantage of this type of device is that it is larger than the PercuSurge GuardWire which, on the other hand, may be advanced even through tight stenosis.

Thus, in view of the lower risk of embolization, in the presence of subocclusive stenosis, we suggest that the carotid artery be dilated with a small balloon inflated at low pressure before trying to cross the stenosis with the Angioguard system.

The postoperative outcome of the present case report is consistent with the results of numerous recent studies[16,17,19] that confirm the safety and efficacy of combined percutaneous treatment of coronary and carotid artery disease.

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