

Surgical treatment for bilateral carotid arterial stenosis

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Summary

Carotid endarterectomy (CEA) is a beneficial procedure for patients with high-grade carotid stenosis. However, patients with bilateral carotid stenosis have a higher surgical risk during CEA. Since the introduction of carotid stenting (CAS) may decrease some of the surgical complications of CEA, a combined treatment using CEA and CAS may be favorable for patients with bilateral carotid stenosis. We analyzed the safety and efficacy of this treatment strategy. Eighteen patients with bilateral carotid stenosis were treated from January 2000. Bilateral CEA was performed on the first two patients, CAS then CEA of contra-lateral symptomatic side in 13 patients, and bilateral CAS in three patients. There were no perioperative neurological complications or strokes during the follow-up period (mean 17 months). The combined treatment of CAS and CEA was a safe and effective strategy for bilateral carotid stenosis.

Keywords: Carotid endarterectomy (CEA), carotid artery stenting (CAS), bilateral carotid stenosis.

Introduction

The North American Symptomatic Carotid Endarterectomy Trial (NASCET) demonstrated the highly beneficial effect of endarterectomy (CEA) in patients with high-grade carotid stenosis [1]. NASCET also demonstrated that a contra-lateral carotid lesion increases the perioperative risk of stroke associated with a severely stenosed ipsilateral carotid artery, although the long-term outcome of patients who had undergone CEA was considerably better than that for medically treated patients [2]. Since hemodynamic stroke of the contra-lateral cerebral hemisphere during cross clamping of the carotid arteries and lower cranial nerve palsy are major surgical complications of CEA, introduction of carotid artery angioplasty and placement of stent (CAS) may be a safer treatment. This study examined the results of our combined CAS and CEA therapy for patients with bilateral carotid stenosis.

Clinical material and methods

Patient population

Between January 2000 and December 2003, we surgically treated 219 patients with carotid stenosis. Surgical treatment (CEA or CAS) was used for 1) angiographical severe stenosis (60% to 99% stenosis), 2) echographical severe stenosis (75% to 99% stenosis) and 3) symptomatic stenosis with intra-luminal ulceration. CEA and CAS were performed for 145 and 111 lesions, respectively.

Eighteen patients (8.2%; 16 male, mean age 71.1 years, range 56–80) had bilateral carotid stenosis. For the bilateral stenoses, we treated the symptomatic side first; except when high hemodynamic risk was anticipated during CEA for the contra-lateral symptomatic side; CAS was then performed first. Bilateral CEA were performed in the first 2 cases, CAS before CEA in 13 cases, and bilateral CAS in 3 cases.

CEA was performed under general anesthesia with the intra-operative monitors of INVOS (SaO₂), EEG, and SEP. Intra-operative carotid arterial shunt was not used during cross clamping.

CAS was performed under local anesthesia. Pre-dilatation was performed after distal protection was inserted in the internal carotid artery, then a stent (Smart®) was placed. A balloon occlusion test (BOT) of contra-lateral ICA was then performed for selective cases.

Representative cases and results

Case 1

A 76-year-old man with a history of hypertension and hyperlipidemia developed left amaurosis fugax and was referred to our hospital. His angiography revealed bilateral internal carotid artery stenosis (Fig. 1A, B). Stenting was performed for the right internal carotid artery stenosis. The angiography immediately after stenting showed sufficient dilatation of the lesion (Fig. 1C). Ten days later, CEA was performed for symptomatic left internal carotid artery stenosis. The CT angiography after CEA showed excellent dilata-

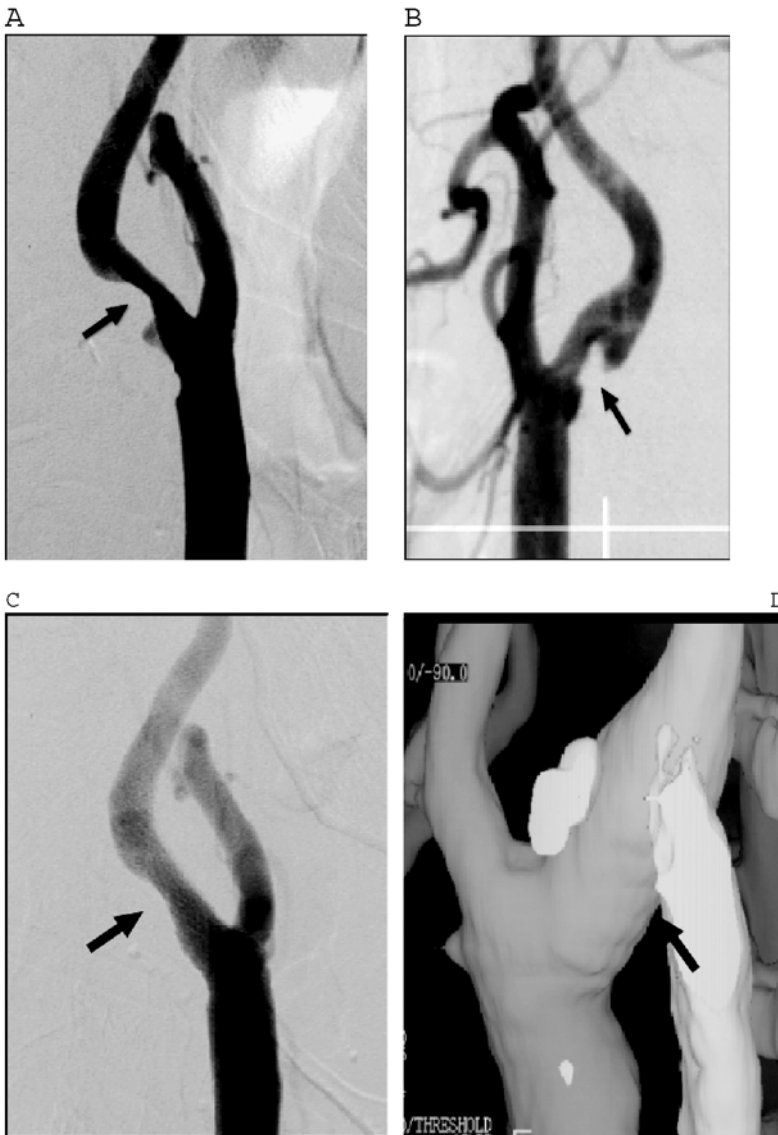


Fig. 1. (A) Right carotid angiogram showing asymptomatic stenosis of internal carotid artery. (Arrow). (B) Left carotid angiogram showing symptomatic severe stenosis of left internal carotid artery. (Arrow). (C) Angiogram taken immediately after stenting shows sufficient dilatation of the lesion. (Arrow). (D) A CT angiography after CEA shows excellent dilatation of the lesion

tion of the lesion (Figure 1D). No complications occurred during either of these procedures. A follow-up angiogram six months after stenting showed no restenosis. There were no ischemic symptoms during the follow-up period.

Case 2

A 69-year-old man with a history of unstable angina pectoris, hypertension, and hyperlipidemia developed repetitive transient left hemiparesis. His MRI showed multiple cerebral infarction. His angiography revealed right internal and left common carotid artery stenosis (Fig. 2A, B). Stenting was performed for the symptomatic right internal carotid artery stenosis. One

week later, stenting was performed for asymptomatic left internal carotid artery stenosis. The angiography after stenting showed sufficient dilatation of the lesions (Fig. 2C, D). There was no periprocedural complication.

Surgical results

Vascular dilatation

Stenosis of the carotid arteries was relieved in all cases after CEA or CAS. Mean stenotic rates of the carotid arteries were 82% in CEA cases and 65% in CAS cases preoperatively. They were 0% after CEA and 6% after CAS, respectively.

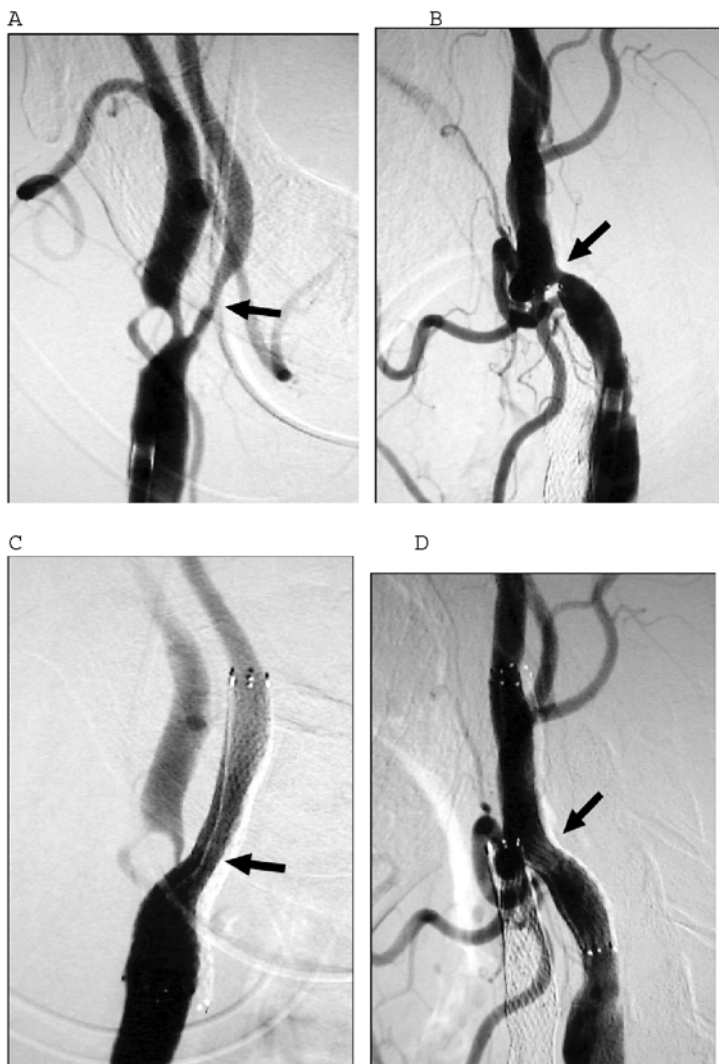


Fig. 2. (A) Right carotid angiogram showing symptomatic stenosis of internal carotid artery. (Arrow). (B) Left carotid angiogram showing asymptomatic stenosis of internal carotid artery. (Arrow). (C) Angiogram taken immediately after stenting shows sufficient dilatation of the lesion. (Arrow). (D) Angiogram taken immediately after stenting shows sufficient dilatation of the lesion. (Arrow)

Character of the plaques of CEA cases

Symptomatic plaques in 13 cases showed intraluminal thrombi in 4, ulceration in 9, intraplaque hemorrhage in 4, and calcification in 3. Asymptomatic plaques in 4 cases showed one ulceration and one calcification.

Surgical complications

There were no neurological deteriorations after treatments, although diffusion weighted brain MRI showed asymptomatic small ischemic lesions in three of nine cases after CAS and none after CEA.

Palsy of lower cranial nerves was not apparent in any of the treated cases.

Follow-up

Mean follow-up period of the surgically treated cases was 16 months. Follow-up angiography was performed in all cases at least six months after treatment. No re-stenosis or recurrent stroke occurred during the follow-up period (mean 16 months).

Discussion

Although CEA is highly beneficial in patients with high-grade carotid stenosis, surgical indication for bilateral carotid stenosis is still controversial [1, 2, 4]. When considering a treatment procedure for bilateral carotid stenosis, the risk of hemodynamic stroke on the contralateral side during surgery should be taken

into account. To avoid this risk, it is sometimes necessary to treat the asymptomatic lesion on the other side. The treatment order of bilateral lesions is another important factor to be considered.

Since the introduction of CAS, treatment options for carotid stenosis have changed. CEA is an established method, and its beneficial effect has been confirmed by randomized studies. However, CEA represents a high risk for patients with contra-lateral ICA lesion, distal ICA lesion, higher level lesion, and other medical risk factors [6]. On the other hand, CAS is a newly developed method, and its beneficial effects are not as established as CEA. However, CAS may be performed for such lesions with less risk. Safety of carotid percutaneous intervention has been improved by the introduction of carotid stenting with self-expandable stents and distal embolization blocking system.

CAS has been routinely performed in clinical practice, especially in Japan. Since many Japanese patients with carotid stenosis have higher cervical lesions compared with European patients, special attention is needed to avoid complications like lower cranial nerve palsy in Japanese patients [7]. The timing of contra-lateral CEA is also of concern when both carotid arteries are involved. Before the introduction of CAS, bilateral CEA was performed at varying surgical intervals. Many surgeons considered a delay of several weeks appropriate in preventing complications such as neurological deficits, nerve injuries, and vocal cord paralysis and its resultant respiratory failure [5, 6]. CAS offers a great advantage in avoiding this life threatening complication.

Although CAS is a less-invasive surgical method, it may be a high risk treatment for soft plaque, eccentric or tortuous lesion, and narrow residual lumen with

massive carotid plaque. Consequently, CEA should be chosen for patients with these lesions.

Therefore, combined therapy using CAS and CEA is beneficial for patients with bilateral carotid stenoses.

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