Extracranial Internal Carotid Stenting in Phramongkutklao Hospital

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Abstract

Background : Carotid artery occlusive disease is estimated to be the primary cause in 20-30 per cent of all strokes. This report was to demonstrate the safety and efficacy of the treatment of extracranial stenosis by carotid artery stenting.

Method : From June 1995 to December 2001, there were 13 patients with internal carotid stenosis ≥60 per cent who were eligible for carotid stenting.

Results : Twelve patients were male. The mean age was 68 years old. Fifty-four per cent had neurological symptoms. The percentage of pre stenting stenosis was 86 ± 8 and the percentage of post stenting stenosis was 18 ± 15. There were 3 patients who had complications after the procedure (minor stroke = 2, severe bradycardia = 1). One patient died. There were no new or recurrent neurological events during the 6 to 84 month-follow-up.

Conclusions : Carotid stent implantation may be an alternate treatment for extracranial carotid stenosis.

Key word : Carotid Artery Occlusive Disease, Extracranial Stenting

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Stroke is the third most common cause of death and an important cause of disability. Carotid artery occlusive disease is the primary cause of 20-30 per cent of all strokes[1]. The North American Symptomatic Carotid Endarterectomy Trial (NASCET) demonstrated the superiority of endarterectomy over medical treatment for symptomatic carotid stenoses >70 per cent[2]. In asymptomatic patients with carotid stenoses >60 per cent, carotid endartectomy showed a stroke reduction[3].

Recently, carotid stenting has become an alternative to endarterectomy in patients with carotid stenosis who are poor candidates for surgery. A combined periprocedural stroke and death rate of 5.06 per cent was found[4]. This was below the 6 per cent rate required by the American Heart Association guidelines for endarterectomy of symptomatic patients[5].

The purpose of this study was to report the results of extracranial internal carotid stenting in Phramongkutklao Hospital.

METHOD

Patient eligibility

Clinical requirements. Patients must have: 1) history of transient ischemic attack, characterized by distinct focal neurologic dysfunction or monocular blindness with clearing of signs and symptoms with 24 hours; or 2) history of complete stroke; or 3) patients who underwent coronary bypass graft.

Radiological requirements. Patients must have extracarotid stenosis more than 60 per cent.

Exclusion criteria. Patients were excluded if any of the following was applicable: 1) presence of an intracranial tumor or arteriovenous malformation; 2) presence of intracranial stenosis that exceeded the severity of extracranial stenosis; 3) presence of peripheral vascular disease sufficiently severe to prevent adequate vascular access; 4) presence of severe disability due to previous stroke or dementia; 5) inability to give informed consent.

Clinical and carotid stenting procedure

Magnetic resonance angiography or intra and extracranial angiography were performed to evaluate the severity and anatomically suitability for percutaneous angioplasty of the lesion and to document baseline change. A complete neurological history was taken and an examination was performed on all patients before and at 24 hours and every 8 weeks after the procedure. All patients were premedicated with aspirin 300 mg twice a day 2 days before the procedure as well as on the morning of the procedure. Ticlopidine 250 mg twice a day 2 days before or clopidogrel 300 mg was begun a day before the procedure.

No sedative was given before or throughout the procedure. Neurological assessment was performed at predetermined intervals throughout the procedure. Hemodymamic and oxygen saturation were continuously monitored. Nitroglycerin, atropine, metaraminol, and dopamine were administrated as required to manage hypertension, bradycardia, and hypotension. Five thousand units of heparin were given as an intravenous bolus before angioplasty.

Femoral arterial access was preferred. Brachiocephalic angiography was performed on all the patients. Diagnostic angiography consisted of visualization of the origins of the brachiocephalic arteries, carotid bifurcation in several injections, and intracranial study of carotid artery. After the brachiocephalic angiography was performed, the 7Fr shuttler sheath was placed into the common carotid artery. Carotid stenting was performed by use of coaxial catheterization technique adopted from coronary intervention [6]. Several angular angiographic views were recorded to fully display the stenosis and the tip of the catheter. On-line Quantitative Caronary Angiography (QCA) was undertaken to measure minimal luminal diameter and percentage of stenosis of the vessel and to facilitate sizing of the balloon.

The carotid stenosis was dilated with a 4.0 mm coronary balloon catheter before stent placement. Atropine 0.6 mg was given intravenously before the balloon inflated. For the self-expandable stent, the stent was placed in the common carotid artery crossing the bifurcation into the internal carotid artery. Self-expandable stent was usually oversized 1-2 mm greater than the diameter of the common carotid artery. For the balloon-expandable stent, the stent was directly placed in the internal carotid artery. High pressure (10 to 15 ATM) balloon inflation was routinely performed within the stent after placement[6]. On completion of the procedure, ipsilateral intracranial angiography was performed to exclude major branch vessel embolic occlusions. Fig. 1 and 2 demonstrate the pre and post procedure.

The vascular sheath was removed on the same day. Patients were on aspirin 300 mg and ticlo-

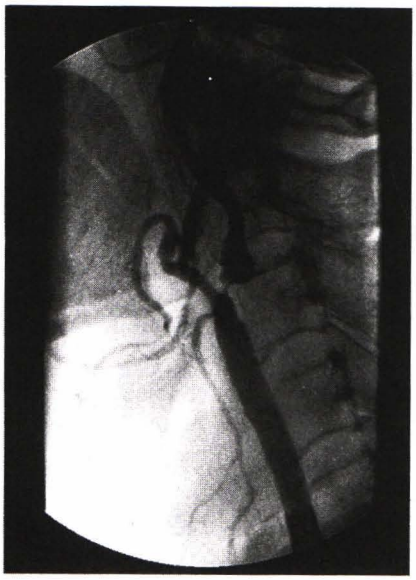

Fig. 1. Severe stenosis of the left internal carotid artery before the procedure.

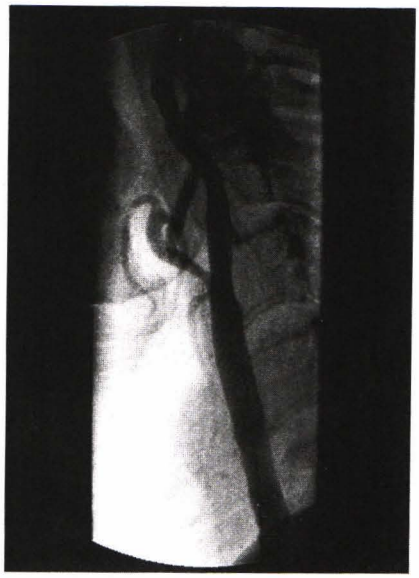

Fig. 2. Left internal carotid artery after stent placement.

pidine 250 mg twice a day or aspirin 300 mg twice a day and clopidogrel 75 mg a day for 4 weeks. After 4 weeks, aspirin 300 mg daily was continued indefinitely.

Follow-up

All patients were scheduled to be seen with complete neurological examination 30 days after the procedure and after that every 2 months. Carotid Doppler study was scheduled at 1 year.

Data collection

Angiographic and procedural data were prospectively recorded on standard forms by a physician. QCA was performed on all vessels before stenting and after stenting by using an on-line system (Toshiba, Japan). Percentage diameter stenosis was determined with the use of the NASCET criteria, with the distal non-tapering portions of the internal carotid artery serving as the reference segment[7]. Minimal lumen diameter and the common carotid artery diameter were measured after calibration of the system with the use of the known diameter of the guiding catheter.

Definitions

Minor stroke is defined as a new neurological deficit with NIH stroke scale change of 1 to 3 points that either resolves completely or returns to baseline within 30 days. Major stroke is defined as a new neurological disabling deficit with NIH stroke scale change of ≥4 points that persists after 30 days[8].

Procedure success is defined as the extracranial carotid occlusion being successfully dilated and stented.

RESULTS

Between June 1995 and December 2001, 13 patients were eligible for carotid stenting. Twelve of the patients were male. Eight patients had neurological symptoms (Table 1). Sixty-four per cent of the patients had right internal carotid stenosis. One patient had significant bilateral carotid stenosis. One patient had bilateral total internal carotid stenosis. Self-expanding stent was deployed in ninety-three per cent of the cases. The mean diameter and length were 7.5 ± 1.1 mm, 34.1 ± 9.1 mm (Table 2). The mean minimal luminal stenosis before the procedure was 0.9 ± 0.4 mm and after stent placement was 4.2 ± 1.5 mm (Table 3).

There were 4 patients who had periprocedural complications. Two patients experienced a minor stroke. One patient developed severe bradyarrhythmia and was treated with permanent pacemaker implantation. One patient who had bilateral total carotid

Table 1 Baseline clinical characteristics of the patients.

	Symtomatic (n=10)	Asymptomatic (n=3)
Male	10	2
Age (age)	66 ± 6	71 ± 6
Hypertension	8	4
CAD	3	3
Hyperlipidemia	6	1
NIDDM	3	2
Smoking	3	2

TIA = Transient ischemic attack, CAD = Coronary artery disease, NIDDM = Non insulin dependent Diabetes mellitus.

Table 2. Angiographic data of the patients.

	N =14
Carotid artery	
Right	9
Left	5
Stent	
Self-expanding	13
Balloon expanding	1
Mean of stent diameter (mm)	7.8 ± 1.1
Mean of stent length (mm)	34.1 ± 9.1

Table 3. Results of quantitative coronary angiography.

	Pre-dilatation (n=14)	Post-dilatation (n=14)
Reference diameter (mm)	5.1 ± 1.6	5 ± 1.5
MLD (mm)	0.9 ± 0.4	4.2 ± 1.5
% stenosis	86 ± 8	17.8 ± 15

MLD = minimal luminal stenosis

Table 4. Procedural complications.

	N	%
Neurological complications		
Major stroke	0	
Minor stroke	2	15
Death	1	7
Non neurological complication		
Severe bradycardia	1	7

stenosis died from hyperperfusion complication (Table 4). No patient had new or recurrent neurological events at follow-up of 6 to 84 months.

DICUSSION

Carotid endartectomy is the standard treatment for patients with high-grade extracranial carotid stenosis. Several large randomized studies have shown benefit of surgery compared to medical treatment[2, 3,9]. However, carotid endarterectomy also has some complications. Death and major stroke rate are 2.3 per cent to 7.5 per cent[2,3,9,10]. Other complications such as cranial nerve injury, wound infection, and myocardial infarction have also been reported[2].

Matthias et al reported the first case of carotid angioplasty in 1980[11]. Mathur et al (1998), in hospital and 30 day outcome was death 1.6 per cent, minor stroke 5.5 per cent, and major stroke 1.1 per cent[8]. Wholey et al (2000), the stroke and death rate were 5 per cent in 5,201 stent implantations in 36 centers[12]. This was below the 6 per cent rate required by the American Heart Association guidelines for endarterectomy of symptomatic patients [5]. Roubin et al reported long-term follow-up after carotid stenting[13]. The three year freedom from all fatal and nonfatal stroke was 88 ± 2 per cent. For patients who survived the thirty day procedural period the three year freedom from fatal and non fatal stroke was 95 ± 2 per cent. Carotid angioplasty and stenting may be an alternative treatment for extracranial carotid stenosis.

In Phramongkutklao Hospital the success rate was 100 per cent because suitable patients were selected for the procedure. There were 2 patients who had a minor stroke. Both of them recovered within 1 week after the procedure. Recently, neuroprotective devices such as the PercuSurge system, the AngioGuard and the E.P.I. Filter Wire system have demonstrated that can reduce post procedural neurological events can be reduced[14]. One patient who had severe coronary heart disease, old age, and multiple transient ischemic attack developed severe bradycardia and was treated by permanent pacemaker implantation. One patient died the day after the pro-

cedure due to hyperperfusion complication. This patient had bilateral carotid stenosis. At follow-up (range 6 to 84 months), the patients did not have any neurological events.

SUMMARY

Carotid stent implantation may be an alternative treatment for extracranial carotid stenosis but it needs more data to evaluate its safety and efficacy.

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การรักษาเส้นเลือดคารอติดตีบด้วยขดลวดค้ำเส้นเลือดในโรงพยาบาลพระมงกุฎเกล้า

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ระหว่างมิถุนายน 2538 และ ธันวาคม 2545 ผู้ป่วยจำนวน 13 รายได้รับการรักษาเส้นเลือดคารอติดตีบด้วยขดลวดค้ำเส้นเลือดโดยมีค่าเฉลี่ยของเส้นเลือดตีบก่อนรักษา 86 $\pm$ 8 เปอร์เซ็นต์ และหลังการรักษาเหลือ 18 $\pm$ 15 เปอร์เซ็นต์ มีผลแทรกซ้อนหลังการรักษา 3 ราย (2 ราย เป็นอัมพฤกษ์ช่วงคราว, 1 ราย หัวใจเต้นช้าผิดปกติ) 1 ราย เสียชีวิต ไม่มีผู้ป่วยเกิดอาการทางหลอดเลือดสมองหลังจากการรักษาอีก

สรุป การรักษาเส้นเลือดคารอติดตีบด้วยขดลวดค้ำเส้นเลือดอาจเป็นอีกทางเลือกหนึ่งในการรักษาเส้นเลือดคารอติดตีบนอกจากการผ่าตัด

คำสำคัญ : คารอติดตีบ, ขดลวดค้ำเส้นเลือด

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