Long-term Morbidity and Mortality of Carotid Endarterectomy in Patients with End-stage Renal Disease Receiving Hemodialysis

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Background and Purpose: Renal insufficiency is a known risk factor for stroke. However, the impact of carotid endarterectomy (CEA) on stroke incidence in patients requiring dialysis remains controversial. We hypothesized that patients undergoing dialysis have no greater risk for periprocedural adverse events. *Methods:* We performed a retrospective chart review of 12 CEA patients who were on dialysis at the time of CEA. The charts were reviewed for patient demographics, systemic vascular disease, perioperative morbidity and mortality rates, and long-term outcome. Outcomes were recorded in terms of modified Rankin Scale (mRS). *Results:* The mean patient age at the time of CEA was 66.9 ± 7.3 years, with 1 patient having received carotid artery stenting for restenosis. Of the 12 patients undergoing 15 CEAs while being dialysis dependent, none exhibited periprocedural complications including stroke and myocardial infarction. During the follow-up period (mean, 56.1 ± 38.8 months), 3 patients had strokes unrelated to the target vessels for CEA, and 3 patients died from acute myocardial infarction, congestive heart failure, and sepsis. The calculated 5-year survival rate in our series was 58.3% in all cases, 40.0% in symptomatic patients, and 71.4% in asymptomatic patients. Eight patients (66.6%) had a good outcome. *Conclusions:* These data suggest that patients undergoing dialysis were at no greater risk for periprocedural complications when undergoing CEA. Thus, CEA may be effective for stroke prevention in hemodialysis patients. **Key Words:** Hemodialysis—carotid endarterectomy—symptomatic—long-term follow-up.

Introduction

End-stage renal disease (ESRD) requiring hemodialysis (HD) represents a major public health problem in Japan and is related to an aging population and an increasing incidence of risk factors such as diabetes mellitus.[1] In HD patients, cerebrovascular disease is one of the main causes of death.[1-4] For example, in an American prospective cohort study of patients initiating dialysis therapy for ESRD, cerebrovascular events, including fatal and nonfatal clinical stroke and carotid endarterectomy (CEA), occurred 10 times more frequently than in the general population, with an incidence rate of 4.9 events/100 person-years.[3] Most of those events were related to ischemic stroke in dialysis patients. Nevertheless, there is no long-term outcome study of HD patients, in particular those including outcomes after CEA. Although carotid artery stenting is an alternative modality, its outcome for the patients with chronic kidney disease is generally worse.[5] Moreover, marked calcification is frequently found in systemic arteries of HD patients,[6] which would make us difficult to place the carotid artery

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stent and to perform needle puncture. Aortic calcification is also one of the risk factor of cholesterol emboli. Therefore, we conducted CEA as a first-line modality. The aim of the present study was to evaluate the perioperative morbidity and mortality and long-term outcomes of CEA in Japanese HD patients.

Methods

All patients diagnosed as ESRD were cross-referenced with those who underwent CEA at the Kyushu Medical Center and Fukuoka University between April 2002 and July 2012. Patients with maintenance HD at the time of their CEA were enrolled in this evaluation. The degree of stenosis was calculated on the basis of angiography according to the criteria of the North American Symptomatic Carotid Endarterectomy Trial (NASCET) study.[7] The surgical indications were 70% or greater stenosis for symptomatic cases and 60% or greater stenosis for asymptomatic cases and non-HD patients.

Conventional CEA was performed while the patient was under general anesthesia, using an operating microscope and electroencephalographic monitoring. Shunts were used in all patients. No patients underwent patch closure. Hemodialysis was performed continuously 2 days before the operation and restarted 2 days after the operation to prevent hemodynamic change and hemorrhage; HD requires anticoagulation drugs, such as heparin. After CEA, propofol sedation was continued until the next morning. Transcranial color-coded real-time sonography was then performed serially to evaluate flow velocity of the middle cerebral artery for diagnosis of hyperperfusion.[8] Blood pressure was controlled to levels less than 150 mm Hg in systole and more than 90 mm Hg in diastole in all patients using nitroglycerin and/or diltiazem until 7 days after CEA.

The charts were reviewed for patient demographics, systemic vascular disease, perioperative morbidity and mortality rates, and long-term follow-up. Outcomes were evaluated in terms of modified Rankin Scale (mRS) at the latest follow-up and the change in mRS from before the operation to the final follow-up. Good outcome was defined as a final mRS score of 0-2, and poor outcome was defined as a final mRS score greater than 2. Five-year survival rate was calculated using Kaplan–Meier methodology. Data were analyzed using SPSS 14.0.J program (SPSS Inc., Chicago, IL).

Results

Demographics

The demographics of cases are reported in Table 1. Between April 2002 and July 2012, 592 CEAs were performed at our institution, of which 15 (2.5%) CEAs were performed in 12 patients undergoing HD. There were 9 male and 3 female patients, with ages ranging from 56 to 81 years (mean age, 66.9 years). Five lesions (33.3%) were symptomatic carotid stenosis, and the other 10 were asymptomatic. Two of 10 asymptomatic lesions were indicated because of stenosis progression under medical treatment. The mean stenotic rate measured by the NASCET method was 79.3% ± 9.1%. Eight patients had diabetic nephropathy as the original kidney disease that resulted in HD, whereas the other 4 had chronic

Table 1. *Characteristics of the 12 patients and the 15 lesions*

Case	Age/sex	Side	Symptom	NASCET	Plaque calcificatio	Original	Duration	HT	HL	DM	IHD	PVD
1	74/M	R	TIA	80	(+)	DM	0.5	(+)	(+)	(+)	(+)	(+)
2	64/M	R	TIA	79	(+)	DM	6	(+)	(−)	(+)	(−)	(−)
3	63/M	R	TIA	75	(+)	CGN	7	(+)	(−)	(−)	(−)	(−)
	66/M	L	Asymptomatic	82	(+)	CGN	9	(+)	(−)	(−)	(−)	(−)
4	76/F	R	TIA	80	(+)	CGN	9	(+)	(−)	(−)	(−)	(−)
5	56/M	R	TIA	91	(+)	CGN	10	(+)	(−)	(−)	(+)	(−)
6	81/M	R	Asymptomatic*	80	(+)	DM	1	(+)	(+)	(+)	(+)	(+)
7	70/M	L	Asymptomatic	88	(+)	DM	2	(−)	(−)	(+)	(+)	(+)
8	58/F	R	Asymptomatic	90	(+)	DM	2	(+)	(−)	(+)	(−)	(−)
	64/F	L	Asymptomatic*	75	(+)	DM	8	(+)	(−)	(+)	(−)	(−)
9	61/M	L	Asymptomatic	78	(+)	DM	4	(+)	(+)	(+)	(+)	(+)
	61/M	R	Asymptomatic	73	(+)	DM	4	(+)	(+)	(+)	(+)	(+)
10	75/M	L	Asymptomatic	63	(+)	DM	4	(+)	(−)	(+)	(−)	(+)
11	72/F	L	Asymptomatic	93	(−)	CGN	5	(+)	(−)	(−)	(−)	(−)
12	63/M	R	Asymptomatic	62	(+)	DM	7	(+)	(+)	(+)	(−)	(−)

Abbreviations: CGN, chronic glomerulonephritis; DM, diabetes mellitus; F, female; HD, hemodialysis; HL, hyperlipidemia; HT, hypertension; IHD, ischemic heart disease; L, left; M, male; NASCET, North American Symptomatic Carotid Endarterectomy Trial; PVD, peripheral vascular disasel; R, right; TIA, transient ischemic attack.

*Stenosis progression during follow-up.