# Clinical Outcomes after Carotid Endarterectomy in Patients with Contralateral Carotid Occlusion

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**Background:** Severe carotid stenosis is typically treated with carotid endarterectomy (CEA), but there is debate about the safety of this procedure in patients with contralateral carotid occlusion (CCO). To compare 30-day outcomes after CEA in patients with severe carotid stenosis or without CCO.

**Methods:** This retrospective, single-institution analysis included 434 patients who underwent CEA. All CEAs were performed under general anesthesia, and carotid shunts were used in 32 patients. Patients were categorized into 2 groups according to patency of the contralateral carotid artery: groups I (no CCO, $n = 394$) and II (with CCO, $n = 40$). Demographics, preoperative symptomatic status, and frequency of early (<30 days) symptomatic neurologic complications and death were compared.

**Results:** Total mortality after CEA was 1.6% ($n = 7$), 7 and 0 in groups I and II, respectively ($P = 0.39$). Overall stroke rate was 3.5% ($n = 15$), 15 and 0 in groups I and II, respectively ($P = 0.20$). Rate of transient ischemic attacks was 1.4% ($n = 6$), 5 and 1 in groups I and II, respectively ($P = 0.37$). Symptomatic group I patients had a higher rate of stroke and/or death (6.7% vs. 0%) ($P = 0.85$). In asymptomatic patients, the stroke and/or death rate was higher in group II (3.4% vs. 8.3%, $P < 0.05$). In group II, the frequency of shunt placement was higher (3% vs. 53%, $P = 0.001$). At mean follow-ups of 75.4 ± 47.5 months (group I) and 72.7 ± 49.9 months (group II), 157 and 13 additional deaths had occurred in groups I and II, respectively ($P = 0.21$).

**Conclusions:** Patients with CCO who undergo CEA do not appear to be at increased risk for perioperative incidence of stroke and/or death, or any neurologic event.

## INTRODUCTION

The North American Symptomatic Carotid Trial (NASCET)[1] and the European Carotid Surgery Trial (ECST)[2] demonstrated that carotid endarterectomy (CEA) is the treatment of choice in patients with symptomatic carotid stenosis. The absolute risk reduction in stroke in favor of endarterectomy compared with medical treatment alone is 17%. Carotid stenosis is associated with contralateral carotid occlusion (CCO) in approximately 10% of patients.[3,4] In these patients, cerebral perfusion is maintained with collateral circulation. A preexisting CCO has been described as a risk factor for stroke after CEA,[3,5] and many authors believe that using an intraoperative shunt is important for stroke rate reduction during CEA in those patients with CCO.[6] The aim of the present work was to assess how CCO affects 30-day outcome.

## METHODS

### Patients

We retrospectively reviewed data from all consecutive patients who underwent CEA at Universitary

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Hospital of Lugo, Spain, from January 1995 through November 2010. This was the first CEA for all patients. Follow-up data were collected from hospital electronic medical records and clinical visit documentation, ending in October 2012. The protocol was approved by the Medical Ethics Committee of the Universitary Hospital of Lugo, Spain. Clinical characteristics included: age, gender, presence of high blood pressure (systolic blood pressure > 140 mm Hg, diastolic blood pressure > 90 mm Hg, or specific therapy), presence of dyslipidemia (total cholesterol > 200 mg/dL or low density lipoprotein > 120 mg/dL or statin therapy), diagnosis of diabetes mellitus, any smoking history, coronary artery disease, chronic obstructive pulmonary disease, and diagnosis of renal insufficiency (creatinine level > 2 mg/dL).

Mortality was determined from medical records and the social security electronic records of Galicia, Spain.

### Diagnostic Criteria

For most patients, the diagnosis of carotid disease was based on preoperative duplex ultrasound, combined with magnetic resonance angiography or arteriography. Duplex scan criteria used to determine percent stenosis were for carotid artery stenosis of >60% a peak systolic velocity (PSV) of 250–270 cm/sec and for carotid artery stenosis of >70% a PSV > 275 cm/sec. Patients were categorized into 2 groups according to the presence or absence of CCO: group I, patients without CCO; group II, patients with CCO. The neurologic status of the patients was classified as either symptomatic or asymptomatic. For symptomatic status, patients must have had 1 of the following neurologic events in the 6 months before the operation: stroke, transient ischemic attack (TIA) or amaurosis fugax.

### Surgical Procedures

Carotid revascularization was performed in accordance with the guidelines of the European Society of Vascular and Endovascular Surgery.[7] Carotid revascularization was performed for symptomatic >60% carotid artery stenosis and asymptomatic >70% carotid artery stenosis. All surgical procedures were performed under general anesthesia, using conventional endarterectomy techniques and with routine intraoperative electroencephalographic monitoring for a selective use of intraluminal shunting, such as electroencephalogram changes with clamping. No bilateral procedures were performed in any of the patients. Surgical options comprised conventional CEA and eversion CEA. The type of operation was chosen by the surgeon. Intraoperative data including the frequency of shunting, arterial closing technique, clamping time and operation time were analyzed.

### Outcomes

The main outcome was any stroke or death 30 days after surgery. We compared the unadjusted rates of any 30-day stroke or death after CEA between patients with and without CCO. Cranial nerve injury and hematoma were also investigated. All patients were followed up prospectively at the Vascular Surgery Department of the University Hospital of Lugo. All patients had routine postoperative clinical check up 1, 6, and 12 months after surgery and then annually during follow-up.

### Statistical Analysis

Descriptive statistics are provided as mean ± standard deviation for continuous variables and percent, frequency, for categorical variables. Baseline and outcome comparisons of the 2 groups were performed with either the Student's *t*-test or Fisher's exact test. Differences were considered significant at $P < 0.05$. The correlation between multiple risk factors and 30-day adverse outcome was assessed by univariate analysis, and multivariate analyses were performed using a regression model, assuming statistical significance $P < 0.05$. Statistical analyses were performed with SPSS 13.0 for Windows (Chicago, IL).

## RESULTS

We reviewed a total of 434 procedures performed on 434 patients, for patient demographics and adverse events during the 30-day postoperative period. Clinical follow-up at the end of October 2012 was available for all, 434 patients who underwent CEA. Of the 434 patients, 394 (90.8%) patients formed the control group (group I). Forty patients (9.2%) who had CCO formed group II. There were no significant differences in baseline patient characteristics between the groups (Table I). The most prevalent comorbidities included hypertension (63.7%), smoking history (50.7%), and peripheral vascular disease (40.3%). The mean age was 72 years (range 46–88 years) in group I and 71.3 years (range 38–86 years) in group II. The male-to-female ratio was 4.7:1 in group I and 7:1 in group II. Most patients were symptomatic: 63.7% in group I and 70% in group II. Perioperative data are summarized in Table II.