Carotid Surgery without External Carotid Endarterectomy: A 6-year Clinical Experience with 1027 Cases


Maimonides Medical Center, Division of Vascular Surgery, Brooklyn, U.S.A.

Purpose: previously we routinely performed endarterectomy of the external carotid artery (ECA) during carotid surgery. However, discouraging experience and lack of supportive data in the literature made us question its necessity. The present report describes our experience with a modified carotid endarterectomy (CEA) technique where the ECA is left undisturbed regardless of its degree of stenosis.

Methods: from January 1996 to June 2001, 1027 CEAs were performed in 905 patients with this technique at our institution. All operations were performed for at least 60% internal carotid artery (ICA) stenosis. A preoperative carotid duplex scan was available for review in 990 cases (96%). Follow-up duplex scans were recovered from 0 to 1 months in 851 cases (83%) and from >1 month in 655 cases (64%). Seventy percent of these cases were performed for asymptomatic lesions.

Results: the perioperative (30-day) mortality rate for the entire group of patients was 0.5% and the stroke rate was 0.7%. Mean follow-up was 18 months (range: 2–66 months). Only two ECAs occluded in the first postoperative month. During the follow-up period, 37 additional ECAs (5.6%) were found to progress from mild to severe (>75%) stenosis post-operatively. In addition, 7% of the cases were found to have worsened the degree of stenosis, 8% improved and 85% remained unchanged.

Conclusion: these data support sparing of the ECA during CEA.

Introduction

Vascular surgeons have developed numerous approaches to deal with an atherosclerotic plaque and its complications in the arterial system. Although many techniques are available to potentially treat a stenotic plaque situated at the carotid bifurcation, the standard approach has been to perform an endarterectomy of the internal, common and external carotid arteries. While the results of endarterectomy (CEA) of the internal carotid artery (ICA) and common carotid artery (CCA) have been excellent, scattered reports of less than acceptable short- and long-term results have been noted when these approaches are taken with the external carotid artery (ECA). A partial explanation for this may be differences in the flow characteristics of the ECA vis-à-vis the ICA and CCA, as well as the techniques utilized in handling the endpoint in the traditional approach to the ECA. We first questioned the need to routinely include ECA endarterectomy during carotid surgery in 1995 and proposed performing CEA without endarterectomy of the ECA.

Our preliminary study reviewed the preoperative and postoperative carotid artery duplex examinations in 114 CEAs with specific evaluation of the extent of ECA stenosis. Our approach to the management of the ECA during standard CEA was modified by averting any attempt at external CEA. Short- and intermediate-term follow-up demonstrated insignificant changes in ECA diameter after operation, with no cases of ECA occlusion. Thus, we concluded that averting external CEA during standard CEA did not result in significant progression of ECA stenosis or occlusion.

However, since the results that could be drawn from our initial data in this small number of patients with the limited follow-up, were restricted, we have elected to revisit this issue and determine the effect of longer term follow-up with a larger patient base.

Methods

From January 1996 to June 2001, 1027 CEAs were performed on 905 patients with this modified
technique at our institution. Aged ranged from 43 to 100 years (mean 74 ± 0.3 years). Diabetes mellitus was noted in 39% of patients and hypertension in 60%. All operations were performed for at least 60% ICA stenosis.

Duplex criteria for high-grade stenosis were made by B-mode imaging and color flow imaging in transverse and longitudinal sections and confirmed by velocity measurements. These duplex scans were performed by registered vascular technologists in an ICAVL accredited laboratory. Local percent stenosis was estimated as a 10% interval, i.e. 60±70%. This interval reading accounted for measurement error and variability.12 Velocity criteria were used to confirm these data. The University of Washington criterion was used to corroborate stenosis > 50% with peak systolic velocity > 125 cm/s.13 An end-diastolic velocity of 100 cm/s14,15 was used to corroborate severe stenosis > 70%. Because of velocity measurement variations, a 20% range was allowed for these velocity thresholds during ultrasound imaging–velocity matching. Velocity/imaging mismatches due to kinking, tortuosity, contralateral occlusion or severe stenosis, poor cardiac ejection etc., were interpreted accordingly.

The interpretation of ECA disease was based on cross-sectional and longitudinal B-mode ultrasound imaging, as well as Doppler peak systolic velocity measurements. Our estimation of ECA stenosis had been previously validated by comparison with magnetic resonance angiography on the basis of 60 bifurcations studied.11 The correlation for stenoses either greater or less than 60% diameter reduction was 94% and the Kappa statistic 0.76. ECA peak systolic velocities less than 150 cm/s or greater than 250 cm/s were consistently associated with stenoses less than 50% or greater than 60%, respectively. The respective negative and positive predictive values were 95 and 87%. These results were classified as <50%, 51–75%, >75% and occluded.

A daily aspirin was started the night before surgery and continued postoperatively unless the patients were not able to tolerate aspirin. General anesthesia was used in all patients. Shunts were placed in 21.5% of the patients when the internal carotid artery systolic backpressure was less than 50 mmHg or when electroencephalographic changes were suggestive of cerebral ischemia (prolongation of frequency or reduction of amplitude). The endarterectomy at the orifice of the ECA was sharply transected flush with its ostium with no attempt to blindly endarterectomize more distally into the ECA. Patency was assessed by backbleeding. Patients underwent selective patching of the carotid artery until 1996 when routine synthetic patching was initiated. No drains were used. All patients underwent routine postoperative measurement of serum creatinine phosphokinase (CPK) isoenzymes every 8 h for three sets of tests. All patients had routine EKGs performed after the procedure and the next morning. Patients were sent to the floor after two sets of negative CPKs. They were discharged when deemed clinically stable.

Patient follow-up typically was within 2 weeks after operation and then at 3- to 6-month intervals thereafter. Cross-referencing these patients with the vascular laboratory database revealed 4893 duplex exams. The latest preoperative duplex, 1-month postoperative duplex and the latest duplex after 1 month were used for the analysis. Preoperative duplexes were obtained in 990 cases (96%), follow-up duplex scans in the first postoperative month in 851 cases (83%), and duplex scans > 1 month postoperative in 655 cases (64%).

Follow-up data were also obtained from a review of hospital databases, office records, a computerized database of carotid duplex results, medical records, the Social Security Death Index and the New York City Department of Vital Statistics.

Results

Five hundred and thirty-eight (52%) of the CEAs were on the right. Staged bilateral CEAs were performed in 154 patients (10%). Indications for the CEAs were asymptomatic lesion (70%), transient ischemic attack (16%), stroke (12%) and non-hemispheric symptoms in 2%.

Follow-up ranged from 2 months to 66 months, on average 18 months. Only 2 ECAs (0.2%) occluded in the first postoperative month. During the follow-up period 37 additional ECAs (5.6%) were found to progress from mild to severe (> 75%) stenosis. The follow-up period of the patients who had a duplex more than 1 month after CEA was 23 ± 0.7 months.

A summary of the preoperative and postoperative duplexes are shown in Tables 1 and 2. Changes in follow-up duplex were only considered to be worsened or improved if there was a change >10% and the degree of stenosis changed from the <50%, 51–75%, >75% or occluded categories. No correlation could be ascertained between ECA and ICA degree of stenosis as only 138 (13%) of these patients with severe ICA stenosis has > 75% ECA stenosis. None of the 27 patients who developed severe recurrent ICA stenosis requiring redo carotid surgery had progression of ECA disease to a severe degree. None of the patients with progression of ECA disease had symptomatic. The perioperative (30-day) mortality rate for the entire
group of patients was 0.5%, the incidence of transient ischemic attack was 0.4% and the stroke rate was 0.9%.

Discussion

We have reviewed the results of 1028 CEAs performed on 905 patients over a 6-year period and have found that sparing the ECA during CEA did not result in significant progression of ECA stenosis, occlusion or symptoms. In contrast, prior reports have suggested that a small but significant percentage of patients will have postoperative occlusion of the ECA even with modern techniques of CEA.1-3 Additionally, a prior report by Archie that examined the long-term patency of the ECA after standard CEA with a combination of proximal eversion technique and blind distal endarterectomy on the ECA suggested mediocre results in terms of long-term patency.16 In this series by Archie, 1069 primary CEAs were performed. Intraoperative post-CEA continuous-wave doppler scans identified low flow or occlusion of the ECA in 37 CEAs (4%). These ECAs were isolated and repaired. Of the 37 repaired ECAs, 20 (54%) had <50% stenosis, 10 (27%) had 50–74% stenosis, 5 (14%) had ≥75% stenosis and 2 (5%) were occluded on follow-up duplex. Cumulative life-table analysis revealed ≥50% stenosis rate was 36% at 1 year, 40% at 3 years, 48% at 5 years, and 81% at 10 years. The cumulative ≥75% stenosis rate was 12% at 1 year, 12% at 3 years, 15% at 5 years, and 37% at 10 years. Preoperative studies showed <50% stenosis in 152 of the 313 ECAs (48%). In the early postoperative period, 102 of these ECAs (66%) had <50% stenosis, 35 (23%) had 50–74% stenosis, 13 (9%) had ≥75% stenosis and 3 (2%) were occluded. Of the 161 ECAs with ≥50% preoperative stenosis, only 66 (41%) had <50% stenosis in the first 6 months after CEA, 61 (38%) had 50–74% stenosis, 32 (20%) had ≥75% stenosis and 2 (1%) were occluded. Thus, the Archie series concluded that combined proximal eversion technique and blind distal ECA endarterectomy during routine CEA gives poor and unacceptable early and late outcomes. Nevertheless, the results reported by Archie require careful follow-up duplex confirmation from other centers of excellence.

In our earlier report, the patency of the ECA utilizing this sparing technique was demonstrated. We again noted the long-term patency of the ECA after this modified technique vis à vis our earlier report. Interestingly, we once more detected some ECAs with decreased degrees of stenosis on follow-up duplex in the present larger series.11 While variability in the measurements of the ECA stenosis may explain some of these observed changes, the repeat duplex exams performed by various technologists did appear to be consistent. Other possibilities to explain these changes may include removal of orificial ECA stenosis resulting in improved flow dynamics, increased pressure and dilatation of the ECA resulting from possible changes in altered flow dynamics of the bifurcation or remodeling of the ECA plaque. Nonetheless, even with longer term follow-up, leaving disease in the ECA did not seem to be associated with a significant incidence of progression of ECA stenosis, occlusion or symptoms.

All of the above data question the justification of performing a blind or poorly assessed endarterectomy in a low flow, high resistance vascular bed. While occlusion of the ECA may indeed result in symptoms, we have observed occlusion to be an extremely infrequent finding utilizing this modified technique. While we recognize that our data is not based upon a controlled study and contains limited follow-up, we nevertheless, conclude that sparing the ECA during CEA is safe, simple and appears to maintain the patency of the ECA.

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References


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