A reassessment of carotid endarterectomy in the face of contralateral carotid occlusion: Surgical results in symptomatic and asymptomatic patients

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Objective: Total occlusion of the contralateral internal carotid artery has often been considered to be a predictor of poor outcome after carotid endarterectomy (CEA) of ipsilateral carotid stenosis. Data from both the North American Symptomatic Carotid Endarterectomy Trial and the Asymptomatic Carotid Atherosclerosis Study have suggested this to be true. However, each of these trials had relatively few patients with contralateral occlusion in the surgical arms of the studies. Recently, advocates of carotid angioplasty and stenting have suggested that this technique may be preferable in patients with a contralateral occlusion because of the perceived poor outcome with surgery. The purpose of this study was to review a large series of CEsAs performed in patients with contralateral occlusion to see whether results differed from patients with patent contralateral arteries and to determine whether the presence of preoperative symptoms was an important factor in outcome in these cases.

Patients and Methods: A review was conducted of a prospectively compiled database of all primary CEsAs performed at our institution from 1985 to 1999. Surgery was performed on 2420 patients, of whom 338 (14.0%) had contralateral total occlusion.

Results: Patients with contralateral total occlusion were more likely to be symptomatic (65.7% versus 60.1%; P = .1), male (70.9% versus 58%; P < .001), and hypertensive (63.9% versus 58.4%; P = .07) with a positive smoking history (42.6% versus 31.4%; P < .001) than patients with patent contralateral carotid artery. No significant difference was seen in the rate of perioperative neurologic events between patients with contralateral occlusion (3.0%) and those without (2.1%; P = .34). Among the total of 913 asymptomatic patients, of whom 115 had contralateral occlusion, no difference was seen in the rate of perioperative neurologic events (1.8% for contralateral occlusion cases; 1.9% for cases without contralateral occlusion; P = .2).

Conclusion: The presence of contralateral occlusion does not appear to increase the perioperative risk of CEA. Although the risk of CEA in symptomatic patients with contralateral occlusion may be slightly increased, this must be weighed against the risk with medical treatment alone. CEA can be performed safely in patients with contralateral occlusion, which should not necessarily be considered a high-risk condition for surgery in favor of angioplasty and stenting. (J Vasc Surg 2002;36:668-73.)

Total occlusion of the contralateral internal carotid artery has often been considered to be a predictor of poor outcome after carotid endarterectomy (CEA) of ipsilateral carotid stenosis. Data from both the Asymptomatic Carotid Atherosclerosis Study (ACAS) and the North American Symptomatic Carotid Endarterectomy Trial (NASCET) have suggested this to be true. However, each of these trials had relatively few patients with contralateral occlusion in the surgical arms of the studies. Despite the previously noted results, multiple surgical series in the literature show excellent outcomes of CEA in patients with CO.6-18

Recently, advocates of carotid angioplasty and stenting have suggested that this technique may be preferable in patients with CO because of the perceived poor outcome with surgery. Several of these report the outcome of carotid angioplasty and stenting in high-risk cases, including patients with CO. A report of only 23 cases of carotid artery angioplasty and stenting of carotid stenosis in the setting of CO states that the “risks appear to be lower than carotid endarterectomy.” With these issues in mind, the purpose of this study was to review a large series of CEsAs performed in patients with CO to see whether results differed from patients with patent contralateral arteries and to determine whether the presence of preoperative symptoms was an important factor in outcome in these cases.

PATIENTS AND METHODS

A retrospective review was conducted of a prospectively compiled computerized database of all primary CEsAs performed by the Division of Vascular Surgery at the New York University Medical Center.

From the Division of Vascular Surgery, New York University Medical Center.

Competition of interest: nil.


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York University Medical Center from 1985 to 1999. Reoperative carotid operations and combined carotid/coronary bypass operations were excluded from analysis. Patients without CO who underwent bilateral CEA during the study period had their second carotid operation excluded from analysis.

Patients underwent diagnosis on the basis of duplex scanning, combined with either formal cerebral angiography or magnetic resonance angiography. Before 1993, formal angiography was routinely obtained. Subsequently, we switched to magnetic resonance angiography, which is usually enhanced with gadolinium. No patient in this series had carotid occlusion diagnosed with duplex scanning alone. Currently, if a discrepancy exists between the duplex scan and the magnetic resonance angiography results with regard to total occlusion, formal angiography is obtained.

General guidelines for CEA at our institution include a preference for regional anesthesia and selective shunting, empiric shunting for those cases performed with general anesthesia, and routine patch angioplasty. Since 1991, most patch angioplasties have been performed with polyester; before 1991, the preference was for saphenous vein. The decision of whether or not to use a shunt in patients with CO was ultimately left to the judgment of the operating surgeon. Generally, patients with CO and asymptomatic ipsilateral carotid stenosis underwent shunting only on the basis of the occurrence of symptoms with test clamping of the carotid artery with regional anesthesia. If these patients underwent operation with general anesthetic for another reason, routine shunting was used. Patients with CO and ipsilateral transient ischemic attacks were treated similarly. However, patients with CO and recent ipsilateral or contralateral stroke often underwent shunting empirically even if they underwent operation while awake. This has been based on the concern that monitoring of the contralateral hemisphere for clamp ischemia is difficult, even when the patient is awake.

Perioperative events were considered if they occurred up to 30 days after surgery. A perioperative myocardial infarction was diagnosed with or without clinical symptoms if accompanied by either appropriate electrocardiographic findings or cardiac enzyme indices. A perioperative neurologic event was diagnosed if a patient manifested any focal deficit in the perioperative period, whether transient or permanent, that prompted either neurologic consultation, reoperation, or the obtaining of atypical postoperative imaging studies, such as computerized tomographic scans, magnetic resonance imaging of the brain, cerebral angiography, or duplex scans other than those ordered routinely. Therefore, the perioperative neurologic event rate included events that might have been considered as perioperative “transient ischemic attacks” elsewhere.

Statistical analysis was performed with the statistical software package SPSS (SPSS, Inc, Chicago, Ill). The χ2 test (or the Fisher exact test when appropriate) and Student t test were used for comparison of data. A P value of .05 or less was considered to be statistically significant.

Table I. Comparison of patient demographics and preoperative neurologic status between patients with CO and patients with patent contralateral carotid artery

<table>
<thead>
<tr>
<th>Age* (mean; y)</th>
<th>CO (n = 338)</th>
<th>Contralateral patent (n = 2082)</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male gender</td>
<td>70.9% (240)</td>
<td>58.0% (1208)</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Hypertension</td>
<td>63.9% (216)</td>
<td>58.4% (1216)</td>
<td>0.07</td>
</tr>
<tr>
<td>Diabetes</td>
<td>21.5% (73)</td>
<td>22.6% (470)</td>
<td>NS</td>
</tr>
<tr>
<td>Cardiac disease</td>
<td>50.3% (170)</td>
<td>45.9% (956)</td>
<td>NS</td>
</tr>
<tr>
<td>Positive smoking history</td>
<td>42.6% (144)</td>
<td>31.4% (654)</td>
<td>&lt;.001</td>
</tr>
</tbody>
</table>

*P value with two-tailed Student t test.
NS, Not significant.

Table II. Comparison of preoperative symptoms and indications for CEA between patients with CO and patients with patent contralateral carotid artery

<table>
<thead>
<tr>
<th>Asymptomatic</th>
<th>TIA/amaurosis</th>
<th>Stroke</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO (n = 338)</td>
<td>(n = 2082)</td>
<td></td>
</tr>
<tr>
<td>Asymptomatic</td>
<td>34.3% (115)</td>
<td>38.3% (798)</td>
</tr>
<tr>
<td>TIA/amaurosis</td>
<td>34.3% (115)</td>
<td>41.1% (855)</td>
</tr>
<tr>
<td>Stroke</td>
<td>31.3% (108)</td>
<td>20.6% (429)</td>
</tr>
</tbody>
</table>

*P value derived from 3 × 2 table χ2 analysis.
TIA, Transient ischemic attack.

RESULTS

From 1985 to 1999, 2420 CEAs were performed. Of these cases, 338 (14.0%) had total occlusion of the contralateral carotid artery; the remainder had patent contralateral carotid arteries.

Comparison of patient demographics and preoperative neurologic status between patients with contralateral occlusion and patients with patent contralateral carotid artery. Patient demographics and the preoperative neurologic status were compared between patients with CO and those without CO. The results are depicted in Table I. Patients with CO were more likely to be symptomatic (65.7% versus 60.1%; P = .1), male (70.9% versus 58%; P < .001), and hypertensive (63.9% versus 58.4%; P = .07) with a positive smoking history (42.6% versus 31.4%; P < .001) than patients without CO.

Comparison of preoperative symptoms and indications for carotid endarterectomy between patients with contralateral occlusion and patients with patent contralateral carotid artery. The indications for CEA were compared between patients with CO and those without CO. The results are depicted in Table II. The indications for surgery differed significantly between the two patient groups, with patients with CO being more likely to have had a perioperative stroke.

Comparison of intraoperative factors between patients with contralateral occlusion and patients with patent contralateral artery. Intraoperative factors were compared between patients with CO and patients with
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<table>
<thead>
<tr>
<th></th>
<th>CO (n = 338)</th>
<th>Contralateral patent (n = 2082)</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Regional anesthetic</td>
<td>72% (243)</td>
<td>82.6% (1720)</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Shunt used</td>
<td>66.2% (224)</td>
<td>27.3% (568)</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Tolerated clamping*</td>
<td>63.6% (155)</td>
<td>92.3% (1588)</td>
<td>&lt;.001</td>
</tr>
</tbody>
</table>

*Results for patients who underwent operation with regional anesthetic only.

Comparison of perioperative complications between patients with CO and patients with patent contralateral carotid artery.

<table>
<thead>
<tr>
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<th>CO (n = 338)</th>
<th>Contralateral patent (n = 2082)</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Perioperative MI</td>
<td>0.6% (2)</td>
<td>0.6% (2)</td>
<td>NS</td>
</tr>
<tr>
<td>Perioperative death</td>
<td>0.6% (2)</td>
<td>0.6% (2)</td>
<td>NS</td>
</tr>
<tr>
<td>Perioperative neurologic deficit</td>
<td>5.0% (10)</td>
<td>2.1% (43)</td>
<td>.3</td>
</tr>
</tbody>
</table>

MI, Myocardial infarction; NS, not significant.

Among a total of 1507 symptomatic patients, 223 had CO (14.8%). Symptomatic patients with CO were more likely than asymptomatic patients without CO to be male (73.5% versus 58.0%; P < .001) and to have a positive smoking history (45.6% versus 33.0%; P = .001). Symptomatic patients with CO were less likely to have undergone operation with general anesthesia (69.7% versus 79.5%; P = .002) and were less likely to tolerate carotid clamping (53.8% versus 89.8%; P < .001) than asymptomatic patients with patent contralateral arteries.

Comparison of perioperative neurologic event rate as related to patency of contralateral carotid artery and presence of preoperative symptoms.

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<th>P value</th>
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<tbody>
<tr>
<td>Asymptomatic</td>
<td>1.8% (2/115)</td>
<td>1.9% (15/798)</td>
<td>NS</td>
</tr>
<tr>
<td>Symptomatic</td>
<td>3.7% (8/223)</td>
<td>2.2% (28/1284)</td>
<td>NS (.2)</td>
</tr>
</tbody>
</table>

NS, Not significant.

Comparison of perioperative neurologic deficit rate as related to patency of contralateral carotid artery and presence of preoperative symptoms. Patient groups were divided into asymptomatic or symptomatic on the basis of the absence or presence of preoperative focal symptoms. Among a total of 913 asymptomatic patients, 115 had CO (12.6%). No significant differences were seen among asymptomatic patients with or without CO with regard to gender or medical risk factors. Asymptomatic patients with CO were less likely to have undergone operation with regional anesthesia (77.4% versus 87.9%; P = .003) and were less likely to tolerate carotid clamping (74.6% versus 94.5%; P < .001) than asymptomatic patients with patent contralateral arteries.

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risk. However, exactly how many patients with CO were included in this analysis is unclear. More specific data from NASCET addressing the issue of CO analyzed 43 patients with this condition who underwent CEA. The risk of perioperative stroke and death in these patients was initially alarming 14.3%. However, the outcome of medically treated patients in this subgroup was found to be extremely poor, with a 2-year stroke risk of 69.4%. Therefore, despite the increased perioperative morbidity rate, surgery was associated with a considerably better outcome than medical treatment.

Despite the previous results, it is clear that many surgical series of CEA in the setting of CO have been reported with excellent results. Table VI depicts a representative series of CEA in the setting of CO have been reported. These reports have less than 100 patients in the surgical arm without CO. However, like ACAS and NASCET, most of these studies, most of which show equivalent perioperative results for CEA between patients with and without CO. Patients with CO were more likely to have had a preoperative stroke, to undergo operation with general anesthesia, and to need a shunt than patients without CO.

In addition to good perioperative results, the long-term freedom from stroke rate in patients with CO who have undergone CEA has been reported. Jacobowitz et al reported that CEA in the presence of CO provides long-term benefit to the patient with respect to prevention of stroke in both cerebral hemispheres. Rutgers et al reported a sustained improvement in hemodynamic benefit in both cerebral hemispheres after CEA in the presence of CO. Of equal importance, the natural history of medically treated patients with CO has been generally found to be poor; Brengman et al studied 87 patients with CO and found that they were at high risk for disease progression of the other carotid artery. Of 87 patients, 33 (37.9%) eventually needed CEA of the contralateral patent artery in long-term follow-up.

This study delineated surgical results in a large cohort of patients who underwent CEA in the setting of CO. This study included outcomes in nearly double the amount of cases than in even the largest of previous studies. Although it may have been somewhat limited by its retrospective nature, our database was actually compiled prospectively. In addition, this report could only address perioperative outcome because the long-term results in this group are still being collected. Finally, we cannot address the outcome of medically managed patients with CO from these data.

Patients with CO were significantly more likely to be male and to have a history of tobacco use than patients without CO. Patients with CO were more likely to have had a preoperative stroke, to undergo operation with general anesthesia, and to need a shunt than patients without CO. The history of a preoperative stroke in and of itself has been found to be predictive of increased perioperative risk at our institution. Therefore, one might assume that patients with CO are at increased risk simply on that basis alone. However, our results have shown this not to be the case.

Among the entire group of 2420 CEAs, the rates of perioperative neurologic events and perioperative mortality were not significantly different in patients with CO when compared with patients with a patent contralateral artery. Specific examination of asymptomatic patients revealed that again perioperative results in patients with CO were nearly identical to those without CO. These results are in agreement with the ACAS report. Specific examination of symptomatic patients revealed no statistically significant differences with regard to perioperative outcome in patients with CO when compared with patients without CO. However, symptomatic patients with CO were noted to have the highest rate of perioperative neurologic events of all subgroups (3.7%). Although this did not reach statistical significance, this complication rate was nearly double that of any other subgroup. This difference may possibly be actually a statistically significant one; this may represent a
type II error from the relatively small absolute number of perioperative neurologic events among CO cases. However, previous extensive multivariate analysis on the causes of perioperative stroke at our institution has found that CO is not an independent predictor of a perioperative neurologic event. Finally, as delineated in NASCET and other studies, this subgroup appears to be the group with the worst outcome when medical management is pursued as well.

Why the surgical results in CO cases in this series and others appear to be markedly better than those reported in the NASCET study is unclear. Our performance of most cases with regional anesthetic to directly monitor patient neurologic status during surgery possibly has allowed us to respond immediately to any evidence of cerebral ischemia in these patients with less global cerebral blood flow. Also, our routine use of patch angioplasty possibly has reduced technical errors and thromboembolization, which may manifest clinically with more severity in CO cases. NASCET surgeons used a variety of techniques in performing CEA. However, these are only hypotheses and further study in this area is necessary.

In review of these data, we have noted that surgical results in this series of CO cases from 1985 to 1999 appear to be somewhat worse than the first reported 135 cases of this cohort. In CO cases performed between 1985 and 1991, a 0.7% perioperative neurologic deficit rate was noted. In the current total series of 338 cases, a 3.0% perioperative neurologic deficit rate was found. Why this is the case is unclear. Perhaps more recent cases have become higher risk in some way that we cannot easily delineate. However, this complication rate remains satisfactory; most events (eight of 10) occurred in CO cases in which the patients were symptomatic before surgery. This is certainly a subgroup at somewhat higher risk on the basis of preoperative symptoms alone. Finally, the overall complication rate in CO cases remained comparable with cases with a patent contralateral artery.

Although we are confident that CO in and of itself does not significantly increase the risk of CEA, our approach to these patients remains somewhat conservative. We have not decreased our threshold for operating on an ipsilateral lesion in patients with CO. Our criteria for performing CEA for either symptomatic or asymptomatic lesions have remained the same whether or not the patient has a contralateral occluded artery, in accordance with published randomized prospective studies.

CONCLUSION

In conclusion, the presence of a CO does not appear to significantly increase the perioperative risk of CEA. Although the risk of CEA in symptomatic patients with CO may be slightly increased, this must be weighed against the risk with medical treatment alone. CEA can be performed safely in patients with CO, which should not be considered a high-risk condition for surgery in favor of angioplasty and stenting.

REFERENCES


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