Unilateral Internal Carotid Arterial Occlusion: Special Considerations

CHARLES A. ANDERSEN, M.D., LT C M.C. U.S.A.,
NORMAN M. RICH, M.D., F.A.C.S., COL M.C. U.S.A.,
GEORGE J. COLLINS, JR., M.D., LT C M.C. U.S.A.,
P AUL T. MCDONALD, M.D., LT C M.C. U.S.A.,
AND STEPHEN C. BOONE, M.D., LT C M.C. U.S.A.

SUMMARY Cases of patients with unilateral internal carotid arterial occlusion and contralateral internal carotid arterial stenosis are reviewed. Forty-two percent presented with a fixed neurological deficit. The deficit was referable to the side of occlusion in 92% and to the side of stenosis in 8%. Eleven percent had a neurological complication following carotid endarterectomy on the side of the stenotic lesion. The neurological complication was referable to the side of stenosis in 67% and to the side of occlusion in 33%. Patients have been followed for an average of 19 months and have not developed any additional TIA's or strokes in the followup period. There may be a role for an extracranial-intracranial bypass (ECIC) on the occluded side prior to an endarterectomy on the stenotic side if a poor collateral situation exists. An ECIC should be done in patients who remain symptomatic following carotid endarterectomy on the stenotic side. These data do not support doing ECIC in asymptomatic patients with unilateral carotid arterial occlusion.

IT HAS RECENTLY been suggested that unilateral internal carotid arterial occlusion may be an indication for superficial temporal to middle cerebral arterial bypass.\(^1\)\(^-\)\(^9\) It has also been suggested that extracranial-intracranial bypass (ECIC) should be done on the side of a unilateral internal carotid arterial occlusion prior to performing carotid endarterectomy for stenosis of the contralateral internal carotid artery.\(^1\) Also, Fields and Lemmer in their recent review\(^1\) of data obtained by the joint study of extracranial arterial occlusion, suggested that medical therapy is superior to surgical therapy in patients with unilateral carotid arterial occlusion and contralateral carotid arterial stenosis.\(^4\) Because of the emergence of these new and controversial concepts, we reviewed our recent operative experience in patients with unilateral internal carotid arterial occlusion and contra-lateral stenosis.

Methods

Between January 1974 and December 1976, 189 carotid endarterectomies were performed on 154 patients at Walter Reed Army Medical Center. Twenty-eight of the 154 patients (18%) presented with a unilateral internal carotid arterial occlusion and a contralateral significant (greater than 50% as demonstrated arteriographically) internal carotid arterial stenosis. An analysis of these 28 cases forms the basis of this report. There were 24 males and 4 females ranging in age from 26 to 73 years with an average age of 56 years. Twelve of the 28 patients (43%) had a fixed neurological deficit at the time of initial evaluation. In 11 of the 12 patients (92%), the deficit was referable to the side of the occlusion; however, in one patient, it was referable to the side of the stenosis.

The indications for surgery in these 28 patients were transient ischemic attacks (TIA's) in 15 (54%); fixed neurological deficit with TIA's in 6 (21%); fixed neurological deficit without TIA's in 6, (21%); and as prophylaxis prior to major surgery in 1, (4%). An analysis of the 21 patients having TIA's showed the TIA's to be referable to the side of the occlusion in 6 patients, (29%), referable to the side of stenosis in 9 patients, (43%), and non-localizing or bilateral in 6 patients (29%).

All 28 patients had a carotid endarterectomy performed on the side of the stenotic lesion. In none of the patients was an attempt made to open the occluded internal carotid artery. No patients were operated on during the acute phase of a stroke. Following a stroke, patients were stabilized for at least six weeks or until the static portion of the brain scan returned to normal before an operation was performed. Also, no arteriograms were performed during the acute

\(^1\) Gertler MM, Leetma HE, Kostroba BA, Johnson ED: The assessment of insulin, glucose and lipids in ischemic thrombotic cerebrovascular disease. Stroke 6: 77-84, 1975
lateral carotid arterial occlusion presented with some degree of neurological deficit. Dycan and associates demonstrated a 3% incidence of asymptomatic unilateral carotid arterial occlusions in hospital patients over 50 years of age. In the patients presenting with a fixed neurological deficit, it was usually referable to the side of occlusion. In the present series, 11 of 12 patients, (92%), had the deficit referable to the side of the occlusion.

In patients with unilateral carotid arterial occlusion and contralateral stenosis, transient ischemic symptoms can be referable to either hemisphere or be non-localizing. Symptoms referable to the occluded side suggest a low flow state, although embolization from the stump of an occluded internal carotid artery has been reported. Symptoms referable to the stenotic side can be due to either embolization or decreased perfusion.

In considering operative intervention, several authors have suggested that patients with unilateral carotid arterial occlusion and contralateral stenosis are at an increased risk of mortality and neurological morbidity during and following a carotid endarterectomy. Fields and Lemak reported that 43% of patients in this category either expired or had a stroke as the result of surgical intervention. They reported that among randomized patients with unilateral carotid arterial occlusion and contralateral carotid stenosis, 63% of medically treated patients were alive at the end of a 66 month follow-up, whereas only 34% of surgically treated patients were still living. Analysis of their high mortality, however, shows that most of the deaths occurred in patients in whom disobliteration of an occluded internal carotid artery had been tried or in patients operated upon during the acute phase of a stroke. As pointed out previously, we have abandoned both of these procedures. Other authors have reported a low rate of complications in this group of patients. Thompson reported no increase in morbidity or mortality in this select group of patients, but points out that they present special problems since they are at a higher than normal risk. Patterson recently reported on 23 patients with unilateral carotid arterial stenosis and contralateral occlusion. He reported no mortality or morbidity following carotid endarterectomy. In the present series, there was no mortality but an 11% incidence of postoperative strokes. However, as we have become more aware of the high risks in these types of patients, the incidence of neurological deficits has decreased. The last 11 patients have been done with no neurological complications.

Following carotid endarterectomy, 20 of 21 patients were relieved of their transient ischemic symptoms. This suggests that in most cases symptoms can be relieved by increasing total cerebral perfusion via well developed intra-cerebral collateral pathways. Without good collateral pathways, symptoms may persist even after carotid endarterectomy. The one patient in our series who continued to have symptoms after carotid endarterectomy had an ECIC performed on the side of occlusion with good relief of symptoms.

In the follow up period, the patients have not developed any further TIA’s or strokes. This suggests that with at least one patent carotid artery and good collateral pathways, these patients are not at a high risk of developing future strokes. This is in contra-distinction to the group of medically treated patients that Fields and Lemak reported in which 23% of patients developed strokes during a 44
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A month average follow-up period. Fifty percent of these strokes were fatal.

The role of ECIC in patients such as those described above remains undefined. Patients with symptoms referable to the side of the occluded internal carotid artery with poor collateral pathways may benefit from an ECIC on the side of the occlusion prior to doing the carotid endarterectomy on the side of the stenosis. This sequence of operations was suggested by Andersen and co-workers in 1974. They reported doing an ECIC on the side of a totally occluded internal carotid artery prior to doing an endarterectomy of the contralateral stenotic artery. Their patient had no postoperative neurological complications. Our policy in these types of patients is to preoperatively evaluate the competency of the anterior and posterior communicating branches of the circle of Willis and the patency of the vertebral arteries in an attempt to evaluate angiographically the adequacy of the collateral circulation. Also, the stump pressure on the side of the occlusion is measured using the Gee OPG. If a poor collateral situation exists then an ECIC is done on the side of occlusion prior to doing the carotid endarterectomy on the side of stenosis. The one patient in this series that had this sequence of operations did not have any neurological complications and has remained asymptomatic.

An ECIC may also be indicated in patients following carotid endarterectomy on the stenotic side if they continue to have symptoms referable to the side of occlusion. One patient in this series had this sequence of operations and has remained asymptomatic following ECIC. This approach is supported by the work of Sampson and co-workers who followed a group of symptomatic patients with unilateral carotid arterial occlusion who refused an ECIC. Twenty-nine percent of their patients developed strokes.

Whether or not patients with a unilateral carotid arterial occlusion are at increased risk for developing neurological symptoms in the future, thus warranting prophylactic ECIC on the side of the occlusion remains in question. This problem has previously been addressed by Grillo and Patterson. They reviewed the cases of 44 patients with unilateral internal carotid arterial occlusion. Five patients developed strokes in the follow-up period. However, all strokes occurred in the cerebral hemisphere opposite the occlusion. Based on our current limited study where no patients became symptomatic in the follow-up period and based on the work of Grillo and Patterson, it is difficult to justify doing an ECIC on the side of an occluded internal carotid artery in an asymptomatic patient. As pointed out as early as 1970 by Yasargil and co-workers, it may be impossible to solve the complex issues without the benefit of randomized, prospective trials.

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