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THE INTERNAL CAROTID ARTERY WITH CHRONIC COMPLETE OCCLUSION: ANGIOGRAPHIC EVALUATION*

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Abstract

Chronic complete occlusion of the internal carotid artery is usually considered a contraindication to carotid endarterectomy in view of the very low rate of successful reconstruction. Our observation has shown, however, that a certain type of apparent complete occlusion in a small number of patients can be reconstructed with a relatively high rate of success. This particular type of occlusion is associated with a characteristic angiographic appearance. The involved internal carotid artery in these patients appears to be completely occluded about 7-10 mm distal to its origin, as opposed to occlusion exactly at the origin, which is typical for the inoperable complete occlusion. Five cases are reported with this type of potentially correctable occlusion. Successful reconstruction was achieved in three (60%) of these cases. The radiologist and particulary the vascular surgeon should be aware of and be able to recognize this condition so that proper management can be provided whenever indicated. Patho-physiologic explanation for this angiographic phenomenon is discussed.

Introduction

Chronic complete occlusion of the internal carotid artery is usually considered a contraindication to carotid endarterectomy in view of the very low rate of successful reconstruction. Over the years, however, a few reports have given a brighter picture of the subject. Thompson et al[1] reported successful reconstruction in 40.7% of all occluded internal carotid arteries and in 20% of the ones with chronic occlusion. Garamella et al[2] reported a flow restoration rate of 42.8% when all occluded arteries were considered, or a rate of 36% when the cases with recent occlusion for less than 36 hours were excluded. Turnipseed et al[3] were able to restore flow in 55.6% of their arteries with chronic occlusion and in all of their arteries with recent occlusion.

These sporadic optimistic reports, however, still face the vast majority of reports in the carotid surgery literature which are more pessimistic in nature and which give a meagre successful reconstruction rate ranging anywhere from zero to 16%, or which simply consider it to be a futile attempt to try to reopen a chronically occluded internal carotid artery.[4,5,6,7,8,9] How could this discrepancy be explained?

We have made the observation that a certain type of apparent complete occlusion in a small number of patients can be reconstructed with a relatively high rate of success. This particular type of occlusion is associated with a characteristic angiographic appearance. The involved internal carotid artery in these patients appears to be completely occluded about seven to ten millimeters distal to its origin (Fig. 1 and 2), as opposed to occlusion exactly at the origin which is typical for the inoperable complete occlusion.

Materials and Methods

During a three year period, from January 1, 1977 to December 31, 1979, five patients with angiographic evidence of complete occlusion of the internal carotid artery with a patent short proximal stump were evaluated and treated at the Department of Surgery of the Pensacola Educational Program. There were two males and three females ranging in age from 40 to 86 years with an average age of 68 years. All five patients presented with transient ischemic attacks, three with unilateral focal symptoms, one with visual and speech manifestations, and one with syncope. There were a total of six internal carotid arteries which qualified for the study in these five patients, since one of the patients had both of her carotid arteries occluded in a similar fashion. All six carotid arteries were explored and endarterectomy was performed under local anesthesia. Utilizing the method of talking to the patient during the test clamping period as a means of monitoring the cerebral function during carotid clamping, no shunt was required during the carotid clamping in any of these patients. The arteriotomy was extended from the common carotid artery into the internal carotid artery and the endarterectomy was carried out removing the plaques from both internal and external carotid arteries. Following the endarterectomy, a no. 3 Fogarty catheter was passed into the distal portion of the internal carotid arteries as far as it could be advanced

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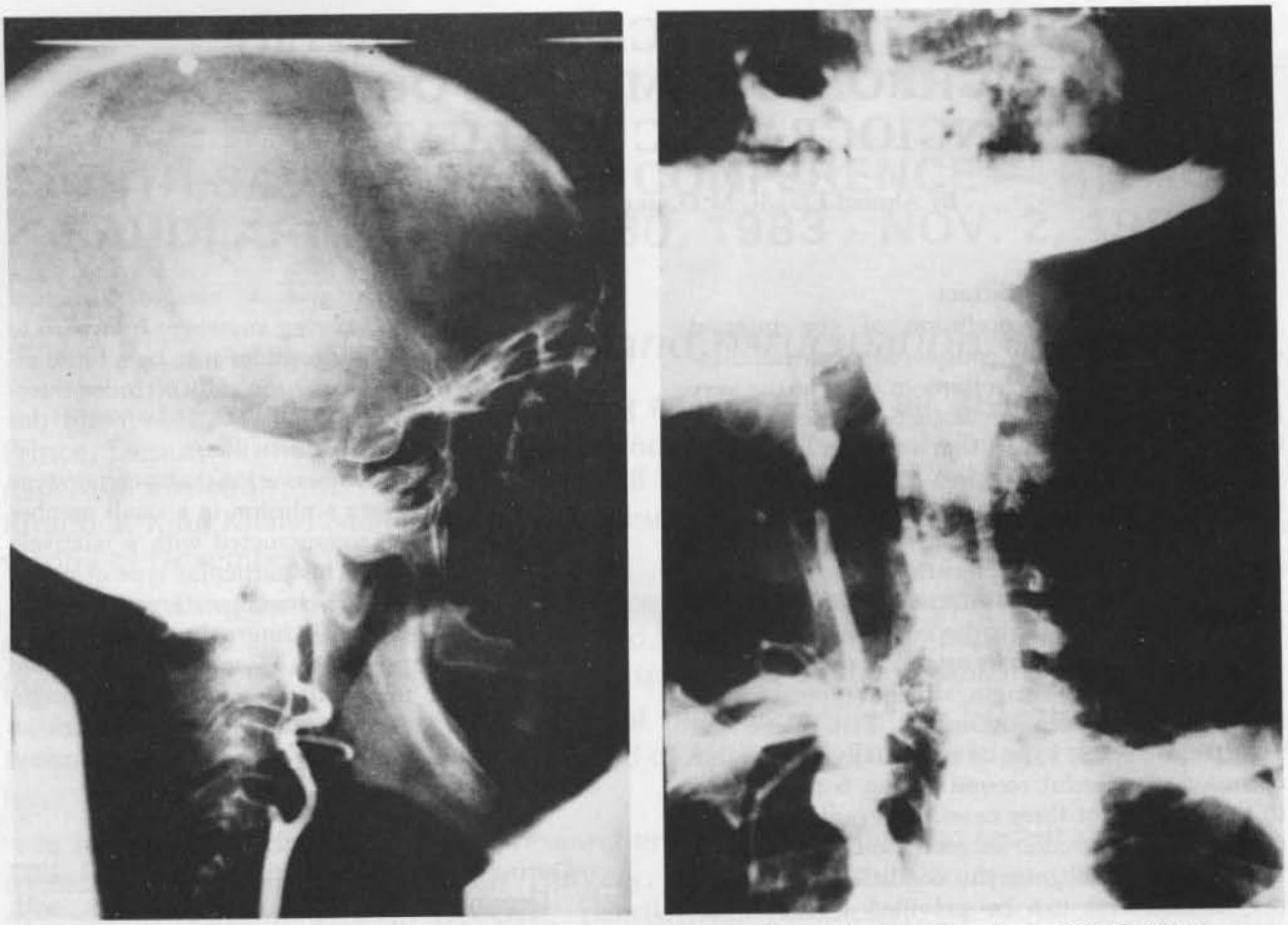

Figure 1 and 2: Angiograms of two patients with occluded internal carotid artery and patent proximal stump.

without extensive pressure, in order to remove any possible residual fresh or organized thrombotic material. The arteriotomy was closed without patch using a running suture of 6-0 prolene. The procedures were performed under systemic heparinization giving 5,000 units of heparin intravenously just prior to the carotid cross clamping.

Results

The endarterectomy could be performed in all cases and excellent back bleeding from the external carotid artery was present in each case. Satisfactory back bleeding from the internal carotid artery indicative of restoration of flow was present in only three carotid arteries in three patients, one of whom was the patient with bilateral occlusion. Although the lumina of the remaining three internal carotid arteries were patent all the way up to the carotid siphon, the lack of back flow indicated the presence of luminal occlusion just beyond the carotid siphon, meaning an unsuccessful restoration of flow. In other words, it was possible to achieve successful restoration of flow in 60% of the patients (three out of five) or 50% of the arteries involved (three out of six). It should also be noted that, in all cases, the procedure resulted in significant improvement of the blood flow through the external carotid artery which, in these patients, is one of the major sources of cerebral blood supply. There was no mortality and no neurologic complication related to the procedure in any of these patients. Various degrees of clinical improvement were documented following the procedure in all of these patients.

Discussion

The internal carotid artery does not normally have any branches between its origin and the base of the skull. In the majority of patients with chronic complete occlusion of the internal carotid artery, the entire extracranial segment of the artery will ultimately become occluded due to the proximal and distal progression of a thrombus which develops in the segment where no flow is present. This thrombus will gradually become organized and will cause fibrosis and obliteration of the extracranial segment of the artery. These pathological changes are the main reason for the unsuccessful restoration of flow in the great majority of internal

carotid arteries with chronic complete occlusion. The presence of a patent portion of the extracranial segment of the internal carotid artery may imply that the occlusion was not complete and that there is still some flow present in the extracranial portion of the artery, or that the occlusion is relatively recent and the stagnating column of blood has not had enough time to become thrombosed and organized. Another possible situation is a real complete occlusion and some residual flow in the extracranial segment of the artery distal to the occlusion due to an aberrant branch of the cervical portion of the internal carotid artery. In cases with complete cessation of flow in the cervical portion of the artery, it is usually a matter of time before the stagnating column of blood thromboses and then becomes organized. As to exactly how much time it takes for this to happen cannot be predicted, and it probably varies from one person to another. It is certain, however, that the longer the complete occlusion lasts, the more likely it is that an irreversible fibrotic obliteration exists.

Garamella et al[2] correlated the high rate of successful reconstruction with the relatively short duration of complete occlusion. They described this period to be not longer than three to four weeks. Turnipseed et al[3] correlated their high rate of successful reconstruction with the presence of symptoms which can be traced to the site of occlusion. This correlation is also quite valid and may imply, among other things, that there is still some flow in the "occluded" artery and that the occlusion is probably not a complete one. It should be noted that an extremely high grade stenosis with only a tiny patent lumen may be easily mistaken for a complete occlusion, not only on angiography, but even during surgical exploration. The tiny lumen may be difficult to visualize, and the flow through such a lumen may have to be maintained only with the higher systemic pressure in an antegrade fashion, and hence no back bleeding may be present through the arteriotomy. Neither Garamella et al[2] nor Turnipseed et al[3] have mentioned anything about a special angiographic feature to look for in these cases with complete occlusion. When we recently reviewed their papers while preparing this manuscript, we were amazed to find that the same unique angiographic appearance, namely the patent proximal stump of the occluded internal carotid artery, which we have been independently observing in our patients, was apparently present in the great majority of their patients. In Garamella's paper, angiograms and one specimen of six of their patients (who could be reopened) were shown. Five of these six had a patent proximal stump. In Turnipseed's paper, angiograms and sonograms were shown of two of their patients with chronic occlusion who had successful restoration of flow. Both of these had the same finding of a patent proximal stump. We feel that this finding further supports our observation that the presence of a patent proximal stump in an internal carotid artery with chronic complete occlusion is associated with a fairly high successful reconstruction rate. It is therefore justified to explore the carotid artery in a symptomatic patient who presents such an angiographic finding.

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