The Hypoglossal Nerve in Carotid Arterial Reconstructions

BY ANTHONY M. IMPARATO, M.D., F.A.C.S.,* ALDO BRACCO, M.D.,† GEUN EUN KIM, M.D.,† AND LOUIS BERGMANN, M.D.,†

Abstract:
The importance of hypoglossal nerve in performing carotid arterial reconstructions has been illustrated by two case reports. Unilateral palsy is troublesome but bilateral damage may result in upper airway obstruction. Simple surgical maneuvers consisting of division of the sternocleidomastoid artery and vein and freeing up of the descendens hypoglossus permit nontraumatic retraction of the nerve, avoiding tongue paralysis.

Additional Key Words
sternocleidomastoid artery and vein
descendens hypoglossus
carotid bifurcation plaques
internal carotid aneurysms
palsy

Carotid arterial reconstructions will undoubtedly be performed with increasing frequency in the light of the published results of the Joint Study of Extracranial Arterial Occlusion,* suggesting that strokes are preventable by prophylactic carotid endarterectomy. Although the technical maneuvers of reconstruction are not complex,⁴-⁶ they must be performed with precision and good exposure. The hypoglossal nerve, because of its intimate relationship to the internal carotid artery, may limit exposure since it crosses the internal carotid artery at various levels in different individuals, from just above the carotid bifurcation to as high as the level of the anterior belly of the digastric muscle. Frequently, in order to visualize the uppermost extent of carotid bifurcation plaques, to deal with internal carotid kinks⁷ or internal carotid aneurysms the hypoglossal nerve may be retracted, resulting in temporary paralysis of one-half of the tongue. Unilateral palsy is merely troublesome, resulting in difficulty with speech, tongue biting during mastication of food, and difficulties in swallowing for as long as four months postoperatively. Bilateral palsy, however, which can be anticipated in view of the frequency of bilateral carotid reconstructions, can pose a life-threatening situation by producing upper airway obstruction. The problem is illustrated by the following case histories.

Case Reports
CASE 1
A 52-year-old man was admitted to the New York University Hospital in 1960 with transient left cerebral dysfunction and bilateral high-grade carotid stenoses. Under local anesthesia, right carotid endarterectomy and roof patch vein angioplasty were performed. The hypoglossal nerve was retracted cephalad and medially because of its low course in the neck. One week later the left side was similarly reconstructed. The patient complained immediately postoperatively of difficulty in breathing except while sitting up with the head anteflexed. Phrenic nerve palsy was ruled out by fluoroscopy of the diaphragms. It was then noted that the patient could only weakly protrude the tongue. For the ensuing four weeks he slept in the upright posture until recovery occurred.

CASE 2
A 64-year-old man was admitted to the New York University Hospital in 1961 with mild right and left brain dysfunction and occlusion of both internal carotid arteries and the right vertebral. Exploration of the right carotid under local anesthesia revealed fibrous organization of thrombus in the internal carotid artery. Flow could not
be restored. The hypoglossal nerve required retraction during the procedure. One week later the left carotid was similarly explored under general anesthesia, with identical findings. The endotracheal tube was removed before the patient was fully awake while in the supine position. Upper airway obstruction occurred immediately. The patient was reintubated and the tube removed only after he was fully awake and able to sit up. It was noted then that the tongue could be only weakly protruded from the mouth. Full tongue recovery subsequently occurred within one month.

In the light of these two observations early in our experience, occurrence of hypoglossal palsy on the first side of anticipated bilateral reconstructions has constituted a contraindication to surgery on the second side until recovery has occurred.

A technique for mobilizing the nerve without injury was found when it was noted that it is prevented from being easily moved cephalad and medially by the descendens hypoglossus as well as by a small artery and a small vein which cross the cephalad surface of the main nerve (fig. 1). The artery is the sternocleidomastoid branch of the external carotid artery which originates on its anterior wall just above the carotid bifurcation, courses almost truly cephalad parallel to its parent vessel and then loops over the hypoglossal nerve at a 90° or smaller angle. The vein is usually just cephalad to the artery and passes between internal and external carotid arteries to reach the internal jugular vein.

Division of these two usually small vessels (fig. 2) with dissection of the descendens hypoglossus to the lowermost extent of the wound permits the hypoglossal nerve to be displaced medially and cephalad by retracting the digastric muscle or the areolar tissue superficial to the nerve, thereby exposing the internal carotid artery.

Since this maneuver has been employed the incidence of hypoglossal palsy has been reduced to less than 1% in the last more than 100 carotid reconstructions performed.

**Discussion**

Attention is drawn to the sternocleidomastoid artery and vein since they appear to be inadequately described in most Anglo-American textbooks of anatomy. Piersal (de. Huber) and a number of German texts described it accurately. Prior to the need for atraumatic surgical exposure of the internal carotid artery and vein, these vessels were often injured by an uncustomized surgical approach.

**FIGURE 1**

Diagrammatic representation of the usually encountered relationship between the sternocleidomastoid artery and vein during carotid endarterectomies.
Division of the sternocleidomastoid artery and vein and mobilization of the descendens hypoglossus permit atraumatic retraction of the hypoglossal nerve.

carotid artery these small vessels were of no apparent surgical importance. At present, awareness of their existence and their proper management may be of considerable importance to the surgeon operating upon carotid arteries.

References
The Hypoglossal Nerve in Carotid Arterial Reconstructions
Anthony M. Imparato, Aldo Bracco, Geun Eun Kim and Louis Bergmann

Stroke. 1972;3:576-585
doi: 10.1161/01.STR.3.5.576

Stroke is published by the American Heart Association, 7272 Greenville Avenue, Dallas, TX 75231
Copyright © 1972 American Heart Association, Inc. All rights reserved.
Print ISSN: 0039-2499. Online ISSN: 1524-4628

The online version of this article, along with updated information and services, is located on the World Wide Web at:
http://stroke.ahajournals.org/content/3/5/576

Permissions: Requests for permissions to reproduce figures, tables, or portions of articles originally published in Stroke can be obtained via RightsLink, a service of the Copyright Clearance Center, not the Editorial Office. Once the online version of the published article for which permission is being requested is located, click Request Permissions in the middle column of the Web page under Services. Further information about this process is available in the Permissions and Rights Question and Answer document.

Reprints: Information about reprints can be found online at:
http://www.lww.com/reprints

Subscriptions: Information about subscribing to Stroke is online at:
http://stroke.ahajournals.org/subscriptions/