
CAROTID BODY TUMOR

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Carotid body tumor is an uncommon neoplasm arising from the carotid bifurcation, and complete surgical resection is the treatment of choice. Most of the tumors generally present a slow growth. Despite slow growth, these tumors enlarge to encase the carotid bifurcation and adjacent cranial nerves. A 57-year-old female was referred to our clinic with a mass in the neck. Neurological examinations revealed no abnormality including the function of the cranial nerves. She underwent preoperative ultrasonography and computerized tomography. The tumor, which arising from carotid bifurcation, was removed. A temporary shunt was not used, because of the absence of noticeable changes in EEG on the carotid compression test. The patient's neurological status was stable after surgery. The results of the surgical treatment of carotid body tumors are successful with a recurrence rate after complete resection of about 5%, and a low incidence of metastatic disease of 1.7-2%. We think that almost every carotid body tumor can be removed with excellent long-term survival and with low incidence of stroke.

Key words: Carotid body tumor

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Carotid body tumor is an uncommon neoplasm arising from the carotid bifurcation, and complete surgical resection is the treatment of choice. The carotid body tumor can be defined as a nonfunctioning paraganglioma¹. Bilateral tumors are described in about 4% of cases with a maximum of 25% in familial manifestation (autosomal dominant mechanism)^{2,3}. Most of the tumors generally present a slow growth. Despite slow growth, these tumors enlarge to encase the carotid bifurcation and adjacent cranial nerves⁴. In addition to the problems related to the local growth, they can show malignant changes from 2-30%, and can metastasize^{4,5}.

CASE REPORT

A 57-year-old female was referred to our clinic with a mass in the neck. Her symptoms were dizziness and syncop, which started six months ago. A hard elastic oval mass smaller than 4 cm in diameter was palpable on the right side of the neck during the last three months. She had hypertension. No vascular bruit or lymph node swelling was evident. Neurological examinations revealed no abnormality including the function of the cranial nerves. A carotid compression test done to determine the possibility of combined

resection of the tumor with the carotid bifurcation revealed no noticeable changes in EEG. She underwent preoperative ultrasonography and computerized tomography. Carotid echo color Doppler revealed a hypervascular tumor originating from the carotid bifurcation (Fig.1,2,3).

SURGICAL TECHNIQUE

The operation was performed under general anaesthesia. A anterior incision to the sternocleidomastoid muscle with a wide preparation of the common carotid artery and then of the external and internal carotid arteries were done. Attention was given not to



Fig.1- Echocolor Doppler of a carotid body tumor showing a solid vascular mass on the right side at the level of the carotid bifurcation. It encircles the external carotid artery almost totally and the internal carotid artery partially, measuring 48x40x30 mm. This vascular mass is mainly perfused by the proximal branches of the external carotid artery. The mass displays the internal carotid artery to anterolateral side, but it does not cause any significant obstruction to the blood flow.

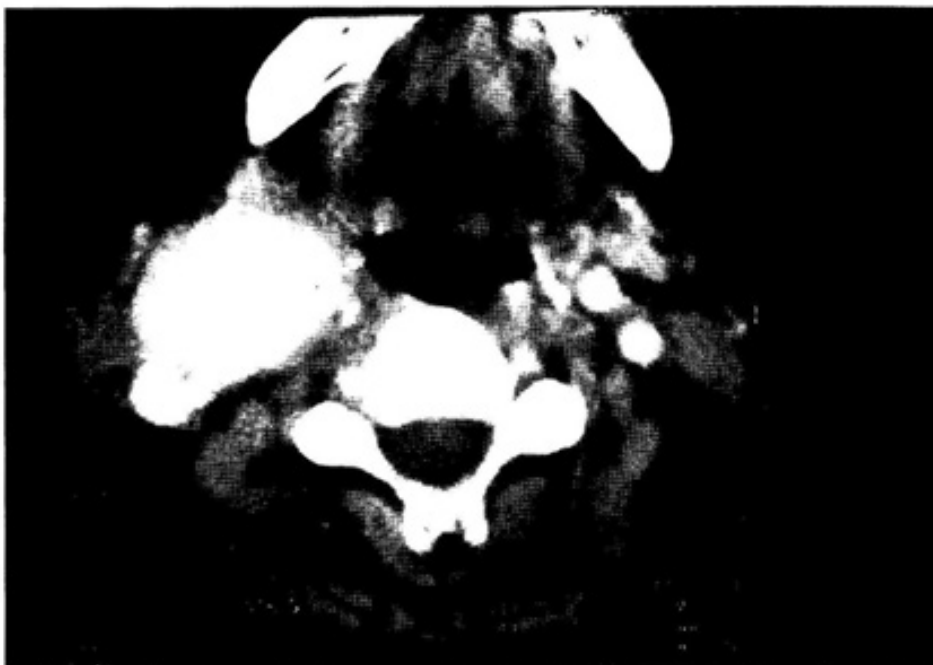


Fig.2- CT scanning of the neck shows that the mass is localized at the right carotid bulb and both internal and external carotid arteries can not be distinguished from the mass.

damage cranial nerves. Because potential bleeding from the tumor during dissection, an autotransfusion system was established. The tumor, which arising from carotid bifurcation, 4x4.5 cm in size, was explored (Fig.4-A). It

had extensive vascular structures, and all the peripheral vascular exisions were ligated and cut. Although it was difficult to remove the entire tumor from the carotid bifurcation, and possible invasion of the tumor into the vessel

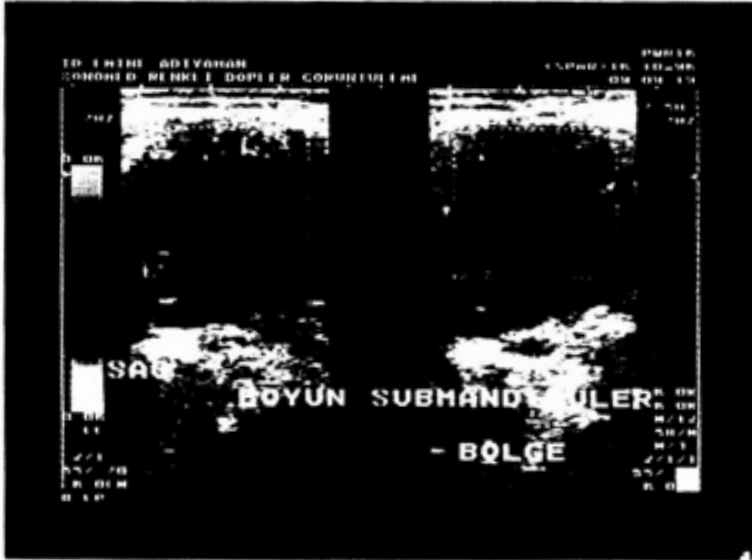


Fig.3- Echo color Doppler, which is performed after CT scanning of the neck with contrast infusion, reveals that the mass is in hypervascular character.

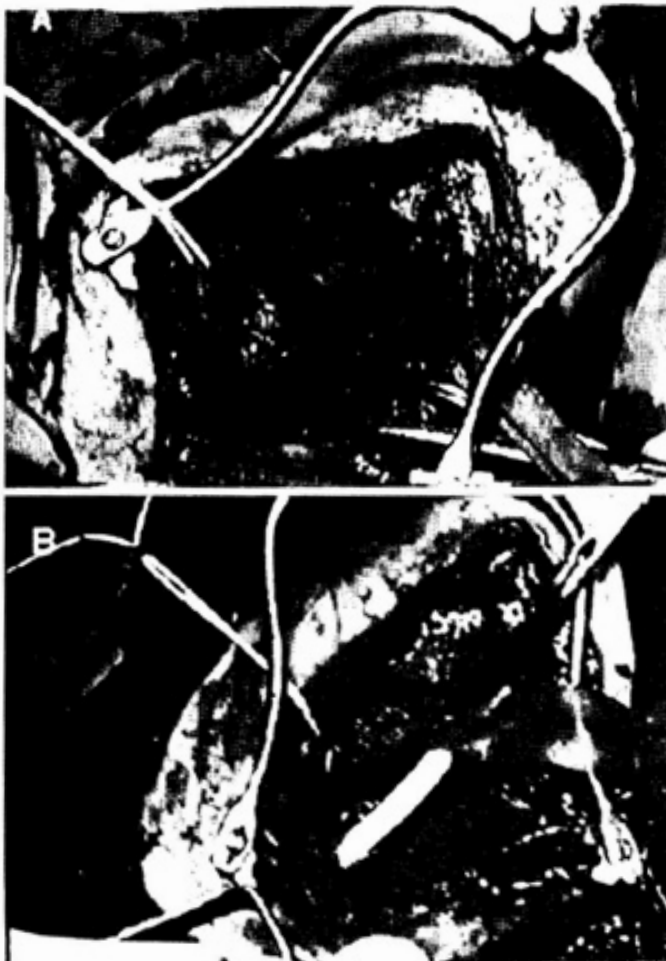


Fig.4- Operative Views.
A- The carotid body tumor is originated from carotid bifurcation.

B- After resection of the tumor a Goro-Tex tubuler graft is anastomozed to the proximal and distal ends of the carotid artery.

wall was suspected, the tumor was completely resected with the carotid bifurcation. A temporary shunt was not used, because of the absence of noticeable changes in EEG on the carotid compression test. After systemic heparinization, proximal anastomosis of the Gore-Tex tubular graft was first performed in end-to-end fashion with 5/0 polypropylene sutures (Fig.4-B). Then distal anastomosis was performed. The common carotid artery occlusion time was 15 minutes. Total blood loss was estimated to be 450 ml, and any blood transfusion was not performed. A Hemovac drain was placed after surgical hemostasis. The patient's neurological status was stable after surgery, and no specific treatment was required. Microscopic examination of the resected specimen revealed a carotid body tumor (Fig.5). Histologically the exuberant growth of paraganglionic cells were identified.

DISCUSSION

Although carotid body tumors may grow slowly and be asymptomatic for many years, they eventually cause symptoms in nearly 75% of patients⁶, such as carotid artery and cranial nerve compression due to local effect. If the tumor has hormonal activity, it may cause headache, palpitation, hypertension, photofobias, swelling and dysrhythmia⁷. The first surgical treatment of the carotid body tumor was performed in the end of the 19th century⁸. During the past 50 years, several trends in the surgical management of cervical paragangliomas have become clear. Instead of only biopsy or partial excision, complete surgical resection is now achieved in nearly all patients⁶. Especially in young patients such as this one, immediate and complete resection of the tumor is indicated because of the higher incidence of malignant manifestations⁹. Currently percutaneous needle or incisional

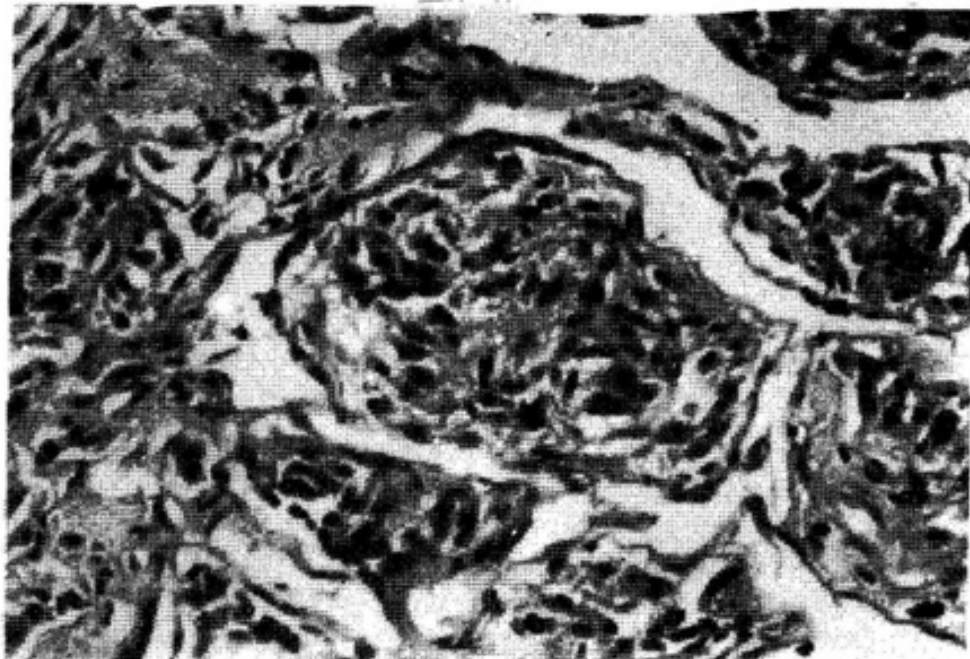


Fig.5- Microscopic view (Hematoxylen-eosin , x400)
The exuberant growth of paraganglionic cells are seen.

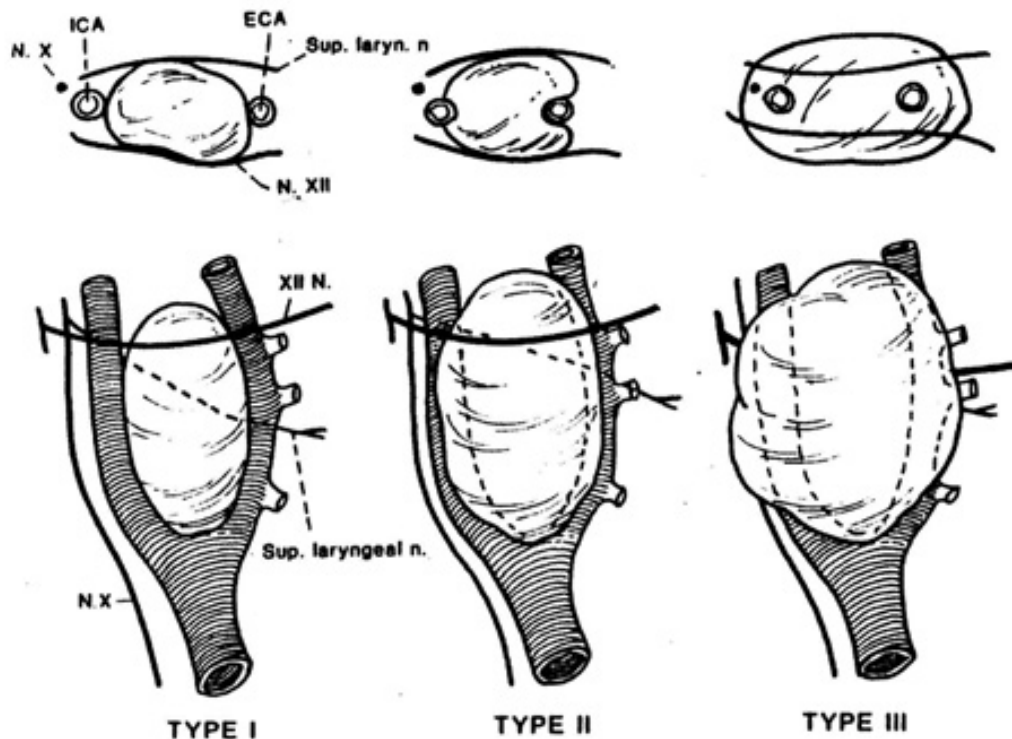


Fig.6- Shamblin classification of difficulty of surgical resection. Group-I tumors are localized and easily resected. Group-II includes tumors adherent or partially surrounding vessels. Group-III paragangliomas intimately surround or encase the vessels. (From Hallett JW et al: J Vasc Surg 7:284-291;1988)

biopsy should be absolutely avoided because of the high incidence of complications⁴. Balfour and Wildner emphasized the difficulty of surgical resection of such tumors¹⁰. Complication rates which include cranial nerve injury, bleeding, carotid artery injury, and stroke have been reported between 10-40%⁶⁻¹¹.

Shamblin classified the tumors the difficulty of surgical resection according to¹² (Fig.6):

type-1: These tumors should be easily resected from the adjacent vessel without significant trauma to the vessel wall or tumor capsula,

type-2: They seem to partially surround the vessel and are much more adherent to the vessel adventitia. Dissection of these tumors should be carried out only by surgeons who are prepared to restore the cerebral circulation if it becomes necessary,

type-3: These tumors are intimately adherent to the entire circumference of the carotid

bifurcation, and surgical resection may be impossible. They can be excised only by completely interrupting the internal carotid circulation, and cerebral circulation must be reestablished by bypass grafting.

If the tumor size smaller than 3-4 cm, it is called small tumor and it can be resected with the surrounding capsula without damaging peripheral vital structure. Surgical exposure is enough from anterior border of sternocleidomastoid muscle. If the tumor is greater than 4-5cm in size, it is called a great tumor. The surgical exposure could be more aggressive such as a T-radical neck incision (Fig.7). During surgical resection, surrounding tissue could be damaged. Preoperative embolisation could be performed to reduce postoperative bleeding. External carotid artery and its branches could be ligated to reduce bleeding during surgical resection⁷.

To minimize cranial nerve injury, tumor dissection could be considered in three anatomic zones⁷ (Fig.8):

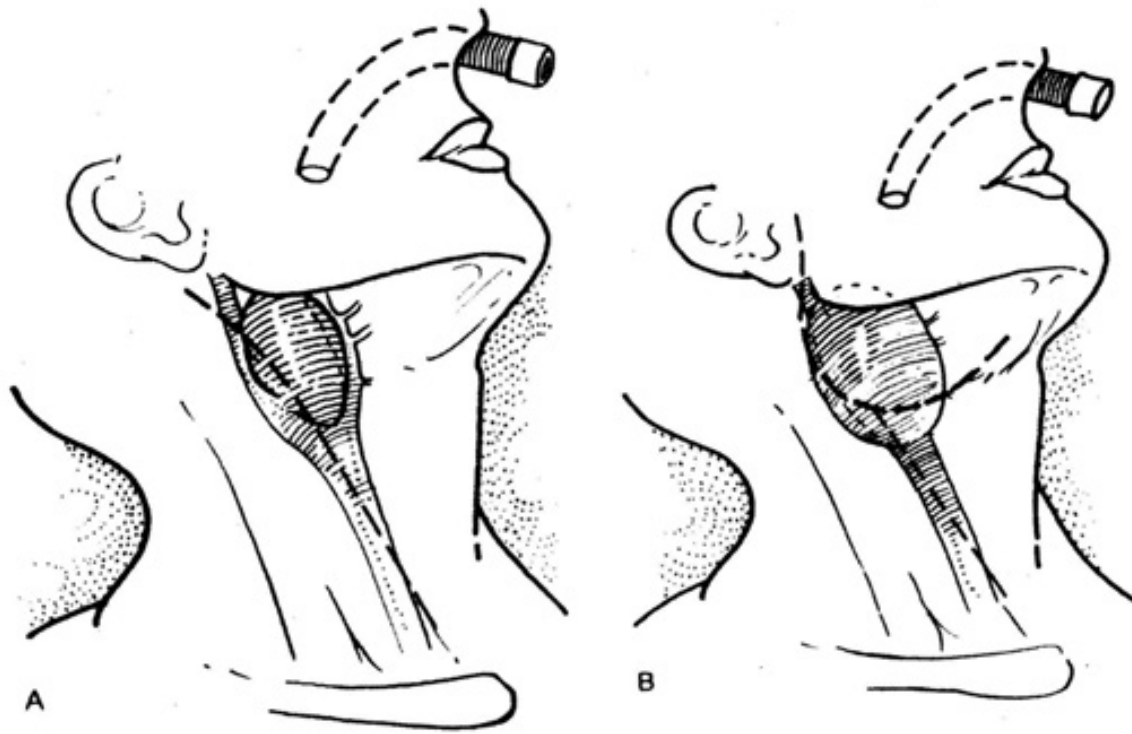


Fig.7- Neck incision for carotid body tumor resection. A nasotracheal tube allows greater displacement of the floor of the mouth during retraction and dissection beneath the mandible. A: Incision for small tumor (<3-4 cm, Shamblin I). B: Incision for medium and large tumors (>4-5 cm, Shamblin II and III). (From Bergen JJ, Yao JST: *Techniques in Arterial Surgery*. WB Saunders Company, Philadelphia, 1990; p 217)

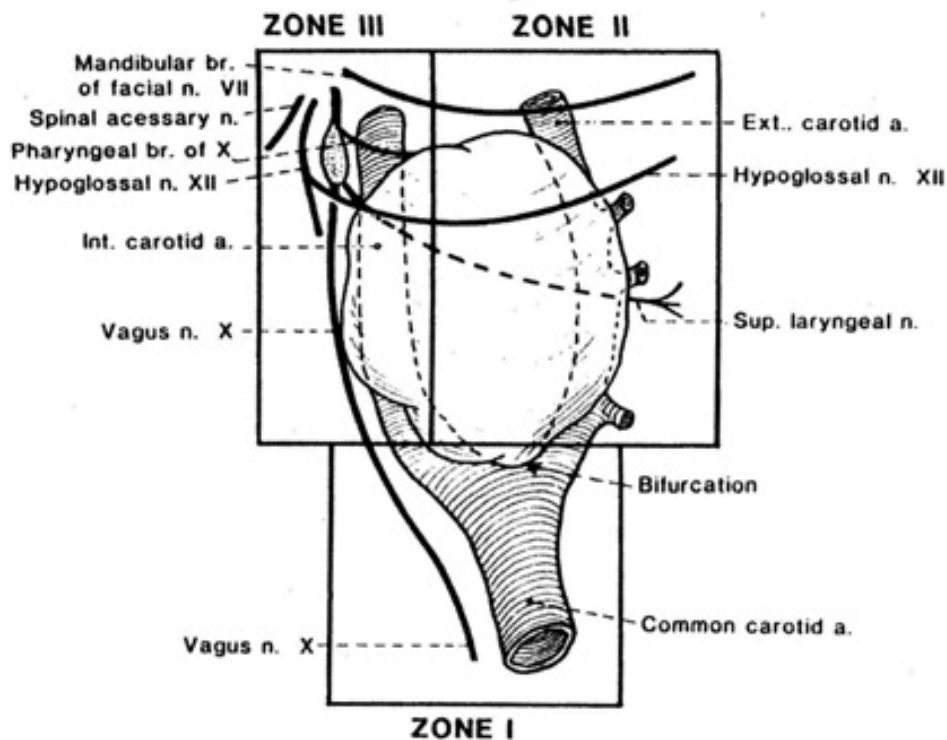


Fig.8- Dissection zones. Most serious neurovascular injuries occur in Zone-3. (From Hallett JW et al: *J Vasc Surg* 7:284-291, 1988)

zone-1: Include the carotid artery bifurcation and adjacent vagus nerve. The vagus nerve can be injured during exposure or clamping of the common carotid artery,

zone-2: Encompasses the external carotid artery territory, the overlying hypoglossal nerve, and the underlying superior laryngeal nerve. The hypoglossal nerve can usually be dissected from the tumor surface. The superior laryngeal nerve can be saved by dissecting right on the tumor surface,

zone-3: Contains the internal carotid artery and confluence of many cranial nerves. Most of the serious neurovascular injuries occur in this crowded zone.

Alternative treatment method is tumor embolization and radiotherapy. Embolization is performed by the introduction of polyvinylalcohol beads into the microvasculature of the paraganglioma and gelfoam into artery branch itself to obliterate the flow^{4,8}. Preoperative embolization reduces the blood circulation and tends to cause a necrosis with reduction of the tumoral size⁴. It reduces tumor bleeding and provides surgical comfort⁸. Even the radiation therapy plays a complementary and limited role; in cases where extirpation is not possible, the radiotherapy can be employed even though the carotid body tumor has a relatively poor radiosensitivity¹³. In our case we have not performed preoperative embolization.

The surgical treatment of the carotid body tumor has three goals:

- 1- for long term survey the tumor must be resected fully,
- 2- to diagnose the tumor digital selective angiography is the most important invasive study, and it has advantage for the planning a preoperative embolization,
- 3- full attention to preserve internal carotid artery during surgical resection, will be reduced postoperative morbidity and mortality.

The result of the surgical treatment of carotid body tumor are successful with a recurrence rate after complete resection of about 5% and a low incidence of metastatic disease 1.7-2%^{14,15}. We think that almost every carotid body tumor can be removed with excellent long-term survival and with low incidence of stroke.

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