Care of the Patient Undergoing Surgical Excision of a Carotid Body Chemodectoma

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ABSTRACT

The carotid body is a small mass of tissue inside the carotid bifurcation that reacts to the body's level of oxygen. In rare cases, the carotid body may develop a tumor known as a chemodectoma or paraganglioma. These tumors can vary in size and, typically, they are benign. Although carotid body tumors usually are painless and slow growing, they may cause a compression syndrome that results in symptoms such as dysphagia.

The treatment of choice for many carotid body tumors is surgical removal, but there are risks involved with resecting these tumors because of their close location to the carotid vessels and cranial nerves. The use of newer imaging modalities to allow earlier detection of carotid body tumors and careful surgical technique can decrease the complications associated with this challenging surgical procedure. *AORN J* 91 (January 2010) 117-128. © AORN, Inc, 2010

Key words: chemodectoma, carotid body tumor, paraganglioma, carotid body, Shamblin's classification.

A chemodectoma or paraganglioma is a rare, usually benign tumor of the chemoreceptor system.[1] Carotid body tumors are among the most common paragangliomas.[2] These hard, solid, usually painless tumors are slow growing and can cause compression syndrome problems, such as dysphagia and hoarseness.[3] These tumors occur primarily in women, followed by men aged 40 to 60 years.[3] In 1891, Felix Jacob Marchand, a German pathologist, provided a report on carotid body tumors that indicated how infrequently they occur, and only approximately 100 cases were reported during the following century.[4]

Carotid body tumors can be confused with other conditions, such as enlarged lymph nodes, brachial cysts, salivary glands, carotid aneurysms,

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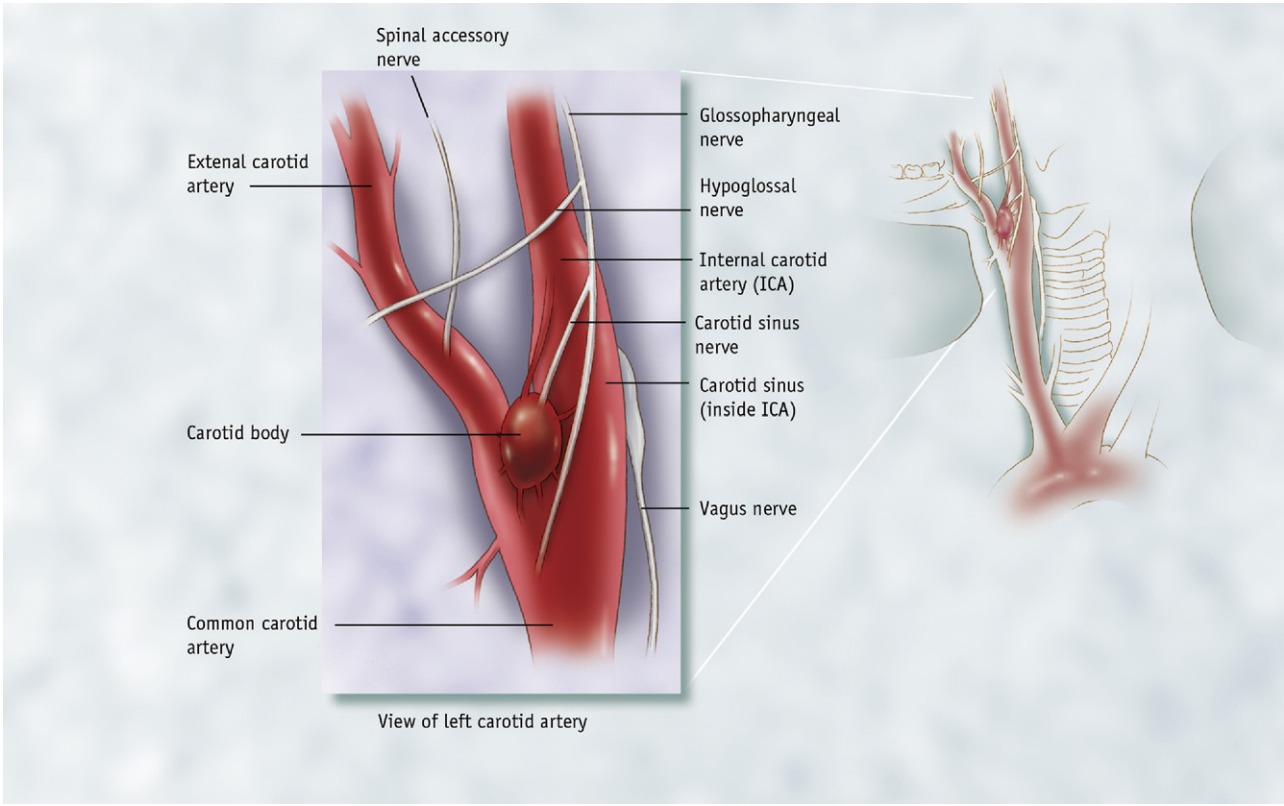


Figure 1. Diagram showing a left-sided view of the anatomy of the carotid structures.

or neurofibromas.[4] A useful clinical sign for distinguishing between a carotid body tumor and these other conditions is Fontaine's sign, in which the tumor usually can be moved laterally but not vertically.[4] Although these tumors are usually benign, Kopfstein reported the first case of lymph node involvement in 1894 and Sapegno reported a case of distant metastases in 1913.[5] Usually, these tumors are treated with careful surgical excision, which sometimes requires arterial resection. To optimize patient outcomes, perioperative nurses need to be aware of the intraoperative and postoperative risks and the potential for life-threatening complications associated with surgical excision of carotid body chemodectomas.

ANATOMY

The anterior cervical region of the neck contains the common carotid artery, which produces the pulse palpated at the side of the neck (Figure 1). The common carotid artery divides into two smaller vessels—the internal and external carotid—forming a structure known as the carotid triangle.[6] In the carotid triangle are two important structures: the carotid sinus and the carotid body.[6] The carotid sinus is located inside the proximal internal carotid artery. It is a baroreceptor that responds to fluctuations in arterial blood pressure.[6] The carotid body is a small mass of tissue (ie, approximately 3 mm by 5 mm in diameter) inside the common carotid artery bifurcation, close to the carotid sinus. It was first identified in 1743 by Albrecht von Haller, a Swiss anatomist and physiologist.[7] The carotid body is a chemoreceptor that responds to low blood oxygen levels by increasing respiration, heart rate, and blood pressure.[6] Carotid body tumors are vascular tumors that develop at the bifurcation of the common carotid artery, where it branches into the internal and external carotid arteries.[8]

DIAGNOSIS

Preoperative diagnostic imaging studies are valuable for demonstrating the relationship between the tumor and the adjoining carotid vessels and for determining the adequacy of cerebral blood flow when the carotid artery is clamped during tumor excision.[7] Diagnosis of a carotid body tumor or chemodectoma usually begins with a color flow duplex scan.[5] Magnetic resonance imaging and magnetic resonance angiography also are useful, especially to evaluate bilateral disease.[5] Arteriography is valuable, especially in larger tumors, and is regarded as the best practice for diagnosis.[5]

TREATMENT OPTIONS

Typically carotid body tumors are slow growing and asymptomatic; therefore, conservative options, such as observation and radiation, may be chosen. Although observation is a nontraumatic treatment, there are still risks involved with this option. The tumor may continue to enlarge, compressing surrounding nerves and structures. This can lead to symptoms such as dysphagia, bradycardia, or dizziness. Radiation also has risks, including redness and soreness of the radiated tissue, dry mouth, dysphagia, changes in taste, or nausea. Radiation therapy usually is recommended only

- for patients who cannot tolerate the surgical procedure,
- for tumors that are unresectable or demonstrate recurrence after a previous resection, or
- in cases of malignancy.[5]

The treatment of choice for many carotid body tumors is surgical removal.[7] There are major risks involved with resecting these tumors because of their close location to the carotid vessels and cranial nerves; these risks increase as the tumor increases in size. Tumors smaller than 5 cm in diameter are associated with a complication rate of 15%; however, tumors with a diameter greater than 5 cm have a 67% complication rate. Thus, tumor size is an important predictor of possible complications.[7] Shamblin's classification system is used to categorize carotid body tumors based on their size and the difficulty of surgical resection, and this system is often used in the plan of care for patients with a carotid body tumor (Table 1).[7] Although surgical resection is usually safe and produces good results, stroke, blood loss, and nerve damage, particularly to those nerves that control the movement of the tongue and vocal cords, are possible risks with this surgery. There is also a risk of recurrence, and follow-up x-rays may be used to screen for this.[9]

TABLE 1. Shamblin's Tumor Classification[1,2]

Type	Size	Placement
I	Small	■ Easy to dissect ■ No arterial wall invasion
II	Medium	■ Can be dissected carefully ■ More intimately attached to the carotid artery
III	Large	■ Requires vascular resection and grafting ■ Invasion of carotid artery

1. Stevens R, Rassekh CH. Carotid body paraganglioma. In: Dr Quinn's Online Textbook of Otolaryngology. *Galveston, TX: University of Texas; 1995. http://www.utmb.edu/otoref/Grnds/carotidbody.htm. Accessed October 1, 2009.*
2. Shamblin WR, ReMine WH, Sheps SG, Harrison EG, Jr. Carotid body tumor (chemodectoma): clinicopathologic analysis of ninety cases. Am J Surg. *1971;122(6):732-739.*

There is some discussion of the use of angiographic embolization to reduce the vascularity of the tumor, thus decreasing blood loss during surgical resections.[4] Some researchers, however, discourage this approach because it seems to cause an inflammatory phase that makes the subadventitial dissection more difficult.[4] "The routine use of preoperative tumor embolization has [also] been questioned because of the potential neurological complications associated with the accidental reflux of particulate matter into the ophthalmic and cerebral circulation."[4(p90)]

PREOPERATIVE ASSESSMENT

In addition to a radiological workup, patients undergoing surgical carotid body tumor resection also need baseline laboratory tests, such as a

TABLE 2. Normal Laboratory Test Values[1–3]

Red blood cells (depends on gender)	4.5 million cells/mcL to 6.1 million cells/mcL
White blood cells	3.5 thousand cells/mcL to 10.5 thousand cells/mcL
Hemoglobin	12.0 g/dL to 17.5 g/dL (depends on gender)
Hematocrit	34.9% to 50% (depends on gender)
Prothrombin time	10.9 seconds to 12.5 seconds
Activated partial thromboplastin time	25 seconds to 35 seconds
International normalized ratio	1 to 2

1. Complete blood cell count. Mayo Clinic. http://www.mayoclinic.com/health/complete-blood-count/MY00476/DSECTION=results. *Accessed October 2, 2009.*
2. Liver function tests: results. Mayo Clinic. http://www.mayoclinic.com/health/liver-function-tests/MY00093/DSECTION=results. *Accessed October 2, 2009.*
3. Partial thromboplastin time. MedlinePlus. http://www.nlm.nih.gov/medlineplus/ency/article/003653.htm *Accessed October 2, 2009.*

complete blood count, comprehensive metabolic panel, prothrombin time, partial thromboplastin time, and an international normalized ratio (Table 2). These blood tests are important preoperatively because many patients with a carotid body tumor may also have other vascular diseases that require the use of anticoagulant therapies and could exacerbate the bleeding risks already associated with carotid body tumor resection.[7] Urinary catecholamine levels are also important because some of these tumors produce catecholamines. An increase in catecholamine levels may cause ventricular arrhythmias and require perioperative alpha- and beta-adrenergic blocker medications (Table 3).[7] Carotid body tumors are highly vascular in nature; therefore, typing and crossing for blood products also may be deemed necessary.

TABLE 3. Normal Catecholamine Laboratory Test Values[1]

Dopamine	65 mcg to 400 mcg/24 hours
Epinephrine	0.5 mcg to 20 mcg/24 hours
Metanephrine	24 mcg to 96 mcg/24 hours*
Norepinephrine	15 mcg to 80 mcg/24 hours
Normetanephrine	75 mcg to 375 mcg/24 hours
Total urine catecholamines	14 mcg to 110 mcg/24 hours
Vanillylmandelic acid	2 mg to 7 mg/24 hours

** Some laboratories cite the range as 140 mcg to 785 mcg/24 hours.*
1. Catecholamines-urine. Medline Plus. http://www.nlm.nih.gov/medlineplus/ency/article/003613.htm. *Accessed October 2, 2009.*

The surgeon or anesthesia care provider may determine that the patient should have a medical cardiac clearance. This is particularly important if the patient has cardiac-related comorbidities (eg, coronary artery disease), which could be exacerbated by general anesthetic agents.

Before surgery, the preoperative nurse assesses the patient for potential risks and lack of knowledge regarding the procedure and postoperative complications. The nurse educates the patient and family members about the surgical procedure and what to expect during the patient's recovery. The nurse identifies factors that may lead to increased intraoperative bleeding, such as the use of anticoagulation medications, and ensures that all team members are aware of these factors.

INTRAOPERATIVE CARE

After reviewing the patient's medical record and assessing the patient in the preoperative holding area, the circulating nurse develops a care plan specific to the patient undergoing carotid body chemodectoma resection (Table 4). The nurse then transports the patient to the OR and helps the patient move onto the OR bed in a supine position. The nurse secures the patient's arms at his or her sides with the palms facing upward and pads bony prominences appropriately to prevent pressure injury. After inducing general anesthesia, the anesthesia care provider carefully rotates the

TABLE 4. Nursing Care Plan for Patients Undergoing Surgical Excision of a Carotid Body Tumor

Diagnosis	Nursing Interventions	Outcome Indicator	Outcome Statement

Ineffective protection	■ Assesses current physiological status and reports variances to appropriate members of the health care team.
	■ Assesses baseline neurological status.
	■ Implements protective measures by
	  ■ reviewing/establishing neurological nursing assessment;
	  ■ obtaining previous diagnostic tests for comparison during the surgical procedure (eg, x-rays, computed tomography scans, magnetic resonance imaging scans, angiograms);
	  ■ monitoring cognition, level of consciousness, orientation to person, place, and time, and the presence of restlessness or agitation;
	  ■ providing hemostatic agents to minimize bleeding; and
	  ■ ensuring the Doppler probe and unit are available and functioning.
	■ Protects the patient from harm caused by equipment, supplies, or positioning specific to neurosurgical procedures.
	■ Evaluates postoperative neurological status throughout the postoperative phase of care.
		■ The patient flexes and extends all extremities at discharge from the OR.
		■ The patient's sensory responses are within expected ranges at discharge from the OR.
		■ The patient's peripheral pulses and Doppler readings are present and equal bilaterally at discharge from the OR.
			■ The patient's neurological status is consistent with or improved from baseline levels established preoperatively.

Acute pain	■ Assesses pain control using a validated pain scale.
	■ Implements pain guidelines by
	  ■ providing care consistent with clinical practice guidelines related to pain assessment and management;
	  ■ reviewing patient assessment for type of pain being treated, medical condition, and health status; and
	  ■ administering medications as prescribed.
		■ The patient verbalizes control of pain.
		■ The patient's vital signs at discharge from the OR are equal to or improved from preoperative values.
			■ The patient demonstrates and/or reports adequate pain control throughout the perioperative period.

TABLE 4. *(continued)* Nursing Care Plan for Patients Undergoing Surgical Excision of a Carotid Body Tumor

Diagnosis	Nursing Interventions	Outcome Indicator	Outcome Statement
Acute pain (Continued)	■ Implements alternative methods of pain control by using diversified activities, therapeutic touch, meditation, breathing, and positioning to augment pain control methods. ■ Assesses the patient's responses to pain management interventions, including physiological parameters and subjective and objective findings.		
Risk for fluid volume imbalance	■ Identifies factors associated with an increased risk for hemorrhage or fluid and electrolyte loss by ■ verifying the patient's preoperative hydration status, height, weight, skin turgor, and pulses; ■ conferring with the physician and/or anesthesia care provider if there are unusual assessment data or if signs or symptoms of fluid, electrolyte, or acid-base imbalances are noted. ■ Monitors physiological parameters, such as ■ measuring intake and output, ■ evaluating serum blood counts and electrolyte levels; ■ evaluating laboratory results specific to fluid balance (eg, hematocrit, blood urea nitrogen, albumin, total protein, serum osmolality, specific gravity); ■ estimating blood and fluid loss by weighing sponges, measuring suctioned output, and summing fluid amounts from drainage devices (wound drains, chest tubes). ■ Obtaining peripheral blood specimen as ordered for monitoring of fluid and electrolyte levels (eg, hematocrit, blood urea nitrogen, protein, sodium, potassium, glucose levels).	■ The patient's blood cell count is within normal limits at discharge from the OR. ■ The patient's blood pressure and pulse are within the expected range and remain stable with position change at the time of transfer to the postanesthesia care unit. ■ The patient's urinary output is within the expected range at discharge from the OR.	■ The patient's fluid, electrolyte, and acid-base balances are consistent with or improved from baseline levels established preoperatively.

TABLE 4. *(continued)* Nursing Care Plan for Patients Undergoing Surgical Excision of a Carotid Body Tumor

Diagnosis	Nursing Interventions	Outcome Indicator	Outcome Statement
Risk for fluid volume imbalance (Continued)	■ Implements hemostasis techniques by ■ ensuring an adequate supply of warm intravenous fluids; ■ providing supplies (eg, sponges, suction containers, suture, hemostatic agents); instrumentation (eg, hemostats); and appropriate surgical techniques (eg, electrosurgery) as needed to control hemorrhage; and ■ applying pressure to bleeding sites as directed. ■ Establishes IV access and maintains peripheral IV access to administer IV fluids, medications, and blood products per physician order. ■ Administers blood product therapy as prescribed by ■ identifying and verifying availability of blood/plasma replacement; and ■ collaborating with the blood bank to ensure the supply of blood/plasma replacement. ■ Evaluates response to administration of fluids and electrolytes.		

patient's head and neck to the nonsurgical side to expose the surgical site. The anesthesia care provider, surgeon, and circulating nurse may place a padded roll horizontally under the patient's shoulders to extend the patient's neck.

This positioning is very similar to the positioning for a carotid endarterectomy, but the need for carotid artery resection cannot always be predicted. Therefore, one of the patient's legs is also prepped in all procedures in case the saphenous vein should be needed for arterial repair.[4] The circulating nurse may insert a urinary drainage catheter and the anesthesia care provider may insert an arterial line according to the surgeon's request. The circulating nurse may place an underbody or lower body thermoregulating blanket over the nonsurgical leg to help prevent hypothermia intraoperatively. Intraoperative electroencephalographic monitoring may also be used during the surgery to help assess cerebral circulation if carotid clamping or vessel replacement is needed.[8]

Many of the supplies and instruments used are similar for both carotid body tumor excision and carotid endarterectomy. Depending on the location in the neck, some carotid body tumor procedures may require a partial dislocation, or sublux-

ation, of the mandible to fully reach the area. Should this need arise, additional otorhinolaryngological supplies and orthopedic instruments may be required based on the surgeon's request (Table 5).

SURGICAL RESECTION

The surgeon obtains surgical exposure via an oblique incision along the anterior border of the sternocleidomastoid muscle, although larger tumors may require a Y-shaped incision.[8] The surgeon uses vessel loops to control the common, internal, and external carotid arteries and then identifies the hypoglossal nerve (ie, cranial nerve 12) and vagus nerve (ie, cranial nerve 10).[4] The hypoglossal nerve controls tongue movement.[6] Injury to the right hypoglossal nerve causes paralysis to the left side of the tongue and vice versa, causing difficulty with word articulation.[6] The vagus nerve controls movement of the voluntary muscles of the larynx, including the vocal cords and superior esophagus. Injury to the vagus nerve causes difficulty with swallowing and speaking.[6] Depending on the severity of the injury, complete paralysis of the vocal cords can occur.[6] In addition to damage to involved cranial nerves, risk of stroke from embolization of loose plaque in the carotid as well as hypovolemia as a result of potential blood loss are possible risks during the surgical procedure. The perioperative nurse should pay close attention to the patient's intraoperative temperature and input and output.

The approach to the carotid bifurcation is similar to that used for a carotid endarterectomy, and the surgeon may chose to insert a shunt device if vessel resection or replacement is necessary.[10] The surgeon then carefully dissects the tumor from the common carotid, often following the subadventitial plane.[7] If the tumor encompasses the internal carotid artery, the involved portion may be removed and replaced with a saphenous interposition vein graft.[4] When the tumor has been removed, the circulating nurse sends it to the pathology department to be evaluated by a pathologist. The surgeon then closes the surgical incision.

TABLE 5. Carotid Body Tumor Resection Preference Card[1]

Basic supplies
Prep set/solution of choice
Sterile drape of choice—often thyroid
Drape for neck and split sheet for leg if saphenous vein is needed
Sterile gowns and gloves*
Medication labels*
Electrosurgical unit (ESU) hand piece* and ESU dispersive pad
Radiolucent 4 × 4 sponges*
Suction tubing and tip*
Sterile light handles*
Sharps holder*
Vessel loops—12 inches
Suture boots
Hemoclips (small and medium)
Bipolar ESU forceps and disposable cord
Valvulotome if performing vein replacement
Carotid shunt (small and large) if placing a shunt
Carotid patch or larger graft if carotid resection is required
Vascular and closing sutures
Intradental wire and wire cutters if mandible subluxation is required
Compressed rayon cotton pledgets or strips and hemostatic agents
Dressings

Instrumentation
Minor vascular instrument set
Major basin set
Minor orthopedic tray available if mandibular joint capsule incision needed

Equipment
Electroencephalograph monitoring equipment and supplies
Doppler ultrasound
Bispectral index (ie, neurophysiological) monitoring device if requested
ESU
Suction unit
Sequential compression device

* *These items may be packed together in several custom packs.*

1. Frim DM, Padwa B, Buckley D, Crowell RM, Ogilvy CS. Mandibular subluxation as an adjunct to exposure of the distal internal carotid artery in endarterectomy surgery. Technical note. J Neurosurg. *1995;83(5): 926-928.*

POSTOPERATIVE CARE

After surgery, the patient is transferred to the postanesthesia care unit and may spend the first postoperative night in the surgical intensive care unit. Later, the patient may need to have a radiological follow-up scan to ensure that the tumor has not recurred; follow-up scanning is performed at one year or earlier, as ordered by the surgeon.

CASE STUDIES

Carotid body chemodectomas are rare, so it was an unusual coincidence that two patients with this condition were seen at the same facility within a three-month period. The first was a 59-year-old white man who presented with a 4-cm Shamblin II right carotid body tumor verified by magnetic resonance imaging and angiography. The patient had no other health problems noted and was a nonsmoker. He reported hoarseness and a large mass in his neck but no other neurological symptoms. A previous attempt by an otorhinolaryngologist to remove the tumor had failed, so the patient was subsequently referred to a vascular surgeon for treatment. During this second surgery, the tumor was completely freed from the carotid arteries without need for artery resection or replacement. Frozen section was performed in the OR suite and revealed no evidence of malignancy. The surgery lasted approximately four hours with an estimated blood loss of 200 mL.

The second patient was a 73-year-old Hispanic woman who presented with a 3.5-cm Shamblin III right carotid body tumor verified by angiography (Figure 2). The patient had no other health problems and was a nonsmoker. She had undergone two previous abdominal surgeries. The patient's major symptom was dizziness. The standard preoperative workup was performed.

The circulating nurse identified the patient using two identifiers and performed a preoperative assessment to evaluate the patient's medical history, including other medical conditions. This patient's body mass index was 30.1 kg/m^2, but she had no other comorbidities. The nurse reviewed the patient's current medication list for any medications that might pose additional risk for surgical complications, such as anticoagulant use. The patient's only medication was a nonsteroidal anti-inflammatory drug.

Figure 2. Angiogram denoting a high carotid body tumor on the right side of the patient's neck.

All of the patient's laboratory test results were within normal limits with the exception of the electrocardiogram, which showed sinus bradycardia rhythm from stimulation of the affected carotid body. The patient confirmed the surgery and the correct side, and the surgeon marked the site. The patient was alert and oriented, denied having pain, and expressed understanding of the surgery with no additional questions. The circulating nurse transported the patient from the preoperative holding area to the OR suite via a stretcher.

With assistance of OR staff members, the patient moved herself from the transport stretcher to

PATIENT EDUCATION

Carotid Body Tumor Resection[1]

What is a carotid body tumor?

A carotid body tumor (CBT) is also called a chemodectoma or paraganglioma. It is a slow growing tumor found in the upper neck between the internal and external carotid artery branches. The tumor is usually painless and usually noncancerous but can cause problems by compressing surrounding tissues. Treatment options are often based on the size of the tumor and symptoms.

What are the signs and symptoms of CBT?

You may not have any symptoms, but you may experience difficulty swallowing, hoarseness, ear pain, or palpitations. Because the tumor presses on the carotid arteries, it is possible that it will loosen plaque in the arteries, which may lead to a stroke.

What are the risk factors of CBT?

Although there are no conclusive risk factors, some families may be more prone to developing carotid body tumors.

What diagnostic tests might be needed?

There are several radiological tests your doctor may order such as color flow duplex scanning, magnetic resonance imaging (MRI), magnetic resonance angiography, and arteriography.

What are my treatment options?

Depending on the size and symptoms of your tumor, your doctor may decide to treat you with observation, but most often, surgical resection is recommended, sometimes with radiation. In some cases, your doctor may also recommend a procedure called transcatheter embolization in which your doctor may try to stop or reduce the blood supply to the tumor by injecting medication into the area a few days before your surgery. Depending on the size of the tumor and its invasion of the surrounding arteries, it may be necessary to remove part of the carotid artery with the tumor. In this case, your surgeon may use a synthetic graft or a vein from your leg to replace the removed area.

Are there risks to surgical resection?

Although surgical resection is usually safe and produces good results, it also has risks. Stroke, blood loss, and nerve damage, particularly to those nerves that control the movement of the tongue and vocal cords, are possible risks with this surgery. There is also a risk of recurrence, and you might need to have follow-up x-rays to screen for this.

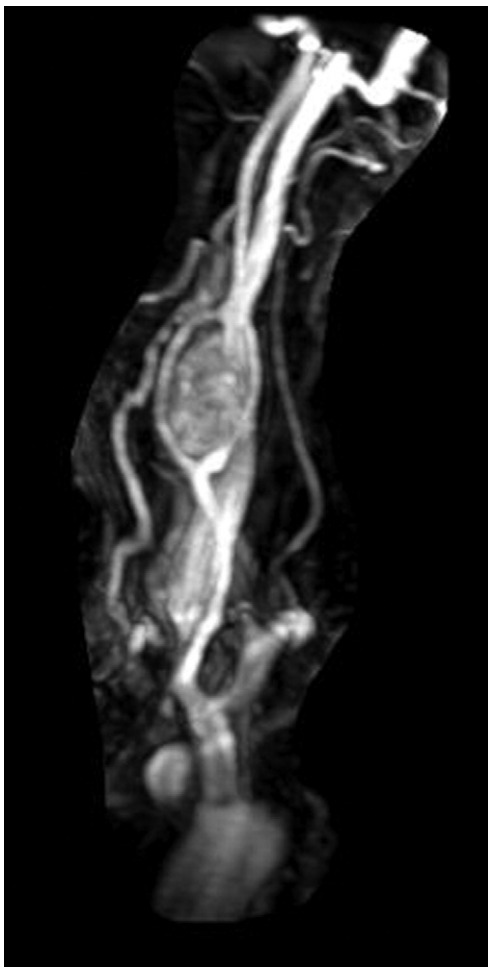
What is the postoperative care after surgery for CBT?

Recovery is usually rapid. Depending on the extent of the resection, you may spend the first night in the intensive care unit and may go home the next day. There is usually some pain to the neck, and your doctor will recommend the best pain medication for you. There may also be mild swelling and bleeding at the surgical site. Be sure to contact your doctor if you have questions.

Call your doctor immediately if you experience any of the following complications:

- excessive bleeding or swelling to surgical site;
- sudden numbness or weakness, especially on one side of your body; or
- confusion; dizziness; or difficulty speaking seeing, breathing, or walking.

[1]Carotid body tumors. The Cleveland Clinic. *http://my.clevelandclinic.org/heart/disorders/vascular/carotid_body_tumors.aspx*. Accessed October 2, 2009.



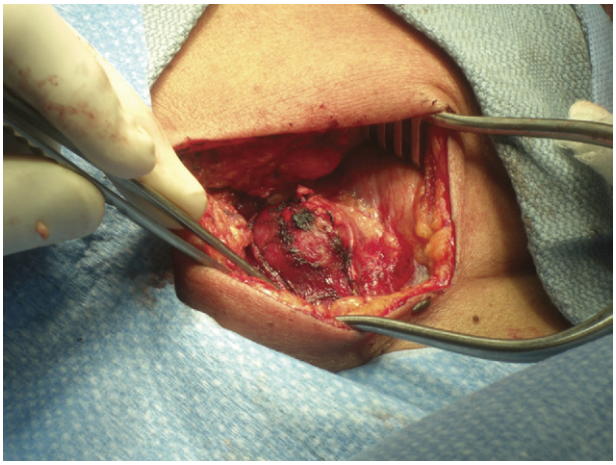


Figure 3. Dissection of the soft tissue, exposing the carotid body tumor.

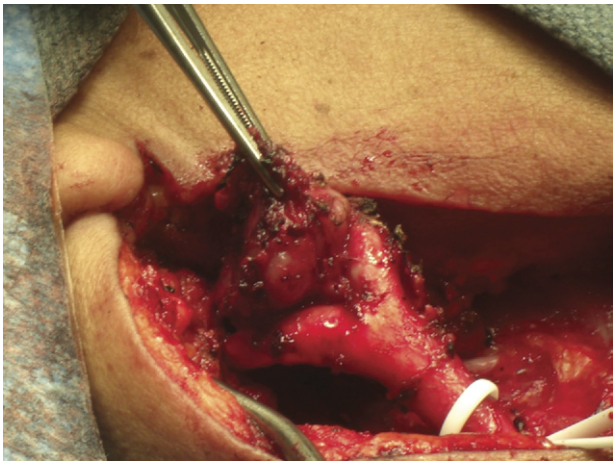


Figure 4. The tumor after it is released from the internal carotid but is still encompassing the external carotid.

the OR bed. The circulating nurse placed her in a supine position with arms padded and tucked to her sides. After intubation, the surgeon, anesthesia care provider, and circulating nurse placed a shoulder roll. The anesthesia care provider turned the patient's head to her left side, exposing the surgical site. The circulating nurse inserted a urinary drainage catheter, and the anesthesia care provider inserted a radial arterial line. All team members participated in a surgical time-out to verify the patient's identify, position, type of surgery to be performed, surgical site, antibiotic administration, and availability of all necessary equipment and images.

The surgeon dissected down to the carotid body tumor (Figure 3). Using bipolar cautery, the surgeon completely freed the tumor from the internal carotid artery (Figure 4); arterial resection or replacement was not required. The surgeon did, however, have to ligate some branches of the external carotid artery because they were embedded in the tumor (Figure 5). The circulating nurse sent the tumor to the OR laboratory for frozen section, which revealed no evidence of malignancy (Figure 6). The surgery lasted approximately three-and-a-half hours with an estimated blood loss of 100 mL. No evidence of stroke or damage to the surrounding nerves was noted. After the initial recovery, the patient was transferred to the surgical intensive care unit and discharged home the next day. The patient was seen in the surgeon's office for follow-up one week after surgery. The patient was stable with her bradycardia resolved and no signs of postoperative stroke or nerve damage.

CONCLUSIONS

Although it was said as early as 1917 that "these curious little tumors have been dissected, studied, and described . . . ,"[5(p823)] there is more to learn. In the past, many physicians believed carotid

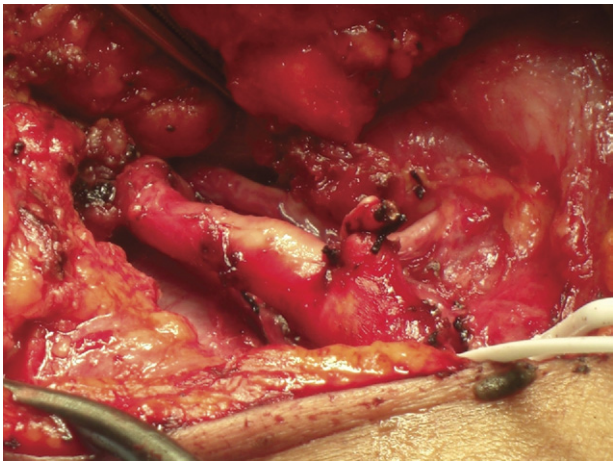


Figure 5. The carotid structures after the tumor is removed and the external carotid branch is ligated.

Figure 6. After the blood supply is removed, the tumor shrinks in size. It is then evaluated by the pathology laboratory for malignancy status.

body tumors to be malignant, so they recommended aggressive surgical resection.[4] As these tumors were studied more, it was determined that they were slow growing and usually benign, but because of the high risk of damage to the surrounding nerves, it was recommended that these tumors be carefully observed rather than surgically removed.[4] Currently, many surgeons believe that carotid body tumors should be removed in all patients for whom the surgery is deemed appropriate and safe.[4] "The increasing use of newer imaging modalities, particularly duplex scanning, may allow earlier detection of carotid body tumors and hence safer operations."[4(p91)] These techniques, paired with the use of electroencephalographic monitoring, careful surgical technique, and possibly perioperative embolization, have greatly decreased the complications of this challenging surgical procedure.[10] Now, these patients have risks similar to those of patients undergoing carotid endarterectomy. Most patients with a carotid body tumor have a short hospital stay and few complications. Yearly follow-up may be necessary for early identification of recurrence, but because of the slow growth of these tumors, additional surgical interventions should be few. AORN

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EXAMINATION

CONTINUING EDUCATION PROGRAM

2.9 CE

Care of the Patient Undergoing Surgical Excision of a Carotid Body Chemodectoma

PURPOSE/GOAL

To educate perioperative nurses about caring for patients undergoing surgical excision of a carotid body chemodectoma.

OBJECTIVES

1. Describe carotid artery anatomy.
2. Explain the pathophysiology of carotid body tumors.
3. Discuss options for diagnosing carotid body tumors.
4. Identify treatment options for carotid body tumors.
5. Describe the surgical procedure for resecting carotid body tumors.
6. Discuss perioperative nursing care of patients undergoing carotid body tumors resection.

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QUESTIONS

1. The carotid body
   1. can affect respiration, heart rate, and blood pressure.
   2. is a baroreceptor that responds to fluctuations in arterial blood pressure.
   3. is a chemoreceptor that responds to low blood oxygen.
   4. is located inside the common carotid artery bifurcation.
   5. is located inside the proximal internal carotid artery.

   a. 2 and 4 *b.* 3 and 5
   c. 1, 3, and 4 *d.* 1, 2, and 5

2. Carotid body tumors
   1. are vascular tumors.
   2. are usually painless and slow growing.
   3. can cause compression syndrome problems (eg, dysphagia, hoarseness).
   4. originate from the ganglionic cells of the intimal layer of the aortic arch.

   a. 1 and 3 *b.* 2 and 4
   c. 1, 2, and 3 *d.* 1, 2, 3, and 4

3. A useful clinical sign for distinguishing between a carotid body tumor and other conditions is
   a. Fontaine's sign.
   b. Moro's reflex.

c. parachute reflex.
d. Babinski's sign.

4. Carotid body tumors can be diagnosed with
1. an arteriography.
2. a color flow duplex scan.
3. a biopsy.
4. a magnetic resonance angiography.
5. a magnetic resonance imaging scan.
a. 1 and 3 *b.* 2, 3, and 5
c. 1, 2, 4, and 5 *d.* 1, 2, 3, 4, and 5

5. Treatment options for carotid body tumor include
1. observation.
2. surgical removal.
3. chemotherapy.
4. radiation.
a. 1 and 3 *b.* 2 and 4
c. 1, 2, and 4 *d.* 1, 2, 3, and 4

6. A CBT that can be dissected carefully but is more intimately attached to the carotid artery is classified as a Shamblin type
a. I *b.* II
c. III *d.* IV

7. The preoperative nurse should be aware of an increased risk of ventricular arrhythmias requiring perioperative alpha- and beta-adrenergic blocker medications if preoperative laboratory results indicate an increase in _____ levels.
a. catecholamine *b.* cortisol
c. hematocrit *d.* insulin

8. Intraoperative electroencephalographic monitoring may be used during surgery if
a. the patient had neurological compromise preoperatively.
b. carotid clamping or vessel replacement is needed.
c. surgery is anticipated to last longer than four hours.

9. The circulating nurse should anticipate the possible need for orthopedic instruments if the surgeon must perform a partial dislocation of the mandible.
a. true *b.* false

10. Possible risks of surgery include
1. hypovolemia.
2. hypoglossal nerve injury.
3. stroke.
4. vagus nerve injury.
a. 1 and 3 *b.* 2 and 4
c. 1, 2, and 3 *d.* 1, 2, 3, and 4

The behavioral objectives and examination for this program were prepared by Rebecca Holm, RN, MSN, CNOR, clinical editor, with consultation from Susan Bakewell, RN, MS, BC, director, Center for Perioperative Education. Ms Holm and Ms Bakewell have no declared affiliations that could be perceived as potential conflicts of interest in publishing this article.

LEARNER EVALUATION

CONTINUING EDUCATION PROGRAM

2.9 CE

Care of the Patient Undergoing Surgical Excision of a Carotid Body Chemodectoma

This evaluation is used to determine the extent to which this continuing education program met your learning needs. Rate the items as described below.

OBJECTIVES

To what extent were the following objectives of this continuing education program achieved?

1. Describe carotid artery anatomy.
   Low 1. 2. 3. 4. 5. High
2. Explain the pathophysiology of carotid body tumors.
   Low 1. 2. 3. 4. 5. High
3. Discuss options for diagnosing carotid body tumors.
   Low 1. 2. 3. 4. 5. High
4. Identify treatment options for carotid body tumors.
   Low 1. 2. 3. 4. 5. High
5. Describe the surgical procedure for resecting carotid body tumors.
   Low 1. 2. 3. 4. 5. High
6. Discuss perioperative nursing care of patients undergoing carotid body tumor resection.
   Low 1. 2. 3. 4. 5. High

CONTENT

7. To what extent did this article increase your knowledge of the subject matter?
   Low 1. 2. 3. 4. 5. High
8. To what extent were your individual objectives met? *Low 1. 2. 3. 4. 5. High*
9. Will you be able to use the information from this article in your work setting? *1. Yes 2. No*
10. Will you change your practice as a result of reading this article? (If yes, answer question #10A. If no, answer question #10B.)

10A. How will you change your practice *(Select all that apply)*

1. I will provide education to my team regarding why change is needed.
2. I will work with management to change/implement a policy and procedure.
3. I will plan an informational meeting with physicians to seek their input and acceptance of the need for change.
4. I will implement change and evaluate the effect of the change at regular intervals until the change is incorporated as best practice.
5. Other: _____

10B. If you will not change your practice as a result of reading this article, why? (Select all that apply)

1. The content of this article is not relevant to my practice.
2. I do not have enough time to teach others about the purpose of the needed change.
3. I do not have management support to make the change.
4. Other: _____

11. Our accrediting body requires that we verify the time you needed to complete this 2.9 continuing education contact hour (174-minute) program: ___

This program meets criteria for CNOR and CRNFA recertification, as well as other continuing education requirements.

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Event: #10004; **Session:** #2116 **Fee:** Members $14.50, Nonmembers $29

The deadline for this program is January 31, 2013.

A score of 70% correct on the examination is required for credit. Participants receive feedback on incorrect answers. Each applicant who successfully completes this program will be able to print a certificate of completion.