



Complications associated with carotid body tumor excision

Karotis cisim tümörü eksizyonu ile ilişkili komplikasyonlar

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ABSTRACT

Background: This study aims to evaluate associated complications of carotid tumor excisions and outcomes.

Methods: Between January 2013 and April 2016, a total of 29 patients (2 males, 27 females; mean age 55.2±4.4 years; range, 17 to 76 years) were operated with the preliminary diagnosis of a carotid body tumor. According to the Shamblyn classification of carotid body tumors, 12 patients were type 1, 13 patients were type 2, and four patients were type 3.

Results: Main symptoms were dizziness, pain in the neck area, tinnitus, and headache. Headache was the most common symptom among them. Neurological and surgical complications developed in 10 patients (34.4%). Of operated patients, dysphagia developed in three (8.7%), facial hemiparesis in two (6.8%), hemorrhage in two (6.8%), hematoma-related respiratory distress in one (3.4%), left hemiparesis in one (3.4%), and transient bradycardia in one (3.4%). The patient who had respiratory distress associated with bleeding following extubation was reoperated. In the patients with facial and left hemiparesis, paresis was transient. Dysphagia also resolved in the subsequent follow-up outpatient visits. None of the patients experienced a permanent complication.

Conclusion: Surgical excision is the most appropriate choice of treatment in carotid body tumors, and postoperative complications can be minimized through careful dissections and retractions. A special attention should be paid to nerve-preserving surgery.

Keywords: Carotid body tumors; complications; excision.

ÖZ

Amaç: Bu çalışmada karotis cisim tümörü eksizyonları ile ilişkili komplikasyonlar ve sonuçları değerlendirildi.

Çalışma planı: Ocak 2013 - Nisan 2016 tarihleri arasında karotis cisim tümörü ön tanısı ile toplam 29 hasta (2 erkek, 27 kadın; ort. yaş 55.2±4.4 yıl; dağılım 17-76 yıl) ameliyat edildi. Shamblyn karotis cisim tümörü sınıflamasına göre, 12 hasta tip 1, 13 hasta tip 2 ve dört hasta tip 3 idi.

Bulgular: Başlıca semptomlar baş dönmesi, boyun bölgesinde ağrı, kulak çınlaması ve baş ağrısı idi. Bu semptomların en sık görüleni baş ağrısı idi. On hastada (%34.4) nörolojik ve cerrahi komplikasyonlar gelişti. Ameliyat edilen hastaların üçünde (%8.7) yutma güçlüğü, ikisinde (%6.8) fasiyal hemiparezi, ikisinde (%6.8) kanama, birinde (%3.4) hematoma ile ilişkili solunum sıkıntısı, birinde (%3.4) sol hemiparezi ve birinde (%3.4) geçici bradikardi gelişti. Ekstübasyon sonrası kanama nedeniyle solunum sıkıntısı olan bir hasta tekrar ameliyata alındı. Fasiyal ve sol hemiparezili hastaların parezi durumları geçici idi. Yutma güçlüğü de, takip eden poliklinik kontrollerinde düzeldi. Hiçbir hastada kalıcı komplikasyon görülmedi.

Sonuç: Cerrahi eksizyonun en uygun tedavi seçeneği olduğu karotis cisim tümörlerinde ameliyat sonrası komplikasyonlar, dikkatli diseksiyonlar ve ekartasyonlar ile en aza indirgenebilir. Özellikle sinir koruyucu cerrahiye dikkat edilmelidir.

Anahtar sözcükler: Karotis cisim tümörleri; komplikasyonlar; eksizyon.

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Carotid bodies (Carotid glomus) tumors originate from the paraganglionic chemoreceptors at the bifurcation of the carotid artery, are usually benign in character, and were first described in 1891 by Marchand.^[1] Diagnosis is usually delayed because of the slow growth nature of the tumor and because of the absence of a unique complaint. Diagnosis is usually made incidentally in patients who are subjected to ultrasonography (US) of the head and neck for some other reason. These tumors, which are observed in the vascular nerve bundle of the neck region, should be surgically excised at an early stage after diagnosis due to compression or invasion of adjacent vascular structures and nerves. The Shamblin classification is used for planning of the pre-excisional surgery of these tumors.^[2] Type 1 tumors are in close proximity to large blood vessels (Figure 1); type 2 tumors must have begun to wrap around large blood vessels (Figure 2); type 3 tumors show blood vessels in the tumor and these vessels are completely surrounded by the tumor (Figure 3). This classification is important because surgical excision can be difficult in Shamblin type 3 and carotid artery graft interposition may be required. The anatomical characteristics of neighboring vascular and neural structures during the removal of these tumors should be well known and particular care should be taken for these structures. The vagus nerve (N), hypoglossal N, facial N, recurrent N, glossopharyngeal N, and the jugular vein are within these structures and are adjacent to the tumor. Some complications may be observed when performing tumor excision, due to excessive strain during injury,

cauterization or retraction of these nervous structures. Complications such as facial paralysis, bradycardia, nasolabial sulcus erosion, dysphagia, blood pressure irregularities, and heart rhythm disorders can be observed. Bleeding and hematoma may occur due to intense vascular texture of the tumor. Bleeding and hematoma can cause respiratory distress and even difficult intubation, especially after extubation. In this study, neurological and surgical complications of patients who underwent surgery in our clinic due to carotid glomus tumor were evaluated.

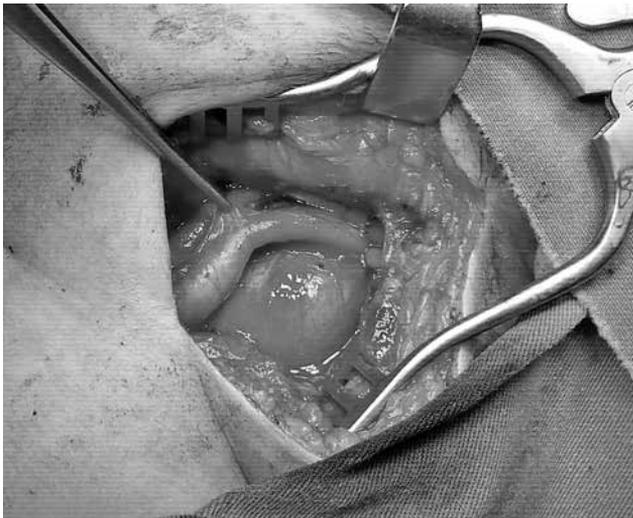


Figure 1. Shamblin type 1 (Mass is in close proximity with vessel).



Figure 2. Shamblin type 2 (Mass has started surrounding the vessels).



Figure 3. Shamblin type 3 (Mass has completely surrounded the vessels).

Table 1. Clinical and demographic characteristics of patients (n=29)

Variable	n	%	Mean±SD
Mean age (year)			55.2±4.4
Gender			
Male	2		
Female	27		
Mean Body Mass Index			2.1±1.01
Mean mass size (cm ²)			4×4.5±1.2
Hypertension	16	55.1	
Diabetes mellitus	13	44.8	
Ejection fraction (%)			55±5.2
Bleeding volume (mL)			580±150
Extubation time (h)			2.4±1.4
Mean stay at intensive care unit (days)			1.2±1.1
Preoperative hemoglobin level (gr/dL)			13±1.4
Preoperative international normalized ratio			1.2±0.2
Preoperative platelet level			230.000±40.000

SD: Standard deviation.

PATIENTS AND METHODS

A total of 29 patients (2 males, 27 females; mean age 55.2±4.4 years; range of 17 to 76 years), underwent surgery between January 2013 and April 2016 with a preliminary diagnosis of carotid body tumor. The study protocol was approved by the Ethics Committee of the Medicine Faculty of Yüzüncü Yıl University. The study was carried out in accordance with principles of the Declaration of Helsinki. Ten (34.4%) of the 29 patients had a mass on the right side, whereas the mass was on the left side in 19 (65.6%) of the patients. Headache was the main symptom reported by the patients, who also had symptoms such as dizziness, neck pain, and tinnitus. Physical examination of the patients revealed a non-mobile, hard, and non-pulsating mass on the middle upper side of the neck, below the sternocleidomastoid muscle. The size of the mass ranged from 2×3 cm² to 7×6 cm² with a mean of 4×4.5±1.2 cm². Cardiology consultation was performed for all patients older than 45 years. Coronary angiography was performed in eight patients. Type 2 diabetes mellitus was present in 13 patients (44.8%), hypertension in 16 patients (55.1%), concomitant peripheral arterial disease in two patients (6.8%) and coronary artery disease in three patients (Table 1). The diagnosis of the patients was confirmed by magnetic resonance (MR) angiography after a previous neck US. Carotid artery stenosis was not detected in any of the patients on Doppler US or MR imaging (MRI). Classification of the tumor was performed following MRI. Shamblin carotid body tumor classification was reported as type 1 in 12 patients, type 2 in 13 patients, and type 3 in four patients (Table 2). After surgery all patients were

transferred to the intensive care unit (ICU) in intubated conditions. The mean duration of stay in the ICU was 1.2±1.1 days.

RESULTS

Various neurological and surgical complications developed in 10 of the patients (34.4%). Of these 10 patients, dysphagia developed in three (8.7%), facial hemiparesis in two (6.8%), hemorrhage in two (6.8%), hematoma followed by respiratory distress in one (3.4%), left hemiparesis in one (3.4%), and transient sinus bradycardia in one (3.4%) (Table 3). One patient was taken in for reoperation due to respiratory distress

Table 2. Distribution of tumor types according to Shamblin classification

	Female	Male	Total	
	n	n	n	%
Type 1	10	2	12	41.3
Type 2	13	-	13	44.8
Type 3	4	-	4	13.9

Table 3. Complication in the patients

Complication	n	%
Dysphagia	3	10.3
Facial hemiparesis	2	6.8
Bleeding	2	6.8
Hematoma	1	3.4
Left hemiparesis	1	3.4
Sinus bradycardia	1	3.4

following the development hematoma associated with bleeding after extubation. In another patient, an injury of the bifurcation site during the operation resulted in 1,200 mL of bleeding. Bleeding was kept under control with a 6/0 proline suture. A mean of 580 ± 150 mL of bleeding was reported during the operation in all of the patients. The condition of patients with facial and left-sided hemiparesis was found to be temporary. Patients with dysphagia recovered from this condition during their outpatient clinical follow-up. The patient with sinus bradycardia (heart rate: 35/min) was extubated on the first postoperative day after the heart rate returned to normal ranges (heart rate: 78/min). None of the patient who was discharged was reported to have permanent injury during the follow-up. Results of the histopathological examinations of the patients revealed benign paraganglioma.

DISCUSSION

Paraganglia are found in various parts of the body and provide autonomic control of the cardiovascular system via chemoreceptors. Paraganglionic cells are structures that help in autonomic control by detecting blood pressure levels, and the levels of oxygen (O_2) and carbon dioxide (CO_2) in the blood.^[3] Although there is no definite record of a genetic background, the majority of these tumors with a familial transmission, are benign in character. Only 3-7% of the cases have a malignant characteristic.^[4]

These tumors were first described in 1891 by Marchand, and are more common in women than in men.^[5] Results of our study show that the rate of female patients was significantly higher, which is consistent with the studies in the literature. Of the 29 patients 27 (93.1%) were female, while two (6.9%) were male. Although carotid glomus tumors can be seen at all ages, they occur predominantly at the age of 30 and 40 years.^[6] The age distribution of patients who were included in our study varied between 27 and 77, with a mean age of 54.2 ± 3.4 for females and 65 for males.

Signs and symptoms of carotid glomus tumors are detected late at diagnosed due to the slow growing nature of the tumors. They can cause pressure and regional pain to surrounding tissues because of their local growth. Headache is the most common complaint, especially following pressure to the jugular vein. Symptoms such as dysphagia, hoarseness, and feeling of fullness in the ear may be observed due to growth in the neck region, and also cardiac arrhythmia due to vagal nerve compression.^[7]

Diagnosis of such tumors is usually made incidentally after US of the neck for a different reason.

Definite diagnosis is made by CT or MRI following US. MRI of carotid tumors provides mostly preoperative information on the mode of surgery. McPherson et al.^[8] in their study demonstrated the superiority of MRI over CT. The type of tumor is important for preoperative surgical strategy. Shamblin type 1 and type 2 tumors can be easily resected from vascular structures and from surrounding tissues when compared to type 3 tumors. Severe bleeding may be observed with such tumors during removal due to their intense vascular structure. In recent years, attempts to reduce the amount of hemorrhage during surgery have been made in these patients by administering embolization materials under angiography before surgery, to the arterial structures feeding the tumor. In a study by Power et al.,^[5] bleeding was reported to be significantly reduced after pre-operative embolization; however, no change in cranial nerve injury was observed. In the study conducted by Ilhan et al.^[9] no embolization substance was used in any of the patients. No embolization is reported to have been performed due to the risk of cranial embolism in the carotid artery.

Removal of these tumors may result in damage to the neural structures during both dissection and retraction. Especially for the tumors extending under the mandible, there is a risk of temporary paralysis and paresis after the operation due both to stress and compression of the facial nerve from the retraction and dissection performed. Ma et al.^[10] reported temporary neurological damage in 14 patients and permanent neurological damage in three patients in their study on 57 patients with a glomus tumor. In our study, no permanent damage was reported in any of our patients during the outpatient clinical follow-ups.

Bradycardia or tachycardia may occur during the operation. Arterial blood pressure from the radial or brachial arteries of the patients should be monitored invasively during dissection of the tumor. Hypertensive crises due to adrenaline and noradrenalin discharge may occur, in paragangliomas cases.^[11]

In a study conducted by Amato et al.,^[12] 625 patients were studied from data collected from 19 clinics, and a 3% mortality rate was reported due to carotid body tumor. In the same study, cranial nerve injury was reported at a rate of 48% (31% temporary and 17% permanent), whereas a 17% rate of external carotid artery injury was reported.

Postoperative respiratory distress and dysphagia may be due to vagal nerve damage. In a study conducted by Metheetraitur et al.,^[13] 38 patients were examined and 5% of the patients were observed to

have dysphagia. Three of our patients suffered from dysphagia; however, the condition was observed to have improved during outpatient clinical follow-ups.

In conclusion, surgical excision for carotid body tumors should be considered as the first choice among treatment options. We suggest that it is beneficial to have surgery as soon as the diagnosis is made, because after the growth of the mass excision becomes difficult and the risk of complication also increases. Cranial and peripheral nerve complications which may occur during the operation should be taken into consideration, and removal of the mass should be ensured while paying attention to dissection of the anatomical structures. The mass should be removed as a whole together with the sheath or membrane that surrounds it, otherwise recurrence of the tumor may occur.

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