

Presentation and surgical outcome of carotid body tumors in Upper Egypt: A retrospective study

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Abstract

Background and aims:

Carotid body tumors (CBTs) are rare, hypervascular neoplasms and are usually located at the carotid artery bifurcation. However, surgery is the gold standard for curative treatment of CBTs it carries a high risk of mortality and morbidity. The aim of this study was to find out the pattern of presentation of CBTs in our locality and to evaluate the outcome of their surgical treatment.

Materials and methods:

A retrospective group of patients that presented with CBTs and subjected to surgical resection in the period from May 2006 to April 2011 were included in this study. All cases were evaluated clinically, radiologically before surgical treatment and diagnosis confirmed with postoperative histopathology. Surgical outcome was recorded.

Results:

A total of 16 patients were presented in the study period and only 12 of them were subjected to surgical excision and they were 7 women and 5 men and their age ranged from 33 to 65 years (mean 46±13). Six patients with Shamblin group I and II, subadventitial tumor excision was performed after ligation of the feeding vessels of the tumor and 3 of them were in need for ligation of the external carotid artery (ECA) and primary vascular repair of the internal carotid artery (ICA) was needed in another patient. The remaining 6 patients with Shamblin group III, ECA ligation was done in 5 patients, primary vascular repair of the ICA was needed in 3 patients and ICA reconstruction by saphenous vein graft in one patient. Postoperative hemiparesis occurred in 2 patients with Shamblin III, one of them improved in 3 months after surgery. Postoperative cranial nerve deficits occurred in 3 patients (2 cases with Shamblin III and one case with Shamblin II), 2 of them with transient hypoglossal paresis and the remaining one developed hoarseness of voice due to permanent vocal cord paralysis. There was no recurrences in the follow up period.

Conclusions:

Patients with CBTs in our locality are usually presented with an advanced stage. Early diagnosis and surgical resection of these tumors will minimize the morbidity and carry good surgical outcome. A team approach including head and neck and vascular surgeons are essential to achieve good surgical results.

Keywords: Carotid body, paragangliomas, carotid repair

Introduction

Carotid body tumors (CBTs) are hypervascular tumors arising from paraganglionic cells of the carotid body and are usually located at the carotid artery bifurcation. They are slowly growing tumors. The other head and neck paragangliomas are typically located in three main sites; the foramen jugulare (jugular paraganglioma), the middle ear cavity (tympanic paraganglioma), and along the cervical portion of the vagus nerve (vagal paraganglioma) ⁽¹⁾.

CBT is a rare disease with an incidence of 0.012% from pathological studies ⁽²⁾. The sporadic form of CBT is common than the inherited variety and tends to occur slightly more often in women. It is seen more frequently in people living at high altitudes and is multicentric in approximately among 10% of cases ⁽³⁾. Bilateral and multicentric forms described (3-5%) with a higher incidence in familial forms (32%). Malignancy occurs in 6-12.5% of cases, which ranks carotid body paragangliomas as the most frequently occurring malignant head and neck paraganglioma ^(4, 5).

Surgery is the gold standard for curative treatment of CBTs. The first successful CBT excision was performed by Alber in 1889⁽⁶⁾, and Gordon-Taylor ⁽⁷⁾ who described a safe, subadventitial dissection in 1940. Since the 1980s, devascularization of CBTs by ligation of feeding branches of the external carotid artery (ECA) during operation has been a common practical technique ⁽⁸⁾. Recently, Van der Bogt et al; ⁽⁹⁾ proposed a craniocaudal dissection technique that would minimize postoperative morbidity.

Shamblin et al; in 1971⁽¹⁰⁾ proposed the classification of CBTs based on the

tumor - vessel relationship. It has been widely used and maintained its usefulness in surgical techniques of resection. Shamblin group I: tumors are localized and do not involve the surrounding major vessels, group II: are adherent or partially surround the vessels, and group III: are large and encase the vessels.

The aim of this study was to find out the pattern of presentation of CBTs in our locality and to evaluate the outcome of their surgical treatment.

Patients and Methods

A retrospective study included patients with CBTs that had been presented to the Department of Surgery, at Sohag University Hospital in the period from May 2006 to April 2011. During this period, 16 patients diagnosed with CBTs, but 12 of them were treated by surgical excision after consenting. Three of the remaining 4 patients refused the consent as they did not accept the possible complications after surgery. One of them had bilateral and multicentric paraganglioma (Figure 1 a and b) and another one was referred to the Oncology Department, from the start, as the patient diagnosed histopathologically as a malignant CBT before his referral to our department. The remaining one was unfit for operation.

Data of this study included; demographic details, radiologic findings, surgical details and outcome during the follow up period. Five patients were referred from other hospitals with an initial biopsy suggesting the diagnosis. These cases were mismanaged as neck nodes in other places and the treating surgeons did perform open biopsies without proper preoperative evaluation. The other cases diagnosed clinically and

radiologically in our hospital and confirmed by postoperative histopathology. We avoided the need for preoperative biopsy. All patients were subjected to complete clinical evaluation, duplex scan, CT scan with angiography and selective angiography (Figure 2).

Our goal was to excise the tumor completely without neurovascular compromise. The surgical procedures are briefly described as follows (Figure 3a, b and c): the patient is under general anesthesia with endotracheal intubation. Wide transverse cervical incision was achieved to provide good exposure of the tumor and the carotid vessels controlled proximally and distally. Careful dissection to preserve the adjacent cranial nerves (vagus,

hypoglossal, superior laryngeal and mandibular branch of the facial nerve). Certain precautions were applied to reduce the bleeding before tumor resection as using gentle blunt dissection in the adventitial plane, ligation of the feeding vessels supplying the tumor, ligation of ECA and use of electrocautery. Any undesirable lesions of the vessel wall are immediately managed by vascular surgeon via primary vascular repair or vascular reconstruction. After complete haemostasis, wound closure with suction drain application. Clinical evaluation and follow up was accomplished to all patients. The patients were evaluated clinically and by duplex scan every 3 months for the first year and each 6 months later on in a regular outpatient visits

Results

A total of 16 patients were presented in the study period and they were 10 women and 6 men and their age ranged from 22 to 75 years (mean 42 ± 19). All patients were presented with unilateral painless lump in the neck. In addition to that one case presented with bilateral and multicentric paragangelioma with no elevation of catecholamine secretion, which had been confirmed by laboratory investigations and another case, who presented with difficulty in deglutition, hypoglossal nerve paresis, and cervical lymphadenopathy in addition to neck swelling, who proved to be malignant CBT.

Twelve out of the sixteen cases accepted to have surgery and they were 7 women and 5 men and their age ranged from 33 to 65 years (mean 46 ± 13). Five tumors (42%) were located in the right side and seven (58%) in the left side. None of the patients had a functioning CBT that presented with hypertension, palpitation and tachycardia due to elevated catecholamines level. Complete excision of the tumor was performed to all cases. According to Shamblin classification, it was found that Shamblin group I included 2 patients, group II included 4 cases, and group III were 6 patients (table 1).

Six patients with Shamblin group I and II, subadventitial tumor excision was performed after ligation of the feeding vessels of the tumor and 3 of them were in need for ligation of the ECA and primary vascular repair of the internal carotid artery (ICA) was needed in another patient. The remaining 6 patients with Shamblin group III, ECA ligation was done in 5 patients, primary vascular repair of the ICA was needed in 3 patients and ICA reconstruction by saphenous vein graft was accomplished in another patient.

Postoperative hemiparesis occurred in 2 patients with Shamblin III, one of them improved in 3 months after surgery, while the other one was permanently affected.

Postoperative cranial nerve complications occurred in 3 patients, 2 of them with transient hypoglossal paresis and the remaining one developed hoarseness of voice due to permanent vocal cord paralysis.

All postoperative specimens diagnosed histopathologically to be benign paraganglioma except in one case that proved to be malignant CBT. This case was in need for intraoperative vascular reconstruction by saphenous vein graft and it was the case that complicated postoperatively with permanent hemiparesis. This patient transferred to oncology department for adjuvant postoperative radiotherapy. All patients were followed up from 6 - 46 months (mean 22 ± 12) with no local recurrence or mortality.

Table (1): Operative findings and postoperative complications

Shamblin group	No.	Tumor size (cm)	Operative finding			Complications		
			ligation of ECA	Primary vascular repair	Saphenous vein graft	Cerebral ischaemia	Hypoglossal paresis	Hoarseness
I	2	2-2.5	-	-	-	-	-	-
II	4	2.5-3.5	3	1	-	-	1	-
III	6	3.5-8	5	3	1	2	1	1
Total No.	12		8	4	1	2	2	1

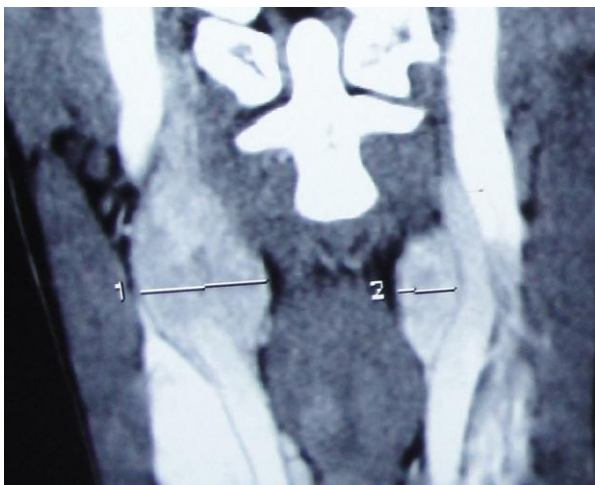
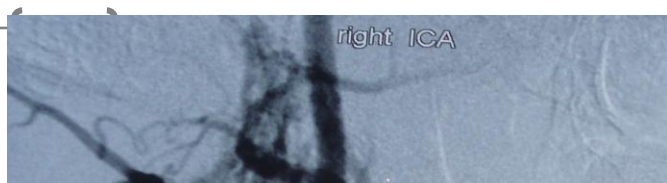


Figure (1 a): Bilateral carotid body tumor as shown by CT angiography



Figure (1 b): Abdominal paraganglioma of the same patients as shown by CT angiography of the abdomen confirming the multicentric nature of the case.



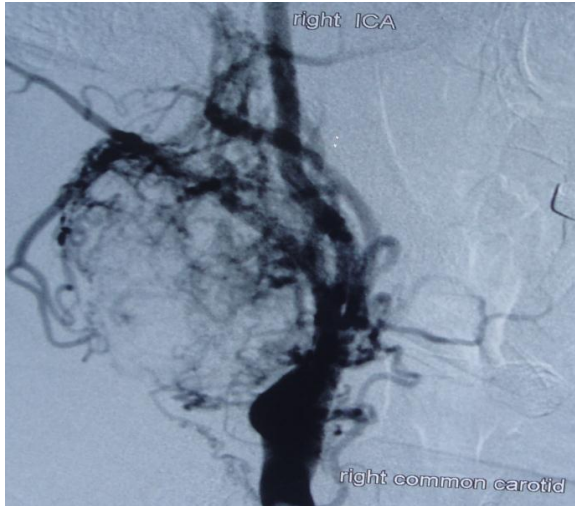


Figure (2): Digital subtraction angiography of the right carotid artery showing a huge hypervascular CBT.

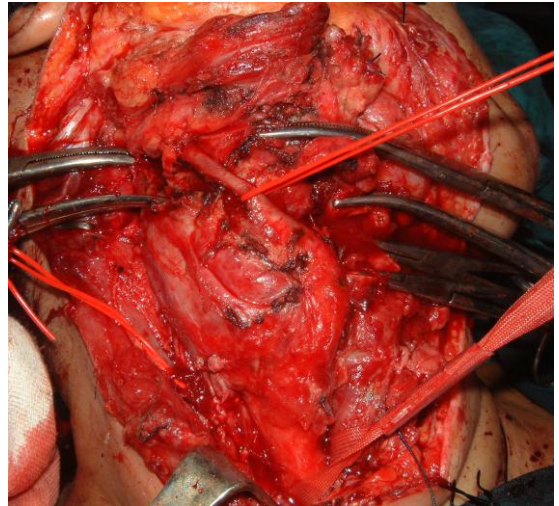


Figure (3 a): Intraoperative photo showing the tumor mass and controlling the CCA and the ICA.

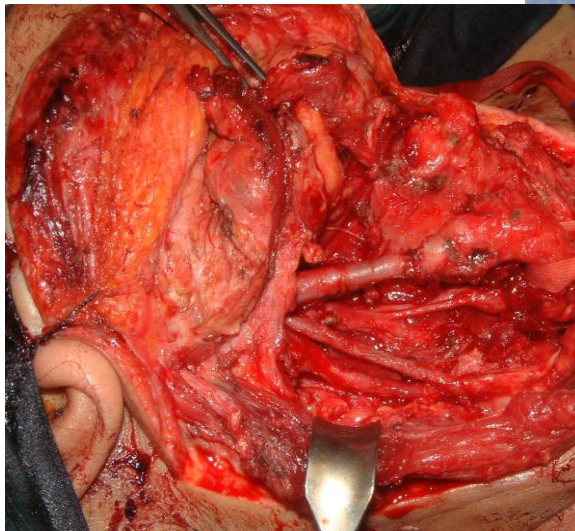


Figure (3 b): Intraoperative photo after complete resection of the CBT and primary repair of the ICA.



Figure (3 c): Post operative CBT measuring about 7 cm, Shamblin III.

Discussion

CBTs in the head and neck area impose a dilemma and their treatment is challenging for the surgeons. Most CBTs are benign and slow growing and surgical excision is the treatment of choice when the patient is young and fit. Some authors have found that radiotherapy is effective in inhibiting further growth of CBTs, However, it is often considered to be an alternative treatment modality for patients who can not undergo surgery due to extensive involvement⁽¹⁾.

CBTs tend to occur slightly more often in women⁽³⁾; and that is parallel to the reported incidence in our cases. In this study 16 cases were diagnosed as CBTs in our department during the study period. Four of these patients did not have surgery due do different reasons. This does not seem to be surprising since many other studies showed cases that did not have surgical treatment for the same reasons^(8,14).

Five cases referred to us from other physicians with definite preoperative histological diagnosis after their misdiagnosis as neck nodes and they had been biopsied. This is surprising since all these cases went for biopsy without prior neck ultrasound scan, which is an essential minimum prerequisite in management of these cases. It is needless to say that preoperative open biopsy or even percutaneous needle biopsy are contraindicated⁽¹²⁾. These may cause intractable bleeding, pseudo aneurysm formation and carotid artery thrombosis.

The main purpose of the surgery is to remove all neoplastic tissue, saving the nearby important neurovascular structures of the neck. Surgical resection of CBTs was performed to all the studied cases with special

maneuvers to facilitate and make the surgical procedure safer via wide transverse cervical incision, dissection and controlling the carotid vessels proximally and distally, and then subadventitial dissection of the carotid vessels and early ligation of the feeding vessels. These performed steps were reported in many other studies^(8, 13-14).

As CBTs are close to important vessels and nerves in the neck, so there is a risk of morbidity and mortality, which is variable. The incidence of ICA injury has been reported to be 2% to 23% with or without reconstruction^(8,15-16). The sacrifice of ECA and ICA has been reported to be needed from 13-39% and 11% respectively^(8,16). In our study, ligation of the ECA was done in 8 patients (67%), while primary vascular repair of ICA in 4 patients (33%) and reconstruction by using saphenous vein graft in one patient (8%). It was noticed that the incidence of vascular complications in our study was higher than the previous studies because this study included cases with more advanced tumors.

Postoperative cerebrovascular complications such as stroke can occur with or without manipulation of major neck vessels, and its incidence has been reported to be 0 to 11%⁽¹⁶⁻¹⁹⁾. In our study, 2 patients developed postoperative cerebral ischaemia, one of them was transient and improved by conservative measures and the other case with permanent left sided hemiparesis (8%).

Postoperative neurological complications as cranial nerve deficits can occur, and the incidence of postoperative affection ranges from 6.9-42%. The hypoglossal and vagus nerve appeared to be the most vulnerable to injury from the sacrifice

or retraction⁽⁸⁾. Regarding to our postsurgical neurological complications; 2 cases showed temporary tongue deviation that may be due to retraction of the hypoglossal nerve and both cases improved spontaneously; while one patient developed permanent postoperative hoarseness (8%) due to vocal cord paralysis. These findings are parallel to the results of other studies^(9,15,18,19). Postoperative mortality was not encountered in our cases. However, it is not unusual hazard after surgery especially in Shamblin III⁽⁸⁾.

In this study it has been noticed that all patients with permanent postoperative neurovascular complications and 80% of patients who had carotid artery reconstruction were referred to Shamblin group III. These results also support the reports that the Shamblin classification can be used to predict the possible postoperative neurovascular complications^(10,15-22).

Conclusions:

Patients with CBT in our locality are usually presented with an advanced stage. Early diagnosis and surgical resection of these tumors will minimize the morbidity and carry good surgical outcome. A team approach including head and neck and vascular surgeons are essential to achieve good surgical results.

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الملخص العربي

العوارض الإكلينيكية ونتائج الجراحة لأورام الجسم السباتي في صعيد مصر: دراسة استرجاعية

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تعد أورام الجسم السباتي من أورام الرقبة النادرة ، وحيث أنها تنشأ عند ملتقى الشريان السباتي بالرقبة وقريبة من الأعصاب المخية، ولهذا يمثل التدخل الجراحي لإستئصالها خطورة على حياة المريض وكذلك في حدوث مضاعفات ما بعد العملية. وقد هدف هذا البحث لدراسة اعراض هذه الاورام وتقييم نتائج العلاج الجراحي لها .

وقد تناول هذا البحث دراسة استرجاعية للعوارض الاكلينيكية لهذه الأورام وطرق تشخيصها والطرق الجراحية التي تم اجرائها لاستئصال هذه الاورام وقد تم تسجيل النتائج الجراحية والمضاعفات اثناء و ما بعد العملية .

وقد اشتمل البحث على عدد ١٦ مريضا ممن يعانون من ورم الجسم السباتي بعد التشخيص الاكلينيكي وبواسطة الاشعة التشخيصية وقد تم عمل العلاج الجراحي لإثنى عشرة حالة فقط ممن وافقوا على إجراء العملية .

وبعد دراسة المضاعفات الناتجة من عمليات إستئصال أورام الجسم السباتي ، وجد أن حالتين تعرضوا لشلل نصفي منهم حالة تحسنت بالعلاج التحفظي، والأخرى لم يطرأ عليها أى تحسن ملحوظ، وحالتين تعرضوا لشلل مؤقت للعصب المخى الثانى عشر والحالة الأخيرة تعرضت لخشونة مستديمة فى الصوت نتيجة لإصابة العصب الحنجري المرتجع أثناء العملية. وقد لوحظ أن أغلب هذه المضاعفات، حدثت نتيجة للعلاج الجراحي للحالات المتأخرة والتي لم يتم تشخيصها مبكرا .

وبمتابعة المرض لفترة تتراوح من ٦-٤٦ شهر لم تحدث هناك أى حالات إرتجاع للورم أو أى حالات وفيات .

ونستنتج من هذه الدراسة:

-التشخيص الاكلينيكي لحالات أورام الجسم السباتي فى صعيد مصر عادة ما تكون فى مراحل متأخرة.

-التشخيص المبكر لمثل هذه الحالات يقلل من مخاطر التدخل الجراحي.

-لابد من تعاون فريق عمل يضم جراح الوجه والرقبة وجراح الأوعية الدوية والشرابين للحصول على نتائج جراحية جيدة.