

# Carotid Body Tumor: Experience at Jinnah Postgraduate Medical Centre, Pakistan

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## ABSTRACT

**Introduction:** To assess the clinical and pathological characteristics associated with the carotid body tumor in Pakistani population.

**Methodology:** This retrospective study was conducted in the ENT and Head and Neck Surgery department, Jinnah Postgraduate Medical Centre, Karachi. Medical records of patients with carotid body tumor from 2000 to 2008 were retrieved after taking ethical approval. The sampling technique was non probability convenient.

**Results:** During this duration a total of 16 patients with symptoms consistent with a carotid body tumor were admitted. 12 (62.5%) were female and six (37.5%) were male. Mean age (SD) was 42 (10.9) years. All patients have unilateral tumors. 12 (75%) patients had tumors on the right side while 4 (25%) patients had it on the left side. On MRI four (25%) patients were reported as Shamblin I, six (37.5%) as Shamblin type II and six (37.5%) as Shamblin type III. Preoperatively there was no neurological deficit associated with carotid body tumor. Embolization was not preferred because of sub adventitial dissection. Internal carotid artery was damaged in four (25%) cases which was repaired with 6/0 proline by vascular surgeon. There was no cerebral damage postoperatively after applying a bulldog clamp on the common carotid artery for 45 min.

**Conclusion:** Carotid body tumors are slow growing and benign. The keys to successful surgery are careful preoperative planning, proximal and distal control of the vasculature with vessel loops, careful identification and preservation of neural structures.

**Key words:** Carotid body tumor, Paraganglioma, Carotid body

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## INTRODUCTION

Carotid body tumor is a rare tumor of the head and neck, which arises from the medial side of the carotid bulb. Historically carotid body was first described by Von Haller in 1743 [1]. It is a reddish brown to tan structure, 3-5 mm in diameter in the adventitia of the common carotid artery located on the postero-medial wall of the vessel at its bifurcation. Its feeding vessel is mainly the external carotid artery. It is sensitive to change in pH and arterial oxygen tension [2].

Carotid body tumor was formerly called Chemodectoma and Glomus tumor but now called Carotid body Paraganglioma [1]. Carotid tumors are dark, tan to purple in color, slow growing (~5 mm/year), rarely malignant (6-12.5%)[2]. Tumor is located at the level of the Hyoid bone. It is non-tender, firm, rubbery (potato tumor), pulsatile, bruit may be present. It can move side to side but not up and down because of its attachment to the carotid bifurcation. It refills in step synchronous fashion with the pulse after compression [1-2].

Treatment for carotid body tumor is excision but because of its relationship with internal and external carotid arteries and hypoglossal, vagus and accessory nerves, it is a challenging job [3]. Radiological investigations help to

plan the surgery and risk evaluation to surrounding structures. Shamblin classification was an attempt to predict the surgical difficulties and risk stratification for carotid body tumor excision. Shamblin classifies the tumor into type I, type II and type III tumors depending on the involvement/ encasement of internal and external carotid arteries [4]. However, there are some studies challenging the reliability of this criterion [5].

When tumor on MRI labeled as type III, should we excise the internal and external carotid and common carotid artery with tumor, or should we try for sub adventitial resection of tumor are some of the questions we are still exploring. Hence, the current study was conducted to observe the sociodemographic and clinical profile as well as the anatomy of vessels and their relationship with the carotid tumor and adventitial involvement.

### MATERIALS AND METHODS

This study was conducted in ENT and Head and Neck Surgery department, Jinnah Postgraduate Medical Centre, Karachi for period 2010 to 2020. Data was retrieved from the ENT department medical record. History, surgical notes and investigations of all the patients were reviewed.

Apart from routine investigations MRI, Angiography and Doppler Ultrasound was done. Angiography showed typical lyre sign. Patients were classified according to Shamblin classification according to the degree of involvement of the carotid vessels. Grade I was defined as small carotid tumor with minimal attachment to the surrounding vessels, Grade II tumor was defined as a larger lesion with certain degree of attachment of vessels, and Grade III was defined as a tumor that encased the entire carotid vessel [6]. MRI was reported by radiologist with more than 10 years post fellowship experience. Although MRI was done at different centres, but all the MRI was reported by single radiologist. Surgery was done by single surgeon having more than 15 years surgical

experience with vascular surgeon backup. Synthetic polytetrafluoroethylene graft was also kept ready in cases of patients reported as Shamblin type III for grafting.

Regarding surgical technique, a long incision along the anterior border of sternomastoid muscle from mastoid process to clavicle was given. Bulldog clamps were applied on the common carotid during dissection for 45 minute and the tumor dissected out. Three tumors reported as shamblin type III were also attempted to be removed with sub adventitial dissection and was successful. But in two patients the internal carotid artery was injured and repaired with 6/0 proline uneventfully by a vascular surgeon.

Patients were discharged on 3rd-5th postoperative day and advised to come weekly for one month then monthly.

All the data regarding history, examination surgical notes and post-surgical events/complication were recorded on Performa. All the data was entered in SPSS 16. Descriptive statistics, frequency and percentages were computed for qualitative variables like gender, area and shamblin type. Mean +/- standard deviation were computed for quantitative variables like age and blood loss during surgery. Data were stratified according to gender, area and Shamblin type of the tumor.

### RESULTS

During this duration a total of 16 patients with symptoms consistent with a carotid body tumor were admitted. 10 (62.5%) were female and six (37.5%) were male. Mean age (SD) was 42 (10.9) years. 10 (62.5%) patients were from Karachi and four (25%) patients were referred from Punjab and two (12.5%) patients were from Baluchistan (Table 1). One patient with a 10 by 10 cm tumor refused treatment. Surgery was done on seven (43.75%) patients.

**Table 1: Sociodemographic characteristics of patients in our study (n=16).**

Characteristics	n	%	
Gender	Male	6	37.5
	Female	10	62.5
Residence	Karachi, Sindh	10	62.5
	Punjab	4	25
	Balochistan	2	12.5
Marital Status	Married	11	68.75
	Unmarried	5	31.25
Comorbidity	No known comorbidities	7	43.75
	Hypertension	9	56.25
	Diabetes Mellitus	8	50

All patients have unilateral tumors. 12 (75%) patients had tumors on the right side while 4 (25%) patients had it on the left side. The tumors were firm, rubbery,

pulsatile, bruit was positive in 05 patients and reduced in size on compressing the carotid artery.

All patients presented with a mass in the antero-lateral region of the neck. All patients were from low altitude areas.

On MRI four (25%) patients were reported as Shamblin I, six (37.5%) as Shamblin type II and six (37.5%) as Shamblin type III. Preoperatively there was no neurological deficit associated with carotid body tumor.

Embolization was not preferred because of sub adventitial dissection. Internal carotid artery was damaged in four (25%) cases which was repaired with 6/0 proline by vascular surgeon. There was no cerebral damage postoperatively after applying a bulldog clamp on the common carotid artery for 45 min. Average blood loss during surgery was 300 ml. 5 (31.25%) had blood loss of more than 500 ml (Table 2).

**Table 2: Clinical Characteristics of Patients in the Study (n=16).**

Characteristics		n	%
Signs and symptoms	Hoarseness	14	87.5
	Difficulty swallowing	5	31.25
	Numbness in the tongue	2	12.5
	Weakness or pain in the arms and shoulders	4	25
Shamblin Classification	Grade I	4	25
	Grade II	6	37.5
	Grade III	6	37.5
Site of Carcinoma/tumor	Right anterolateral region of the neck	12	75
	Left anterolateral region of the neck	4	25
Postoperative Complications	Internal Carotid artery damage	4	25
	Cerebral damage	0	0
	Blood loss > 500 ml	5	31.25

## DISCUSSION

Surgery of carotid body tumor is always a challenge with preservation of all vital structures. Radiotherapy is a controversial option only for those having advance unresectable disease or multiple tumors [1-3].

Usually individual's complaint of a consistent painless cervical mass below the jaw angle. Some classic signs can be observed on physical examination such as non-tender tumor on palpation, located between the internal and external carotid arteries (Kocher's sign I), mobile tumor horizontally and fix vertically (Fontaine's sign), and on digital palpation (external an intraoral), tumor in the tonsillar region (Kocher's sign II) [7]. The differential diagnosis includes carotid artery aneurysm (so why FNAC and Biopsy is contraindicated), neck tumors, and Branchial cyst.

Carotid body tumors are found in high altitude areas, present in 5th decade and male: female is 1:1 which is contrary to our study. In our study all patients were belonged from low altitude areas. Mean age was 42 years and male: female ratio is 5:3. These findings were consistent with the previous studies [8,9].

A classification system based on size and difficulty of resection has been developed [6-8]. This classification was basically designed to stage the tumor over MRI which will help to choose surgical approach or option during surgery. Type I tumors were those minimally attach to the vessels so easily resectable. Type II tumors were partially encasing the carotid arteries and there

were some adhesions between the tumor and the adventitia hence can be separated from the vessels but with careful subadventitial dissection [6]. Tumors completely encasing the vessels (more than 50% of circumference) and adherent to vessels were classified as type III. Type III tumors if only encasing the vessels can be resected with careful dissection but if adventitia is involved grossly resection and carotid reconstruction is the only option.

It should also be remembered that it is not the size of the tumor which is important for carotid resection but the extent of adventitial involvement. In our study, six patients were Shamblin type III on MRI preoperatively, because of encasement of entire carotid vessels. Among these three patient's minimal adventitial involvement was found preoperatively. In all six patients we were able to save the carotid vessels. Because of this observation Luna-Ortiz made a modification in Shamblin classification [10]. He classified all the tumors irrespective of size on gross adventitial involvement as type III B. So Shamblin type III is divided in type III A which was previous Shamblin type III and type III B. But preoperatively identifying type III B tumors is a challenge [11-14]. In our study we were unable to differentiate between type III A and III B preoperatively.

Group I consisted of small and easily resectable tumors. Group II included medium sized tumors adherent to or partially surrounding the vessels. Group III completely encased the carotids and were adherent to its whole circumference.

Different institutions used different definitions of unresectable tumor. In some institutions carotid resection and reconstruction is not a viable option so they consider such tumors unresectable. Preoperatively, it is challenging for a surgeon to decide upon the treatment modality and the extent to which the surgical excision is possible without injuring the internal carotid arteries [13]. Certain local studies from Pakistan reported similar results, indicating surgical resection to be the most effective treatment plan for selected patients [14,15].

The current study represented a small series of cases therefore, not much statistically significant findings can be retrieved. Further large-scale cohorts can help determine the disease course and patient prognosis in more details.

### CONCLUSION

The current study highlighted the importance of MRI in identifying Shamblin type I, II and III however, the involvement of carotid vessels adventitia can only be identified per-operatively. So, in all patients with Shamblin III tumors first attempt should be made to conserve the carotid vessels.

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