

## Multidisciplinary Management of Carotid Body Tumors: First Experience in Boyaca/Colombia

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### Original Research Article

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**Abstract:** The objective of this study was to present our first experience in the management of carotid body tumors (CBT) and to compare the impact of preoperative embolization of these tumors versus those that were not embolized.

**Keywords:** Carotid body tumors, preoperative embolization, surgery.

### INTRODUCTION

Carotid body tumors (CBT) are infrequent neoplasms born from the chemoreceptor organs located in the adventitia of the bifurcation of the carotid arteries. These tumors are known as carotid glomus, chemodectomas or paragangliomas. Heights higher than 2,000 meters above sea level, chronic hypoxemia and lung disease are factors that are associated with the pathogenesis of this disease, however, it is not known what the mechanism is [1].

These tumors occur, in most cases, between the 5th and 7th decades of life, most often in the female sex. It is considered that the paragangliomas correspond to 0.0012% of the tumors of the organism, 3% are located in the neck, 12% in the thorax and 85% in the abdomen [2]. The malignancy is caused by invasion of neighboring organs, metastasis or recurrence observed between 5-10% [3].

They have a hereditary predisposition between 10-20% [4]. Some authors [5, 6] recommend the preoperative embolization of these tumors to reduce blood loss and time of surgery.

Radiotherapy should be reserved for rare cases of malignant gangliomas. The CBT is diagnosed as an asymptomatic palpable mass located in the lower angle of the jaw, the diagnosis is made with an optimal physical examination and is complemented with imaging studies such as ultrasound, contrast neck tomography, angio-tomography of the neck with 3D reconstruction, Magnetic Resonance image and digital subtraction angiography.

### METHODS

All cases treated by Division of Endovascular Neurosurgery and Vascular Surgery Department, Medilaser Clinic Tunja, Colombia from April 2014 to October 2017 were retrospectively evaluated. Demographic, diagnostic and treatment strategies were recorded. All patients with known CBT underwent

Ultrasound, CT and MRI before treatment. All cases were classified according to the type of Shamblin and were evaluated by a Vascular Surgeon and an Endovascular Neurosurgeon before and after treatment. The main results included mortality, stroke and cranial nerve injury. The 2 groups were compared: Only Surgery Vs Embolization + surgery.

### RESULTS

Twenty patients were treated with a total of 21 CBT, 14 women (70%) and 6 men (30%) Fig. 1, the average age in men was 35.5 years and in women of 49.3 years Fig. 2, the location of the tumor was: 15 right, 4 left and 1 bilateral Fig. 3. All patients with known CBT underwent Ultrasound, CT and MRI before treatment Fig 4, 5, and 6. Surgery was performed only in 12 patients and in 8 patient's embolization + Surgery

Fig.7. The preoperative embolization was performed with microspheres of 100-300 micograms by means of a supraselective micro catheter until complete devascularization of the tumor was achieved (Fig. 8, 9 and 10). The surgical approach was performed by a transverse cervicotomy and tumor resection was initiated by sub-adventitial dissection according to the surgical technique described by Taylor Gordon [7] Fig. 11. According to the Classification of Shamblin were 8 patients of type I and 4 patients of type II in the group

of only Surgery and in the group of embolization + surgery were 3 patients Shamblin type II and 5 patients of type III Fig. 12. They obtained 21 tumors with an average of diameter of 4.5 cm. No malignancy was found in any of the histopathological studies. There was no mortality in any of the groups. There were no complications in the embolization group + surgery, in the group of only surgery there were 3 complications: 1 intra-operative (major bleeding) and 2 post-operatives (transient neuropraxia of the hypoglossal nerve) Fig. 13.

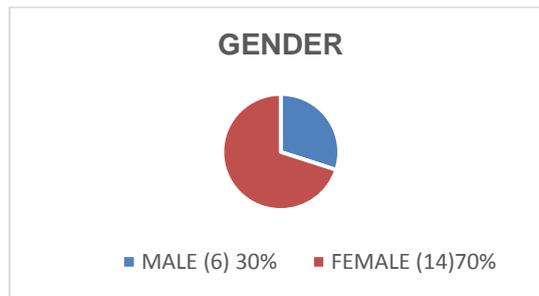


Fig-1: 20 Patients: 14 women (70%) and 6 men (30%)

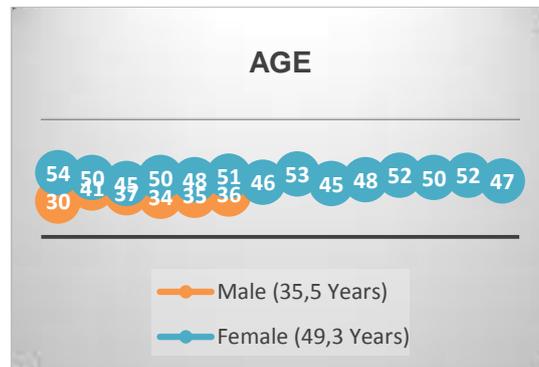


Fig-2: The average age in men was 35.5 years and in women of 49.3 years



Fig-3: The location of the tumor was: 15 right, 4 left and 1 bilateral



Fig-4: Contrast CT showing the carotid tumor. Angio-tomography of the neck with 3D reconstruction, Observe the involvement of the carotid arteries



Fig-5: Angiotomography with 3D reconstruction



Fig-6: Carotid angio-CT with 3D reconstruction and Neck MRI: CBT

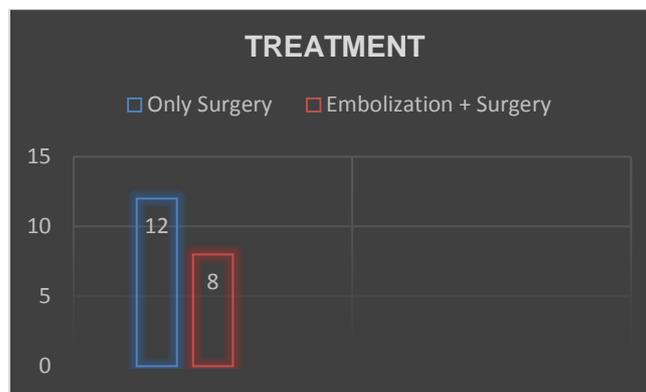


Fig-7: Only Surgery was performed in 12 patients and in 8 patients' embolization + Surgery

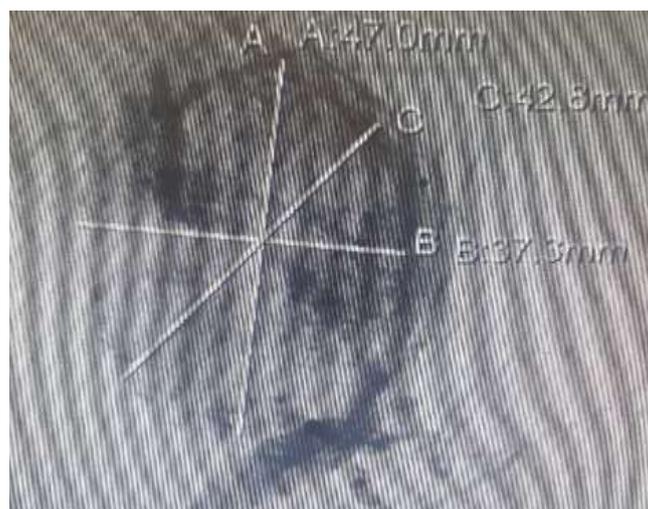
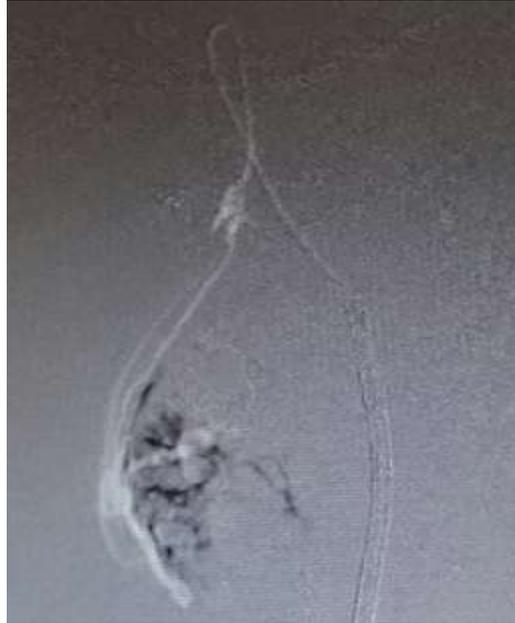
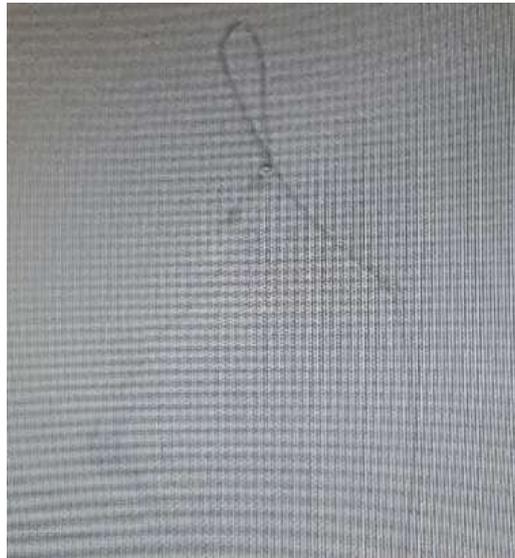


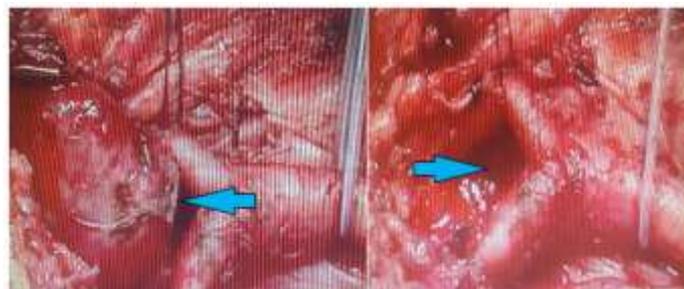
Fig-8: Digital Subtraction Angiography: Vascularization of the tumor by right external carotid artery



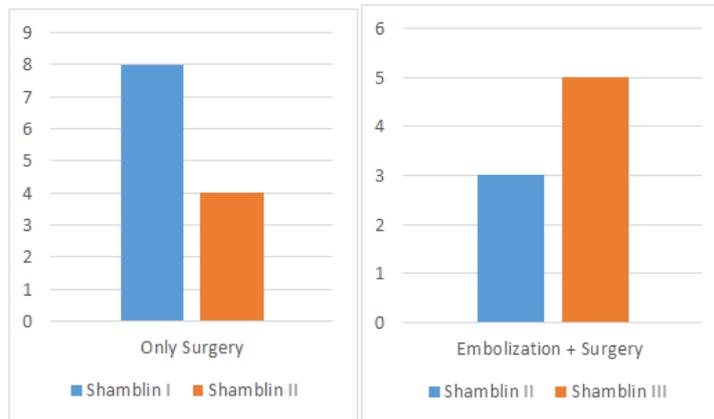
**Fig-9: Supraselective microcatheterism and embolization with microspheres**



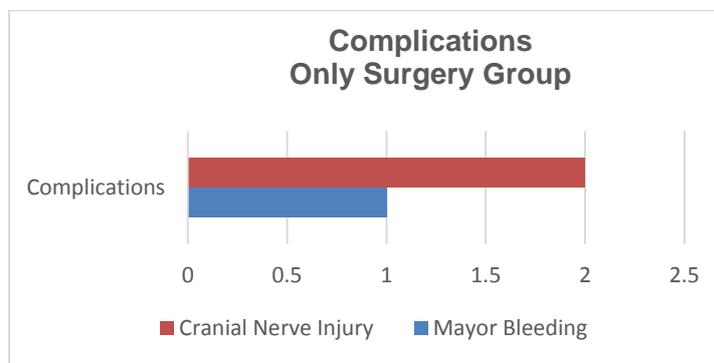
**Fig-10: Complete devascularization of the tumor**



**Fig-11: Dissection of CBT. Total resection of the carotid body Tumor**



**Fig-12:** According to the Shamblin Classification, there were 8 patients of type I and 4 patients of type II in the group of only Surgery and in the group of embolization + surgery were 3 Shamblin type II patients and 5 patients of type III



**Fig-13:** In the group of only surgery there were 3 complications: 1 intra-operative (major bleeding) and 2 post-operatives (transient neuropraxia of the hypoglossal nerve). There were no complications in the embolization + surgery group

**DISCUSSIONS**

In our cases we found that patients lived at altitudes higher than 2,000 meters above sea level (Mountain range of the Colombian Andes), some with chronic hypoxia and chronic obstructive pulmonary disease, these findings have been found by other authors, and however, it is not known how they influence the pathogenesis of this tumor. The average size of the resected tumors was 4.5 cm in diameter. It is reported in the literature as that the appearance of these tumors occurs between the 5th and 7th decade of life [8, 9], however, in our series it was found that they occurred between the 4th and 5th decade of life, being more frequent, as has been reported, in the female sex.

In our study, all patients with known CBT underwent ultrasound, CT and MRI before treatment. We believe that a proper pre-surgical diagnostic evaluation is essential to establish accurately the size of the tumor, its position, its relationships with adjacent structures and the possible vascular afferences to the tumor and in this way be able to stipulate which patients can benefit from a preoperative embolization, with the aim of reducing the tumor size, reducing its vascularization and minimizing the risk of intra-

operative bleeding, especially in large CBT (Shamblin Type II and III)

In our study, there were no complications in the embolization + surgery group, but in the surgery-only group there were 3 complications: 1 intra-operative (major bleeding) and 2 post-operatives (transient neuropraxia of the hypoglossal nerve) that resolved completely with rehabilitation. Surgery, as is known, is associated with several complications such as stroke, cranial nerve injury and hemorrhage. Cranial nerve injury occurs between 19% and 49% of cases [10].

**CONCLUSIONS**

The multidisciplinary management of patients with CBT is essential to obtain good results, especially in type III tumors and bilateral cases that require careful treatment planning and, if possible, a preoperative embolization, which in our series of cases showed a decrease of the complications and a reduction of the intra-operative hemorrhage and the surgical time in relation to the group of patients not embolized preoperatively.

**Conflicts of interest**

The authors declare that there is no conflict of interest with respect to the publication of this manuscript.

**REFERENCES**

1. Muhm M, Polterauer P, Gstöttner W, Temmel A, Richling B, Undt G, Niederle B, Staudacher M, Ehringer H. Diagnostic and therapeutic approaches to carotid body tumors: review of 24 patients. *Archives of Surgery*. 1997 Mar 1;132(3):279-84.
2. Patetsios P, Gable DR, Garrett WV, Lamont JP, Kuhn JA, Shutze WP, Kourlis H, Grimsley B, Pearl GJ, Smith BL, Talkington CM. Management of carotid body paragangliomas and review of a 30-year experience. *Annals of vascular surgery*. 2002 May 1;16(3):331-8.
3. Ma D, Liu M, Yang H, Ma X, Zhang C. Diagnosis and surgical treatment of carotid body tumor: A report of 18 cases. *Journal of cardiovascular disease research*. 2010 Jul 1;1(3):122-4.
4. LaMuraglia GM, Fabian RL, Brewster DC, Pile-Spellman J, Darling RC, Cambria RP, Abbott WM. The current surgical management of carotid body paragangliomas. *Journal of vascular surgery*. 1992 Jun 30;15(6):1038-45.
5. Li J, Wang S, Zee C, Yang J, Chen W, Zhuang W, Li X, Lv W, Huang Y, Li S. Preoperative angiography and transarterial embolization in the management of carotid body tumor: a single-center, 10-year experience. *Neurosurgery*. 2010 Oct 1; 67(4):941-8.
6. Kalani MY, Ducruet AF, Crowley RW, Spetzler RF, McDougall CG, Albuquerque FC. Transfemoral Transarterial Onyx Embolization of Carotid Body Paragangliomas. *Neurosurgery*. 2012 Oct 26; 72(1):9-15.
7. Gordon Taylor G. On carotids tumors, *Br.J Surg*. 1940; 28 :163-72
8. Kasper GC, Welling RE, Wladis AR, Cajacob DE, Grisham AD, Tomsick TA, Gluckman JL, Muck PE. A multidisciplinary approach to carotid paragangliomas. *Vascular and endovascular surgery*. 2007 Dec; 40(6):467-74.
9. Shamblin WR, ReMine WH, Sheps SG, Harrison EG. Carotid body tumor (chemodectoma): clinicopathologic analysis of ninety cases. *The American Journal of Surgery*. 1971 Dec 1; 122(6): 732-9.
10. Tikkakoski T, Luotonen J, Leinonen S, Siniluoto T, Heikkilä O, Päivänsalo M, Hyrynkangas K. Preoperative embolization in the management of neck paragangliomas. *The Laryngoscope*. 1997 Jun 1; 107(6):821-6.