Carotid glomus in childhood: presentation of a clinical case

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ABSTRACT

Introduction. Carotid glomus is an exceptional extra-adrenal paraganglioma in childhood originating at the carotid body. Only 3% of paragangliomas occur in the head and the neck. Familial forms, associated with Succinate Dehydrogenase (SDH) gene mutations, account for 10% of cases, the proportion being higher in childhood. They are benign in 95% of patients, but they can extend to both carotids. Treatment is surgical with or without previous embolization. Metastasis is rare and associated with malignant cases, which are limited.

Clinical case. 8-year-old patient with a cervical mass originating 4 months ago and normal serum levels. Regarding family history, she had an aunt who underwent cervical surgery. Ultrasound examination demonstrated a greatly vascularized hypoechoic mass most likely related to carotid glomus. Full surgical resection without embolization was decided upon, which proved uneventful. The genetic study was positive for SDH gene mutation.

Conclusion. Carotid glomus in childhood should be considered as a differential diagnosis in cervical masses. Surgical treatment without previous embolization represents a safe therapeutic option in selected cases.

KEY WORDS: Carotid glomus; Carotid sinus tumor; Chemodectoma.

GLOMUS CAROTÍDEO EN LA INFANCIA. PRESENTACIÓN DE UN CASO CLÍNICO

RESUMEN

Introducción. El glomus carotídeo es un paraganglioma extraadrenal, excepcional en la infancia, cuyo origen es el cuerpo carotídeo. Solo el 3% de los paragangliomas se presentan en cabeza y cuello. Existe un 10% de formas familiares asociadas a mutaciones en el gen de la succinato deshidrogenasa (SDH), porcentaje que es mayor en la infancia. Son tumores benignos en un 95% de los pacientes, pero pueden afectar por extensión a ambas carótidas. Su tratamiento es quirúrgico con o sin embolización previa. Las metástasis son raras y están asociadas a los escasos casos de malignidad.

Caso clínico. Paciente de 8 años de edad con masa cervical de 4 meses de evolución, serologías normales. Como antecedente destaca una tía sometida a cirugía cervical. Ecográficamente se objetiva masa hipoecoica muy vascularizada en probable relación con glomus carotídeo. Se decide resección quirúrgica sin embolización que resulta completa y sin incidencias. Estudio genético positivo para la mutación en el gen de la SDH.

Conclusión. El glomus carotídeo en la infancia ha de ser tenido en cuenta como diagnóstico diferencial en masas cervicales. El tratamiento quirúrgico sin embolización previa es una opción terapéutica segura en casos seleccionados.

PALABRAS CLAVE: Glomus carotídeo; Tumor del seno carotídeo; Quemodectoma.

INTRODUCTION

Carotid body tumor, also known as chemodectoma or carotid glomus, is a rare extra-adrenal paraganglioma in childhood. It originates at the carotid body, located on the adventitious layer of the carotid bifurcation. Global paraganglioma incidence is 1:30,000-100,000. Most paragangliomas are located at the adrenal gland, with only 3% of them occurring in the head and the neck, where they are typically unilateral and solitary. There are familial forms in up to 10% of cases, the proportion being higher in childhood[(1)]. The most frequent familial form is associated with Succinate Dehydrogenase (SDH) gene mutations[(2)]. This tumor is benign in 95% of patients, but it can extend to the common carotid, either external or internal. Treatment is surgical, with or without previous embolization. Lymph node metastasis and distant metastasis are rare and typically associated with malignant cases, which are limited.

CLINICAL CASE

8-year-old patient of Maghreb origin under study as a result of the presence of a cervical mass originating 4

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This work was presented as a poster at the 2019 Spanish National Congress of Pediatric Surgery.

Date of submission: October 2020 *Date of acceptance:* August 2020

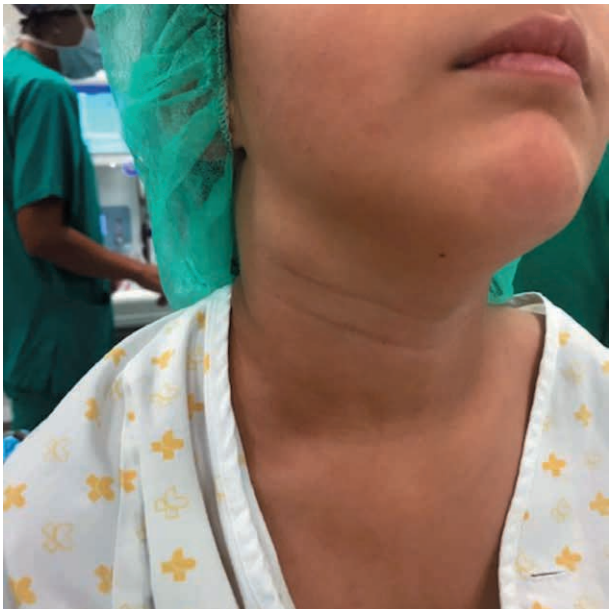

Figure 1. Physical exploration.

months ago (Fig. 1). Regarding family history, she had an aunt who underwent unspecified cervical surgery. The lesion emerged gradually, with a slow and ongoing growth from the beginning, and without pain or sensitive/motor symptoms. At physical exploration, the lesion had no superficial inflammatory signs, with a fixed, rubber-like consistency. It was not pulsatile at superficial palpation, and murmurs were not found at this location. Mantoux test, X-ray, and serum levels, which had been previously carried out given the suspicion of cervical lymphadenopathy, were normal. Therefore, suspected diagnosis was cervical lymphadenopathy or second branchial arch cyst. Ultrasound examination demonstrated a remarkably vascularized hypoechoic mass, which allowed second branchial arch cyst to be ruled out. Considering presentation, hypervascularization, and location, carotid glomus was also contemplated, but cervical lymphadenopathy, which looked less likely, had to be ruled out. A CT-scan was performed, demonstrating the presence of a 30 x 35 x 36 mm mass with great contrast enhancement in the right perivascular space, adjacent to the carotid bifurcation. These findings were compatible with carotid glomus (Fig. 2). Urine catecholamines were negative. Once the most likely diagnosis had been established, embolization prior to surgery was considered in conjunction with the vascular surgery and interventional radiology departments. After taking into account the specifics of this case and embolization's controversial results, full surgical resection without embolization was decided upon, which proved uneventful. Patient heparinization was not deemed necessary as the procedure required no carotid clamping. This was due to the fact the dissection only involved the adventitious layer, since it was a type 1 carotid glomus according to Shamblin classification (i.e., with no carotid involvement) (Fig. 3). The pathological study showed a macroscopically nodular, well-delimitated lesion, approximately 3.5x2.5cm in size, with an elastic consistency. It was yellowish and had a solid, homogeneous, brownish surface on cutting. Histologically speaking, a tumor with a thin peripheral capsule was noted. It was made up of nests of variable sizes, well-defined, and separated by fibroconnective walls. Cell nests were surrounded by flattened sustentacular cells positive for S100 stain. Nest cells were polygonal, with wide eosinophilic cytoplasms and round nuclei, some of which were increased in size and occasionally hyperchromatic. These cells express neuroendocrine

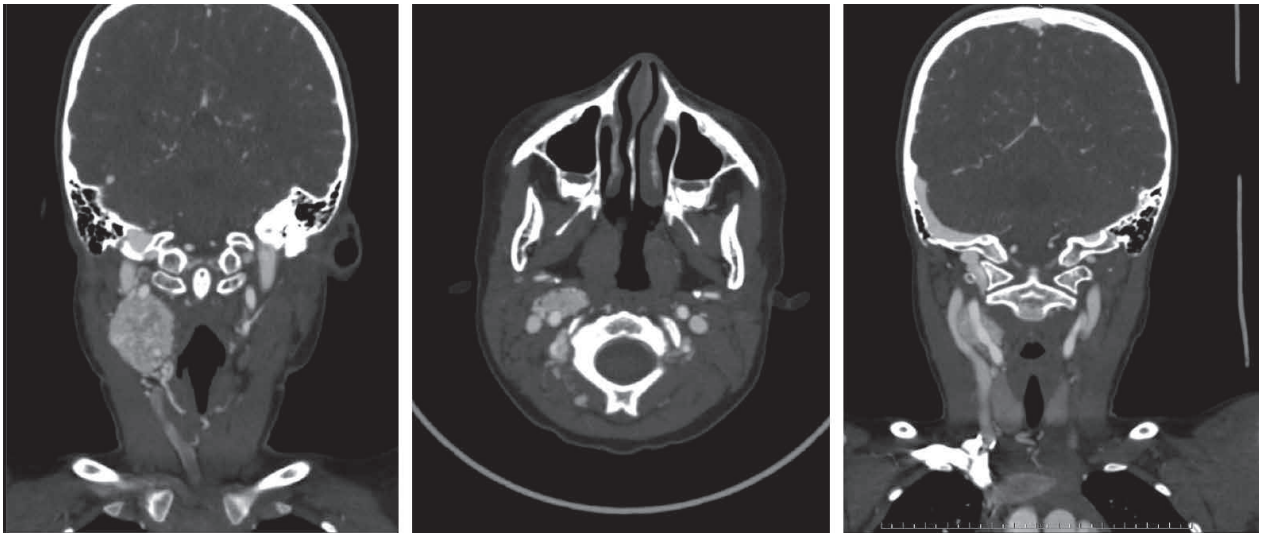

Figure 2. CT-scan.

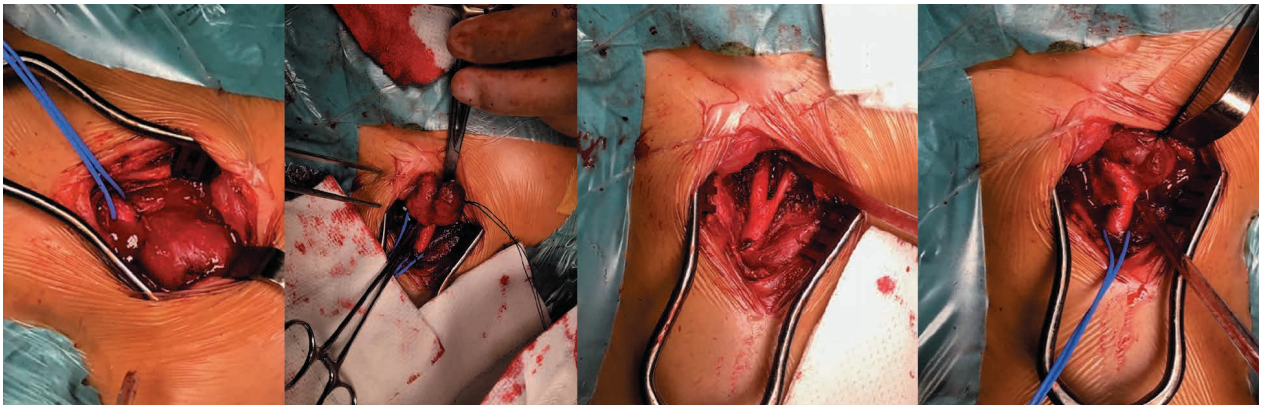

Figure 3. Surgical procedure.

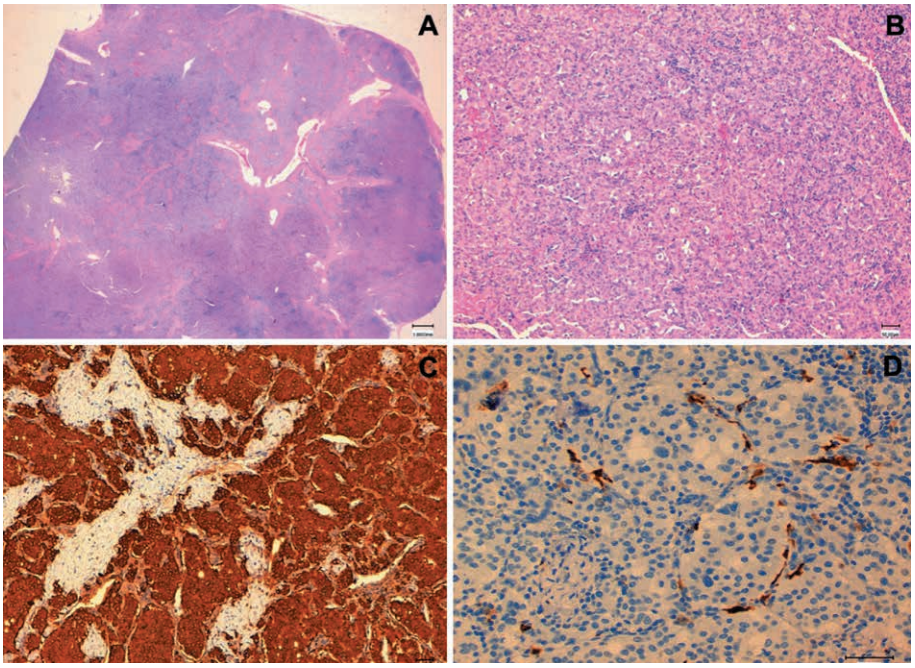

Figure 4. Histological study: the tumor has a thin layer made up of tumor cell nests of different sizes separated by fibroconnective walls of variable thickness (A. HE, magnifying glass; B. HE, 10x). Immunohistochemical techniques demonstrate if tumor cells are synaptophysin positive (C., 10x) and if sustentacular cells are S100 positive (D., 20x).

markers synaptophysin-chromogranin. The study confirmed the presence of carotid glomus (Fig. 4). The genetic study was positive for SDH gene mutation. In light of this and considering the patient's history, familial carotid glomus became the most likely diagnosis, so an extension study was carried out to rule out synchronic paragangliomas at other locations. Scintigraphy with a marked octreotride analogue (DTPA pentetreotide) was negative.

DISCUSSION

Paragangliomas are neuroectodermal tumors originating outside the adrenal gland; they can be found from the cervical region to the pelvic floor. Carotid body tumor, also known as chemodectoma or carotid glomus, is an extra-adrenal paraganglioma originating in the neural tissue at the carotid bifurcation – the carotid body[1].

The carotid body originates in the neuroectoderm migrating from the aortopulmonary window to the skull base. It is located on the adventitious layer of the carotid bifurcation and measures 2-5 mm. It is innerved by the glossopharyngeal nerve and irrigated by the ascending pharyngeal artery, potentially with aberrant vessels.

Carotid body tumors are usually unilateral and solitary. There are familial forms in 10-20% of cases, and they predispose to further lesions at other levels[1]. Familial forms are associated with gene mutations of one of the subunits of Succinate Dehydrogenase (SDH), type 1 neurofibromatosis, and Von Hipple Lindau syndrome[2].

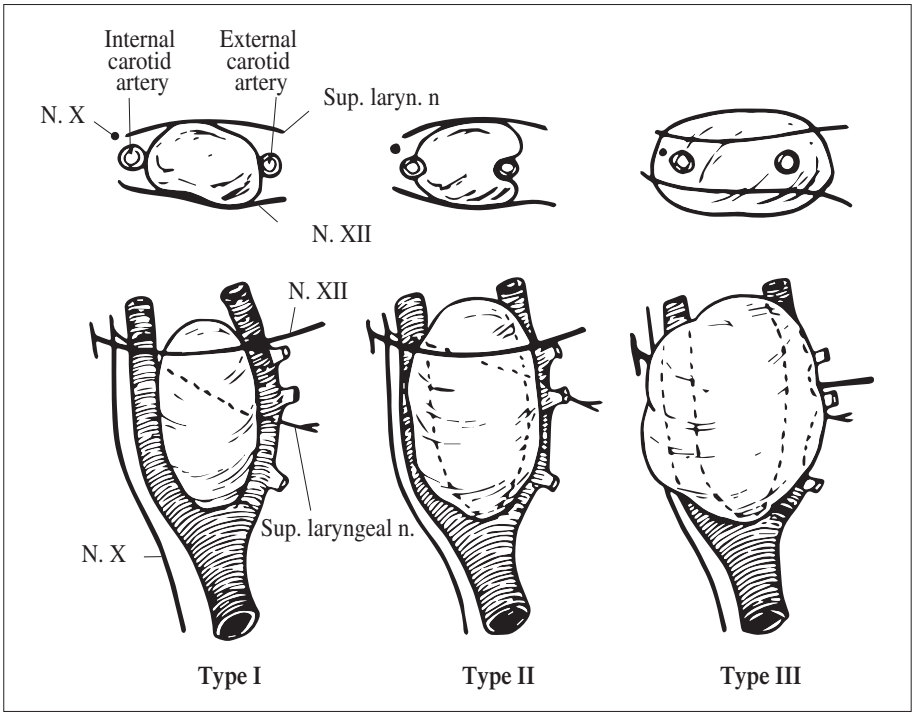

Figure 5. Shamblin classification. *Available from Shamblin WR, ReMine WH, Sheps SG, Harrison EG. Carotid body tumor (chemodectoma): clinicopathologic analysis of ninety cases. Am J Surg 1971; 122: 732-739.*

Global paraganglioma incidence is 1:30,000-100,000. Most paragangliomas are located at the adrenal gland, with only 3% occurring in the head and the neck. This location, especially in childhood, is rare. In 2008, there were 20 cases published in the literature, and 2 further cases have been reported ever since in patients under 14 years of age[3,4].

This tumor is benign in 95% of cases, but it can extend to the common carotid, either external or internal. Lymph node metastasis and distant metastasis are rare and typically associated with malignant cases, which are limited[5].

Clinically speaking, it manifests as a painless, slowly growing tumor in the anterior laterocervical region. It is rarely associated with sensitive symptoms locally or symptoms secondary to hormonally functioning tumors. Initial diagnostic suspicion is typically cervical lymphadenopathy or second branchial arch cyst. Doppler ultrasound examination allows the actual diagnosis to be suspected, showing a hypoechoic mass at the carotid bifurcation with abundant vascular flow. A further well-defined imaging test, preferably a CT-scan owing to its sensitivity when it comes to describing size, margins, and anatomical relationships, is also required. However, in pediatric patients, MRI is a feasible radiation-free alternative. In adult patients, Shamblin classification establishes various tumor types: type 1 tumors are located between both carotids without surrounding them, type 2 tumors partially surround either of the carotids, and type 3 tumors fully surround at least one carotid (Fig. 5). This classification has surgical and prognostic implications, since type 2 and especially type 3 tumors will most likely require clamping and even the division of either carotid during the procedure[5]. Our patient had a type 1 tumor, so surgery should technically imply dissecting externally to the carotids, at the level of the adventitious layer, without involving these arteries. Angiographic study is optional and is usually indicated if previous embolization is decided upon. Scintigraphy with a marked octreotride analogue (DTPA pentetreotide) is indicated in familial cases with suspicion of multifocal lesions, recurrence, or metastasis[6].

Puncture is contraindicated owing to the risk of bleeding, so it was not performed in our patient. Pathological diagnosis was confirmed following surgical treatment[7]. The immunohistochemical study provides a definitive diagnosis, since neuroendocrine tumor cells have a strong reaction to neuron-specific enolase and synaptophysin.

Treatment is surgical and not free from complications, from nerve lesions (hypoglossal, vagus, glossopharyngeal, and superior laryngeal nerves) and strokes to death as a result of uncontrolled bleeding[8]. Radiotherapy treatment is reserved for specific cases not eligible for surgery.

The use of embolization prior to definitive surgery is controversial. According to a recent meta-analysis by Jackson et al. with 578 adult patients based on the review of non-randomized studies, bleeding is lower and operating times are shorter in cases with previous embolization[9,10]. Embolization entails an added risk of stroke. In our patient, given this controversy in terms of advantages and the lack of experience available in children, decision was made not to perform previous embolization, with no intraoperative or postoperative complications recorded.

In children, the occurrence of this type of tumor has a genetic basis in 50% of cases. Therefore, follow-up is required as if dealing with a systemic condition, with serial scintigraphic controls. Distant metastasis, multifocality, and local recurrence are higher in childhood in spite of administering the adequate treatment from baseline. Given her age and family history, our patient underwent a genetic study which turned out to be positive. Annual follow-ups are performed with cervical MRI and scintigraphy[10-12].

CONCLUSION

Carotid glomus, even if rare in childhood, should be considered as a differential diagnosis when dealing with a cervical mass, especially in children with family history of paraganglioma. It can also be associated with SDH gene mutations and the same type of tumor at other locations. Surgical treatment without previous embolization represents a safe therapeutic option in selected cases.

REFERENCES

1. Patetsios P, Gable DR, Garrett WV, Lamont JP, Kuhn JA, Shutze WP, et al. Management of carotid body paragangliomas and review of a 30-year experience. Ann Vasc Surg. 2002; 16(3): 331-8.
2. Hensen EF, Bayley JP. Recent advances in the genetics of SDH-related paraganglioma and pheochromocytoma. Fam Cancer. 2011; 10(2): 355-63.
3. Georgiadis GS, Lazarides MK, Tsalkidis A, Argyropoulou P, Giatromanolaki A. Carotid body tumor in a 13-year-old child: Case report and review of the literature. J Vasc Surg. 2008; 47(4): 874-80.
4. Hogan AR, Sola JE, Jernigan SC, Peterson EC, Younis RT. A pediatric carotid body tumor. J Pediatr Surg. 2018; 53(7): 1432-6.
5. Shamblin WR, ReMine WH, Sheps SG, Harrison EG. Carotid body tumor (chemodectoma): clinicopathologic analysis of ninety cases. Am J Surg. 1971; 122: 732-9.
6. Moore MG, Netterville JL, Mendenhall WM, Isaacson B, Nussenbaum B. Head and neck paragangliomas: An update on evaluation and management. Otolaryngol Head Neck Surg. 2016; 154(4): 597-605.
7. Rosa M, Sahoo S. Bilateral carotid body tumor: the role of fine-needle aspiration biopsy in the preoperative diagnosis. Diagn Cytopathol. 2008; 36(3): 178-80.
8. Davila VJ, Chang JM, Stone WM, Fowl RJ, Bower TC, Hinni ML, Money SR. Current surgical management of carotid body tumors. J Vasc Surg. 2016; 64(6): 1703-10.
9. Ifeoluwa A, Lázár I, Szövördi É, Karosi T. Management of carotid body tumor in pediatric patients: A case report and review of the literature. Int J Pediatr Otorhinolaryngol. 2017; 93: 47-52.
10. Jackson RS, Myhill JA, Padhya TA, McCaffrey JC, McCaffrey TV, Mhaskar RS.The effects of preoperative embolization on carotid body paraganglioma surgery: A systematic review and meta-analysis. Otolaryngol Head Neck Surg. 2015; 153(6): 943-50.
11. Tekautz TM, Pratt CB, Jenkins JJ, Spunt SL. Pediatric extraadrenal paraganglioma. J Pediatr Surg. 2003; 38(9): 1317-21.
12. Koch C, Vortmeyer A, Zhuang Z, Brouwers FM, Pacak K. New insights into the genetics of familial chromaffin cell tumors. Ann N Y Acad Sci. 2002; 970: 11-28.