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Hybrid embolization and radiosurgery for glossopharyngeal glomus tumour. A successful case report

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Abstract

Introduction: Tumours of the glossopharyngeal nerve are extremely rare, posing a challenge in diagnosis and treatment. These tumours can cause a variety of neurological symptoms, including sore throat, numbness of the tongue, decreased sensitivity, and changes in taste, difficulty swallowing, and dizziness. Due to their rarity, there is no standardised treatment protocol, and the approach is often tailored to the individual patient.

Aim: To present a rare case of glomus tumour of the glossopharyngeal nerve, and that the hybrid method of embolisation and radiosurgery proved to be a successful treatment.

Case description: We present the case of a 31-year-old female patient who came to the Emergency Centre due to excruciating headaches, vomiting and loss of taste and

tingling in the tongue. After a detailed neurological examination and MRI diagnostics, a glossopharyngeal nerve tumour was discovered in the jugular foramen region. Due to the tumour's proximity to vital structures, surgical resection would have been high-risk. Therefore, it was decided to apply a hybrid approach, combining embolisation and radiosurgery. MRI scans showed a decrease in the size of the tumour. The patient was monitored regularly, and the results remained stable.

Conclusion: Hybrid treatment with embolisation and radiosurgery represents an effective option for the treatment of rare tumours of the glossopharyngeal nerve. This combination allows for the reduction of symptoms, reduction of tumour size, and improvement in patients' quality of life. Further research is needed to determine the optimal treatment protocols for these rare tumours.

Introduction

Tumors of the glossopharyngeal nerve are extremely rare, posing a challenge in diagnosis and treatment. These tumors can cause a variety of neurological symptoms, including sore throat, numbness of the tongue, decreased sensitivity, and changes in taste, difficulty swallowing, and dizziness. Due to their rarity, there is no standardized treatment protocol, and the approach is often tailored to the individual patient.

Case report

A 31-year-old female patient presented to the Emergency Center in March 2024 due to complaints of left-sided pulsating headache, nausea, and vomiting. Regarding previous headache episodes, the patient stated that she had experienced them before, but they were mostly correlated with her menstrual cycle. However, the headache she felt this time was extremely severe and unbearable. The patient mentioned that she had taken analgesics, but vomited them up. During the patient's examination, a blood pressure of 133/80mmHg was recorded, with a heart frequency rate of 90/min. Based on the neurological examination, it was noted that she complained of numbness of the tongue on the left side and decreased sensitivity.

The patient was then subjected to a CT diagnosis of the endocranium (Figure 1). It was found that in the left lateral cerebellomedullary cistern and cerebellopontine cistern, an irregular, lobulated, heterodense expansive lesion of approximate dimensions 25x16x29 mm was observed, propagating from the left jugular foramen, remodeling (eroding) its walls, with heterogeneous post-contrast opacification. Differential diagnosis suggested either a centrally cystic degenerated lesion or a necrotic lesion with accompanying compressive effect on the ipsilateral aspect of the medulla and cerebellum, in contact with the medial side of the left internal jugular vein. The radiological finding raised suspicion of a jugular paraganglioma, schwannoma, or meningioma. Also, at the level and partly below the left aspect of the foramen magnum, along the dura mater, a smaller expansive lesion was seen, encasing 3/4 of the circumference of the left vertebral artery like a "muff," measuring 11x14 mm, appearing separate without clear continuity with the previously described lesion, which could differentially represent either a meningioma or an exophytic component of the previously described lesion. Also, on Figure 2., the 3D VR reconstruction is displaying vascular structures of the skull base. Note the two masses located left and superior of the foramen magnum, connected by a thin vascular bridge.

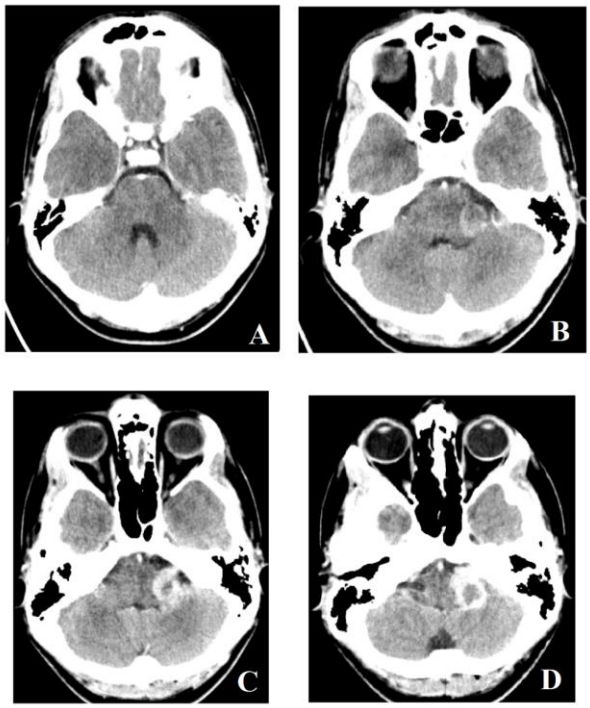

Figure 1.

After complete diagnosis and preparation, the patient was referred from the Emergency Center for further in-hospital treatment to the Clinic of Neurosurgery. During that time, from March 28, 2024. until April 12, 2024., an MRI of the

endocranium was performed (Figure 3.), which showed a tumor in the area of the jugular foramen on the left with an associated minor change below a mixed (solid-cystic) change in the left lateral cerebellomedullary and cerebellopontine cisterns, with areas of necrosis/cystic degeneration and in contact with the medial side of the left v. jugularis internae. The described strand propagates caudally under the foramen magnum, anterolaterally to the left in relation to the medulla, with which it is in contact, and that both changes are connected by an isthmus. On Figure 3, high-resolution, contiguous, thin-section coronal and sagittal MRI reconstructions are shown, displaying both masses and the bridge connecting them. Contrast-enhanced MP-RAGE MRI reconstruction shows enhancement patterns of the described masses.

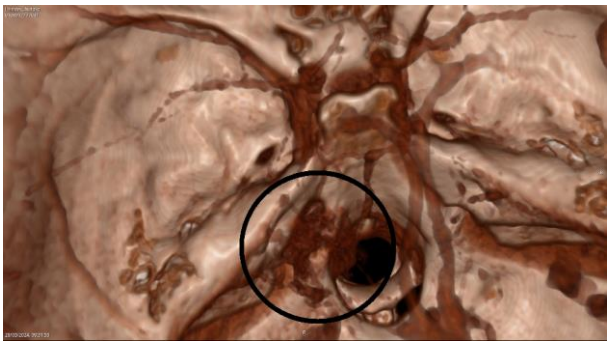

Figure 2.

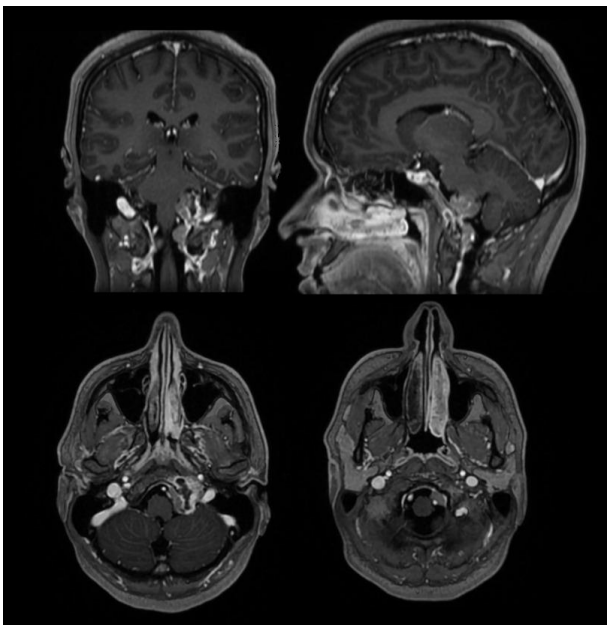

Figure 3.

As part of the preoperative preparation, the patient was examined by an endocrinologist. Normal findings were established for chromogranin A, and urinary catecholamines; there were no signs of secretory activity of the observed tumor lesion indicative of a glomus jugulare tumor. She was then examined by an otorhinolaryngologist who, based on audiometric diagnostics, found mild sensorineural hearing loss on the right side at 250, 4000, and 8000Hz, and mild to moderate sensorineural hearing loss on the left side at 4 and 8kHz.

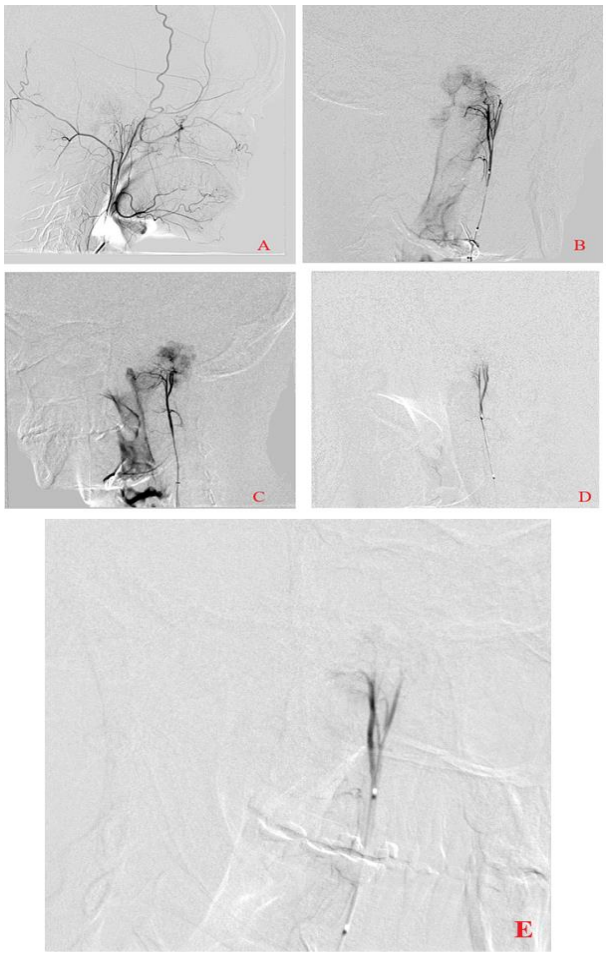

Figure 4.

The angiography of the blood vessels of the head and neck (Figure 4) - on the angiograms of both carotid and posterior basins from both vertebral arteries in the projection of the left pontocerebellar angle, a zone of pathological opacification is shown, which is vascularized from the branches of the ascending pharyngeal artery on the left side. After that, endovascular treatment was performed - the

pre-procedural angiograms from the left external carotid artery (ACE) show a zone of pathological opacification vascularized from the branches of the left AphA, then a microcatheter is used to access the feeding arteries and the particle embolization agent PVA Contour (150-250 μm) is applied, which devascularizes the tumor. She was then examined by a neurosurgeon in this department and presented to the Gamma Knife Council. The conclusion was that the patient needs to do an endocrinological examination in terms of additional evidence of a glomus jugular tumor.

Figure 4 shows a profile image of the carotid artery before the intervention (A), then the working position of the eastern pharyngeal artery (AphA) before the intervention, where predominantly marginal tumor opacification is visible (B, C), then the working position of the eastern pharyngeal artery (AphA) after the intervention (D, E). Figure 5. shows a distal profile image of the left external carotid artery (ACE) after embolization.

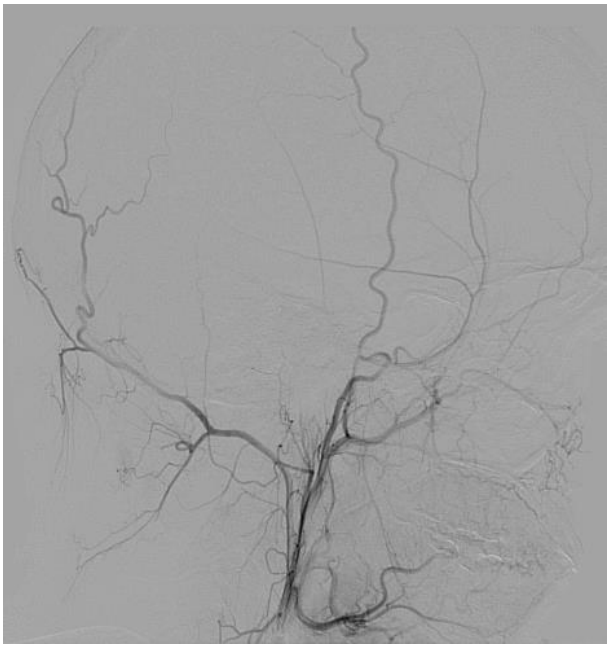

Figure 5.

After standard preparation, the patient underwent radiosurgical intervention in May 2024. A Leksell stereotactic frame was placed under local anesthesia. A pre-procedural MRI of the endocranium was performed according to protocol. Multiple radiation "shots" were delivered using different collimators. A dose of 14Gy at the 50% isodose was applied to the (T1) embolized tumor in the region of the left jugular foramen. The patient tolerated the procedure well.

Following the procedure, the patient was discharged for further home care in unchanged general and neurological condition compared to admission. The patient was regularly monitored and controlled, and no recurrence of the pathological change was recorded.

Discussion

Glomus tumors (paragangliomas) are highly vascular neuroendocrine neoplasms arising from the paraganglionic system. These tumors most commonly originate from the carotid body, jugular bulb, vagus nerve, and tympanic plexus. However, primary involvement of the ascending pharyngeal artery (APhA) is exceptionally rare (1). Even more uncommon is a tumor spanning multiple cisternal compartments while extending inferiorly beyond the cranium, and are considered complex cases (2).

Morphology

MRI reveals an expansile lesion in the left cerebellomedullary and cerebellopontine cisterns, with a second lesion of similar imaging characteristics just below the foramen magnum, anterolateral left to the medulla oblongata. The two lesions appear connected via an isthmus passing through the foramen magnum.

Both lesions exert a moderate mass effect, compressing the anterolateral part of the pons and left cerebellar peduncles while slightly remodeling adjacent bone. The superior lesion borders the medial border of the left internal jugular vein, whereas the inferior lesion encases approximately 75% of the left vertebral artery circumference.

MRI Characteristics

On T1-weighted imaging, both lesions are slightly hypointense relative to normal parenchyma, with punctate hyperintensities suggestive of flow voids, indicative of hypervascularity. Marked susceptibility on SWI and intense enhancement on post-contrast T1-weighted images further emphasize their vascular nature. On T2W/FLAIR, the lesions are moderately hyperintense. DWI demonstrates focal high signal areas, but the ADC map reveals no significant diffusion restriction—consistent with

either high cellularity or rich vascularity, both characteristic of paragangliomas. (3, 6)

Special Characteristics

The isthmus connecting the two lesions raises the possibility of either a single, extensive tumor following neurovascular structures or multiple lesions bridged by tumor tissue. A multifocal paraganglioma may appear contiguous, particularly in patients with hereditary paraganglioma syndromes (10). Additionally, a vascularized fibrous band rather than tumor tissue cannot be entirely excluded.

Given the hypervascular nature of these tumors, it is plausible that a single, expansive glomus tumor could arise from the APhA and extend superiorly. As a key feeder of skull base structures, the APhA may serve as a vascular conduit for tumor infiltration into adjacent compartments.

Interventional Radiology Findings

The patient underwent cerebral digital subtraction angiography (DSA), which demonstrated pathological opacification in the left cerebellopontine (CP) angle. The lesion was found to be vascularized by the ascending pharyngeal artery (APhA), confirming the primary feeder for the tumor. Following this, the patient underwent successful embolization, which effectively devascularized the tumor, reducing its vascularity and improving the management outlook. (7)

Gamma Knife Radiosurgery and Endocrine Consultation

In light of the clinical and radiologic findings, including the hypervascularity and the anatomical location, Gamma Knife radiosurgery was suggested as a possible treatment option. This approach is particularly beneficial for tumors located in difficult-to-access areas like the skull base, where surgical resection might carry significant risks. The decision to consider radiosurgery underscores the high vascularity of the lesion and the potential for targeted, minimally invasive treatment. (8)

Additionally, an endocrine consultation was requested due to the suspicion that this could represent a glomus jugulare tumor, a well-known form of paraganglioma that often presents in similar anatomical locations. Endocrinologists may assess for hereditary syndromes or metabolic abnormalities associated with paragangliomas, which could influence long-term management and follow-up care. (9)

Conclusion

The lesion's intense vascularity, flow voids, and enhancement pattern, combined with its anatomical location and bone remodeling rather than destruction, make an atypical paraganglioma the most plausible diagnosis. The isthmus-like structure linking the two lesions further supports a contiguous growth pattern, distinguishing it from other neoplasms. The tumor's likely origin from the ascending pharyngeal artery, a known vascular feeder of skull base structures, aligns with the expected behavior of a paraganglioma rather than any of the alternative diagnoses discussed. The findings from cerebral DSA, which demonstrated vascularization from the APhA, and the successful embolization to devascularize the tumor further confirm the diagnosis. The consideration of Gamma Knife radiosurgery, alongside endocrine consultation, underscores the complex nature of this case and the need for a multidisciplinary approach in managing such a rare and highly vascular tumor.

Schwannoma (e.g., Jugular Foramen or Vagal Schwannoma)	Schwannomas may arise along cranial nerves and exhibit moderate enhancement but typically follow a nerve's trajectory and do not demonstrate significant vascularity. In contrast, this lesion displays marked hypervascularity with flow voids on MRI and susceptibility artifacts on SWI, features strongly suggestive of paraganglioma. Additionally, schwannomas are well-circumscribed and lack the infiltrative growth pattern or isthmus-like connection seen in this case.
Meningioma (Skull Base Meningioma)	The absence of dural attachment, calcifications, or a "dural tail" sign argues against meningioma. Meningiomas typically cause hyperostosis rather than bone remodeling and lack the characteristic flow voids and intense vascularity observed here. The lesion's involvement of neurovascular structures and its continuity across the foramen magnum further support a diagnosis of paraganglioma over meningioma.
Metastatic Disease	Hypervascular metastases (e.g., from renal cell carcinoma or thyroid carcinoma) could theoretically mimic a paraganglioma's imaging characteristics. However, metastases often present as multiple, poorly circumscribed masses with aggressive bone destruction rather than the remodeling seen here. Additionally, the lack of a known primary malignancy and the tumor's contiguous growth through the foramen magnum favor a primary skull base neoplasm over metastasis.
Hemangioblastoma	Hemangioblastomas are highly vascular and may demonstrate flow voids but are more commonly found in the cerebellum and often present with a cystic component and an enhancing mural nodule, features absent in this case. Furthermore, the lack of association with von Hippel-Lindau disease and the lesion's extra-axial location make hemangioblastoma less likely.
Chordoma	Chordomas typically arise from the clivus or sacrum, presenting as destructive, lobulated masses with high T2 signal intensity. However, they generally do not exhibit the extensive flow voids and intense enhancement characteristic of paragangliomas. Unlike chordomas, the present lesion demonstrates vascular remodeling rather than aggressive bone invasion.
Aneurysm or Vascular Malformation	Aneurysms and vascular malformations can mimic hypervascular tumors, but they lack a solid parenchymal component on post-contrast MRI. Additionally, the isthmus-like connection and progressive expansion into adjacent spaces are inconsistent with a purely vascular anomaly. While MRA/CTA would be necessary to definitively exclude a vascular malformation, the imaging characteristics strongly favor a neoplasm.

Figure 6. Differential Diagnosis and Comparison with Present Case (4, 5).

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