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When Jugular Foramen Schwannoma Imitates Other Skull Base Tumors Insights from Advanced Imaging

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ABSTRACT

Jugular schwannoma is a rare benign neoplasm arising from the sheath of the lower cranial nerves within the jugular foramen. Its deep anatomical position and overlapping imaging characteristics with other skull base lesions often complicate diagnosis. We report the case of a 30-year-old male presenting with tinnitus, vertigo, and gait disturbance, in whom imaging findings were crucial for diagnosis. Contrast-enhanced computed tomography (CT) demonstrated a heterogeneously enhancing, partially solid lesion occupying the jugular foramen with evidence of adjacent bone erosion. Magnetic resonance imaging (MRI) revealed a mass that appeared hypointense on T1-weighted images, hyperintense on T2-weighted sequences, and showed moderate to marked post-contrast enhancement. Histopathological evaluation confirmed the diagnosis of jugular schwannoma. This case emphasizes the pivotal role of multimodal imaging—particularly high-resolution MRI, CT with bone detail, and MR angiography—in distinguishing jugular schwannoma from other skull base tumors such as paraganglioma, meningioma, or metastasis by assessing bone remodeling, vascularity, and the nerve of origin. Early and accurate radiologic identification of jugular schwannoma is essential for appropriate surgical planning and improved patient outcomes.

KEYWORDS: Jugular Schwannoma; Cranial Nerve Tumor; Jugular Foramen; Skull Base Lesion; Magnetic Resonance Imaging; Computed Tomography; Differential Diagnosis; Surgical Planning.

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INTRODUCTION

Jugular foramen schwannomas (JFS) are rare benign tumors arising from the lower cranial nerves, most commonly the glossopharyngeal, vagus, or accessory nerves, and account for a small proportion of skull base neoplasms. Their clinical and radiologic presentation often overlaps with other lesions involving the jugular foramen region, such as paragangliomas, meningiomas, metastatic disease, or inflammatory processes, making accurate diagnosis challenging. Conventional imaging may be insufficient to differentiate these entities due to similar patterns of bone remodeling, cranial nerve involvement, and mass effect on adjacent structures. In this context, advanced imaging modalities—including high-resolution MRI, diffusion-weighted imaging, MR angiography, CT with bone algorithm, and occasionally functional sequences—play a pivotal role in characterizing lesion origin, vascularity, growth pattern, and intracranial extension. Improved diagnostic precision is crucial, as it influences treatment strategy, surgical planning, and prognosis, given the complex anatomy of the skull base and the risk of postoperative neurological deficits. Consequently, a comprehensive imaging-based approach is essential to distinguish jugular foramen schwannomas from other skull base lesions and to optimize patient outcomes.

CASE PRESENTATION

We present a case of a 30-year-old male with, tinnitus, ataxia, and vertigo, in whom imaging findings were pivotal in diagnosing a jugular schwannoma. Contrast-enhanced CT demonstrated a heterogeneously enhancing semi-solid mass in the jugular foramen with a bone destruction. MRI shows hypointense on T1WI, hyperintense on T2WI, and moderate-to-marked contrast enhancement. Histopathological examination confirmed jugular schwannoma.

Imaging and Pathological Findings

Non contrast head CT shows hypodense lesion that appears inhomogeneous, located in the right cerebellar region and the right skull base, with ill-defined margins and irregular borders, accompanied by calcification dan concluded as right cerebellopontine angle (CPA) mass with suspected intralesional hemorrhage, with differential diagnoses including vestibular schwannoma and meningioma (Fig1 and Fig2).

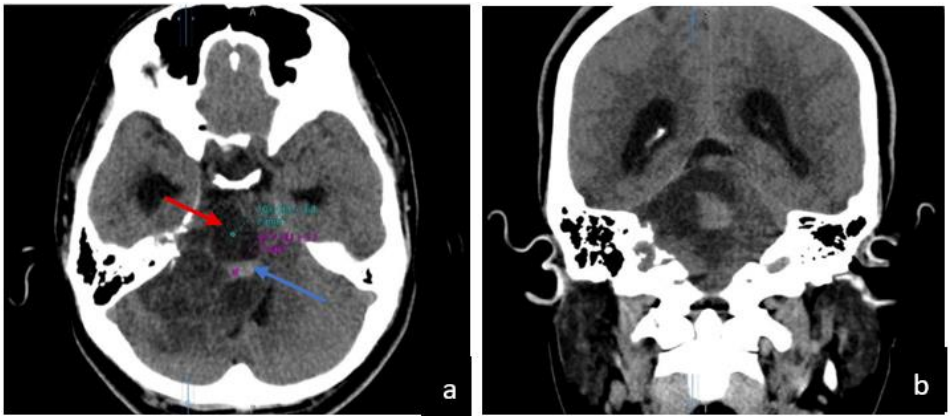

Fig1. (a and b) Non-contrast head CT scans in axial and coronal sections show a hypodense lesion (HU 10.6 ± 4.8, blue arrow) that appears inhomogeneous, with ill-defined margins and irregular borders, accompanied by calcification (HU 47.7 ± 3.7, red arrow). The lesion is located in the right cerebellar region and the right skull base.

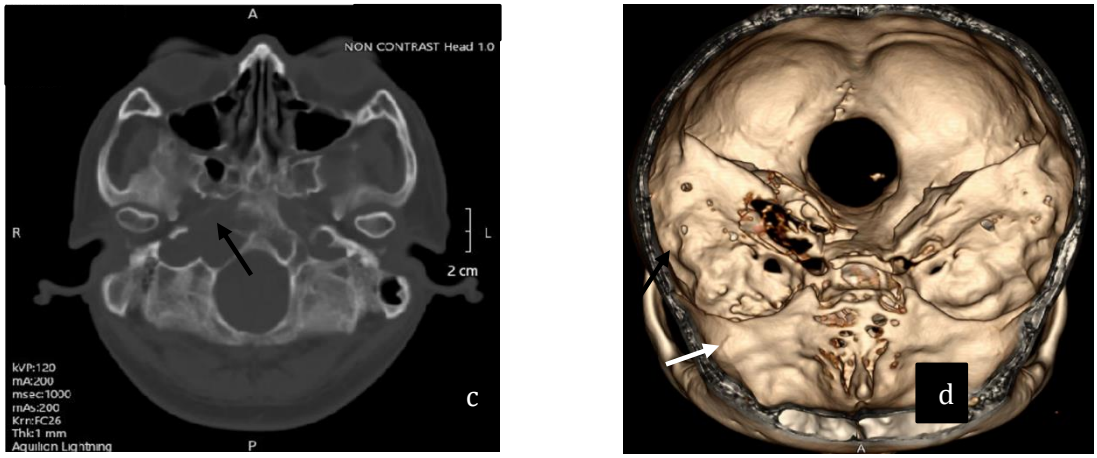

Fig2. (c) The bone window and (d) the 3D reconstruction of the skull base show that the lesion is associated with bone destruction involving the right skull base (black arrow) and the right side of the sella turcica (white arrow).

Subsequently, the patient underwent a brain MRI, which demonstrated the following findings: An inhomogeneous mass with relatively well-defined margins and irregular borders, measuring approximately 4.54 × 4.53 × 4.44 cm, is observed in the right jugular foramen region. The lesion appears to extend and exert mass effect on the medulla oblongata, pons, and right side of the brainstem, as well as compress the cerebellum in the right cerebellopontine angle and cause narrowing of the fourth ventricle. Evidence of neural compression is noted involving the right trigeminal nerve (cranial nerve V), abducens nerve (cranial nerve VI), facial nerve (cranial nerve VII), vestibulocochlear nerve (cranial nerve VIII), glossopharyngeal nerve (cranial nerve IX), vagus nerve (cranial nerve X), and accessory nerve (cranial nerve XI). The mass demonstrates heterogeneously hypointense signal on T1-weighted images, heterogeneously hyperintense signal on T2-weighted and T2FLAIR images (Fig3), no restricted diffusion on DWI-ADC sequences, and no blooming artifact on SWI (Fig4). Post-contrast imaging shows heterogeneous enhancement. These radiological features are consistent with a jugular foramen schwannoma.

The patient underwent surgical excision of the mass, which was subsequently submitted for histopathological examination. Microscopic evaluation revealed a tumor composed of oval to spindle-shaped cells exhibiting hyperplastic growth, arranged in clusters with areas of cellular compaction. The nuclei of the oval to spindle cells appeared mildly hyperchromatic, with few mitotic figures observed. In certain areas, the tumor cells were organized in a palisading pattern, forming Verocay bodies (Fig5). The connective tissue stroma showed infiltration by lymphocytic inflammatory cells accompanied by focal hemorrhage. No malignant tumor cells were identified. These findings are consistent with a schwannoma located in the right jugular foramen region.

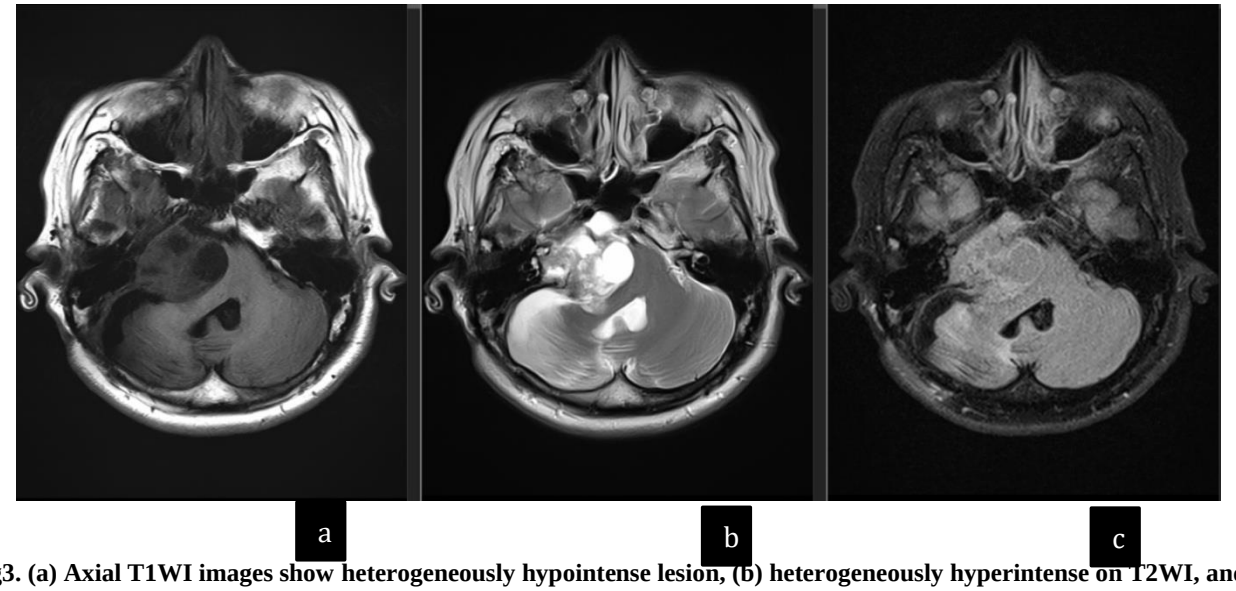

Fig3. (a) Axial T1WI images show heterogeneously hypointense lesion, (b) heterogeneously hyperintense on T2WI, and (c) Irregular hyperintensity at the lesion margin on T2 FLAIR in the right jugular foramen region, which appears to extend and compress the medulla oblongata, pons, and right side of the brainstem.

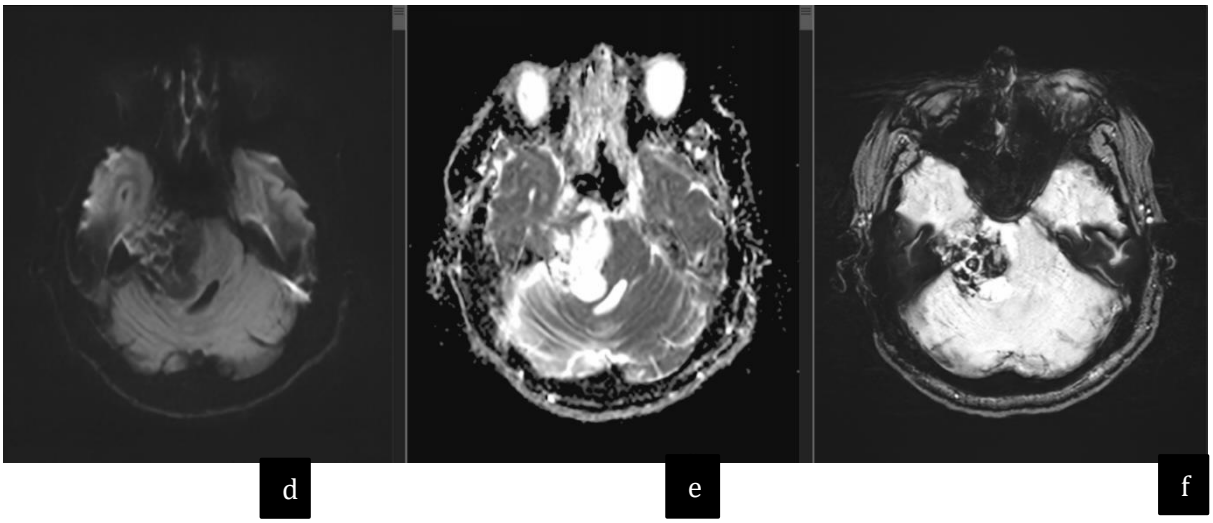

Fig4. (d and e) Axial DWI and ADC slices show no restricted diffusion and (f) SWI images show no evidence of blooming artifact.

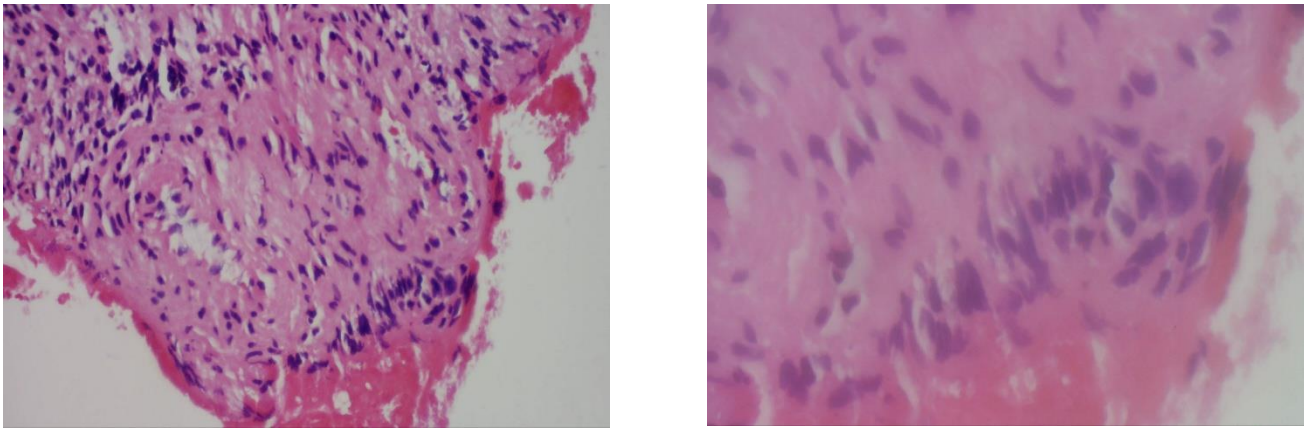

Fig5. Histopathological examination of the jugular foramen mass. Hematoxylin and eosin (H&E) at (a) 400× and (b) 1000× magnification staining shows a spindle-cell neoplasm arranged in intersecting fascicles. The tumor cells have elongated nuclei with tapered ends, forming nuclear palisading around acellular, eosinophilic areas known as Verocay bodies (Antoni A pattern). The stroma shows areas of loose, less cellular tissue consistent with Antoni B pattern. No significant nuclear atypia, mitotic figures, or necrosis are observed. These findings are characteristic of Schwannoma (Neurilemmoma).

DISCUSSION

Jugular foramen schwannomas are uncommon skull base neoplasms that often present with non-specific clinical symptoms, making radiologic evaluation essential for early recognition [1]. In this case, tinnitus, vertigo, and gait imbalance reflected mass effect on vestibulocochlear pathways and posterior fossa structures, a pattern frequently described due to the restricted jugular foramen compartment and early cranial nerve involvement [2].

Imaging is the cornerstone of diagnosis, as clinical presentation alone lacks specificity. CT demonstrated a heterogeneous mass with erosion of the jugular foramen. Although schwannomas typically cause smooth enlargement or remodeling of the foramen, chronic or bulky lesions may produce irregular destruction, as seen here [1]. MRI further characterized the lesion by revealing T1 hypointensity, T2 hyperintensity, and heterogeneous enhancement—hallmark features of schwannoma. Importantly, the absence of flow voids or marked intralesional vascularity helped distinguish this lesion from paragangliomas, which classically show a “salt-and-pepper” pattern on MRI due to serpiginous flow voids and punctate high-signal foci representing hemorrhage and slow flow [3]. The lack of dural attachment or adjacent hyperostosis further argued against meningioma, another key differential diagnosis in this location [4]. The involvement of multiple cranial nerves (CN V–XI) and extension into the cerebellopontine angle illustrates the tumor’s capacity to spread along neural pathways beyond the jugular foramen [1, 4].

Histopathology confirmed the diagnosis by demonstrating spindle-cell proliferation arranged in Antoni A and B patterns with Verocay bodies, without malignant features, consistent with a benign schwannoma [1]. Although surgical excision remains the standard management, complete resection is often technically challenging due to proximity to lower cranial nerves and the jugular bulb [5]. From an imaging perspective, presurgical MRI—including contrast-enhanced, high-resolution T2 sequences, and vascular evaluation with MR angiography or CT angiography—is crucial for defining tumor extent, vascular relationships, and optimal surgical approach planning. In select cases, postoperative imaging and stereotactic radiosurgery may complement subtotal resection to preserve neurological function [5].

This case underscores the key role of advanced multimodality imaging in differentiating jugular foramen schwannomas from radiologic mimics such as paragangliomas, meningiomas, and metastatic disease. Accurate radiologic characterization directly influences treatment decisions, surgical strategy, and prognosis. For radiologists, familiarity with the imaging spectrum and extension patterns of jugular foramen schwannomas is essential to avoid misdiagnosis, ensure timely intervention, and support optimal patient outcomes.

CONCLUSION

This case highlights the key imaging features of jugular schwannomas. Due to their anatomical location and variable growth patterns, jugular schwannoma can mimic other skull base lesions, such as paragangliomas, meningiomas, or metastatic tumors, leading to potential misdiagnosis and inappropriate management. Advanced imaging techniques, including high-resolution MRI with contrast, CT with bone window settings, and MR angiography, play a critical role in differentiating jugular foramen schwannoma from other pathologies by highlighting key features such as bony remodeling, tumor vascularity, and nerve of origin. Early recognition can guide appropriate management and improve patient outcomes.

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