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Magnetic Resonance Imaging and Computed Tomography Features of Jugular Paraganglioma: A Case Report

Dr. Varun Trivedi[1], Dr. Narendra Tembhekar[2], Dr. Nitin Bhutada[3], Dr. Amit Disawal[4], Dr. Ramesh Parate[5], Dr. Varsha Rathi[6]

[1]Junior Resident, Department of Radiology, GMCH Nagpur
[2,3,4]Associate Professor, Department of Radiology, GMCH Nagpur
[5]Professor, Department of Radiology, GMCH Nagpur
[6]Professor and HOD, Department of Radiology, GMCH Nagpur

Abstract
Jugular paraganglioma is a rare, highly vascular tumor arising from paraganglionic cells located in the region of the jugular foramen. It commonly presents with nonspecific symptoms such as hearing loss, pulsatile tinnitus, or lower cranial nerve deficits, making imaging essential for accurate diagnosis. Computed tomography (CT) and magnetic resonance imaging (MRI) play complementary roles in evaluating the extent, vascularity, and bony involvement of these lesions.
A case of a 39 year female presenting with pulsatile tinnitus and progressive right sided conductive hearing loss is described. CT demonstrated a permeative destructive lesion involving the jugular foramen with characteristic moth-eaten appearance of adjacent bone. MRI revealed a well-defined lesion showing multiple flow voids, producing the classic "salt and pepper" appearance on T2-weighted images, with intense post-contrast enhancement. These imaging findings were consistent with jugular paraganglioma.
Recognition of characteristic imaging features on CT and MRI allows accurate diagnosis and helps guide appropriate management strategies, avoiding unnecessary invasive procedures.

Keywords: Jugular Paraganglioma, Glomus Jugulare, Skull Base Tumor, Magnetic Resonance Imaging, Computed Tomography

1. Introduction

Jugular paragangliomas are rare, highly vascular neuroendocrine tumors that arise from paraganglionic cells associated with the jugular bulb and along the course of cranial nerves [1]. These tumors are part of the spectrum of head and neck paragangliomas and are characterized by slow growth but locally aggressive behavior due to their proximity to critical neurovascular structures.
Clinically, patients may present with pulsatile tinnitus, hearing loss, lower cranial nerve palsies, or a mass in the region of the skull base. Due to nonspecific clinical presentation, imaging plays a pivotal role in establishing the diagnosis and assessing the extent of disease [2].
Computed tomography (CT) is useful in evaluating bony involvement, typically demonstrating a moth-eaten or permeative pattern of bone destruction at the jugular foramen. Magnetic resonance imaging (MRI), on the other hand, provides superior soft tissue contrast and demonstrates the characteristic "salt-

and-pepper" appearance due to multiple flow voids representing high vascularity [3].
Accurate radiologic diagnosis and differentiation from other skull base lesions are essential for guiding management, which may include surgical resection, radiotherapy, or a combination of both [4].

2. Case Presentation

A 39-year-old female who presented with complaints of pulsatile tinnitus and progressive right sided conductive hearing loss. There were no significant associated neurological deficits at the time of presentation. Clinical examination suggested a lesion involving the region of the middle ear and skull base.
Computed tomography of the temporal bone revealed a permeative, destructive lesion centered at the jugular foramen with a moth-eaten pattern of bony erosion involving the adjacent temporal bone. The lesion demonstrated expansion of the jugular foramen with irregular margins.
Magnetic resonance imaging demonstrated a well-defined lesion in the region of the jugular foramen appearing hypointense to isointense on T1-weighted images and heterogeneously hyperintense on T2-weighted images. Multiple internal signal voids were noted within the lesion, producing the characteristic salt and pepper appearance, suggestive of high vascularity. Post-contrast images showed intense, homogeneous enhancement of the lesion. The lesion was seen extending into adjacent structures without evidence of intracranial parenchymal invasion. Based on the characteristic imaging features, a diagnosis of jugular paraganglioma was made.

3. Discussion

Paragangliomas of the head and neck are uncommon tumors arising from neural crest-derived paraganglionic tissue and are most frequently located at the carotid body, jugular bulb, and along the vagus nerve [1]. Jugular paragangliomas, also known as glomus jugulare tumors, specifically originate from paraganglia located in the adventitia of the jugular bulb.
These tumors are typically slow-growing but can cause significant morbidity due to local invasion of adjacent structures, including cranial nerves and vascular channels. Clinical manifestations depend on tumor size and location, with common symptoms including pulsatile tinnitus, hearing loss, and cranial nerve deficits.
Imaging plays a central role in diagnosis. CT is particularly useful for assessing bony erosion and typically demonstrates a permeative or moth-eaten pattern of destruction involving the jugular foramen [2]. MRI is the modality of choice for soft tissue characterization and extent evaluation. The classic "salt-and-pepper" appearance seen on T2-weighted images is attributed to a combination of high-flow vascular channels (flow voids) and slow-flow or hemorrhagic components [3].
Differential diagnoses include schwannomas, meningiomas, and metastases involving the skull base. However, the presence of intense contrast enhancement and internal flow voids strongly favors paraganglioma. Radiologic-pathologic correlation is essential for accurate diagnosis and appropriate classification, which in turn guides management strategies [4].
Jugular paragangliomas may be classified using the Glasscock–Jackson classification, which is based on the extent of tumor involvement and local invasion. This classification ranges from small tumors limited to the promontory (Type I) to extensive lesions involving the skull base and intracranial structures (Type IV). Imaging plays a crucial role in accurately determining tumor extent and staging, thereby guiding treatment planning and prognostication.

4. Figures

Figure 1: Computed Tomography Showing Jugular Paraganglioma

Figure 1A: Axial CT Brain Plain shows irregularly eroded with a moth-eaten pattern involving right jugular foramen & right mastoid air cells (arrow).

Figure 1B: Axial CT Brain Plain shows erosion of right jugular spine (right arrow).

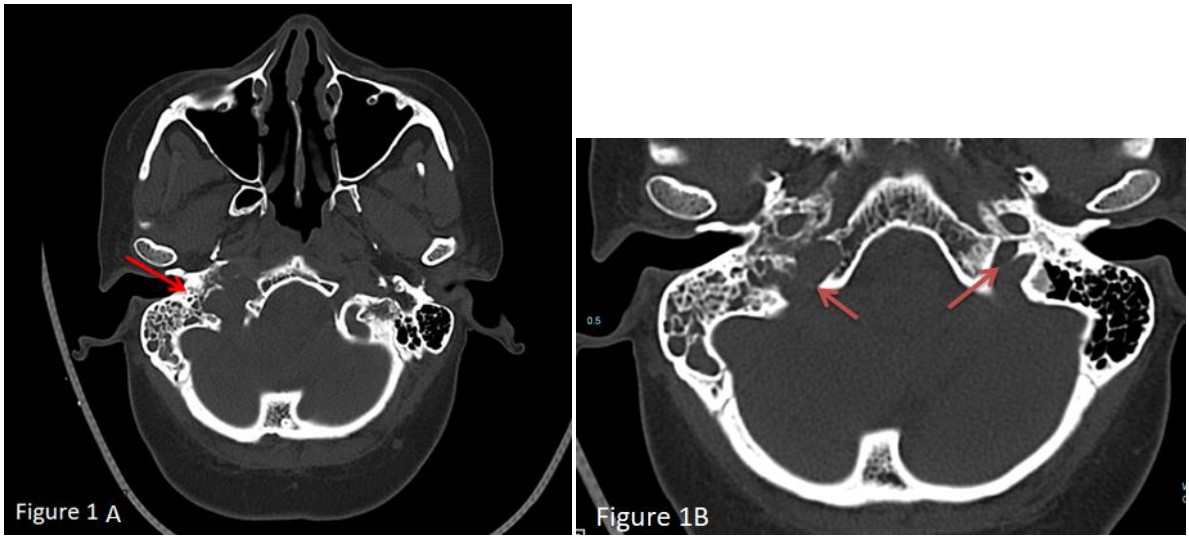
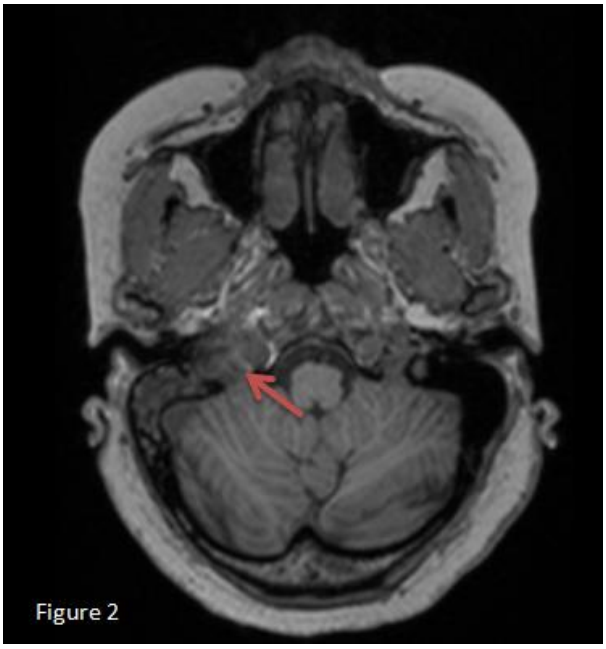


Figure 2: MRI T1-Weighted Image Showing Lesion

Salt and pepper appearance is seen, where "salt" represents hemorrhage/slow flow and "pepper" represents flow voids due to high vascularity (arrow).



Figures 3: MRI T2-Weighted Image Showing Lesion

Salt and pepper appearance is again demonstrated due to multiple internal flow voids (arrow).

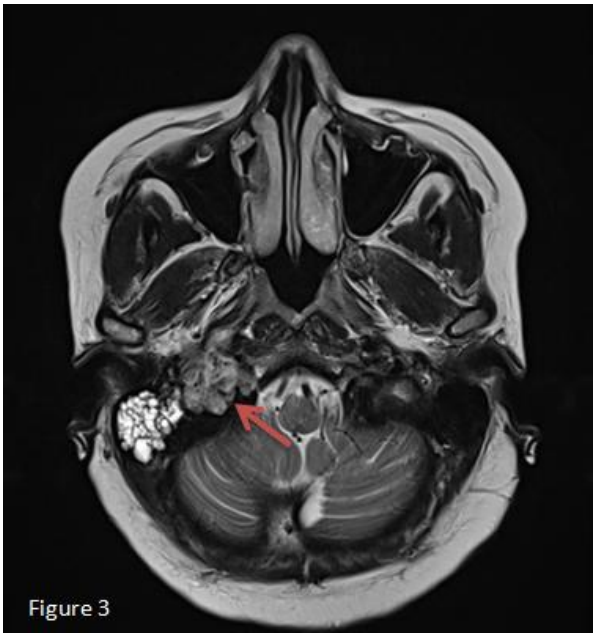


Figure 4: MRI DWI and ADC Images

Lesion shows patchy diffusion restriction with corresponding low ADC values (arrow).

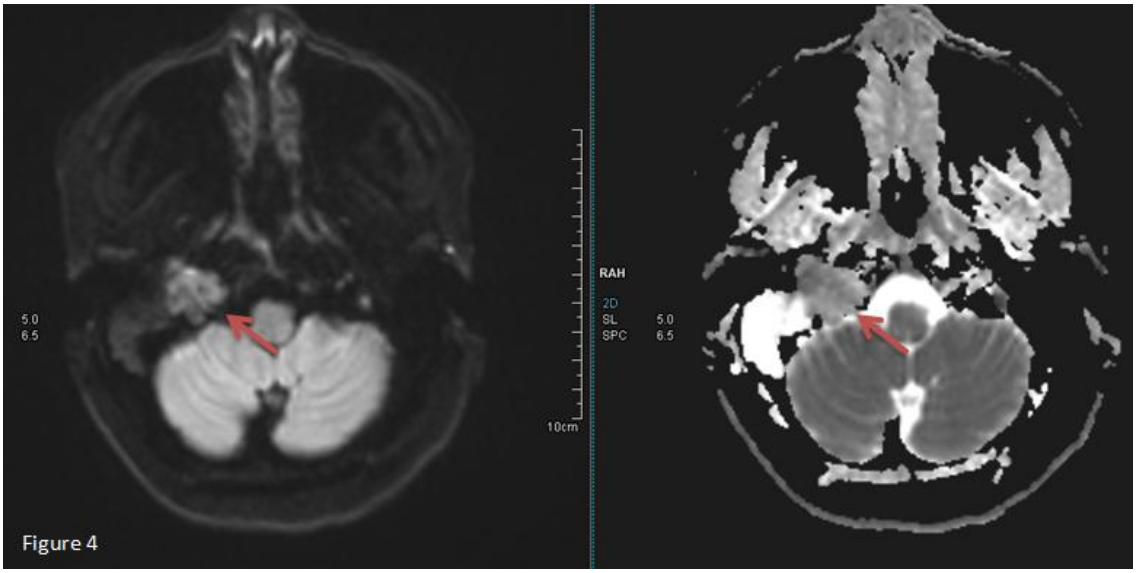


Figure 5: Post-Contrast MRI Image

Lesion shows intense homogeneous post-contrast enhancement (arrow).

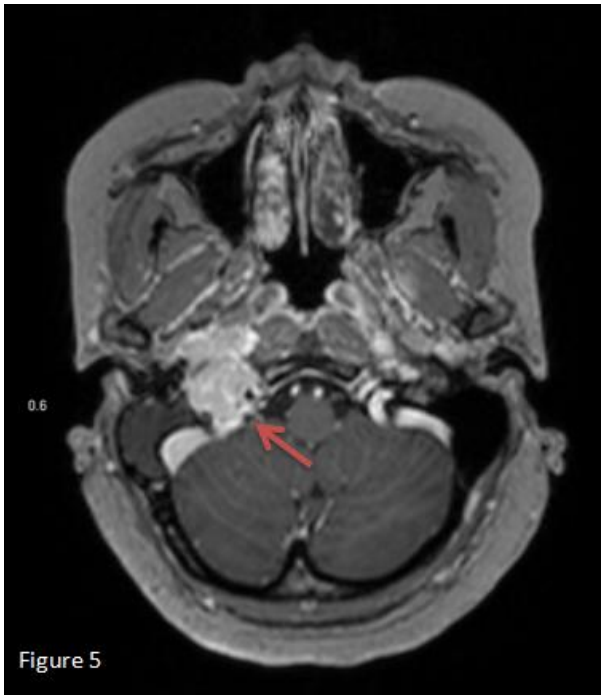


Figure 6: MR Angiography Axial Image

Lesion shows infiltration and compression of the right internal jugular vein with encasement of the petrous internal carotid artery (arrow).

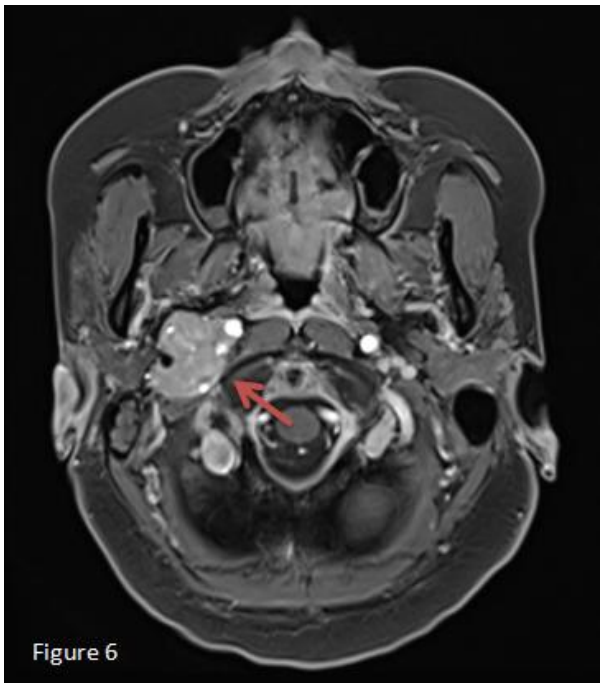
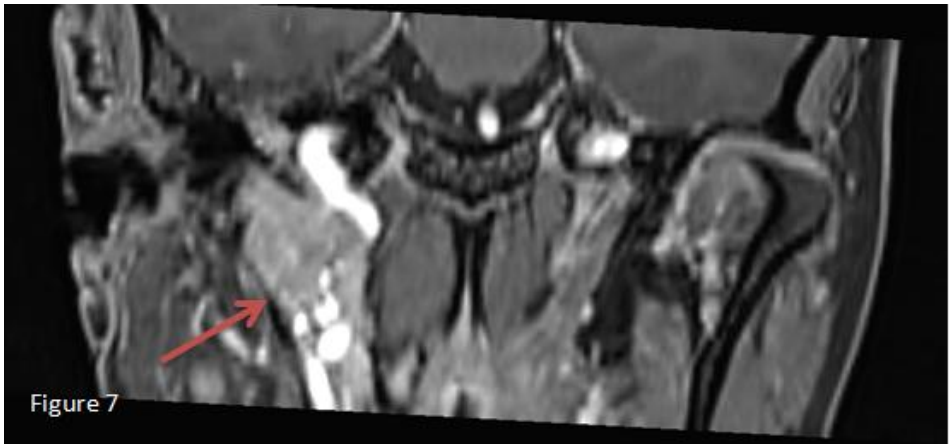


Figure 7: MR Angiography Coronal Image

Coronal image demonstrates vascular encasement and extent of lesion (arrow).



5. Conclusion

Jugular paragangliomas are rare vascular tumors that require a high index of suspicion for diagnosis. Computed tomography and magnetic resonance imaging play complementary roles in identifying characteristic features such as bony destruction and the salt and pepper appearance. Early and accurate diagnosis based on imaging findings is crucial for appropriate management and improved patient outcomes.

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7. References

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