Computed Tomography of Jugular Foramen Neurinomas

—Report of Four Cases—

Akira UCHINO, Kanehiro HASUO, Masashi FUKUI*,
Toshio MATSUSHIMA*, Shozo TAMURA and Kotaro YASUMORI

*Departments of Radiology and *Neurosurgery,
Faculty of Medicine, Kyushu University, Fukuoka*

Abstract

Four jugular foramen neurinomas studied by computed tomography and verified by surgery originated from the glossopharyngeal nerve. Characteristic CT findings were a mixed low- and isodense extraaxial mass with ring-like enhancement in the cerebellopontine angle; enlargement of the jugular foramen, with smooth margins and a normal internal auditory canal; and an extracranial soft tissue mass extending through the jugular foramen.

Key words: jugular foramen, neurinoma, computed tomography

Introduction

Jugular foramen neurinomas (JFNs), which arise from the cranial nerves in the jugular foramen, are rarely unaccompanied by neurofibromatosis. The characteristic computed tomographic (CT) findings of JFN have not been well documented in the literature.^{1-3,5-7,10} The purpose of this report is to review the CT findings of our own and others' JFN cases and describe the characteristic CT manifestations of JFN.

Case Reports

Case 1: A 28-year-old female experienced stiffness in the left shoulder, hoarseness, laryngeal pain, and complete hearing loss in the left ear. Precontrast CT scans demonstrated a mixed low- and isodense mass in the left cerebellopontine (CP) angle (Fig. 1A). Postcontrast CT scans showed ring-like enhancement very much like that of an acoustic neurinoma (Fig. 1B). However, there was no enlargement of the ipsilateral internal auditory canal. Direct coronal CT

scans revealed marked enlargement of the left jugular foramen, which had a smooth margin, and an extracranial soft tissue mass (Fig. 1C). Surgery confirmed the tumor to be a glossopharyngeal neurinoma.

Case 2: A 57-year-old female complained of headache, nausea and vomiting, dysarthria, and dysphagia. Precontrast CT scans revealed a mixed low- and isodense mass in the right CP angle. On postcontrast CT scans the mass exhibited ring-like enhancement. Metrizamide CT cisternograms of the posterior fossa demonstrated an extraaxial mass in the right CP angle cistern and an enlarged right jugular foramen with a smooth margin (Fig. 2A and B). Postcontrast CT scan at the upper cervical level revealed an extracranial mass occupying the right jugular vein (Fig. 2C). This case was therefore easily diagnosed as a JFN, and on surgery it proved to be a glossopharyngeal neurinoma.

Case 3: A 42-year-old female developed tinnitus and hearing impairment of the right ear, right facial paresis, and dysesthesia of the tongue. Precontrast CT scans demonstrated a mixed low- and isodense

Received June 18, 1986; Accepted March 6, 1987

Author's present address: A. Uchino, M.D., Department of Radiology, Kyushu Rosai Hospital, Kitakyushu, Fukuoka, Japan.

Fig. 1 Case 1. A: Precontrast CT scan demonstrates a mixed low- and isodense mass in the left CP angle. B: Postcontrast CT scan shows ring-like enhancement. C: Direct coronal postcontrast CT scan reveals a smooth, enlarged left jugular foramen and an extracranial soft tissue component.

Fig. 2 Case 2. A and B: Metrizamide CT cisternograms clearly demonstrate an extraaxial mass and a smoothly enlarged jugular foramen. C: Postcontrast CT scan at the upper cervical level shows a mass in the right jugular vein.

mass in the right CP angle, which, on postcontrast CT scans, was non-uniformly enhanced but showed a ring-like component (Fig. 3A). Sagittal and coronal reconstructed images of the postcontrast CT scans demonstrated an enlarged, smooth-margined right jugular foramen and a large mass with intra- and extracranial components (Fig. 3B and C). The preoperative diagnosis was JFN; the postoperative diagnosis, glossopharyngeal neurinoma.

Case 4: A 64-year-old male complained of hoarseness and dysphagia. Precontrast CT scans showed

no abnormality. Postcontrast CT disclosed a small, uniformly enhanced mass in the left CP angle (Fig. 4A). Metrizamide CT cisternograms demonstrated a small extraaxial mass in the left CP angle cistern and an enlarged left jugular foramen with smooth margins (Fig. 4B and C). There was also an extracranial extension. The preoperative diagnosis was JFN; the postoperative diagnosis, glossopharyngeal neurinoma.

The CT findings of these four cases are summarized in Table 1.

Discussion

So-called jugular foramen neurinomas (JFNs) are rare. Fink *et al.*³⁾ were the first to report a case of JFN imaged by CT. Kaye *et al.*⁵⁾ described 13 cases of JFN and classified them according to their growth patterns as A) primarily intracranial, B) primarily intraosseous, and C) primarily extracranial. Twelve of these patients were examined with CT, and in 11 cases the images showed abnormalities. However, Kaye *et al.* did not describe the specific CT findings of JFN. The previously reported JFNs imaged by CT are summarized in Table 2.

In our series, Cases 1 to 3 correspond to Kaye's Type A, while Case 4 is probably Type B. The intracranial tumor components in Cases 1 to 3 consisted of large, mixed low- and isodense extraaxial masses with ring-like enhancement in the CP angle; these images resemble those of acoustic neurinomas.⁴⁾ The intracranial component in Case 4 was so small that it was not detected by routine precontrast CT scans. Metrizamide CT cisternography is useful in demon-

Fig. 3 Case 3. A: Postcontrast CT scan shows non-uniform enhancement with a ring-like component. B and C: Sagittal and coronal reconstructed images of the postcontrast CT scans demonstrate an enlarged jugular foramen with smooth margins and an extracranial component.

strating small intracranial extraaxial masses and in differentiating extraaxial from intraaxial masses.⁹⁾

The enlarged jugular foramina had smooth margins in all four of our cases. Glomus jugulare tumors also cause enlargement of the jugular foramen; however, the margins are usually irregular.^{1,6)} Acoustic neurinomas generally cause enlargement of the internal auditory canal but not of the jugular foramen. Thus, enlargement of the jugular foramen with smooth margins is the most characteristic manifestation of JFN. The intracisternal type of accessory nerve neurinoma, however, may not affect the size of the jugular foramen,⁸⁾ and in these cases CT does not provide diagnostic evidence. Since the jugular foramen of normal individuals are usually asymmetrical, it is sometimes difficult to determine whether or not the jugular foramen is enlarged. A large jugular bulb as a normal variant must be differentiated from enlargement caused by a tumor. On CT examination of a large jugular bulb, there is no enhanced mass in the ipsilateral CP angle or below the jugular foramen and the jugular foramen is not hypoplastic on the contralateral side. Such angiographic procedures as intravenous digital subtraction angiography can provide a definite diagnosis.

Extracranial extension *via* the jugular foramen was observed in all of our cases. Demonstration of the caudal margin of the JFN is important in planning the surgical approach. For this reason, additional CT scans of the upper cervical region must be obtained. Direct coronal CT scans or thin-slice axial CT scans with sagittal and coronal reconstructed images are especially useful in delineating the caudal margin of the mass.

Although JFN is a rare tumor, its diagnosis by CT is relatively easy if one is familiar with the characteristic findings described above.

Table 1 CT findings of jugular foramen neurinomas

Case No.	Age/Sex	Size	Density on plain CT	Pattern of contrast enhancement	Findings of metrizamide CT cisternography	Jugular foramen	Extracranial extension
1	28/F	large	mixed low & iso	ring-like	—	smoothly enlarged	present
2	57/F	large	mixed low & iso	ring-like	extraaxial	smoothly enlarged	present
3	42/F	large	mixed low & iso	heterogeneous with ring-like component	—	smoothly enlarged	present
4	64/M	small	iso?*	solid	extraaxial	smoothly enlarged	present

*Routine precontrast CT scans showed no abnormality.

Fig. 4 Case 4. A: Postcontrast CT scan shows a small uniformly enhanced mass in the left CP angle. B and C: Metrizamide CT cisternograms disclose a small extraaxial mass and an enlarged jugular foramen with smooth margins.

Table 2 Published descriptions of jugular foramen neurinomas with CT features

Author (Year)	Age/ Sex	Density on plain CT	Pattern of contrast enhancement	Jugular foramen	Cranial nerve
Fink <i>et al.</i> (1978) ³⁾	30/M	mixed low & iso	ring-like	—	IX
Martinez <i>et al.</i> (1981) ⁷⁾	15/F	high	solid	—	IX
Sugawara <i>et al.</i> (1981) ¹⁰⁾	36/M	low	ring-like	—	?
Lo <i>et al.</i> (1984) ⁶⁾	?	—	—	smoothly enlarged	X
Chakeres <i>et al.</i> (1984) ¹⁾	?	—	ring-like	markedly enlarged	IX
Kaye <i>et al.</i> (1984) ⁵⁾	40/M	mixed low & iso	ring-like	—	?
"	53/F	—	solid	smoothly enlarged	?
"	44/M	—	solid	enlarged	?
Crumley <i>et al.</i> (1984) ²⁾	20/M	—	ring-like	enlarged	?
"	29/M	—	heterogeneous	enlarged	?
"	54/M	—	heterogeneous	enlarged	?

Acknowledgment

We are grateful to Walter J. Russell, M.D., D.M.Sc., of the Radiation Effects Research Foundation, Hiroshima, for his assistance with this manuscript.

References

- Chakeres DW, LaMasters DL: Paragangliomas of the temporal bone: High-resolution CT studies. *Radiology* 150: 749-753, 1984
- Crumley RL, Wilson C: Schwannomas of the jugular foramen. *Laryngoscope* 94: 772-778, 1984
- Fink CLH, Early CCB, Bryan RN: Glossopharyngeal schwannomas. *Surg Neurol* 9: 239-245, 1978
- Gyldensted C, Lester J, Thomsen J: Computer tomography in the diagnosis of cerebellopontine angle tumors. *Neuroradiology* 11: 191-197, 1976
- Kaye AH, Hahn JF, Kinney SE, Hardy RW Jr, Bay JW: Jugular foramen schwannomas. *J Neurosurg* 60: 1045-1053, 1984
- Lo WWM, Solti-Bohman LG, Lambert PR: High-resolution CT in the evaluation of glomus tumors of the temporal bone. *Radiology* 150: 737-742, 1984
- Martinez R, Vaquero J, Cabezudo J, Areitio E, Bravo G: Neurinomas of the jugular foramen in children. Report of two cases. *J Neurosurg* 54: 693-695, 1981
- Matsushima T, Fukui M, Matsunaga M, Kitamura K, Hasuo K: Accessory nerve neurinoma mimicking

- a brain stem tumor on angiography: Report of a case. *Neurosurgery* 16: 839-842, 1985
- 9) Steele JR, Hoffman JC: Brainstem evaluation with CT cisternography. *AJR* 136: 287-292, 1981
- 10) Sugawara A, Kowada M, Nishino K, Sakamoto T: Jugular foramen neurinoma. Report of a case. *No Shinkei Geka* 9: 829-833, 1981 (in Japanese)

Address reprint requests to: A. Uchino, M.D., Department of Radiology, Kyushu Rosai Hospital, 1-3-1 Kuzuhara-takamatsu, Kokuraminami-ku, Kitakyushu, Fukuoka 800-02, Japan.