Dumbbell-Shaped Jugular Foramen Tumors Extending to the Neck: Surgical Considerations Based on Imaging Findings

Jie He[1,2], Jinghai Wan[1,2], Bing Zhao[2], Hongqing Cai[1], Yuehuang Wu[3], Xueji Li[1], Haipeng Qian[1], Xiaoli Meng[1]

■ OBJECTIVE: **Dumbbell-shaped jugular foramen tumors (DSJFTs) extending to the neck present diagnostic and management difficulties because of their rarity, various pathologies, and multidisciplinary involvement. Accurate imaging findings are of great importance for surgical planning and clinical outcomes. However, few articles have discussed this issue to date.**

■ METHODS: **Thirty-one patients with DSJFTs extending to the neck were surgically treated in a single stage at our institute. Their clinical and radiologic features, operative procedures, and outcomes were retrospectively reviewed.**

■ RESULTS: **Preoperative correct diagnosis of DSJFTs extending to the neck was made in all cases of benign tumor and in only 3 cases of malignant tumors in this series. All tumors were removed via a craniocervical approach by a multidisciplinary skull base team because of both their intracranial and neck extensions. Total removal was achieved in 26 patients (83.9%). Preoperative symptoms were improved in 18 patients, whereas new or worsening lower cranial nerve deficits occurred in 4 patients postoperatively. Follow-up (1–132 months, mean 64.4 months) was available in 90.3% of the patients. No clinical or radiologic signs of tumor recurrence were observed.**

■ CONCLUSIONS: **Preoperative radiologic evaluation of DSJFTs extending to the neck is essential for differential diagnosis, patient selection, and surgical planning. Favorable surgical outcomes can be achieved via a craniocervical approach, and some detailed imaging findings are helpful to increase the safety of tumor resection and reduce the morbidity of lower cranial nerve deficits and cerebrospinal fluid leakage.**

INTRODUCTION

Jugular foramen tumors (JFTs) are notably rare skull base lesions. The resection of JFTs poses a formidable challenge because of their deep location and surrounding structures.[1] Previous reports have shown that microsurgery for JFTs could cause considerable postoperative morbidities, including a variety of deficits that affect lower cranial nerves (LCNs).[2] The treatment for patients who have dumbbell-shaped jugular foramen tumors (DSJFTs) with both intracranial and cervical extensions is even more difficult.[3] It is almost impossible to remove these giant tumors completely using a 1-stage, single-discipline approach because their intracranial and cervical extensions require multidisciplinary cooperation including neurosurgery, head and neck surgery, and neuro-otology.[4]

Dumbbell-shaped jugular foramen schwannomas extending to the neck can be removed with favorable results via a craniocervical approach by a multidisciplinary skull base team.[5] However, there are a variety of histologic subtypes of DSJFTs extending to the neck

Key words
- Craniocervical approach
- Jugular foramen
- Microsurgery
- Radiologic features
- Skull base surgery

Abbreviations and Acronyms
BOT: Balloon occlusion test
CN: Cranial nerve
CSF: Cerebrospinal fluid
CT: Computed tomography
DSJFT: Dumbbell-shaped jugular foramen tumor
ICA: Internal carotid artery
IONM: Intraoperative electrophysiological monitoring
JFT: Jugular foramen tumor
LCN: Lower cranial nerve
MRI: Magnetic resonance imaging
MRV: Magnetic resonance venography

From the Departments of [1]Neurosurgery and [3]Head and Neck Surgery, National Cancer Center/Cancer Hospital, Chinese Academy of Medical Sciences and Peking Union Medical College, Beijing; and [2]Department of Neurosurgery, The Second Affiliated Hospital of Anhui Medical University, Hefei, China

To whom correspondence should be addressed: Jinghai Wan, M.D. [E-mail: wanjinghai@sina.com]

Citation: World Neurosurg. (2017) 104:14-23.
http://dx.doi.org/10.1016/j.wneu.2017.04.175

Journal homepage: www.WORLDNEUROSURGERY.org

Available online: www.sciencedirect.com

Table 1. Demographics and Clinical Presentations of Patients with Jugular Foramen Tumors

Number of patients	31
Median age, years (range)	41.0 (18–65)
Number of males/females	11/20
Tumor side, left/right	11/20
Preoperative CN deficits V/VII/VIII/IX–X/XI/XII	4/9/16/21/5/15
Neck mass	12
Headache	6
Ataxia	4
Horner syndrome	2
Previous treatment *(n)*	
1 previous operation	6
2 previous operations	5
Previous operation and Gamma Knife	4
Previous operation and radiosurgery	1

CN, cranial nerve.

other than schwannomas, which play crucial roles in determining the surgical strategy.[6] The preoperative diagnosis of a JFT may be challenging; thus a careful preoperative radiologic assessment is essential for patient selection and surgical planning.[7] To our knowledge, few articles to date have discussed the issue of these special entities.

Here, we present one of the largest series of 31 patients with DSJFTs extending to the neck who underwent operations via a craniocervical approach in a single stage by a multidisciplinary skull base team. The aim of the current study is to focus on the surgical considerations based on radiologic features and surgical techniques for JFTs with different pathologies.

PATIENTS AND METHODS

Patients

From March 2006 to December 2016, 31 consecutive patients with DSJFTs extending to the neck were surgically treated at our institute. In this series, 11 patients experienced tumor recurrences after surgeries at other facilities, 4 of whom received prior Gamma Knife therapy and 1 of whom had sequential radiotherapy. Their clinical symptoms and signs, radiologic features, surgical procedures, histopathologic results, and clinical outcomes were retrospectively reviewed. This study was approved by the Ethics Committee of the Cancer Hospital, Chinese Academy of Medical Sciences.

Imaging Workup

The preoperative workup consisted of computed tomography (CT), magnetic resonance imaging (MRI), magnetic resonance venography (MRV), and digital subtraction angiography. MRI scans clearly showed the characteristics of the tumors. A CT scan

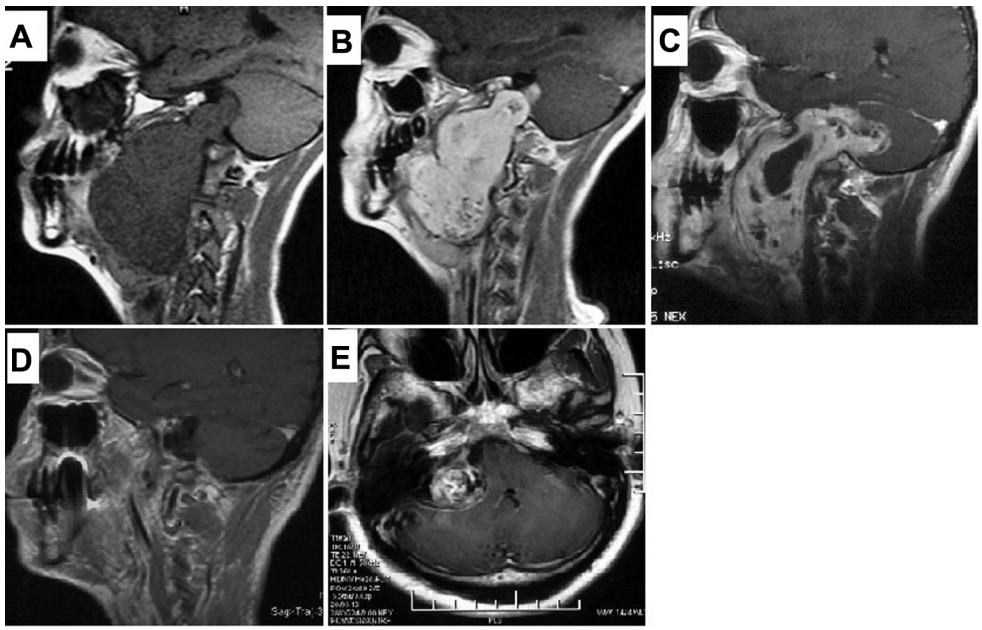

Figure 1. (**A**) Sagittal magnetic resonance imaging (MRI) scan demonstrating a well-delineated, hypointense lesion on T1WI without gadolinium infusion. (**B**) Sagittal MRI on T1WI showing a hyperintense lesion after gadolinium infusion. (**C**) Sagittal contrast-enhanced MRI showing a large dumbbell-shaped jugular foramen schwannoma extending to the neck with notable cystic degeneration. (**D**) Postoperative MRI scan after total removal. (**E**) Axial contrast-enhanced T1WI MRI showing a schwannoma expanding into the posterior fossa through the enlarged jugular foramen with a "dural cap."