Correct Diagnosis of Warthin Tumor in the Parotid Gland with Dynamic MRI

Takenori Ogawa,¹ Takahiro Suzuki,¹ Maya Sakamoto,² Mika Watanabe,³
Yutaka Tateda,¹ Takeshi Oshima,¹ Kengo Kato,¹ Shun Sagai,¹
Toshimitsu Kobayashi¹ and Kiyoto Shiga⁴

¹Department of Otolaryngology-Head and Neck Surgery, Tohoku University School of Medicine, Sendai, Japan

²Department of Oral Diagnosis, Tohoku University School of Dentistry, Sendai, Japan

³Department of Pathology, Tohoku University School of Medicine, Sendai, Japan

⁴Department of Otolaryngology-Head and Neck Surgery, Iwate Medical University, Morioka, Japan

Warthin tumor (WT) is a benign tumor of the salivary gland primarily affecting middle-aged men. WT is almost exclusively located in the parotid gland and tend to grow slowly without symptoms. Although fine needle aspiration cytology (FNAC) often correctly diagnoses these tumors, they are occasionally misdiagnosed as malignant. Our study sought to distinguish between WT and non-WT using dynamic MRI. In dynamic MRI, a series of images are taken over time measuring the intensity of gadolinium uptake by the parotid. We examined two patients for this study. The first was a 53-year old male, heavy smoker, experiencing manic-depressive episodes. He received a brain MRI at which time his parotid tumor was discovered. Parotid FNAC indicated a squamous cell carcinoma. The second patient was a 76-year old male, moderate smoker and drinker, who had been complaining about swelling in the neck. FNAC of the parotid indicated acinic cell carcinoma and gadolinium-enhanced MRI suggested the tumor was malignant. Prior to surgically extracting of these masses, we performed dynamic MRI on each patient. Both tumors exhibited a pattern consisting of rapid enhancement and rapid attenuation, the pattern of which is characteristic of WT. The surgical specimens confirmed that both were WTs without malignant transformation. Our findings indicate that dynamic MRI is a useful tool for preoperative diagnosis of WT, where other examinations indicate malignancy. Early and correct diagnosis of WT can minimize the use of invasive procedures, and eliminate the stress placed on the patient from a diagnosis of cancer.

Keywords: diagnosis; dynamic MRI; fine needle aspiration cytology; parotid tumor; Warthin tumor

Tohoku J. Exp. Med., 2012, 227 (1), 53-57. © 2012 Tohoku University Medical Press

Salivary gland tumors are approximately 5% of all head and neck tumors (McHugh et al. 2009). Tumors of the parotid gland have been described as 70-80% of all salivary gland tumors (Bradley 2004) and are benign dominant. Warthin tumor (WT) is a benign tumor of the salivary gland primarily affecting middle-aged men. WT is almost exclusively located in the parotid and tend to grow slowly without any symptoms. Among the benign parotid tumors, WT is the second most common variety (Lin et al. 2008).

A conservative management scheme should be adopted for these tumors (Reddy et al. 2008), because WTs rarely exhibit malignant transformation (Teymoortash and Werner 2005). For the patient with WT, a conservative approach can avoid more drastic measures in favor of a simple operation, such as a partial parotidectomy or enucleation of the tumor to preserve the facial nerve. Because of their complicated pathology, parotid tumors, including WT, are usu-

ally diagnosed by a combination of clinical and physical findings, as well as by imaging and cytological examinations. Fine needle aspiration cytology (FNAC) is usually useful for diagnosis of these tumors; however, it is notable that parotid malignancies are sometimes diagnosed as WT by FNAC due to atypical features (Viguer et al. 2010). Diagnosis may also depend on the experience of the cytopathologist as well as the condition of the specimens. Although scintigraphy of salivary glands with ^{99m}Tc-pertechnetate is well known to be an effective assay specific for WT (Ishikawa and Ishii 1984), it is not used routinely due to its high cost and patient exposure to radioactive materials.

Recently, dynamic MRI has been employed to effectively diagnose WT (Yabuuchi et al. 2003). In dynamic MRI, a series of images are taken over time measuring the intensity of gadolinium uptake by the parotid. This new

Received December 27, 2011; revision accepted for publication April 10, 2012. doi: 10.1620/tjem.227.53

Correspondence: Takenori Ogawa, M.D., Ph.D., Department of Otolaryngology-Head and Neck Surgery, Tohoku University School of Medicine, 1-1 Seiryomachi, Aoba-ku, Sendai, Miyagi, 980-8574, Japan.
e-mail: ogawa@orl.med.tohoku.ac.jp

technique can estimate the tumor histology by utilizing a time intensity curve. WT examined by dynamic MRI displays a consistent pattern of rapid enhancement and rapid attenuation. Herein, we report two patients where WTs were diagnosed as possible malignancy by FNAC, whereas dynamic MRI indicated benign WT. Institutional review boards approved this study, and written informed consent was obtained from both patients.

Clinical findings

Patient 1

A 53-year-old male who had been diagnosed with right parotid tumor by a brain MRI was referred to our hospital in July 2004. The patient was exhibiting manic-depressive psychosis in the absence of any family history of this or any other disease. He had been smoking 40 cigarettes per day for the last 33 years. No alcohol use was reported. A physical examination revealed a mass in the right parotid region. No facial paralysis was present. Contrast MRI revealed a right parotid tumor in the deep lobe, 25 mm in the longer axis and 20 mm in the shorter axis. This tumor showed heterogeneous signal intensity on T1-weighted images (Fig. 1A) and low signal intensity on T2-weighted images (Fig.

1B). Strong uptake was shown by gadolinium enhancement (Fig. 1C). Prior to performing FNAC, we examined the tumor by dynamic MRI. The results clearly demonstrated a time intensity curve typical of WTs (Fig. 1D). FNAC revealed necrotic tissue and acidophilic squamoid cells (Fig. 2A), and thus the tumor was considered to be class IIIb squamous cell carcinoma. Because of the inconsistency between the dynamic MRI and FNAC findings, an incisional biopsy was performed in September to determine the pre-treatment diagnosis. The tumor was finally diagnosed as WT by histological examination of a biopsy specimen. These findings allowed us to perform extirpation of the tumor with small skin resection cut by incisional biopsy and preservation of facial nerve. The surgery was performed in December 2004. A well-mobile soft tumor of 23 mm in a longer axis and 14 mm in a shorter axis was located in the tail of the parotid gland. The facial nerve was preserved due to its non-adherence to the tumor. The extirpated tumor was yellowish, smooth and well capsulated (Fig. 2B). A histological study of the extirpated tumor showed WT without malignant transformation as well as no tumor infiltration at the margin of the specimen (Fig. 2C). No local recurrent tumor or metastasis was observed for

Fig. 1. MRI images of Patient 1.

A: T1-weighted coronal image, B: T2-weighted axial image, and C: gadolinium enhanced T1-weighted coronal image. Arrows indicate tumor. D: dynamic gadolinium enhancement and time-intensity curve (TIC). A scale of the horizontal axis in TIC was 20 seconds. Three ROIs (#2, 3 and 4) in TIC indicate typical WT patterns.

Fig. 2. Pathological findings of Patient 1.

A: Cytological findings by FNAC of patient 1. Panels (1) and (2) are low and high power fields, respectively. B: Macro image of extirpated tumor, and C: Histological findings (HE staining). Panels (1) and (2) are low and high power fields, respectively. Arrow, tumor cells; arrow head, necrotic tissue; asterisk, lymphoid stroma.

one year, and the patient's follow up ended in October 2005.

Patient 2

A 76-year-old male who had been diagnosed with a left parotid tumor was referred to our hospital in June 2010. His primary complaint was swelling in the left parotid, present for the last year and a half. His family history included nothing of note. He had atrial fibrillation, bronchial asthma and penphigus. He had a 53-year smoking history and moderate alcohol use for the last 50 years. A physical examination revealed a soft mass 40 mm in diameter, free from surrounding tissues. Facial paralysis was not present. Contrast MRI revealed a tumor 50 mm in the longer axis displaying low signal intensity on T1-weighted images (Fig. 3A), low signal intensity on T2-weighted images (Fig. 3B) and strong enhancement by gadolinium (Fig. 3C). A non-encapsulated tumor was seen in T1-weighted and gadolinium enhancement images (Fig. 3A and C). MRI findings such as low signal intensity on T2-weighted images and tumor infiltration indicated the presence of a malignant tumor. However, the time intensity curve from dynamic MRI showed a rapid enhancement and a rapid attenuation pattern typical of a WT (Fig. 3D). Furthermore, 18-fluoro-2-deoxyglucose positron emission tomography (FDG-PET) showed a hot spot in left parotid gland with an SUV max of 9.7 (data not shown). FNAC revealed papillary shaped groups of tumor cells with enlarged nuclei (Fig. 4A), an indication of an acinic cell carcinoma (class IIb). Because

of the inconsistent findings of these various diagnostic measures, an intraoperative frozen biopsy was prepared during surgery. Histological examination of the frozen section led to the diagnosis of WT. Consequently, a left-sided partial parotidectomy was performed in July 2010. A soft tumor 50 mm in the longer axis was located under the parotid capsule. The facial nerve was preserved due to its non-adherence to the tumor. The resected tumor was soft, smooth and well encapsulated without infiltration (Fig. 4B). A histological study of the resected specimen showed WT without malignant transformation (Fig. 4C and D). No local recurrent tumor or metastasis had been observed for one year after removal of the tumor.

Discussion

In this study, we treated two patients with WTs that were also diagnosed as malignant parotid tumors by FNAC. Viguer et al. (2010) reported that 2.6% of WTs are misdiagnosed as parotid malignancies due to nontypical cytological difficulties such as (i) absence of one or more diagnostic components, (ii) squamoid pattern, and (iii) mucinous metaplasia. In our first patient, a wide necrotic area and squamoid cells were observed in the FNAC specimen. On the other hand, Patient 2 lacked a lymphoid stroma in the FNAC specimen and showed papillary shaped groups of tumor cells with enlarged nuclei. Although high diagnostic accuracy is commonly reported for WT by FNAC (Veder et al. 2010), our observations indicate that FNAC alone may

Fig. 3. MRI images of Patient 2.

A: T1-weighted axial images, B: T2-weighted coronal image, and C: gadolinium enhanced T1-weighted coronal image. Arrows indicate tumor. D: dynamic gadolinium enhancement and TIC. A scale of the horizontal axis in TIC was 20 seconds. Three ROIs (#1, 2 and 4) in TIC indicate typical WT patterns.

not yield a definitive diagnosis of WT and other salivary gland tumors.

Imaging diagnosis without dynamic MRIs showed no effective findings for either of the patients described here. Low signal intensities on T2-weighted images were shown in both patients. Because these results are linked to highly cellular tumors (Okahara et al. 2003), they are sometimes reported as a representative finding for parotid malignancies (Christe et al. 2011); however, they are also described as a characteristic of WTs (Thoeny 2007). In Patient 2, it should be noted that the presence of a non-encapsulated tumor and high SUV from the FDG-PET indicate malignancy. These characteristics can also be displayed in some benign tumors as well. Other characteristics of WTs include multiple and bilateral lesions, well-circumscribed partly cystic, partly solid lesions in CT or MRI and are often located in the tail of the parotid gland (Thoeny 2007). These features should not be considered specific characteristics associated with WTs, although some of them were present in both of our patients.

Dynamic MRI was useful for preoperative diagnosis in both patients. Several articles have highlighted that dynamic MRI is useful for parotid tumors including WT using time intensity curves (Yabuuchi et al. 2003; Motoori

et al. 2005; Eida et al. 2008). It was also reported that ^{99m}Tc -pertechnetates cintigraphy has been well accepted for diagnosis of WT (Ishikawa and Ishii 1984). Motoori et al. (2005), however, reported that a dynamic MRI was more useful in the evaluation of WT, compared to scintigraphy with ^{99m}Tc -pertechnetate. We assert that dynamic MRI may be one of the useful tools for diagnosis of WT. In both of our patients, the regions of interest exhibited WT and non-WT characteristics. Despite this, we observed, only one dynamic MRI pattern which strongly supported the diagnosis of WT. It should be noted, however, that the techniques used to devise regions of interest when performing dynamic MRI are important for proper diagnosis. On the other hand, Alibek et al. (2007) reported that time intensity curve data itself could not distinguish WTs from malignant tumors; therefore, further studies are necessary to improve the accuracy of diagnosing WTs by dynamic MRI.

Acknowledgments

We are grateful to Miles Kuperus for editorial work in the preparation of this manuscript and to Hiromi Hamada (Sendai Seiryō Clinic) for her excellent assistance in the preparation of patients' films.

Fig. 4. Pathological findings of Patient 2.

A: Cytological findings by high power field of FNAC, B: Macro image of extirpated tumor, and C: Histological findings (HE staining). Panels (1) and (2) are low and high power fields, respectively. Arrow, tumor cells; asterisk, lymphoid stroma.

Conflict of Interest

We declare no conflict of interest.

References

- Alibek, S., Zenk, J., Bozzato, A., Lell, M., Grunewald, M., Anders, K., Rabe, C., Iro, H., Bautz, W. & Greess, H. (2007) The value of dynamic MRI studies in parotid tumors. *Acad. Radiol.*, **14**, 701-710.
- Bradley, P.J. (2004) Pleomorphic salivary adenoma of the parotid gland: which operation to perform? *Curr. Opin. Otolaryngol. Head Neck Surg.*, **12**, 69-70.
- Christe, A., Waldherr, C., Hallett, R., Zbaeren, P. & Thoeny, H. (2011) MR imaging of parotid tumors: typical lesion characteristics in MR imaging improve discrimination between benign and malignant disease. *Am. J. Neuroradiol.*, **32**, 1202-1207.
- Eida, S., Ohki, M., Sumi, M., Yamada, T. & Nakamura, T. (2008) MR factor analysis: improved technology for the assessment of 2D dynamic structures of benign and malignant salivary gland tumors. *J. Magn. Reson. Imaging*, **27**, 1256-1262.
- Ishikawa, H. & Ishii, Y. (1984) Evaluation of salivary gland tumors with 99mTc-pertechnetate. *J. Oral Maxillofac. Surg.*, **42**, 429-434.
- Lin, C.C., Tsai, M.H., Huang, C.C., Hua, C.H., Tseng, H.C. & Huang, S.T. (2008) Parotid tumors: a 10-year experience. *Am. J. Otolaryngol.*, **29**, 94-100.
- McHugh, J.B., Visscher, D.W. & Barnes, E.L. (2009) Update on selected salivary gland neoplasms. *Arch. Pathol. Lab. Med.*, **133**, 1763-1774.
- Motoori, K., Ueda, T., Uchida, Y., Chazono, H., Suzuki, H. & Ito, H. (2005) Identification of Warthin tumor: magnetic resonance imaging versus salivary scintigraphy with technetium-99m pertechnetate. *J. Comput. Assist. Tomogr.*, **29**, 506-512.
- Okahara, M., Kiyosue, H., Hori, Y., Matsumoto, A., Mori, H. & Yokoyama, S. (2003) Parotid tumors: MR imaging with pathological correlation. *Eur. Radiol.*, **13** Suppl. 4, L25-33.
- Reddy, V.M., Thangarajah, T., Castellanos-Arango, F. & Panarese, A. (2008) Conservative management of warthintumour. *J. Otolaryngol. Head Neck Surg.*, **37**, 744-749.
- Teymoortash, A. & Werner, J.A. (2005) Tissue that has lost its track: Warthin's tumour. *Virchows Arch.*, **446**, 585-588.
- Thoeny, H.C. (2007) Imaging of salivary gland tumours. *Cancer Imaging*, **7**, 52-62.
- Veder, L.L., Kerrebijn, J.D., Smedts, F.M. & den Bakker, M.A. (2010) Diagnostic accuracy of fine-needle aspiration cytology in Warthin tumors. *Head Neck*, **32**, 1635-1640.
- Viguer, J.M., Vicandi, B., Jiménez-Heffernan, J.A., López-Ferrer, P., González-Peramato, P. & Castillo, C. (2010) Role of fine needle aspiration cytology in the diagnosis and management of Warthin's tumour of the salivary glands. *Cytopathology*, **21**, 164-169.
- Yabuuchi, H., Fukuya, T., Tajima, T., Hachitanda, Y., Tomita, K. & Koga, M. (2003) Salivary gland tumors: diagnostic value of gadolinium-enhanced dynamic MR imaging with histopathologic correlation. *Radiology*, **226**, 345-354.