Parapharyngeal Space Revisited: 10-Year Experience with Updated Radiographic Correlations

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ABSTRACT

OBJECTIVE
1. To correlate preoperative radiographic findings with final histopathologic diagnosis of parapharyngeal space tumors
2. To delineate the role of advanced imaging modalities, including positron emission tomography (PET) and Magnetic Resonance Imaging (MRI) in the diagnosis of parapharyngeal space (PPS) lesions

METHODS
This is a 10-year retrospective review of PPS tumors at UCSD. The surgical case log was used to identify patients with lesions of the PPS. Radiographic and histopathologic data was collected. Preoperative images were reviewed with a senior radiologist in a blinded study to identify radiographic information that would aid in correct lesion diagnosis.

RESULTS
Thirty-nine cases of probable primary or secondary PPS lesions were identified. Of these, 15 met inclusion criteria for definite involvement of the PPS. The majority were benign lesions (11/15). All four of the malignancies involved the PPS secondarily by direct extension. The radiologist made the correct diagnoses in 83% of PPS cases reviewed as confirmed by histopathology. Emphasis was placed on the anatomic relationship of the tumor to structures surrounding the pre- and post-styloid PPS.

CONCLUSIONS
With the advent of improved imaging modalities, MRI and PET have become more helpful in the early diagnosis of lesions of the parapharyngeal space. The use of these modalities assists in clinical management, surgical planning and patient education.

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INTRODUCTION

Tumors of the PPS are rare, accounting for ~0.5% of all head and neck neoplasms. They originate mainly from salivary, neural, lymphoid, paraganglionic or chemoreceptor tissues. Branchial cleft cysts, chordomas, and inflammatory masses are less frequently encountered. PPS lesions are usually benign (>70%) and are of salivary origin (~45%). Lymph node (LN) involvement usually denotes a malignancy.

MR and CT imaging studies have become a required component in the diagnosis and management of PPS lesions and are used to:

1. Precisely identify the anatomic origin allowing one to narrow the differential diagnosis list.
2. Identify hypervascular neoplasms to avoid complications of biopsy.
3. Identify rare incidences of traumatic aneurysms of the external carotid and the internal maxillary arteries.
4. Aid surgical planning
5. Develop a preoperative diagnosis based on radiographic findings

MR is generally the preferred imaging modality for PPS lesions because it has a higher soft tissue contrast resolution than CT and its images do not require 3D reconstruction. MR does not expose the patient to ionizing radiation. However, MR scans are longer, more sensitive to motion artifacts and are costly. CT is a good alternative, especially new multi-detector CTs, which provide excellent reformatted images. CTA has replaced standard angiography for defining paragangliomas. PET has become useful in detecting and delineating the extent of malignant tumors.

METHODS AND MATERIALS

This is an IRB approved retrospective chart review of cases from three Otolaryngology-Head and Neck surgeons at the UCSD from July 2001 to January 2010. To identify patients with PPS lesions, 2918 head and neck surgery cases were reviewed. Because there is no CPT code for PPS surgery, all cases with parotidectomy, neck dissection, mandibulotomy and/or known PPS involvement were investigated. From this subset, pathology and operative reports were reviewed individually to identify cases with known PPS involvement. Patient radiographic and histopathologic data as well as operative reports were collected. Cases with preoperative imaging were reviewed with a senior radiologist who was blinded to the diagnosis.

Table 1. Radiographic Characters

Benign lesions	Malignant lesions
Smooth margins	Border irregularities
No involvement of adjacent tissues	Infiltrative
No enlarged LNs	Pathologic LNs
Calcifications	Heterogenous on T2 / T1 post contrast
Facial nerve function intact	Facial Paralysis

RESULTS

The average age of patients in the study is 56.3 years (range 38-83 years). There were 5 men and 10 women. The majority of the PPS tumors were benign (11/15) and include six pleomorphic adenomas, two paragangliomas, one gangioneuroma, one Warthin's tumor, and one low-grade myoepithelial tumor. All four of the malignancies involve the PPS secondarily by direct extension. These were 2 cases of squamous cell carcinoma and 2 of adenoid cystic carcinoma. The radiologist made the correct diagnosis in 83% of the PPS cases reviewed.

Figure 1 shows a high resolution MR of a pharyngeal mucosal mass that might be confused with a PPS mass. Normal parotid is radiolucent and hypodense compared to muscle. If the tumor is in the prestyloid space as shown in Figures 2 and 3, the carotid and IJ remain behind the mass. If the tumor arises from the poststyloid space, the carotid is displaced anterior to tumor. The tumor may also extend between the posterior belly and the prevertebral space. If the stylomandibular tunnel widens, we know the lesion arises from parotid gland.

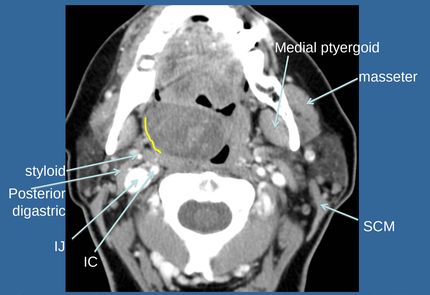

Figure 1. Right mucosal mass that may be confused with a PPS mass. The carotid, IJ, post digastric, deep lobe, parapharyngeal fat, and the constrictor mm are all displaced laterally. This was a pleomorphic adenoma.

RESULTS

All tumors imaged on MR are hypointense on T1 and hyperintense on T2 (Figure 3). As tumors become more cellular they decrease in T2 hyperintensity. MR images of Warthin's tumor (Figure 4) is interesting because it shows a restricted pattern by MRI (bright by DWI and dark on ADC). A similar pattern is seen for lymphoma where cellular tumors result in increased signal on DWI but remain hypointense in T2. Therefore, a mass is dark on ADC due to high cellular content.

Facial nerve schwannoma and pleomorphic adenomas have similar appearances in MR. The only way to differentiate the two is to follow the course of the nerve. In the one case of pleomorphic adenoma that was analyzed by PET, hypermetabolic activity was observed. This is consistent with literature.

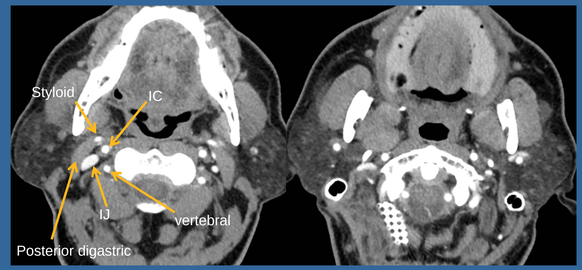

Figure 2. This is a very unusual case of Warthin's that looks like a pleomorphic adenoma. Usually Warthin's arises in superficial lobe or tail of the parotid. This is a prestyloid PPS lesion with smooth margins. The carotid and IJ is behind the mass.

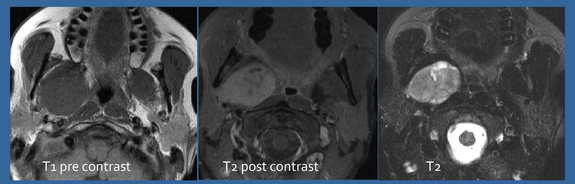

Figure 3. MRI face and orbits showing moderately differentiated adenoid cystic carcinoma. This is a large prestyloid mass with irregular density and lateral invasion.

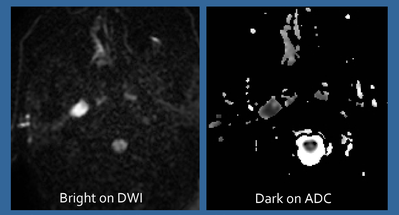

Figure 4. MRI findings of Warthin's tumor.

DISCUSSION

Preoperative imaging work up was not always conducted in tumors involving the deep lobe of the parotid gland. The small number of patients that did have complete chart information limited the number of subjects in this study. The PPS is a difficult area of research as there is no CPT code to simplify the search for these cases. The UCSD experience is similar to published data on the rates of benign (73%) vs malignant (27%) diseases. The use of imaging modalities such as MRI and CT is useful in diagnosing PPS lesions prior to surgery. It is important to note that pleomorphic adenomas, Warthin's tumors and oncocytomas show hypermetabolic activity by PET.

The senior radiologist was quite accurate in the diagnosis of PPS lesions. In broadly classifying a lesion as benign vs malignant, he was correct 100% of the time. With only MR and no PET data he was unable to differentiate between a facial nerve schwannoma and a pleomorphic adenoma. On reviewing a neck CT, one case that was incorrectly diagnosed as pleomorphic adenoma, was rediagnosed as Warthin's tumor vs Oncocytoma once the same patient's MRI was reviewed. This is shown in Figure 4.

CONCLUSION

1. The parapharyngeal space is a complex anatomical region which may be affected by a wide variety of benign and malignant tumors.
2. Imaging by MR and CT is an essential part of PPS diagnosis and work up. CTA has replaced standard angiography for imaging vascular tumors. Several benign salivary tumors can show significant uptake on PET, limiting the utility of PET in distinguishing between benign and malignant tumors in the PPS.
3. Treatment of PPS tumors is usually surgical excision. Radiation therapy and/or other adjuvant therapies may be appropriate, depending on the pathologic diagnosis and patient comorbidities.

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