Overview of Parotid Gland Masses

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Of the major salivary glands, the parotid gland has the highest rate of tumor association, accounting for 64% to 80% of primary epithelial salivary gland tumors. Most parotid tumors are benign with malignancy only comprising approximately 15% to 32%.¹ The typical clinical presentation is a painless mass or swelling in the cheek about the mandibular rami. Facial nerve involvement generally suggests a malignant tumor, which may present with pain or paralysis. Imaging studies provide insight on the degree of glandular involvement, the nature of the tumor, and potential spread, and serve as an important baseline for therapeutic interventions. Familiarity with the normal anatomy of the parotid gland, as well as the imaging characteristics of common neoplasms involving the parotid gland, is crucial in establishing appropriate differential diagnoses and guiding clinical management.

Benign Pleomorphic Adenoma/Benign Mixed Tumor

Pleomorphic adenomas, commonly referred to as benign mixed tumors (BMTs), are the most common benign salivary gland tumors (70% to 80%). Initially presenting as a slow-growing, painless cheek mass, these neoplasms typically appear in middle-aged females 30 to 60 years old.²³ They are mixed tumors comprised of epithelial and myoepithelial cells.

On US, the appearance of BMT is a homogeneous hypoechoic, well-circumscribed mass. A nuclear medicine (NM) pertechnetate scan shows a photopenic/cold defect, differentiating them from a Warthin tumor (typically hot), but the appearance is indistinguishable from malignant parotid lesions (usually cold).⁴ CT will demonstrate a well-circumscribed, homogeneously enhancing ovoid mass. Larger BMTs can show some heterogeneity to their enhancement pattern and may even present with central necrosis or dystrophic calcifications.⁵ T1 MRI sequences show a homogeneous hypointense mass, with larger BMTs showing hyperintense foci in cases of intratumoral hemorrhage. T2-weighted sequences will show uniform intermediate to high signal (Figure 1); very high T2 intensity greater than cerebrospinal fluid is fairly specific for BMTs. Diffusion-weighted imaging (DWI) usually shows higher apparent diffusion coefficient (ADC) signal compared to other parotid tumors, but this is not accurate enough to preclude biopsy. Contrast studies vary, ranging from mild to moderate enhancement (Figure 2).

Although benign, up to 15% of untreated pleomorphic adenomas can undergo malignant transformation, known as carcinoma ex pleomorphic adenoma. Characteristics include rapid growth over the course of a few months and pain.¹ For both conditions, surgical excision remains the gold standard, although recurrence is common if the tumor extends past its capsule. A partial or total parotidectomy has been found to dramatically decrease recurrence rates compared to lesional excision.⁶

Warthin Tumors

Warthin tumors are the second most common benign salivary gland tumor, accounting for 10% of parotid tumors. They present with painless swelling, with 20% of lesions appearing multifocal (unilateral or bilateral). Warthin tumors are classically seen in elderly men in the 6th decade of life, with a strong association with smoking and radiation exposure.¹⁷ Warthin tumors have also been termed...
lymphomatous papillary cystadenoma, corresponding with their histological characteristics: glandular structures with papillary cystic arrangement, along with a stroma filled with lymphoid tissue.¹

Contrast-enhanced CT shows a smoothly marginated, ovoid mass occasionally located in the tail (posterior portion) of the superficial lobe of the parotid gland (Figure 3). Cystic components can be seen in up to 30% of lesions and may be difficult to differentiate from a cystic lymph node, branchial cleft cyst, or other cystic mass. Presence of a mural nodule may also be suggestive of a Warthin tumor.⁵ T1 MRI sequences typically show low signal in the solid and cystic components, although the presence of proteinaceous debris or hemorrhage may increase the T1 signal. Solid components show minimal enhancement (Figure 4). On US, Warthin tumors will show well-defined anechoic areas toward the tail of the superficial parotid gland reflecting cystic components.⁵,⁸,⁹

The incidence of malignancy is <1%. Management involves either surgical excision or routine monitoring, which can be advantageous to avoid iatrogenic complications.⁷ Local recurrence is exceedingly rare but more likely in multifocal disease.

**Facial Nerve Schwannoma**

Facial nerve schwannomas (FNSs) are rare benign neoplasms arising from Schwann cells along cranial nerve (CN) VII, the facial nerve. In the parotid parenchyma, they may present similarly to pleomorphic adenomas as a painless and slow-growing mass. Uncommonly, they present with facial weakness or paralysis. Multiple schwannomas have an association with neurofibromatosis type 2 (NF-2).

Imaging findings of FNS on contrast-enhanced CT are a round or oval well-circumscribed enhancing intraparotid mass. Proximal lesions may cause
enlargement of the stylomastoid foramen. MRI shows a well-defined mass that is T1 isointense and T2 slightly hyperintense to muscle with enhancement on postgadolinium images (Figure 5).

Larger lesions may have a characteristic intramural cyst.

Preoperative diagnosis of FNS is extremely difficult and uncommon. Diagnosis is often made intraoperatively via electrical stimulation and tissue biopsy, followed by radiographic staging to determine neoplastic extent. Total resection is curative; however, this may be declined if the nerve cannot be salvaged.

Benign Lymphoepithelial Lesions (BLELs)

Benign lymphoepithelial lesions (BLELs) are relatively common in HIV patients and are sometimes concurrent manifestations of Sjögren syndrome. Both parotid glands are often involved and can range from purely cystic lesions to mixed cystic and solid masses. They occur more frequently in women than men (3:1), and within the 4th to 7th decades of life. Similar to other benign parotid masses, these typically present as painless swelling with enlargement of the parotid glands.

Imaging features overlap with Warthin tumors of the parotid and show bilateral cystic and solid masses within enlarged parotid glands (Figure 6). US shows the cystic components to be anechoic with variable posterior acoustic enhancement. Solid components are predominantly hypoechoic in appearance, with identified intraparotid lymph nodes showing prominent cortex and hilar architecture. CT will show bilateral solid and cystic masses involving the parotid glands. Postcontrast images show thin rim enhancement of the cystic components and heterogeneous enhancement of the solid components. MRI sequences show hypointense T1 and hyperintense T2 signal in cystic components with variable enhancement of the solid components. Waldeyer’s lymphatic ring is typically enlarged with high T2 signal and can suggest BLEL in an HIV patient.

Histology shows lymphocytic infiltration with lymphocytes and germinal center hyperplasia, resulting in atrophy of the parotid parenchyma. Malignant transformation is rare and can arise from the epithelial or lymphoid component, known as lymphoepithelial carcinomas (LEC). BLEL may be monitored, whereas LEC should be excised along with lymph node dissection or with radiation therapy.

Malignant

Mucoepidermoid Carcinoma

Mucoepidermoid carcinoma is the most common primary malignant tumor of the parotid gland. Initial presentation is a palpable parotid mass. Additional symptoms may include pain, facial nerve paralysis, or sensory deficits in the V3 distribution. These tumors typically affect adults ages 35 to 65 years but can also occur in children. Histology consists of epidermoid and mucous-secreting cells. Treatment depends on the grade of tumor, with local resection sufficient for low-grade tumors, but wide surgical excision and...
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Radiotherapy required for high-grade lesions.\textsuperscript{16-17}

Imaging characteristics may vary based on the histologic grade of the tumor. Low-grade lesions can present as a well-circumscribed parotid mass, mimicking benign entities, while high-grade lesions can have ill-defined or infiltrative margins (Figure 7). Evaluation for malignant nodes or perineural spread along CN VII is important for accurate staging (Figure 8). Loss of the normal fat in the stylomastoid foramen, abnormal enhancement in the mastoid segment of CN VII, or osseous involvement of the mandible or skull base indicates a higher-grade malignancy and delineates the extent of disease.\textsuperscript{8}

Contrast-enhanced CT will typically show an enhancing soft-tissue mass in the parotid gland. Cystic changes can be seen due to mucous-producing cells. On MRI, the lesion will have heterogeneous T1 and T2 signal with areas of high T2 signal indicating cystic changes. Indistinct margins suggest a higher-grade tumor. DWI may show restricted diffusion and/or low ADC signal, but is nonspecific, as a Warthin tumor may show similar findings.\textsuperscript{8} Enhancement is typically heterogeneous, with cystic components having little enhancement.\textsuperscript{8,11}

Recurrence rate correlates with higher histologic grade. Lower-grade tumors have been reported to have up to a 90\% 10-year survival rate. Evidence of metastatic spread or infiltrative margins portends a poorer prognosis and increased rate of recurrence. Late recurrence is possible and routine monitoring for up to 10 years is recommended.\textsuperscript{8,16-17}

\textbf{Adenoid Cystic Carcinoma}

Adenoid cystic carcinoma (ACC) is the second most common primary malignancy of the parotid gland. The lesion presents as a slow-growing parotid mass with pain reported in up to one-third of
cases. Peak incidence is between the 5th and 7th decades, and it is rarely seen before age 20. Among all head and neck tumors, ACC has the highest propensity for perineural spread.\textsuperscript{18}

Imaging characteristics include an enhancing parotid mass with either well-circumscribed borders or infiltrative margins depending on the histologic grade. Enhancement on CT or MR is typically homogenous with T1- and T2-weighted images showing variable low to intermediate signal intensity (Figure 9). DWI may show restricted diffusion but is nonspecific in differentiating ACC from a benign Warthin tumor.\textsuperscript{8} As with all parotid masses, but especially ACC, close attention should be paid to potential perineural spread.\textsuperscript{8,11}

ACC typically has a good short-term prognosis but poor long-term prognosis. Late recurrence can occur up to 20 years after diagnosis. Treatment is typically surgical resection with postoperative radiotherapy. Metastatic involvement of the lungs and bones is more common compared with lymph node spread.\textsuperscript{8,18}

**Lymphoma**

Lymphoma of the parotid glands is of the non-Hodgkin lymphoma (NHL) variety with three distinct forms: primary nodal, systemic, or primary parenchymal. Initial presentation is of a painless, enlarging parotid mass with cervical lymphadenopathy. Mean age of presentation is 55 years with a 1.5:1 male-to-female predominance.\textsuperscript{19}

Imaging characteristics of parotid NHL depend on the type. Nodal NHL usually presents as a well-circumscribed lesion, while the parenchymal type can have infiltrative or indistinct margins. Contrast-enhanced CT shows mild to moderate enhancement and frequent periparotid or upper cervical

![Figure 9: Adenoid cystic carcinoma. Axial T2 image with fat suppression (A) shows a large, lobulated, infiltrative mass involving the right parotid gland that is slightly hyperintense to muscle (arrows). Coronal T1 precontrast (B) and fat-suppressed postcontrast (C) images better demonstrate the infiltrative and aggressive margins of the enhancing right parotid mass (arrows). Case courtesy of Courtney Tomblinson, M.D.](image9)

![Figure 10: Lymphoma. Axial unenhanced CT image (A) shows a round, circumscribed mass isoattenuating to muscle in the left parotid gland. Fused PET/CT (B) shows avid FDG uptake. Axial T2 image (C) demonstrates homogeneous low signal with mild heterogeneous enhancement on fat-suppressed postcontrast T1 images (D).](image10)
lymphadenopathy. MRI may show an intermediate T1 signal intensity mass within a background of hypointense parotid gland. Post-gadolinium administration shows mild to moderate enhancement (Figure 10). F-18 fluorodeoxyglucose (FDG) PET/CT will show avid activity in nodal NHL.  

NHL of the parotid has an increased incidence with autoimmune disorders or immunosuppression and is frequently associated with Sjögren syndrome, rheumatoid arthritis, or systemic lupus erythematosus. Treatment is typically with chemotherapy and radiation.

**Metastases**

Metastases should be a consideration for parotid lesions in patients with a known malignancy, especially head and neck malignancy, such as squamous cell carcinoma. Skin lesions involving the face and scalp, such as squamous cell carcinoma or melanoma, account for the majority of parotid metastases. Systemic metastases to the parotid gland are extremely rare, usually originating from lung or breast cancers.

Imaging findings include one or more intraparotid masses. Cervical lymphadenopathy may also be present. Lesions can be well circumscribed or have indistinct margins. Enhancement pattern is typically homogenous, although if necrosis is present, there may be central areas of decreased enhancement. MR is the best modality for determining perineural spread, and FDG PET/CT can be helpful in assessing involvement of small extra parotid nodes and other sites of metastatic disease.  

**Summary**

Parotid masses have a variety of etiologies that range from benign to malignant. Although many lesions have some overlapping features, imaging appearance and patient demographics often aid in narrowing the list of differential considerations. Familiarity of the imaging characteristics of common parotid masses is critical in providing a comprehensive evaluation that includes determining lesion etiology, assessing staging for malignant lesions, and guiding overall management.

**References**