The major salivary glands include the paired parotid, submandibular and sublingual glands. Minor salivary glands are located in the submucosa of the oral cavity and upper aerodigestive tract. Neoplasms of the salivary glands account for about 5% of all tumors of the head and neck, and cancers are even less common.

The incidence of salivary gland cancers is estimated at approximately 2.5 to 3.0 cases per 100,000 per year in the United States. Etiologic factors for major salivary gland cancer include exposure to low-dose radiation while exposure to wood dust and leather tanning chemicals has been associated with development of minor salivary gland adenocarcinoma in the sinonasal tract.

Parotid tumors typically present as an otherwise asymptomatic rubbery nodular mass in the superficial lobe anterior to the lobule of the ear in the region of the tail of the parotid gland. Facial nerve paralysis is not a feature of benign parotid tumors even if the tumor is large. Features consistent with a malignant salivary neoplasm include abnormal cervical lymph nodes, facial nerve dysfunction or invasion of the overlying skin. Deep lobe parotid gland tumors are rare and are usually detected incidentally on imaging performed for other reasons. Larger tumors present with diffuse fullness in the retromandibular region and/or a submucosal mass in the tonsillar region. Radiographic imaging is essential for diagnosis and assessment of the extent of these tumors which are beyond the reach of clinical examination. The radiographic “spatial approach” is very reliable for differentiating deep lobe tumors from other lesions in this region.

Submandibular gland neoplasms usually present as a painless swelling in the submandibular triangle. The presence of pain signifies an obstructive and/or inflammatory phenomenon such as sialadenitis of the submandibular salivary gland. A submandibular region mass in a patient with carcinoma of the floor of the mouth can result from nodal metastasis, a blocked submandibular salivary gland from involvement of its duct in the floor of the mouth, or from direct extension of the floor-of-the-mouth tumor into the neck across the mylohyoid muscle. Although physical findings may direct the clinician to the appropriate scenario, imaging can readily assess the extent of the tumor, which is important not only for surgical resection with adequate margins but also for planning reconstruction of the surgical defect.

Minor salivary gland neoplasms are more likely to be malignant compared to major salivary neoplasms: the risk of malignancy in the parotid is about 25% compared to 50% in submandibular glands, and 80% in minor salivary glands. The hard palate has the highest density of minor salivary glands and is therefore the most common site of origin of minor salivary gland tumors, followed by other locations in the oral cavity and paranasal sinuses. Tumors of minor salivary gland origin usually present as a submucosal mass that may be ulcerated. The majority of tumors of minor salivary gland origin are malignant. Minor salivary tumors of the lip often mimic a mucocele or a mucous cyst but a soft-to-firm rubbery submucosal mass should raise suspicion for a minor salivary gland tumor. Tumors of minor salivary gland origin generally have a pushing growth pattern in contrast to squamous cell carcinoma and poorly differentiated tumors that are infiltrative and destructive. Regressive remodeling of adjacent bone is a radiographic feature often seen with these slow-growing neoplasms.

Pleomorphic adenoma or benign mixed tumor is the most common benign tumor of salivary gland origin. The parotid gland is the most common site of origin followed by the submandibular gland and then by minor salivary glands. They are typically asymptomatic and slow growing with a long indolent history. Rapid growth in a long standing pleomorphic adenoma should prompt concern for malignant transformation. Infiltrative, irregular borders are the only consistent feature that allows radiographic diagnosis of a malignant tumor in the absence of nodal metastases and perineural spread. Benign mixed tumors are typically bright on T2W MRI, whereas most other parotid tumors are isointense on T2W MRI. This is an extremely useful sequence for assessing the extent of the lesion in relation to the parotid parenchyma. Local recurrence after surgical resection of pleomorphic adenoma
is uncommon, especially after adequate resection. However, rupture of the tumor and spillage in the operative field can result in seeding of the entire surgical bed. Local recurrence in this situation appears as numerous discrete nodules like a cluster of grapes that are bright on T2W MRI.

Warthin’s tumor (papillary cystadenoma lymphomatosum) is the second most common benign salivary neoplasm. It commonly arises from the tail of the parotid gland. Tobacco smoking has been reported to increase the risk for Warthin’s tumor 5-10 times compared to non-smokers. They typically arise in older white males and are bilateral in up to 10% of cases. Oncocytomas also occur in older individuals but are relatively rare. These tumors have a high mitochondrial content, which accounts for FDG avidity on PET scan, similar to Warthin’s tumors. Unlike Warthin’s and oncocytomas most malignant neoplasms of salivary gland origin, including adenoid cystic carcinoma, are not particularly FDG avid on a PET scan unless they are high grade tumors.

Mucoepidermoid carcinoma is overall the most common malignant salivary gland cancer and is the most common parotid gland malignant neoplasm. Histological differentiation is a reliable predictor of the biological behavior of salivary neoplasms. Low-grade malignant tumors are generally indolent and have an excellent prognosis because they rarely metastasize. High-grade tumors have an increased risk of regional and distant metastasis, and therefore have a poorer outcome. High-grade mucoepidermoid carcinomas in particular are locally invasive and are associated with an increased risk of regional nodal metastasis. Mucoepidermoid carcinomas can also arise from minor salivary glands and from ectopic salivary tissue in the parapharyngeal space (PPS).

Adenoid cystic carcinoma (ACC) is the most common malignant tumor of the submandibular and minor salivary glands. Many histologic grading systems have been used for these tumors, but the degree of differentiation does not accurately reflect their behavior. Neurotropism is a peculiar characteristic of ACC with a high risk for perineural spread (PNS). Nodal metastases occur infrequently but pulmonary metastases are not uncommon. However, patients survive decades even with distant metastases and the disease course is generally protracted.

Salivary adenocarcinomas are classified into several histopathological subtypes that vary in their behavior. Polymorphous low-grade adenocarcinomas of minor salivary gland origin characteristically have an indolent course. These tumors most commonly arise in the oral cavity, with the hard palate being the principal site of origin. Adenocarcinomas of nonparotid origin are more likely to be of a high grade and therefore have a worse outcome associated with distant metastases to lung and bone.

Other malignant tumors include acinic cell carcinomas, malignant mixed tumors (myoepithelial carcinomas), and squamous cell carcinomas. About 10% of malignant neoplasms of salivary origin are acinic cell carcinomas, and they most commonly arise from the parotid gland. These tumors tend to be indolent. Myoepithelial carcinoma is the malignant counterpart of benign mixed tumor, and its clinical behavior is dependent on the predominant cell type within the tumor. Primary squamous cell carcinoma of the parotid gland are rare, and most squamous cell carcinomas in the parotid region are actually metastatic disease in an intraparotid lymph node from a synchronous or previously treated skin cancer.

This presentation will focus on the role of radiographic imaging in diagnostic evaluation of the salivary neoplasms. Benign and malignant neoplasms, including those arising from major and minor salivary glands will be discussed. The discussion will also include description of pathways of perineural spread in malignant salivary neoplasms. The advantages and pitfalls of imaging modalities including CT, MRI and PET scan will be highlighted using case examples. Finally, the discussion will include the role of image-guided biopsy in management of these neoplasms.