Salivary Gland Imaging

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Bronwyn E. Hamilton, MD

The dominant salivary glands are comprised of the parotid, submandibular, and sublingual glands. Innumerable minor salivary glands are also present throughout the oral cavity, pharynx, and larynx, which are not visible on routine radiologic imaging. The focus of this talk will be the parotid gland, localized in the parotid space, and the submandibular and sublingual glands, which are part of the oral cavity.

The salivary glands secrete saliva, which is important functionally to lubricate and solubilize food before digestion. Saliva is also important in initiating starch digestion and reducing bacterial overgrowth in the mouth.

Parotid glands

The parotid glands are the largest salivary glands, and thus are more commonly affected by disease processes. The superficial aspect of both paired parotid glands are clinically palpable from their upper extent just below the external auditory canal to their inferior extent at the angle of mandible. Since a large portion of the deep parotid glands is not palpable, there is a large potential area of disease involvement that may remain clinically silent. Imaging of the deep portions of the parotid glands can thus be of great clinical utility. Furthermore deep disease spread along the nerves or deep spaces of the head and neck may only be visible radiographically.

The parotid glands are entirely circumscribed by the superficial layer of the deep cervical fascia, which presents a relative barrier to disease spread. Helpful cross-sectional boundaries that define the parotid space on imaging are the sternocleidomastoid muscle posterolaterally, platysma laterally, and posterior belly of digastric muscle medially. Lower in the neck, the parapharyngeal space is the medial boundary of the parotid space. Note that many authors separate the parapharyngeal space into the pre-styloid and post-styloid compartments because of fascial slips in this area. This anatomy will be better addressed in the parapharyngeal space talk from the same refresher course session. From a practical perspective, pre-styloid parapharyngeal space disease is primarily salivary gland in origin because the deep lobe of parotid in many patients projects medially through the stylomandibular tunnel (or notch) and because of possible “salivary rests” in this space.

The parotid gland is artificially divided by surgeons along the craniocaudal extent of the extratemporal facial nerve, because of the inherent surgical risk related to damage of this nerve. Tissue deep to the superficial aspect of the facial nerve is therefore considered "deep lobe" from a surgical perspective. The facial nerve exits the skull base at the stylomastoid foramen and descends about 1 centimeter before penetrating the parotid. Below the skull base, branches include the posterior auricular nerve and branches to the posterior belly of digastric and stylohyoid muscles. Within the parotid gland the facial nerve divides into 5 major facial branches: temporal, zygomatic, buccal, marginal mandibular, and cervical. The neural anatomy is particularly important to understand because of the propensity of many parotid malignancies to spread along the nerves via perineural extension. This topic will not be further addressed here since it is also the subject of another talk in this refresher course.

The parotid tail is the most inferior extent of the parotid gland that may extend below the angle of mandible in some patients. Like the deep lobe of parotid, the parotid tail is not fascially defined, but represents an area where clinical and radiographic mistakes are made. Masses arising within the parotid tail ("earring lesions") may be mistaken for deeper masses such as level II lymphadenopathy. Excisional biopsy or resection in this location puts the marginal mandibular branch of the facial nerve at risk since it runs through the parotid tail.

Dominant disease processes affecting the parotid glands include infectious or inflammatory disease and neoplastic considerations. Obstruction of the parotid ductal system by calculi predisposes to inflammation and infection, as do other states of relative obstruction or low flow states such as thick secretions in Sjogren's syndrome, post-radiation sialadenitis and dehydration. CT is typically the best way to image suspected infectious or inflammatory disease because parotitis and calcifications due to calculus disease or punctate calcifications in Sjogren's are well demonstrated. Unusual cases may benefit from MRI including DWI, which can be helpful if abscess is suspected but the majority of cases are evident clinically and radiographically.

Congenital malformation such as venous and lymphatic malformations may occur in the parotid and tend to be transpatial. Capillary hemangiomas occur in infants, as they may occur anywhere. Benign neoplasms far exceed malignancy in the parotid, with benign mixed tumor (pleomorphic adenoma) being the most common histology. Neoplastic disease is often well seen with enhanced CT, however MRI is preferable because there is less obscuration from dental amalgam, superior contrast resolution allowing better mass characterization, and because perineural disease is best demonstrated with enhanced MRI. Multiple and/or bilateral

masses suggest the following diagnoses: lymphoma, lymphoepithelial lesions, metastases, and occasionally warthin tumors and oncocytomas.

Submandibular glands

The submandibular (or submaxillary) glands are paired salivary glands in the submandibular spaces within the oral cavity. The submandibular space is lined by the superficial layer of deep cervical fascia and contains the submandibular glands, anterior belly of digastric muscle, lymph nodes, and fat. There is no midline therefore side to side spread easily occurs. The borders of the submandibular space are the hyoid bone inferiorly, the platysma muscle superficially, and the mylohyoid muscle superomedially.

The most common pathology affecting the submandibular gland is calculus disease and sialadenitis. Neoplastic considerations include both benign and malignant tumors, although these are far less commonly seen that parotid neoplasms. Enhanced CT is the best modality for evaluation infection and calculi while suspected neoplastic disease may be imaged with enhanced CT and/or MRI. Systemic diseases including inflammatory disorders such as Sjogren's and malignancy such as lymphoma may rarely involve the submandibular glands. Congenital lesions such as venous and/or lymphatic malformations may occur in the submandibular space, and have similar appearances to elsewhere in the head and neck. Nodal disease in the submandibular space is common, but is a topic for another lecture.

Sublingual glands

The sublingual spaces are paired non-fascial lined spaces of the oral cavity that communicate in the midline underneath the frenulum of the tongue. Given the lack of fascial compartmentalization, disease in the sublingual space may spill into the submandibular and parapharyngeal spaces. The sublingual space contain the sublingual glands distal Wharton duct, lingual artery, vein, and nerve, and glossopharyngeal and hypoglossal nerves. The borders of the sublingual space anatomically include the hyoglossus muscle posterolaterally, the genioglossus and geniohyoid muscle complex medially, and the mylohyoid muscle inferolaterally. Congenital defects in the mylohyoid ("mylohyoid boutonniere") are common, and these provide another route of disease spread from the sublingual space into the submandibular space.

One of the more common pathologies affecting the sublingual gland is ranula, or salivary extravasation pseudocyst. The "plunging" or diving ranula extends into the submandibular space because of the previously mentioned mylohoid defects. Dilation of the distal Wharton duct in the

sublingual space is also common, most often due to stone disease and stricture. By contrast, note that *bilateral* Wharton duct dilation is unlikely to be benign, and this important finding most frequently heralds the presence of an anterior floor of mouth cancer (which can be relatively radiographically occult). Primary infection and malignancy occur in the sublingual glands, but are less common than in the parotid and submandibular glands. Congenital lesions such as venous and/or lymphatic malformations may occur in the sublingual space, and have similar appearances to elsewhere in the head and neck.