Imaging of Minor Salivary Glands

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KEYWORDS

• Minor • Salivary gland • Malignant • Benign • Tumor

KEY POINTS

- The most common malignant tumors of minor salivary glands are adenoid cystic carcinoma and mucoepidermoid carcinoma, and the most common benign tumor is pleomorphic adenoma.
- Routine postcontrast MR imaging helps in detection and extension of minor salivary gland tumors.
- Advanced MR imaging as diffusion MR imaging and dynamic contrast MR imaging may help in characterization of some minor salivary gland tumors.
- Non-neoplastic lesions may involve minor salivary glands such as Sjogrene disease, immunoglobulin G4-related disease, stones, necrotizing sialometaplasia, and subacute necrotizing sialadenitis.
- Computed tomography scan helps in diagnosis of non-neoplastic lesions of minor salivary glands.

INTRODUCTION

The number of minor salivary glands is 450 to 1000, and they are widely distributed in the head and neck region. Most (70%–90%) are located in the oral cavity and oropharynx, including the palate, the tongue, the lips and the buccal mucosa, and the retro-molar trigone. The remainders are located in the nose, paranasal sinuses, pharynx, and the larynx. These salivary glands, as compared with the major salivary glands, are more numerous and have a reduced volume, an abbreviated ductal system, and a paucity of capsular tissue. They contribute 8% to 10% of the saliva.[1–8]

METHODS OF EXAMINATION

MR imaging is best imaging modality for evaluation of minor salivary gland tumors. Routine precontrast imaging and postcontrast imaging accurately localize the tumor and its extension into the adjacent soft tissue and perineural extension. Malignant palatal tumors may demonstrate perineural spread along the greater and lesser palatine nerves, followed by extension to the pterygopalatine fossa and cavernous sinus.[9–11] Diffusion-weighted MR imaging with calculation of apparent diffusion coefficient value (ADC)[12–15] and dynamic contrast-enhanced MR imaging with analysis of time intensity curve may be helpful in characterization of minor salivary gland tumors, but there is overlap in their results.[16–20] Malignant tumors of the minor salivary glands tend to have an irregular tumor margin, signal heterogeneity, tumor infiltration into the surrounding tissue, low signal on T2-weighted images, and restricted diffusion at diffusion-weighted MR imaging. The benign minor salivary gland tumors tend to have a well-defined margin with high signal intensity, and unrestricted diffusion at diffusion-weighted MR imaging.[9–11] Routine computed tomography (CT) scan localizes minor salivary gland tumors, detects associated bony changes, and helps in diagnosis of non-neoplastic lesions of minor salivary glands. Advanced CT such as CT perfusion and dual-energy CT scan, as well as positron emission tomography

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(PET-CT), has a limited role in characterization of minor salivary gland, and these methods are associated with radiation exposure and contrast medium injection.[21–23] Ultrasound is of limited value in evaluation of minor salivary gland lesions, although it has a role in guidance for biopsy.[24,25]

Neoplastic Lesions

Minor salivary gland tumors account for 10% to 15% of all salivary gland tumors and 2% to 4% of head and neck cancers. The proportions of benign to malignant tumors ranged from 20% to 50% benign to 50% to 80% malignant.[1–4] The incidence of malignancy varies according to the site of occurrence, with 40% to 60% malignancy in palatal tumors, but, as one goes from the tongue to the floor of the mouth, the incidence increases up to 90%.[2–5] Most minor salivary gland tumors are located in the oral cavity (70%); other locations include the nasal cavity/sinuses/nasopharynx (25%) and the larynx (3%). The most common location in the oral cavity is the hard palate (50%), mostly at the junction of the hard and soft palate.[3–8]

Most patients are in the sixth decade, and incidence is more common in women (66%) and in black people. Most patients present with a painless nonulcerative, submucosal swelling associated with metastatic cervical lymph nodes in 15% of patients.[3–5] Tumors arising in the oropharyngeal area can cause a painless lump. Minor salivary gland tumors of the nasopharynx and the nasal cavity may cause facial pain, nasal obstruction, or bleeding. If the tumor occurs in the larynx, it can cause hoarseness, voice change, or dyspnea.[4,8] Surgery is the treatment of choice of minor salivary gland tumors that may be followed by radiotherapy in some patients.[7]

The most common malignant tumors of minor salivary gland are adenoid cystic carcinoma (40%–50%) and mucoepidermoid carcinoma (30%–40%). Less frequent tumors are acinic cell carcinoma, polymorphous adenocarcinoma, secretory carcinoma, adenocarcinoma not otherwise specified (NOS), carcinoma ex pleomorphic adenoma, and lymphomas. The most common benign tumors of minor salivary gland are pleomorphic adenoma, followed with myoepithelioma and canalicular adenoma. Other benign tumors include Warthin tumors and basal cell adenomas, which have been reported in minor salivary glands.[4–8]

Malignant tumors

Adenoid cystic carcinoma Adenoid cystic carcinoma is the most common malignancy of minor salivary gland tumors (60%) and occurs most frequently in the oral cavity (palate) (**Figs. 1 and 2**) followed by the paranasal sinuses. The pathologic subtypes of adenoid cystic carcinomas are tubular, cribriform, and solid subtypes, and malignancy is graded as cribriform or tubular (grade I), less than 30% solid (grade II), or greater than 30% solid (grade III).[26,27] The characteristic feature of this tumor is perineural spread, and it may be associated with cervical nodal metastasis. At imaging, high-grade tumors show a destructive pattern and invasion of the underlying bone and surrounding structures. On T2-weighted images, high-grade tumors show hypointensity because of high cellularity, and low-grade tumors show hyperintensity caused by low cellularity (**Fig. 3**).

Mucoepidermoid carcinoma Mucoepidermoid carcinoma is the second common malignant tumor of minor salivary glands. In the oral cavity, these tumors can also be found in the retromolar region, palate, the floor of the mouth, lips, and buccal mucosa. These tumors are pathologically classified as low-, intermediate-, and high-grade subtypes. Mucoepidermoid carcinoma is the most frequent malignant tumor arising from intraoral minor salivary glands, representing about 36% to 59% of all malignant intraoral salivary gland tumors.[28,29] CT and MR images vary according to the pathologic tumor grade. Low-grade tumors have smooth margins and are characterized by mucin-containing cystic components, which appear as hyperintense spots on T1- and T2-weighted images. High-grade tumors tend to be rather solid with poorly defined margins, and they extend into the adjacent structures. High-grade tumors often present as hypo- or isointense lesions on T2-weighted images, indicating their high cellularity (**Fig. 4**).[9–11]

Polymorphous low-grade adenocarcinoma Polymorphous low-grade adenocarcinoma is a rare type of salivary gland malignancy found almost exclusively in the minor salivary glands. The most common site is the hard or soft palate.[8,30] This tumor can potentially cause bone resorption, medullary infiltration, and invasion of nearby nerves. Advanced tumors often extend to the maxillary sinus, nasal cavity, and oropharynx and are accompanied by extensive hard palate bone destruction. CT and MR imaging may be helpful in determining the extent of the tumor (**Fig. 5**).[9–11]

Acinic cell carcinoma Acinic cell carcinoma is an uncommon low-grade malignancy that rarely affects the minor salivary glands. The pathologic subtypes of this tumor are solid, microcystic, papillary-cystic, and follicular types.[4,31] The imaging findings are nonspecific, and most acinic cell