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A BIWEEKLY REVIEW OF CLINICAL RADIOLOGIC PRACTICE

The Swollen Parotid Gland

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After participating in this educational activity, the radiologist should be better able to describe the anatomy of the parotid space, identify causes of diffuse parotid gland enlargement, and assess clinical and imaging findings that aid in the diagnosis.

Category: Head and Neck Radiology
Modality: CT

Key Words: Parotid Gland Enlargement, Parotitis, Sjögren Syndrome, Benign Lymphoepithelial Lesion of HIV, Sialolithiasis

Several systemic diseases and local inflammatory processes can cause diffuse enlargement of the parotid gland. Clinical information regarding the patient's age, localization (including laterality), duration, clinical course of the disease, and presence of associated symptoms can aid in determining the diagnosis. CT and MRI features that help narrow the differential diagnosis include the appearance of the gland (homogeneous, single, or multiple masses); inflammatory changes in, or adjacent to, the parotid gland; pattern of disease spread to adjacent spaces; and the presence of lymphadenopathy. In some cases, imaging is used to monitor treatment response, progression of disease, and identify complications. Some of the diseases/conditions that produce diffuse enlargement of a parotid gland include Sjögren syndrome, sarcoidosis, IgG4 disease, benign lymphoepithelial lesions of HIV, sialolithiasis, sialosis, and Rosai-Dorfman syndrome.

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Anatomy

The parotid space is surrounded by the superficial layer of deep cervical fascia and is bounded superiorly by the external auditory canal and mastoid tip, inferiorly by the angle of the mandible, and medially by the parapharyngeal space. Adjacent spaces include the masticator and buccal spaces anteriorly, submandibular space inferiorly, and carotid space posteromedially (Figure 1). Located within the parotid space are the parotid gland, lymph nodes (intraparotid and periparotid), retromandibular vein, external carotid artery, auriculotemporal nerve (branch of the mandibular nerve), and facial nerve. The parotid gland is the only salivary gland with intraparenchymal lymph nodes because it is the last salivary gland to encapsulate during embryogenesis. The parotid (Stensen) duct arises from the ventral aspect of the gland and travels anteriorly along the surface of the masseter muscle within the lateral extension of the buccal space. The duct turns medially, anterior to the masseter muscle behind the anterior facial vein, and then pierces the buccinator muscle at the level of the second maxillary molar to enter the vestibule. Although there is no true fascial plane within the parotid gland, by convention the facial nerve divides the gland into a superficial lobe (lateral to the facial nerve) and deep lobe (medial to the facial nerve). The intraparotid branches of the facial nerve are not seen on routine cross-sectional images. Therefore, the retromandibular vein, found medial to the facial nerve, is used as a key landmark for its localization on imaging.[1,2]

The parotid gland is the only salivary gland that contains lymph nodes.

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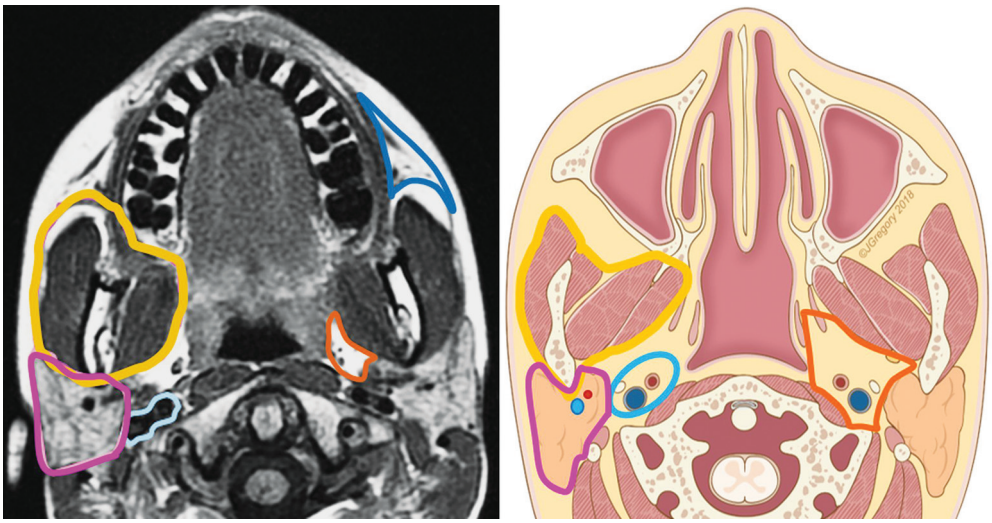

Figure 1. T1-weighted MR image and illustration at the level of the nasopharynx demonstrate the location of the parotid (*pink*), parapharyngeal (*orange*), carotid (*light blue*), masticator (*yellow*), and buccal (*dark blue*) spaces.

Infections

Viral Parotitis

The diagnosis of viral parotitis is made based on clinical findings. It typically occurs in children, beginning with a prodromal period (eg, fever, malaise, aches, pain, and nausea) followed by acute bilateral parotid swelling. The swelling often is not accompanied by erythema and usually resolves in less than 2 weeks. Mumps is the most common cause and can have significant extraglandular complications, such as orchitis, meningoencephalitis, sensorineural hearing loss, and pancreatitis. Other causes of viral parotitis include influenza, paramyxovirus, and coxsackieviruses A and B. Management of systemic symptoms is the primary form of treatment. Imaging findings consist of mildly enlarged and enhancing parotid glands with fat stranding in the adjacent soft tissues (Figure 2).[2,3]

Mumps is the most common cause of viral parotitis causing acute bilateral parotid swelling.

Bacterial Parotitis

Bacterial parotitis occurs in elderly, debilitated, and postoperative patients, and it typically is associated with dehydration and poor oral hygiene. Bacteria parotitis also occurs in preterm infants. Most cases in adults are secondary to ascending parotid ductal infections caused by *Staphylococcus aureus* (50%–90%). In debilitated elderly patients, the mortality rate can be up to 20%. Clinically, patients present with a unilateral, enlarged, painful parotid gland with skin erythema and tenderness. Bilateral parotid involvement often is encountered in neonates because the infection is usually secondary to bacteremia. On imaging, there are unilateral or bilateral enlarged, enhancing parotid glands, with or without adjacent cellulitis and abscess (Figure 3). Images also should be evaluated to exclude parotid duct pathology (ie, calculi, stricture, or obstructing mass) and complications (abscess, or thrombophlebitis of retromandibular or facial veins).[2,3]

When bacterial parotitis occurs in debilitated, elderly patients, mortality can reach up to 20%.

Parotitis Secondary to Adjacent Infections

Infection in areas adjacent to the parotid space (including the overlying skin) can cause parotitis. An inflammatory process in the external auditory canal (otitis externa) can spread to the parotid gland via the fissures of Santorini (clefts in the cartilage of the external auditory canal). It usually is bacterial in origin, commonly due to *Pseudomonas aeruginosa* or *Staphylococcus aureus*. Patients with diabetes mellitus or other immunocompromised states are especially prone to fungal infections. Patients typically present with auricular

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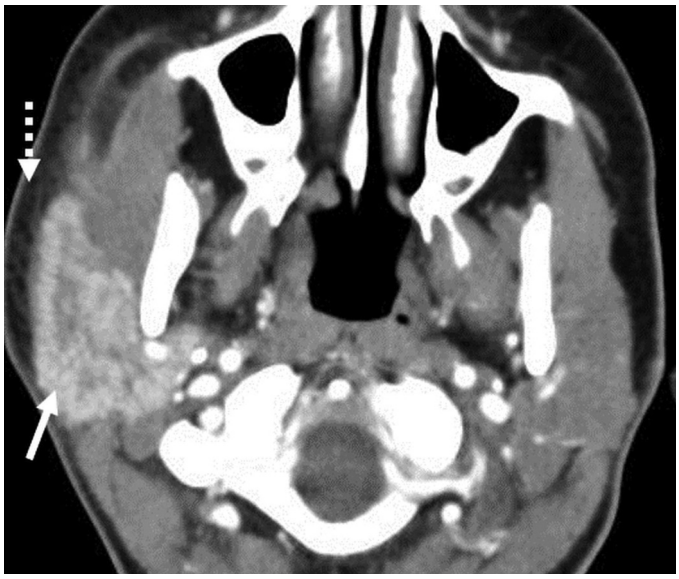

Figure 2. Viral parotitis. An 8-year-old boy presented with fever, swelling, and pain in the region of the right parotid. This CECT scan demonstrates unilateral enlargement and enhancement of the right parotid gland (*arrow*) with inflammatory changes in the subcutaneous fat (*dashed arrow*).

discomfort and swelling and pain in the region of the parotid gland. Imaging usually is indicated when symptoms persist after antibiotic therapy (Figure 4).[4] Infection in the masticator space often is associated with parotitis due to the proximity of the parotid gland. Masticator space infections are usually odontogenic in origin, related to the second and third molars or recent dental work. Presenting symptoms include tooth pain, cheek swelling, or trismus. On imaging, one often can identify a periapical abscess, evidence of dental caries or tooth extraction, in conjunction with enlargement and mild enhancement of the masseter and/or pterygoid muscles and the parotid gland (Figure 5). An intramuscular abscess may

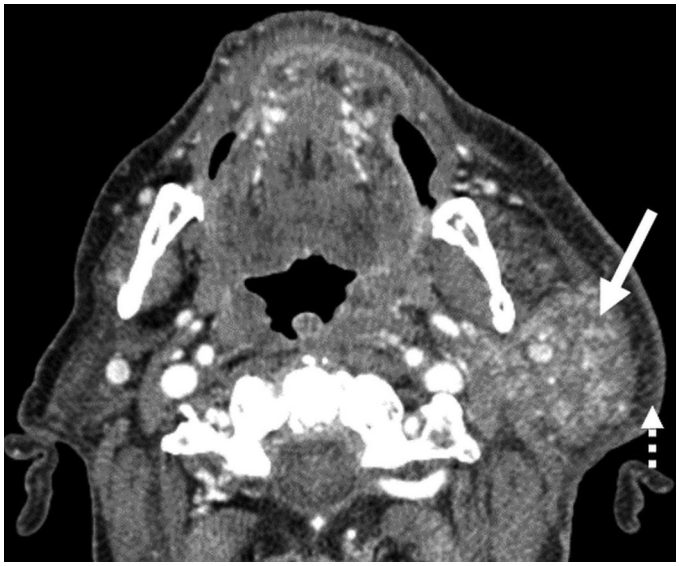

Figure 3. Bacterial sialadenitis. An elderly patient presented with right parotid gland pain and swelling. CECT scan shows enlargement and enhancement of the left parotid gland (*arrow*), increased density, and stranding in the subcutaneous fat and thickening of the overlying skin consistent with cellulitis (*dashed arrow*).

Figure 4. Acute otitis externa. An 8-year-old boy presented with right otitis externa and painful swelling over the right parotid gland. This coronal, CECT scan demonstrates soft tissue swelling and narrowing of the right external auditory canal (*arrow*), increased density in the right parotid gland, and adjacent fat with thickening of the overlying skin consistent with infection.

be identified on imaging. If present, surgical intervention may be required.[5]

Autoimmune/Inflammatory Disorders

Sjögren Syndrome

This autoimmune disorder affects the salivary and lacrimal glands, with a 9:1 female-to-male preponderance. Peak incidence occurs between 40 and 60 years of age. Primary Sjögren syndrome involves only salivary and lacrimal glands; the secondary form is associated with collagen vascular diseases, most commonly rheumatoid arthritis. Clinical findings include Sicca syndrome (dry mouth and dry eyes), and

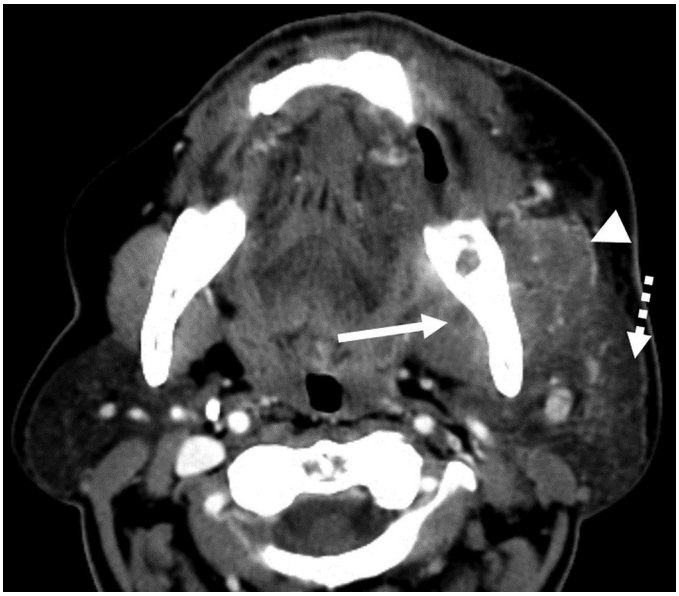

Figure 5. Masticator space abscess. This axial, CECT scan shows a small abscess adjacent to the left ascending ramus of the mandible within the pterygoid muscle (*arrow*). The masticator and pterygoid muscles are enlarged and enhancing (*arrowhead*), consistent with masticator space infection. The parotid gland is enlarged and increased in density with inflammatory changes (thickening of the skin, and increased density and stranding in the subcutaneous fat) in the adjacent soft tissues (*dashed arrow*).

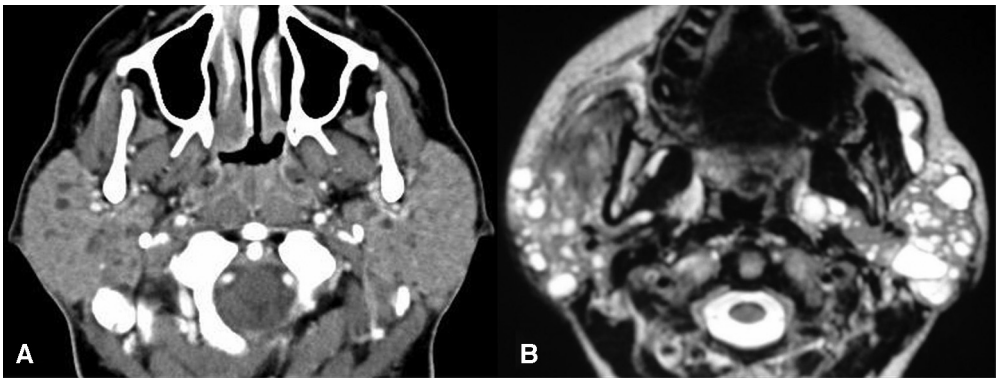

Figure 6. Sjögren syndrome. *A:* Axial, CECT scan shows bilateral, enlarged, high-density parotid glands with multiple, small cysts, consistent with intermediate-stage Sjögren syndrome. *B:* Axial, T2-weighted MR image shows bilateral diffuse parotid gland enlargement, with multiple small and large cysts, consistent with late-stage Sjögren syndrome.

bilateral parotid enlargement. On CT, salivary glands may be normal in appearance early in the disease or show increased density. Sialosis and chronic parotitis (chronic sialadenitis) can have a similar appearance. During the intermediate stage, CT may show bilateral, small, homogenous, intraglandular cysts. Large cysts (parenchymal destruction) with solid lesions (lymphocyte accumulation) occur in the late stage of the disease and ultimately result in atrophy, fatty replacement, and development of punctate calcifications.[6] MRI shows bilateral, progressively enlarging cysts with low T1 and high T2 signal (Figure 6). STIR/FS MRI demonstrates atrophy with fatty replacement, which can be monitored to assess disease progression. Sialography is considered the gold standard for diagnosis and staging. However, the accuracy of MR sialography is similar to that of sialography. The severity of disease on imaging correlates with functional impairment. Patients with primary Sjögren syndrome have an increased risk (estimated to be 44 times greater than normal) of developing non-Hodgkin lymphoma. Therefore, the appearance of a dominant solid mass is concerning for lymphomatous transformation. Cervical lymphadenopathy may or may not be present.[3,7]

Patients with primary Sjögren syndrome have an increased risk of developing non-Hodgkin lymphoma.

Sarcoidosis

Sarcoidosis is a systemic disorder of unknown cause that involves the parotid glands in 6% of patients. It presents as bilateral, painless enlargement of the parotid glands. Patients may have abnormal laboratory findings such as elevated angiotensin-converting enzyme levels, decreased CD4/CD8 blood serum ratio, and hypercalcemia. Heerfordt-Waldenstrom syndrome is sarcoidosis with bilateral parotid gland enlargement, uveitis, and facial nerve palsy. Diagnosis is presumptive if there is a history of sarcoidosis. If there is no history of sarcoidosis, the diagnosis is made based on a biopsy showing noncaseating granulomas. Imaging findings include bilateral enlarged, homogeneous, nonenhancing intraparotid nodes, with or without cervical adenopathy. The differential diagnosis for these imaging findings includes lymphoma. However, sarcoid involvement of the parotid gland itself is not associated with a higher risk of malignancy.[3]

Six percent of patients with sarcoidosis develop bilateral, painless enlargement of the parotid glands.

IgG4-Related Disease—Idiopathic Systemic Fibroinflammatory Disease

Immunoglobulin G4-related disease (IgG4-RD) is a rare, fibroinflammatory condition that can affect almost any organ. Involvement of parotid and lacrimal glands previously (and erroneously) was called Mikulicz disease. Other names for this disease, based on the structure involved, are as follows: Submandibular gland—Kuttner tumor, thyroid—Riedel thyroiditis, and orbital pseudotumor. Abdominal findings include autoimmune pancreatitis, retroperitoneal fibrosis, and sclerosing mesenteritis. Unlike classic autoimmune diseases, it commonly involves middle-aged to elderly men. Diagnosis is based on a combination of imaging, laboratory values, and pathologic findings. Some patients have elevated serum IgG4 levels (3%–30% have normal levels). Histopathology shows IgG4(+) plasma cell infiltrates and fibrosis. A biopsy is required to make a definitive diagnosis and exclude neoplastic or other inflammatory disorders. On imaging, the gland may demonstrate diffuse homogenous enhancement (Figure 7). Treatment is with immunosuppressants.[3,8]

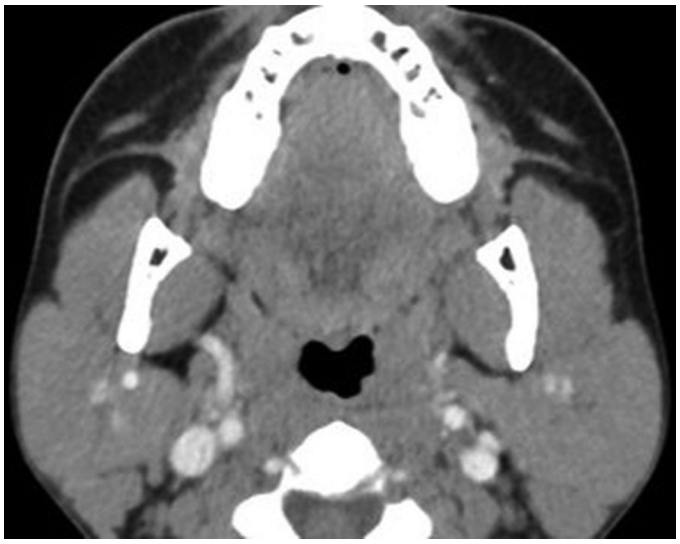

Figure 7. IgG4-related disease. This axial, CECT scan demonstrates diffuse, bilateral parotid gland enlargement.

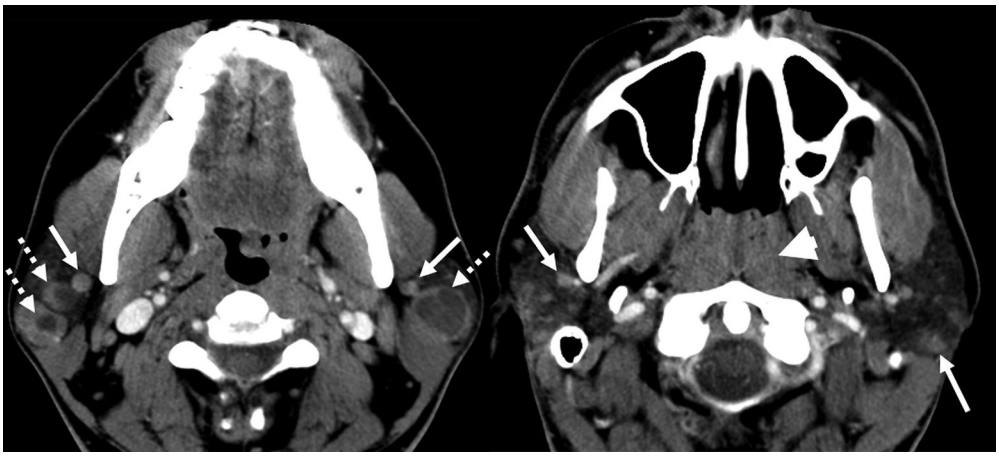

Figure 8. Benign lymphoepithelial lesions. This axial, CECT scan demonstrates multiple bilateral cystic (*dashed arrow*) and solid (*arrow*) parotid lesions and adenoidal hypertrophy (*arrowhead*).

Benign Lymphoepithelial Lesions of HIV

Patients with benign lymphoepithelial lesions of HIV usually present with bilateral, painless, enlargement of the parotid glands. HIV involvement of the parotid gland has a variable appearance on cross-sectional imaging. It may present as persistent enlargement of intraparotid lymph nodes, benign lymphoepithelial parotid cysts, or mixed cystic and solid parotid lesions. Benign lymphoepithelial lesions are lymphoid aggregates that appear as solid lesions; they can cause parotid duct obstruction resulting in proximal ductal dilatation and formation of irregular-sized cysts. Diffuse cervical lymphadenopathy and benign lymphoepithelial lesions can occur in patients with AIDS before seroconversion occurs. Imaging findings include multiple variable-sized cysts, solid and mixed cystic/solid masses within the gland, reactive cervical lymphadenopathy, tonsillar hypertrophy, or intraparotid node enlargement (Figure 8). The differential diagnosis for these imaging findings includes Sjögren syndrome, Warthin tumor, and metastases.[3,9]

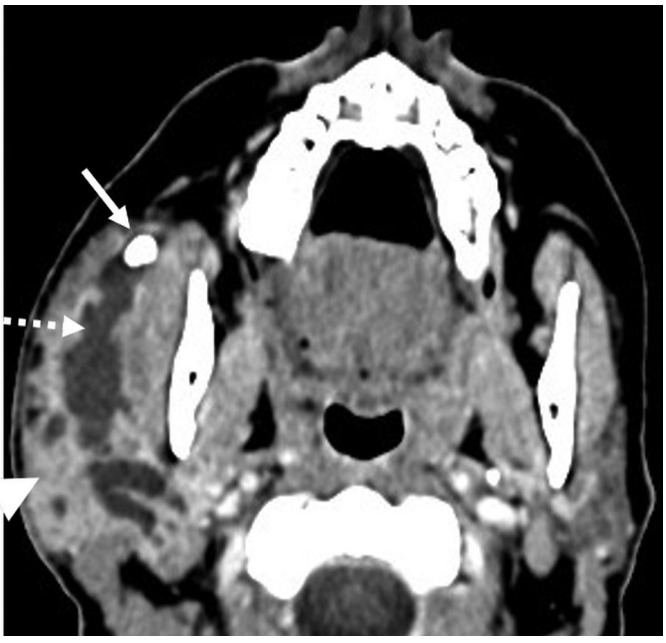

Figure 9. Stensen duct stone. This axial, CECT scan shows a radiopaque stone in the right parotid duct (*arrow*) with postobstructive dilatation of Stensen duct (*dashed arrow*) and enhancement/enlargement of the parotid gland (*arrowhead*).

Sialolithiasis

The submandibular gland is the most common location for sialoliths (stones). Only 10% to 20% of cases occur in the parotid glands. Approximately 20% are radiopaque. Most are intraductal (83%) in location; the remainder are found in the parenchyma. Classic clinical findings include recurrent swelling and pain associated with eating. Contrast enhanced CT (CECT) can identify the stone; postobstructive, and inflammatory changes such as ductal dilatation, enlargement, enhancement of the affected gland; and fat stranding in the adjacent subcutaneous tissue (Figure 9).[1,9]

Only 10% to 20% of sialoliths occur in the parotid glands; approximately 20% are radiopaque; and most are intraductal (83%) in location.

Sialosis

Sialosis (ie, excessive saliva flow) is a noninflammatory and nonneoplastic condition of unknown cause that produces chronic, bilateral enlargement of the parotid and submandibular glands. This condition is associated with diabetes mellitus, chronic malnutrition (anorexia, bulimia); alcoholism; cirrhosis; and certain medications (eg, antihypertensive drugs, anticholinergic drugs, and heavy metals). Sialosis causes degranulation of parenchymal cells and ultimately leads to fatty atrophy (lipomatosis). Patients present with bilateral, symmetric, nontender enlargement of the parotid glands. In the early phase on CT, the parotid glands are enlarged and dense (Figure 10). Eventually, fatty replacement of the gland occurs. [1,3]

Sinus Histiocytosis—Rosai-Dorfman Syndrome

The cause of sinus histiocytosis is unknown and is possibly viral in origin. It has a predilection for young males (typically younger than 20 years), and individuals of African and West Indian heritage. Clinically, patients present with massive, painless, bilateral lymphadenopathy, most commonly of the cervical lymph nodes. Extranodal involvement is common and includes mucocutaneous, intracranial, spinal dural, and lacrimal and salivary gland lesions. On imaging, lymph nodes are massively enlarged and enhancing (Figure 11). Extranodal sites also enhance. Lymphoma, reactive lymph nodes, or Langerhans cell histiocytosis can present with similar imaging findings. However, nodes in sinus histiocytosis tend to be larger in comparison.[10]

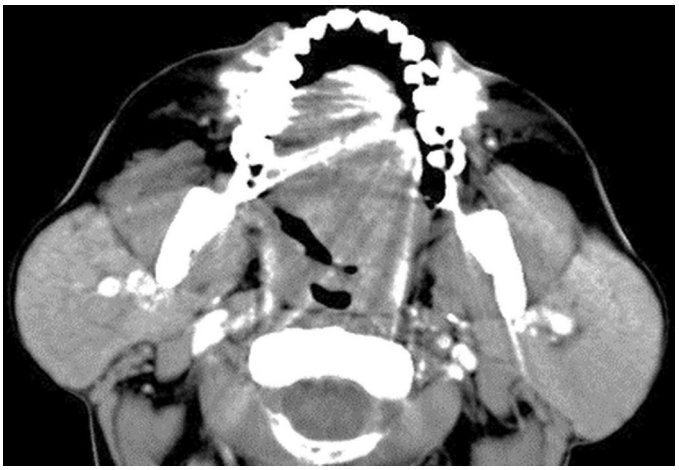

Figure 10. Sialosis. This axial, CECT scan in a 34-year-old man with diabetes shows bilateral, enlarged, high-density, homogenous parotid glands.

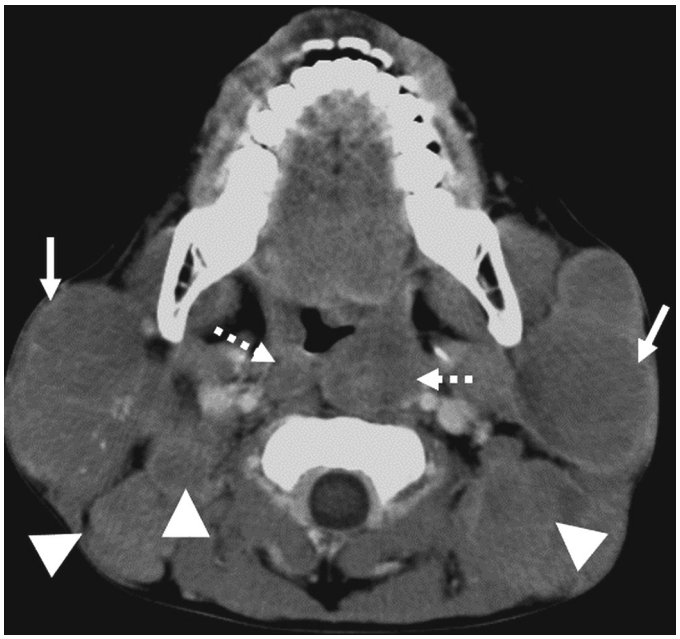

Figure 11. Sinus histiocytosis. This axial, CECT scan demonstrates massive lymphadenopathy involving the parotid glands (*arrows*), retropharyngeal nodes (*dashed arrows*), and deep cervical nodes (*arrowheads*). These nodes often are described as having a "soap bubble appearance."

Conclusion

Various systemic and local disease processes can cause diffuse enlargement of the parotid glands. Use of a systematic approach to correlating clinical and imaging findings is important when trying to determine the cause of parotid enlargement (Table 1).

Table 1. Summary of Disease Entities Involving Parotid Gland with Key Clinical Findings

Chronicity	Cause	Disease	Clinical Findings	Imaging Findings
Acute	Infection	Bacterial parotitis	Elderly, extension from adjacent spaces or second to ascending ductal infection	Unilateral enlargement ± cellulitis or abscess Exclude duct obstruction
		Bacterial parotitis	Neonate, with bacteremia	Bilateral enlargement
		Viral parotitis	Prodrome precedes gland enlargement, mumps epidemic	Bilateral mild enlargement
Chronic	Autoimmune/ inflammatory	Sjögren syndrome	Female predominance, 40–60 yrs of age, Sicca syndrome	Normal to increase density (early), enlarged gland with multiple small cysts (intermediate), atrophic with fatty replacement (late)
		IgG4 disease	Male predominance, middle age to elderly, other autoimmune disease, eg, pancreatitis, elevated serum IgG4 (70%)	Diffuse, homogeneously enhancing masses
		Sarcoidosis	Known sarcoidosis, bilateral parotid swelling, ± elevated ACE levels	Bilateral enlarged intraparotid nodes ± cervical adenopathy
		BLEL	Bilateral painless enlargement	Variable-sized cysts, cervical lymphadenopathy, and tonsillar hypertrophy BLEL can be seen before HIV seroconversion
	Others	Sialosis	Bilateral painless enlargement, associated with diabetes mellitus, malnutrition, alcoholism, various drugs	Bilateral enlarged dense glands (early), fatty replacement (late)
		Sinus histiocytosis (Rosai-Dorfman syndrome)	Predominant in young males of African and West Indian heritage Extranodal involvement	Massive bilateral lymphadenopathy

ACE, angiotensin-converting enzyme; BLEL, benign lymphoepithelial lesion; HIV, human immunodeficiency virus.

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1. Which one of the following statements concerning parotid glands is *false*?
- **A.** They contain intraparenchymal lymph nodes.
- **B.** The parotid ducts arise from the ventral aspect of the glands.
- **C.** Branches of the facial nerve within them are not seen on cross-sectional images.
- **D.** The course of the facial nerves divides them into superficial and deep lobes.
- **E.** They lie within the masticator spaces.

2. The *most* common cause of bacterial parotitis in adults is
- **A.** *Mycobacterium tuberculosis*
- **B.** *Staphylococcus aureus*
- **C.** *Klebsiella pneumoniae*
- **D.** *Pseudomonas aeruginosa*
- **E.** *Streptococcus viridans*

3. Patients with primary Sjögren syndrome are at increased risk to develop which one of the following malignancies?
- **A.** Renal cell carcinoma
- **B.** Pancreatic carcinoma
- **C.** Bronchogenic carcinoma
- **D.** Non-Hodgkin lymphoma
- **E.** Breast carcinoma

4. All of the following conditions can be associated with sialosis, *except*
- **A.** diabetes mellitus
- **B.** cirrhosis
- **C.** chronic cortisone medication
- **D.** bulimia
- **E.** alcoholism

5. Heerfordt-Waldenstrom syndrome consists of all of the following conditions, *except*
- **A.** infertility
- **B.** sarcoidosis
- **C.** bilateral parotid gland enlargement
- **D.** uveitis
- **E.** facial nerve palsy

6. All of the following are features of sialoliths of the salivary glands, *except*
- **A.** can occur in glandular parenchyma
- **B.** pain in the affected gland with eating
- **C.** most commonly located in the parotid glands
- **D.** most are radiolucent
- **E.** most are intraductal

7. All of the following are CT features of benign lymphoepithelial lesions in a patient with HIV, *except*
- **A.** bilateral enlargement of the parotid glands
- **B.** variable-sized intraparotid cysts
- **C.** solid intraparotid lesions
- **D.** bilateral, large, obstructing calculi in Stensen ducts
- **E.** mixed cystic and solid intraparotid lesions

8. Secondary Sjögren syndrome is associated *most* commonly with which one of the following collagen vascular diseases?
- **A.** Lupus erythematosus
- **B.** Dermatomyositis
- **C.** Polyarteritis nodosa
- **D.** Systemic sclerosis (scleroderma)
- **E.** Rheumatoid arthritis

9. The *most* common cause of viral parotitis is
- **A.** influenza
- **B.** mumps
- **C.** paramyxovirus
- **D.** coxsackievirus A
- **E.** coxsackievirus B

10. All of the following structures lie within the parotid space, *except*
- **A.** lymph nodes
- **B.** retromandibular vein
- **C.** internal carotid artery
- **D.** auriculotemporal nerve
- **E.** facial nerve