REVIEW

Bilateral parotid swelling: a radiological review

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Bilateral parotid swelling is not an uncommon occurrence and may pose a challenge for clinicians and radiologists. Numerous causes of bilateral parotid swellings have been identified. The purpose of this pictorial review is to display this wide array with a focus on multimodality approach.

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Introduction

A broad spectrum of pathological conditions can affect the parotid glands. Although unilateral parotid swelling is more frequently seen, bilateral parotid swelling is not uncommon.¹ Bilateral parotid swelling can result from a diverse spectrum of pathologies (Table 1), several of which do not require imaging of any kind and can be easily diagnosed clinically, whereas others can be diagnosed on imaging alone.^{1–3} Salivary gland imaging is currently performed by several modalities including MRI, CT, ultrasonography, scintigraphy and sialography.^{1–5} The algorithm for imaging the salivary glands depends on the clinical scenario with which the patient presents to the clinician. In this article, we display a panel of imaging features of histologically proven bilateral parotid swelling to emphasize diagnostic differentiation based on imaging.

Acute suppurative parotitis

Acute suppurative parotitis is an acute, painful, diffuse disease probably developing from an ascending ductal infection. Parotid swelling is usually unilateral, although bilateral involvement is seen in 15–25% cases. The disease usually occurs in debilitated, dehydrated patients with poor oral hygiene.

Sialography is contraindicated during acute infection. CT scan demonstrates dilated central ducts, enhancing ductal wall and enlarged glands. On MRI, glands can have either lower or higher signal intensity on T_2 weighted images depending on whether oedema or cellular infiltrates predominate. Diffuse glandular enhancement is seen on post-contrast images.^{1–4}

Chronic sialadenitis

Chronic inflammation of the salivary gland tissue leads to alteration in the drainage system of the gland, thus increasing the likelihood of infection. Progressive dilatation of the ductal system proximal to the obstruction occurs and leads to salivary gland enlargement (Figure 1). Chronic sialadenitis is clinically characterized by intermittent, often painful swelling of the gland that may or may not be associated with food.^{1–4}

Viral parotitis (mumps)

Mumps caused by paramyovirus is the most common cause of viral parotitis. Mumps primarily affects children aged less than 15 years. Mumps primarily involves the parotid gland, either bilaterally (75%) or unilaterally, but submandibular or sublingual involvement can also be seen. Diagnosis is made on clinical grounds and imaging is not required. However, if done, imaging reveals non-specific enlargement of parotid glands with increased attenuation on CT. On MRI, glands show increased intensity on T_2 weighted images.^{1,3}

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Table 1 Differential diagnosis of bilateral parotid swelling

Inflammation or infection
Bacterial
Viral (mumps)
HIV sialopathy
Chronic sialadenitis
Autoimmune diseases
Chronic recurrent parotitis
Sjögren disease
Granulomatous diseases
Sarcoidosis
Wegner's granulomatosis
Kimura's disease
Miscellaneous
Sialadenosis
Polycystic disease
Pneumoparotid
Radiation sialadenitis
Neoplastic diseases
Papillary cystadenoma lymphomatosum (Warthin tumour)
mucosa-associated lymphoid tissue lymphoma
Pseudolesion
Masseteric hypertrophy

HIV sialopathy

Parotid enlargement is seen in about 5% of human immunodeficiency virus (HIV)-positive patients.^{6,7} Diffuse infiltrative lymphocytosis syndrome (DILS), a subset of HIV, occurs in certain immunogenetically distinct adults and children. It is characterized by a persistent CD8 lymphocytosis, a diffuse visceral CD8 lymphocytic infiltration (most frequently of the lung), bilateral parotid swelling and cervical lymphadenopathy. The parotid swelling results from a lymphoproliferation originating from the intraparotid lymph nodes. Benign lymphoepithelial lesion (BLEL) cysts commonly develop later in the course of the disease. Ultrasonography demonstrates large anechoic/hypoechoic areas with debris and septa (representing the lymphoepithelial cyst), while large oval hypoechoic areas portray enlargement of intraparotid nodes.⁶ The CT and MRI features of BLEL are non-specific and demonstrate

multiple cystic and solid masses enlarging the parotids (Figure 2), tonsillar hypertrophy and reactive cervical adenopathy.^{3,4,7}

Chronic recurrent parotitis

Chronic recurrent parotitis (CRP) is a rare inflammatory disease of unknown aetiology.^{3,8,9} CRP is characterized by multiple episodes of unilateral or bilateral parotid swelling with or without pain. The age of onset usually ranges between 2 years and 7 years. Ultrasound demonstrates multiple minute (1 mm–3 mm) hypoechoic or anechoic focal lesions corresponding to punctate sialectasis on sialography (Figure 3).^{8,9} The imaging differential diagnosis of CRP includes benign lymphoepithelial cysts and juvenile Sjögren syndrome.

CRP of adults may arise spontaneously in adulthood or can be continuum of a non-resolving CRP of childhood. Inflammation is more significant in CRP of adults than of children. Imaging will reveal sialectasis (cavitary/destructive) and sausageing of the main duct, changes that are seen in advanced stages of CRP.

Sjögren syndrome

Primary Sjögren syndrome (SS) is an autoimmune disorder characterized by chronic lymphocytic infiltration of exocrine tissues. SS may occur either alone (primary SS) or in association with a connective tissue disorder (secondary SS). Major salivary gland enlargement occurs in 25–66% of patients with primary SS. 90% of the patients affected are female and are typically middle aged. The diagnosis is based on clinical confirmation of dry eyes and mouth and biopsy of the labial minor salivary glands, supported by detection of autoantibodies such as anti-Ro (anti-SS-A) and anti-La (anti-SS-B).

Figure 1 Bilateral chronic parotitis in an 8-year-old child. (a) Axial T_2 weighted, (b) half-fourier acquisition single-shot turbo-spin echo (HASTE) axial and (c) HASTE sagittal oblique images of the right parotid gland show dilated main parotid duct and intraglandular branches bilaterally (arrows)

Figure 2 Human immunodeficiency virus associated lymphoepithelial cysts in a 40-year-old male. (a,b) Axial T_2 weighted images show enlarged bilateral parotid glands with multiple tiny hyperintense foci involving the bilateral glands (left > right). Note presence of enlarged cervical nodes in a caudal section

Sialography is a sensitive and reliable method and has been used as a gold standard in the diagnosis of SS. The earliest sialographic changes are the appearance of numerous 1 mm collections of contrast called punctate sialiectasis that are distributed uniformly throughout the gland. Subsequent acinar atrophy causes more globular collections of contrast with eventual formation of contrast-filled peripheral cavities (cavitary sialadenitis). The central ductal system is initially normal but becomes dilated in advanced disease.¹⁻⁴ Cross-sectional imaging is normal in early disease. The ultrasound features of advanced SS include inhomogeneous salivary glands with scattered small, well-defined, oval, hypoechoic or anechoic areas with increased parenchymal blood flow. CT findings are non-specific; the gland is usually enlarged, dense, may contain nodules, exhibit abnormal enhancement and demonstrate small low-attenuation cystic areas (honeycomb appearance). On MRI, advanced SS typically has a “salt and pepper” or “honeycomb” appearance consisting of multiple areas of high-signal intensity mixed with discrete areas of low-signal intensity throughout the gland with both short and long time of repetition sequences.^{3,4} SS is associated with premature fat deposition in the parotid glands (Figure 4) which can be demonstrated using a short tau inversion recovery (STIR) and fat-saturation imaging.¹⁰ The accuracy of MR sialography is similar to that of digital subtraction sialography for the diagnosis and staging of SS.^{11,12} In addition, the risk of parotid lymphoma is increased 44-fold in SS (Figure 5). They are usually marginal zone B-cell neoplasms.¹³

Wegner’s granulomatosis

Wegner’s granulomatosis is characterized by necrosis, granulomatous inflammation, vasculitis and a classic triad of upper and lower respiratory tract involvement and glomerulonephritis.² Involvement of the salivary glands in Wegner’s disease is rare and does not occur as an isolated finding. All patients with salivary gland enlargement will have nasal, ear or lung symptoms and signs. Parotid involvement may be unilateral or bilateral and the findings are non-specific (Figure 6). Diagnosis is based on clinical presentation, histological findings of necrotizing granulomatous vasculitis and positive c-anti-neutrophil cytoplasmic antibody (ANCA) assay.^{2,14}

Sarcoidosis

Sarcoidosis is a systemic disorder of unknown aetiology.¹⁵ It commonly affects young and middle-aged patients. Diagnosis is commonly established on the basis of the clinical and radiological findings supported by histological findings of non-caseating granulomas with epithelioid cell proliferation. Painless parotid enlargement is seen in 10–30% of patients and is usually bilateral (83%). Parotid enlargement may be multinodular or less commonly diffuse.^{2-4,15}

The imaging findings are non-specific; there can be multiple non-cavitary masses representing enlarged intraparotid nodes. These are hypoechoic on ultrasound and hypodense on contrast-enhanced CT

Figure 3 Chronic recurrent parotitis of childhood in a 6-year-old female. (a) Axial T_2 weighted image and (b) three-dimensional constructive interference in steady state (CISS) maximum intensity projection (MIP) images demonstrate multiple high-signal foci in bilateral parotid glands. Right parotid gland is bulky compared with the left and shows hyperintense signal on T_2 weighted images. (c) Digital sialography of the right parotid shows scattered punctate collections of contrast material. (d) Axial ultrasound of the right parotid gland reveals multiple hypoechoic areas in the enlarged glands. These findings suggest chronic recurrent parotitis of childhood

(Figure 7). Multiple bilateral enlarged cervical lymph nodes are also seen. The main differential diagnosis for this appearance is lymphoma. In the diffuse form, parotid glands are symmetrically enlarged and show increased signal intensity on T_2 weighted images with intense enhancement on administration of gadolinium.

Simultaneous homogeneous enhancement and enlargement of lacrimal and parotid glands is a classic feature of sarcoidosis (Figure 8). Scintigraphy using Gallium-67 citrate may produce the classic “panda sign” owing to bilateral increased uptake by the lacrimal and parotid glands.¹⁵

Figure 4 Sjögren syndrome in a 30-year-old female. (a) Axial T_1 weighted, (b) fat-suppressed (FS) T_2 weighted and (c) short tau inversion recovery (STIR) images show multiple small foci involving bilateral parotid glands which are hyperintense on T_1 weighted and hypointense on T_2 weighted-FS and STIR sequences, suggestive of fatty infiltration. Multiple uniform sized foci with hypointense signal on T_1 weighted images and hyperintense on T_2 weighted images, suggesting sialectasis, are also seen. (d) Sagittal-oblique half-fourier acquisition single-shot turbo-spin echo image of right parotid gland shows multiple globular high-signal intensity areas within the glandular parenchyma

Kimura's disease

Kimura's disease is an immune-mediated inflammatory disease characterized by a triad of painless subcutaneous masses in the head or neck region, blood and

tissue eosinophilia, and markedly elevated serum immunoglobulin E levels. Salivary gland involvement can be unilateral or bilateral. Imaging findings are non-specific. CT demonstrates ill-defined homogeneously enhancing intraparotid masses, enhancing cervical

Figure 5 Sjögren syndrome with secondary lymphoma in a 65-year-old male. (a) Axial contrast-enhanced CT image shows a homogeneously enhancing mass lesion in the right parotid gland. Multiple small hypoattenuating foci are seen involving the left parotid gland. (b) Axial T_1 weighted image reveals a large hypointense mass lesion (arrow) involving the superficial lobe of the right parotid gland. Multiple hyperintense foci are seen involving the remaining right parotid gland and left parotid gland, suggesting fatty infiltration. (c) Axial T_2 weighted image at a caudal level shows presence of adenopathy involving the right jugular and accessory chain (curved arrow). Ultrasound-guided biopsy of the right parotid mass revealed large B-cell lymphoma

nodes and/or subcutaneous masses. Other rare sites of involvement include the submandibular gland, auricle, scalp, orbit and oral mucosa. Signal intensity on MRI is variable; however, the majority of lesions show mixed signal intensity on T_1 weighted images and hyperintensity on T_2 weighted images.^{2,3}

Figure 6 Wegener's granulomatosis in a 30-year-old female. Axial contrast-enhanced CT image shows enlarged bilateral parotid glands with multiple focal lesions involving both parotid glands (arrow). Also note presence of bilateral maxillary sinusitis. These findings are non-specific

Sialadenosis

Sialadenosis is defined as a bilateral, persistent, painless, non-inflammatory swelling of the salivary glands, particularly the parotids. The causes include diabetes mellitus, endocrinopathy (hypothyroidism), starvation, medications (thiourea, diuretics), alcohol abuse and heavy metals. The condition usually begins between the age of 20 years and 60 years. Histologically, there is a variable degree of acinar hypertrophy, fatty replacement and fibrosis. Imaging is rarely performed and is usually not helpful as the enlarged gland varies in echotexture, attenuation and signal intensity depending on the dominant histological change. On sialography, the parotid glands are enlarged and the ducts are usually normal in appearance but splayed by the increased gland volume (Figure 9). The clinical setting and history establishes the diagnosis.²⁻⁴

Polycystic (dysgenetic) disease

Polycystic (dysgenetic) disease of the parotid glands is a rare disorder that has only recently been described in the literature. This disease is usually seen in female subjects and is bilateral in the majority of the cases. Patients typically present with recurrent painless swelling of the affected glands. Histologically, numerous various-sized cysts lined by a thinned cuboidal or squamous epithelium are seen. In between the cystic lesions, normal serous acini are present. Inflammatory changes are not usually found. Ultrasound, CT and MRI clearly depict bilateral enlargement of the parotid glands with multiple cystic areas replacing the glandular parenchyma.^{2,3,16}

Figure 7 Sarcoidosis in a 32-year-old male. (a) Axial contrast-enhanced CT (CECT) image shows symmetrically enlarged parotid glands with multiple focal hyperdense lesions (arrow). (b) Axial CECT of thorax shows homogeneously enhancing right paratracheal node (arrowhead)

Pneumoparotid

Pneumoparotid has been described in patients who generate increased intraoral pressures when playing wind instruments, while coughing or when undergoing dental work. Pneumoparotid usually presents as a unilateral or bilateral facial swelling over the parotid region. The swelling may be painless or tender and it may be associated with warmth and erythema. There is crepitus on palpation of the gland in 50% of patients and frothy saliva or air bubbles may be observed emanating from the Stensen's duct during massage of the gland.²

Plain radiographs may show air in the soft tissues and may even outline the course of the main parotid duct. Sialography may demonstrate air bubbles in the duct.²⁻⁴ Ultrasound has been used to demonstrate air within the parotid gland and duct. CT elegantly shows air in both the duct and the gland (Figure 10).

Radiation sialadenitis

Radiation sialadenitis occurs following the radioactive iodine (I^{131}) treatment of thyroid carcinoma because of

Figure 8 Sarcoidosis in a 40-year-old female. (a) Axial T_2 weighted and (b) post-contrast T_1 weighted images show symmetrically enlarged parotid glands with increased signal intensity and diffuse glandular enhancement. (c) Axial T_1 weighted post-contrast image at level of orbit shows diffuse enhancement of bilateral lacrimal glands

a

b

Figure 9 Sialadenosis in a 34-year-old female with hypothyroidism. (a) Digital sialogram right parotid gland shows attenuated main duct and the intraparenchymal branches. (b) Axial T_2 weighted image demonstrates symmetrically enlarged parotid glands without any focal lesion

the unique ability of the salivary glands to concentrate iodine. Parotid glands are affected most, with transient bilateral parotid swelling occurring usually within 24 h of iodine ingestion, which resolves spontaneously

within a week. Sour candies and pilocarpine are known to reduce the severity and duration of the illness. Diagnosis is made on clinical grounds and imaging is not required.^{2,3}

a

b

Figure 10 Pneumoparotid in a 30-year-old male. (a,b) Axial CT images demonstrate air within bilateral main and intraparenchymal ducts which is suggestive of pneumoparotid

Figure 11 Non-Hodgkin lymphoma in a 6-year-old child. (a) Axial T_2 weighted MR image shows multiple focal hyperintense lesions involving bilateral parotid glands. (b) Coronal T_2 weighted image reveals multiple nodes involving the left jugular chain, bilateral axilla and mediastinum

Lymphoma

Primary lymphoma of the salivary gland is a rare entity and is classified as mucosa-associated lymphoid tissue (MALT) lymphoma. Secondary lymphoma is slightly more common than primary parotid lymphoma.²⁻⁴ The

vast majority of major salivary gland lymphomas are non-Hodgkin's lymphoma of B-cell lineage.

The imaging features vary depending on the presence of focal masses (Figure 11) or generalized infiltration of the gland (Figure 12). Focal disease is more common and manifests as enlarged intraparotid lymph nodes

Figure 12 Non-Hodgkin lymphoma in an 8-year-old child. (a) Axial contrast-enhanced CT (CECT) shows symmetrically enlarged parotid glands. No focal lesion is seen. (b) Axial CECT image of the thorax demonstrates large anterior mediastinal mass (arrow) with right pleural effusion

Figure 13 Bilateral Warthin's tumour in a 60-year-old male. (a) Axial T_1 weighted and (b) T_2 weighted images show multiple well-defined focal lesions involving bilateral parotid glands. Lesion involving the left parotid gland is heterogeneous with both solid and cystic components whereas the lesion in the right parotid gland is solid (arrowhead). The cystic component of left parotid gland is hyperintense on both T_1 weighted and T_2 weighted images (arrow)

with altered echogenicity and increased Doppler flow.^{17,18} CT shows enlarged intraparotid lymph nodes that exhibit mild contrast enhancement. The lesions are best seen on T_1 weighted sequences as homogeneous intermediate signal intensity masses. If parenchyma is involved, lymphoma can cause diffuse glandular enlargement with imaging features which are variable and non-specific on all modalities. Identification of extra-parotid nodal disease may be helpful in suggesting the diagnosis.³

Warthin's tumour

Warthin's tumour (papillary cystadenoma lymphomatosum) is a benign epithelial tumour. Warthin's tumour is the most common salivary neoplasm to present bilaterally with synchronous or metachronous foci. It manifests as a painless, slow-growing mass and is bilateral in up to 10% of cases.²⁻⁴

On ultrasound, a well-defined hypoechoic mass is characteristic, often containing multiple small cystic

Figure 14 Bilateral masseteric hypertrophy in a 20-year-old male. (a) Clinical photograph shows broad smooth cheek bulge (right more than left side). (b) Digital sialogram demonstrates narrowing of the main parotid duct (arrow) at the site where it turns over masseter muscle. (c) Axial CT shows enlargement of bilateral masseter muscles with normal attenuation. Findings are suggestive of benign masseteric hypertrophy (right more than left)

Figure 15 Algorithmic approach to a patient with bilateral parotid swelling

areas, but occasionally an almost entirely cystic mass is seen.⁵ MRI reveals presence of a well-defined, partially cystic mass (the cystic component of fluid signal intensity and the solid component of intermediate signal intensity). Multiple or bilateral parotid (Figure 13) or periparotid masses strongly suggest the diagnosis.¹

Benign masseteric hypertrophy

Bilateral masseteric hypertrophy can be mistaken for parotid enlargement because of the fact that the bulk of the superficial lobe of parotid gland rests over posterior aspect of the masseter muscle. Clinically, the face takes a rectangular configuration. Radiographically there is bony hyperplasia at the site of muscle mandibular insertion with flaring of the mandibular angle.^{2,3} The Stensen's duct is laterally displaced and narrowed by an enlarged masseter muscle on sialography (Figure 14).¹⁹ On cross-sectional imaging, there is an enlarged

masseter muscle with normal attenuation (CT) and signal intensity (MRI).

Conclusion

Bilateral parotid swelling is not an uncommon occurrence and numerous causes have been identified. Imaging is a valuable and useful method for diagnosis of salivary gland diseases (Figure 15). Not only does it enable confirmation or exclusion of the presence of a mass, but in many cases the nature of underlying disease may also be suggested on the basis of imaging findings. Diagnosis of CRP, SS, HIV sialopathy, Warthin's tumour, lymphoma and sarcoidosis may be suggested on the basis of imaging findings. Pseudo-lesions such as masseteric hypertrophy can be confidently diagnosed by imaging whereas findings are non-specific in cases of sialadenosis and Wegner's granulomatosis.

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