Multimodality Imaging of Pediatric Parotid Gland Lesions

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Although diseases of the parotid gland are relatively uncommon in children, a variety of benign and malignant lesions may occur and the use of imaging is essential for accurate diagnosis and treatment. Ultrasonography (US) is the initial imaging modality utilized for suspected parotid lesions, and its use may suggest a correct diagnosis in an adequate clinical setting. The use of computed tomography (CT) and magnetic resonance imaging (MRI) are useful for the assessment of large and atypical lesions. These modalities also allow the ability to image the deep parotid lobe and to better define the nature of a lesion. CT is the preferred imaging modality for inflammatory processes, including suspected sialolithiasis, abscesses and salivary duct obstructions, whereas MRI is usually used to evaluate tumors due to excellent anatomic resolution and a lack of ionizing radiation exposure, especially in children. This report describes the imaging findings of various parotid gland lesions in children. Familiarity with these findings will aid in lesion characterization and should facilitate optimal clinical management.

Index words: Parotid gland  
Child  
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X-Ray Tomography  
Magnetic resonance (MR)

A wide spectrum of inflammatory diseases, including sialolithiasis, neoplasms and developmental disorders may be encountered in the pediatric parotid gland. These lesions may present with swelling of the parotid region, which makes diagnosis problematic. The use of imaging plays an important role in defining the location and extent of lesions and for evaluating involvement of the facial nerve, including the mastoid portion. Finally, imaging can provide a specific diagnosis in a proper clinical setting. The imaging modalities used to evaluate parotid lesions have changed over the past several decades. Plain films and sialograms were used initially, but basic approaches today involve ultrasonography (US), computed tomography (CT) and magnetic resonance imaging (MRI) [1]. In this review, we describe the imaging spectrum of a variety of congenital and acquired lesions in the pediatric parotid gland, with a comparison of the findings with the use of various imaging modalities.

Normal Gland Anatomy and Imaging Considerations

The parotid gland is the largest of the three paired sali-
vary glands, which arises as an epithelial invagination in the lining of the oral cavity. It is located at the angle of the mandible, and is bounded by the ramus of the mandible and masseter muscle anteriorly, and by the mastoid process and sternocleidomastoid muscle posteriorly. The gland is divided into the larger superficial (lateral) and smaller deep (medial) lobe by the facial nerve that enters the posterior gland, branches, and then exits the gland anteriorly (Fig. 1).

US is a fast, non-invasive modality that provides excellent resolution of superficial structures, and is generally regarded as the initial imaging tool of choice for the evaluation of suspected parotid lesions (2). US is usually performed with a linear transducer with a frequency of 5-12 MHz. As depicted on US, the normal parotid gland is homogenous and hyperechoic relative to the adjacent muscle (Fig. 2). Intraglandular lymph nodes, which are usually hypoechoic and less than 5-6 mm in size, can be seen in asymptomatic children (2, 3).

As depicted on color Doppler US, the gland parenchyma is not hypervascular and produces minimal flow signals. The course of the facial nerve, which is not readily visualized on US, can be inferred by the identification of the retromandibular vein within the gland, as the nerve lies just lateral to this vessel. The deep lobe of the parotid gland is not usually well demonstrated on US, and thus, there are advantages to the use of CT and MRI in terms of imaging deep or large lesions.

CT is particularly useful for the detection of sialolithiasis and bone destruction, and for the evaluation of extensions of inflammatory or neoplastic diseases out of the parotid capsule. In children, CT attenuation of the parotid gland may be similar to that of muscle due to lower glandular fat levels. It is one of the limitations of the use of CT in children. Progressive fatty infiltration occurs in the gland with age and the gland shows less attenuation than muscle. The use of MRI is preferable to CT for the imaging of parotid masses, especially when associated with facial nerve symptoms, as MRI can identify the facial nerve, and is the most useful modality

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**Fig. 1.** The normal parotid gland in a 10-year-old girl. An axial T1-weighted MR image shows the parotid gland (P) and parotid duct (thick black arrows) piercing the buccinator muscle (B) just lateral to the second maxillary molar. Note the medial external carotid artery (thin white arrow) and more lateral retromandibular vein (thin black arrow). A branch of intraparotid facial nerve (thick white arrow) is seen projecting laterally around the lateral margin of the retromandibular vein. M = masseter muscle

**Fig. 2.** A normal parotid gland in a 6-year-old boy. (A) Transverse and (B) longitudinal US images show a homogenous, hyperechogenic parotid gland at the angle of the mandible. The normal anatomy of the right parotid gland is as follows: P = parotid gland, v = retromandibular vein, a = external carotid artery, M = echogenic surface of the mandible, Ma = masseter muscle.
for the evaluation of tumor extent. The signal intensity of the parotid gland is dependent on fat content; and nerves and ducts have lower signal intensity. The use of fat saturation is helpful for contrast-enhanced imaging.

Sialography is rarely used currently because of the invasive nature of the modality and the current capabilities of CT and MRI. It is performed by injecting contrast material into the ductal system via the oral opening of the parotid (Stensen’s) duct that exits the anteromedial portion of the gland, crosses the masseter superficially, pierces the buccinator, and enters the oral cavity opposite the second maxillary molar. The procedure is indicated as follows: to detect small sialoliths or foreign bodies, assess the extent of irreversible duct damage due to infection, and evaluate fistulas, strictures, diverticula and ductal trauma. However, clinically active infections contraindicate the use of the procedure, as it is likely to cause the spread of infection into the gland in a retrograde manner.

**Inflammatory Disorders**

**Acute Parotitis**

Parotitis is the most common parotid disease in children. Acute parotitis manifests as a unilateral or bilateral painful swelling at the angle of the mandible. In general, it has a viral origin, often secondary to mumps, whereas *Staphylococcus aureus* is the most common cause of bacterial parotitis. Staphylococcal infection usually affects premature babies or immunosuppressed children [2, 4, 5]. As depicted on US, the affected gland shows diffuse enlargement with heterogeneous echogenicity, and may demonstrate multiple, small hypoechoic nodules, representing enlarged intraparotid lymph nodes, small abscesses or dilated ducts [5] (Fig. 3A). Color Doppler US shows increased intraparotid blood flow (Fig. 3B) and contrast-enhanced CT shows an enlarged gland with diffuse enhancement and fat stranding around the gland (Fig. 3C). In severe cases, abscess
formation may occur, which appears as a hypoattenuated focus with peripheral enhancement [Fig. 4].

**Chronic Recurrent Parotitis**

Chronic recurrent parotitis is defined as a recurrent parotid inflammation, generally associated with non-obstructive sialectasis [6]. Although it is a rare condition of unknown etiology, it is the most commonly encountered inflammatory salivary gland disorder in children after the mumps. Typical clinical features are intermittent unilateral or bilateral swelling of the parotid gland accompanied by pain, fever and malaise, and it is usually self-limiting and resolves by adolescence. Chronic recurrent parotitis may be associated with Sjogren’s disease, human immunodeficiency virus infection, and immune deficiencies, such as hypogammaglobulinemia. Occasionally, chronic recurrent parotitis may be also be associated with ductal obstruction by a stone.

US depicts the presence of a heterogenous gland with multiple small hypoechoic or punctuate echogenic areas (Fig. 5). These hypoechoic areas are thought to represent both ectatic ducts and surrounding lymphocyte infiltration. The punctate echogenic foci may correspond to mucus or calcification within the dilated ducts [7]. The use of sialography demonstrates multiple, sharply demarcated, and small round areas of contrast collection, which are equivalent to the hypoechoic areas noted on US.

**Sjogren’s Syndrome**

Sjogren’s syndrome, which occurs rarely in childhood, is an autoimmune disorder characterized by chronic lymphocytic infiltration of the salivary and lacrimal glands, and usually presents as recurrent parotid swelling. As the disease progresses, glandular enlargement appears with denser attenuation than normal as seen on CT. Advanced Sjogren’s syndrome shows US findings similar to those of chronic recurrent parotitis and a gland with a “salt and pepper” or “honeycomb” appearance on CT and MRI [Fig. 6A, B] [1, 4]. During the early stage of the disease, the use of sialography demonstrates innumerable peripheral punctate collections of contrast material, and as the disease progresses, these collections of contrast material become larger, and eventually the gland is destroyed [Fig. 6C]. Sjogren’s syn-

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**Fig. 5.** Chronic recurrent parotitis in a 4-year-old girl who had recurrent swelling at the parotid area. A longitudinal US image of the right parotid gland shows mild enlargement with heterogeneous echogenicity and multiple low echoic areas.

**Fig. 6.** Sjogren’s syndrome in a 15-year-old-girl with recurrent swelling at bilateral parotid areas. An axial contrast-enhanced CT scan (A) and axial T2-weighted MR image (B) show diffuse enlargement of both parotid glands with increased attenuation and signal intensity, respectively (arrows). Note the presence of the multiple microcystic low attenuating lesions on the CT image and multiple punctate low signal intensity areas on the MR image throughout both parotid glands. A lateral view of a parotid sialogram (C) shows multiple punctate collections of contrast material evenly scattered throughout the gland. The central duct system seems to be normal.
Sialolithiasis

Salivary calculi are typically associated with recurrent painful swelling of the parotid during eating and can be accompanied by bacterial infection. About 10-20% of salivary calculi occur in the parotid gland (5). Sialolithiasis has been reported to be associated with cystic fibrosis, but it can also arise as an isolated finding (7). Although 60% of parotid stones are radiopaque, they may be difficult to visualize on plain radiographs due to the superimposition of bony structures (1, 5, 7). Sialography is a highly accurate technique for the diagnosis of sialolithiasis, but is somewhat invasive (Fig. 7A). US is the initial imaging method to utilize in cases with clinically suspected parotid calculi, which are demonstrated as hyperechoic foci with acoustic shadowing associated with sialectasis and inflammatory changes. CT is generally performed without contrast as under such circumstances, small opacified blood vessels may mimic small duct stones (Fig. 7B). If inflammation or an abscess is suspected, a contrast-enhanced scan might be useful to perform after stones have been identified on non-enhanced CT.

Neoplasms

Salivary gland neoplasms are uncommon in children and account for 1% of all pediatric tumors. Salivary gland tumors compose 8% of primary tumors of the head and neck in children, and 90-95% of salivary tumors occur in the parotid gland (5). Up to 65% of pediatric salivary gland neoplasms are benign, and are commonly identified as hemangiomas or pleomorphic adenomas (5, 7). Mucoepidermoid or acinic cell carcinomas account for 60% of malignant salivary gland neoplasms in children and occur most commonly in children near 10 years of age (5, 9). The remaining malignant tumors include rhabdomyosarcomas, adenoid cystic carcinomas, adenocarcinomas, lymphomas, and squamous cell carcinomas. Rapid mass growth, facial nerve paralysis, attachment to the skin or deep tissues and lymphadenopathy increase the possibility of a malignancy. The majority of malignant tumors are poorly circumscribed with irregular margins. However, small or low grade malignant tumors may have features suggesting benign lesions. Thus, tissue sampling is required for a definitive diagnosis.

Hemangiomas

Hemangiomas are benign neoplasms of endothelial cells and are the most common benign salivary gland tumors in children. In particular, they represent 90% of parotid tumors that occur during the first year of life (1) and have a significant female predominance (5). A hemangioma manifests as a soft, non-tender mass shortly after or at birth. Usually, they grow rapidly during the first year of life, reaching a peak size at 1-2 years of age (proliferative phase). In most cases, the lesions then spontaneously regress and disappear completely by the time of adolescence (involutional phase) (1, 10). Therefore, surgery may be avoided until adulthood, but can be indicated in cases with major complications, such as bleeding, compression of vital structures or coagulopathy.
As seen on US, hemangiomas appear as homogenous hypoechoic lesions, often with a lobulated appearance (Fig. 8A). Color Doppler US can confirm the presence of increased vascularity to a variable degree in the masses (Fig. 8B), and can detect the presence of feeding arteries and draining veins. With the use of contrast-enhanced CT, hemangiomas are visualized as well-demarcated masses with intense homogenous enhancement. On T2-weighted images, hemangiomas typically show marked hyperintensity and signal voids representing intralesional or perilesional blood vessels (Fig. 9).

**Pleomorphic Adenomas**

A pleomorphic adenoma or benign mixed tumor is the most common benign epithelial tumor of the pediatric parotid gland [1]. Typically, the tumor manifests as a hard, painless and slow-growing parotid mass. As depicted on US, small pleomorphic adenomas appear as oval or round, well defined and homogenously hypoechoic masses. Large tumors have a more heterogenous appearance due to necrosis, hemorrhage, and cystic changes, and tend to have a lobulated margin (Fig. 10) [1]. On CT, calcifications or ossifications may be observed within this tumor. On MR images, the tumor signal intensity depends on its histological components. Areas containing abundant fibromyxoid stroma appear as bright signal intensity regions on T2-weighted images and show marked enhancement, whereas areas of high cellularity appear as low signal intensity regions on T2-weighted images with weak enhancement (Fig. 11A, B). Malignant transformation and local recurrence after surgery are the major causes of morbidity and mortality associated with this tumor [1, 11].

**Warthin’s Tumor**

Warthin’s tumor or cystadenolymphoma is the second
most common benign neoplasm of the salivary gland in adults, but its presentation is rare in children. It usually occurs in the tail of the parotid gland, and arises from the ectopic ductal epithelium. Multifocal tumors in one or both parotid glands have been reported to occur in up to 10-30% of cases and are highly suggestive of Warthin’s tumor [1, 11].

As depicted on US, a Warthin’s tumor tends to be round or oval, well-defined, hypoechoic mass, which is more inhomogeneous than a pleomorphic adenoma due to common cyst formation, especially in the larger tumors. Cystic portions within a solid lesion are considered typical of a Warthin’s tumor, which may also appear as a cystic mass mimicking cystic carcinomas, such as a mucoepidermoid carcinoma or acinic cell carcinoma. Technetium-99m scintigraphy can help to diagnose Warthin’s tumor, as the tumor shows higher uptake of the radioisotope than the normal gland parenchyma [11]. CT and MRI commonly show a well-defined, cystic or solid lesion located in the posteroinferior segment of the superficial lobe of the parotid gland. Surgical resection is recommended as a Warthin’s tu-

![Image](image1)

**Fig. 10.** A pleomorphic adenoma in a 14-year-old boy. A longitudinal US image (A) shows a lobulating contoured hypoechoic mass in the right parotid gland. An axial contrast-enhanced CT scan (B) demonstrates the presence of a lobulating soft tissue mass in the right parotid gland (arrows).

![Image](image2)

**Fig. 11.** A pleomorphic adenoma in a 19-year-old boy.

**A.** An axial T2-weighted MR image shows a heterogenous hyperintense mass (arrows) with lobulation involving the superficial and deep lobe of the left parotid gland.

**B.** On an axial contrast-enhanced T1-weighted MR image, irregular peripheral enhancement of the mass is noted (arrows).
mor may undergo malignant transformation.

**Neurogenic Tumors**

Neurogenic tumors including schwannomas (neurilemmomas) and neurofibromas may arise from the facial nerve or its branches schwannomas are solitary, whereas neurofibromas are often multiple masses. Multiple or plexiform neurofibromas have ill-defined margins and infiltrate surrounding tissues, and usually occur in patients with neurofibromatosis type 1 (Fig. 12) [10].

Neurogenic tumors often contain cystic areas, and the tumors are seen on CT as homogenous masses isodense to muscle or heterogenous masses with focal areas of cystic change with moderate or marked enhancement after contrast administration. On MRI, this type of tumor tends to show low to intermediate and high signal intensity on T1-weighted images and T2-weighted images, respectively (Fig. 13).

**Mucoepidermoid Carcinomas**

Mucoepidermoid carcinomas (MECs) are the most common malignant tumors of the pediatric salivary gland [9], and are categorized histologically into three grades: low, intermediate and high. Moreover, these grades correspond well with prognosis, and thus this histological grading scheme is an important prognostic indicator.

Imaging findings also depend on tumor grade. Lower grade MECs present as well-defined masses, mimicking a pleomorphic adenoma. High grade MECs are often ill defined with fewer cystic areas than low-grade tumors and tend to be more homogenous as seen on CT, and are likely to appear as regions of low signal intensity on both T1- and T2-weighted images. However, the enhancement patterns are variable as seen on CT and MRI (Fig. 14) [1, 11].

**Acinic Cell Carcinomas**

Acinic cell carcinomas (ACCs) are rare salivary gland tumors in children. Nevertheless, they have been re-

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Fig. 12. A parotid neurofibroma in a 10-year-old boy with neurofibromatosis type 1. On an axial contrast-enhanced CT scan, a diffuse ill-defined low attenuated lesion replaces the entire right parotid gland (white arrows). A neurofibroma is also noted in the right parapharyngeal space (black arrows).

Fig. 13. A neurilemmoma in a 13-year-old boy.

A. An axial T2-weighted MR image shows a well-defined mass with inner cystic or necrotic areas and fluid-fluid level suggesting hemorrhage in the left parotid gland (arrows).

B. On an axial contrast-enhanced T1-weighted MR image, the mass is seen with strong enhancement (arrows) with inner non-enhancing cystic or necrotic areas.
ported to be the second most common parotid malignancy after an MEC in the pediatric population (5, 9). Imaging findings of ACCs are nonspecific (Fig. 15), though most ACCs have a benign appearance and often simulate a pleomorphic adenoma and Warthin’s tumor.

Rhabdomyosarcomas

A rhabdomyosarcoma is the most common pediatric soft tissue sarcoma, and accounts for approximately half of all soft tissue sarcomas in children. About 35-40% of rhabdomyosarcomas occur in the head and neck and 10% of these tumors involve the parotid gland (10).

As seen on US, rhabdomyosarcomas appear as heterogeneous low echoic masses with markedly increased vascularity (Fig. 16A, B), and as seen on CT, the tumors appear as isoattenuating heterogeneous masses relative to muscle, with ill-defined margins (Fig. 16C). Rhabdomyosarcomas are seen with variable enhancement after contrast administration, and MRI also depicts the lesions as indistinct, irregular heterogenous masses. The tumors are isointense on T1-weighted images and hyperintense on T2-weighted images with heterogenous or homogenous enhancement following contrast material administration (Fig. 16D, F). Rhabdomyosarcomas usually infiltrate into the surrounding structures and directly invade contiguous soft tissues and bony structures (10).

Adenoid Cystic Carcinomas

Adenoid cystic carcinomas compose 4-8% of all salivary gland tumors. The tumors usually occur in subjects 20 to 80 years-old and are rare in patients under 20 years of age. Adenoid cystic carcinomas grow slowly; however, late metastases are frequent. Perineural invasion is typical, and therefore pain is a relatively common symptom (1).

These carcinomas often appear as benign tumors with well-defined margins. Nerve enlargement with enhancement suggests perineural infiltration (1).

Fig. 14. A mucoepidermoid carcinoma in a 9-year-old boy. An axial contrast-enhanced CT scan demonstrates a well-defined enhancing intraparotid mass (arrows) with a small focal cystic area.

Fig. 15. An acinic cell carcinoma in an 11-year-old boy.
A. A transverse US image shows the presence of a relatively defined hypoechoic solid mass in the right parotid gland (arrows).
B. An axial contrast-enhanced CT scan shows a homogenously enhancing mass located in the deep lobe of the parotid gland (arrows).
Lymphoma and Leukemia

A salivary gland primary lymphoma is rare and most commonly involves the parotid gland. Of the different histological types, the mucosa-associated lymphoid tissue (MALT) lymphoma is the most common (12). A secondary lymphoma of the salivary glands is also rare and 80% of cases involve the parotid gland (1). In these cases, the prognosis is poor owing to lymphoma dissemination. Clinically, a salivary gland lymphoma is usually painless and manifests only as progressive swelling of the salivary gland. It is usually associated with autoimmune disease, most frequently with Sjogren’s syndrome. Moreover, the risk of non-Hodgkin’s lymphoma in Sjogren’s syndrome is 40 times higher than the risk in the normal population (8). Rheumatoid arthritis also occasionally accompanies a lymphoma and an unusual relationship between lymphoma development and systemic lupus erythematosus (SLE) treatment has been reported (12, 13).

Intraparotid nodal involvement of a lymphoma appears as multiple, round or oval, hypoechoic lesions with a sharp margin as depicted on US. Parenchymal in-

![Image](image_url)

**Fig. 16.** A rhabdomyosarcoma in a 4-year-old boy. A transverse US image (A) shows a lobulating contoured low echoic mass involving the right parotid gland (arrows) and markedly increased vascularity as seen on color Doppler US (B). An axial contrast-enhanced CT scan (C) demonstrates the presence of an ill-defined heterogenous enhancing mass (white arrows) in the right parotid gland with prominent vascular structures and extension to the adjacent parapharyngeal and carotid space (black arrows). Coronal MR images show a large parotid mass (arrows) with T2 high and T1 low signal intensity, respectively (D, E) and strong heterogeneous enhancement after contrast administration (F).
volvement shows diffuse infiltration with an ill-defined margin. An enlarged gland with increased vascularity within the lesion is seen with a lymphoma [11]. On CT, focal masses that are restricted within the intraparotid lymph nodes or diffuse infiltration present with slight homogenous enhancement after contrast administration (Fig. 17) [1].

Leukemic involvement of the parotid gland is uncommon. Enlargement of the gland is associated with variable echogenicity and increased blood flow as seen on US, and CT and MRI also demonstrate various attenuations and signal intensities, respectively. The clinical setting is usually important for diagnosis as it is difficult to distinguish leukemia from other parotid diseases that present with an enlarged gland.

Metastases
Parotid metastases are uncommon in children. Most primary tumors are cutaneous malignancies of the head and neck. Squamous cell carcinomas, melanomas of the scalp or periauricular area, and thyroid carcinomas may metastasize to the parotid gland [4, 14]. Most parotid metastases are located in the intraparotid lymph nodes.

US demonstrates multiple, well-defined, round, hypoechoic lesions with increased vascularity, but it may be difficult to differentiate between metastatic lesions and other diseases, such as inflammation, infectious granulomatous disease, lymphoma and acute adenopathy. Therefore, the use of fine needle aspiration or surgery is necessary to confirm the diagnosis in most cases.

Vascular Malformations
The Mulliken and Glowacki classification system classifies vascular lesions into two main categories: hemangiomas and vascular malformations [15]. Vascular malformations consist of some combination of congenitally abnormal vessels and the malformations are further subdivided into venous, lymphatic, capillary and arteriovenous malformations, depending on the predominant vessel type. MRI has been shown to be helpful for the determination of lesion type and extent. Vascular malformations tend to enlarge as children grow and do not undergo spontaneous involution. Thus, surgical treatment or sclerotherapy are necessary [15].

As seen on US, lymphatic malformations usually appear as thin septated cystic masses with predominant hypoechoic components (Fig. 18). If hemorrhage or in-

**Fig. 17.** A T-cell lymphoblastic lymphoma in a 2-year-old girl. On an axial contrast-enhanced CT scan, both parotid glands are diffusely enlarged with homogenous enhancement (white arrows). Multiple cervical lymph node enlargements are also noted (black arrows).

**Fig. 18.** A parotid lymphatic malformation in a 13-year-old girl. US depicts a multiseptated cystic mass in the right parotid gland (arrows).
fection is present, intrallesional echogenic floating debris can be observed. On CT and MRI, lymphatic malformations are seen as cystic masses with thin septations that frequently infiltrate surrounding tissues. After contrast administration, there is usually little or no enhancement, although an enhancing solid portion can be present within a mass. Hemorrhage occurs frequently and results in fluid-fluid levels with variable attenuations or signal intensities that depend on hemorrhage age at the time of imaging [Fig. 19] [5, 10, 11].

**Developmental Disorders**

*Congenital Agenesis of the Parotid Gland*

Agenesis of the parotid gland is a rare entity. It usually occurs alone or with first branchial arch developmental disorders and other congenital anomalies, such as a hemifacial microstomia, cleft palate, mandibulofacial dysostosis and anophthalmia [1]. It is important to diagnose this disease since the contralateral parotid gland may be mistaken as an abnormal mass due to the presence of facial asymmetry.

*Accessory Parotid Gland*

The accessory parotid gland is a nodule of normal salivary gland tissue that is obviously separated from the main parotid gland. The facial process of the parotid gland, which is a normal anterior extension of the parotid tissue continuing with the main gland, should not be misdiagnosed as an accessory gland. Studies on human cadavers have determined that the incidence of an accessory gland is approximately 20% to 40% [16]. The accessory gland is located on masseter muscle adjacent to Stensen’s duct at variable distances from the main gland, and usually drains into Stensen’s duct through one or more excretory ducts. A palpable mass in the mid-cheek is a common manifestation, with or without tenderness. The accessory parotid may be associated with a benign or malignant neoplasm, benign lymphoepithelial lesions and a congenital fistula from the accessory parotid to the facial skin [Fig. 20] [17].

US depicts soft tissue with the same echogenicity as the normal parotid gland, and provides the precise location of the lesion and its relationship with adjacent structures. CT and MRI provide additional information on the presence of a duct stone, soft tissue calcification, and the internal characteristics of abnormal lesions, es-
especially tumors.

Miscellaneous Lesions

Kimura Disease

Kimura disease is a rare angiolymphoproliferative disorder of unknown etiology, which is characterized by the presence of a lymph-folliculoid granuloma with eosinophilic infiltration in the mass and surrounding tissues. Kimura disease is markedly more prevalent in young Asian males in their second or third decades of life (18). Its typical clinical presentation is a painless, soft-tissue mass with local lymphadenopathy. A head and neck location is most common, and the majority of cases involves subcutaneous tissues, the major salivary glands or regional lymph nodes. Peripheral blood eosinophilia and an elevated serum IgE level are often associated with the disorder.

US findings of Kimura disease are varied. Soft tissue masses are well-defined or ill-defined and hypoechoic with homogenous or heterogenous internal architecture, and although masses contain a predominant solid component, cystic or necrotic portions may also be present (18). T2 signal intensities on MRI and degrees of enhancement are diverse and depend on the ratio of fibrosis to vascular proliferation within a lesion. Masses demonstrate high signal intensity of a varying degree on T2-weighted images and low to intermediate signal intensity on T1-weighted images (Fig. 21, 22) (19).

It is difficult to diagnose Kimura disease based solely

![Fig. 21](image1)

**Fig. 21.** Kimura disease in a 10-year-old boy. An axial contrast-enhanced CT scan shows well-enhancing infiltrative soft tissue lesions involving the right parotid gland and periparotid area (white arrows). Multiple enlarged lymph nodes are also seen in both necks (black arrows).

![Fig. 22](image2)

**Fig. 22.** Kimura disease in a 10-year-old girl. **A.** An axial T2-weighted MR image shows a relatively well-circumscribed hyperintense mass (arrows) involving the right parotid gland and superficial masticator space. **B, C.** On an axial T1-weighted MR image, the mass shows iso-signal intensity (arrows in **B**) with strong enhancement after contrast administration (arrows in **C**).

![Fig. 23](image3)

**Fig. 23.** Castleman’s disease in a 6-year-old girl. An axial contrast-enhanced CT scan shows a well-defined mass with homogenous and strong enhancement in the right parotid gland (arrows).
on radiological findings. Thus, a biopsy and consideration of its unique clinical features are necessary. Treatment options include surgery, administration of regional or systemic corticosteroids, and radiation therapy. Although Kimura disease is a chronic benign condition with an indolent course, recurrence after surgery or after the cessation of steroid therapy is common.

**Castleman’s Disease**

Castleman’s disease is a rare, benign lymphoproliferative disease of unknown etiology. The majority of lesions occur within the head and neck, and salivary gland involvement is rare.

Two histologic types of Castleman’s disease have been described: the hyaline vascular and plasma cell types. The hyaline vascular type is usually unicentric, whereas the plasma cell type often occurs at multiple sites and can be associated with systemic symptoms. This multicentric Castleman’s disease has a high risk to develop into a malignancy, such as lymphoma or Kaposi’s sarcoma [20].

CT and MRI findings are nonspecific, demonstrating a well-defined, homogenous mass with strong enhancement within the gland [Fig. 23] [20].

**Langerhans Cell Histiocytosis**

Langerhans cell histiocytosis (LCH) can involve the parotid gland; however, this is extremely rare, even for multisystem LCH [21]. Involved bilateral parotid glands are homogenously enlarged as seen on CT and are associated with multiple enlarged regional cervical lymph nodes [Fig. 24] [21].

**Pneumoparotid**

A pneumoparotid, also known as pneumoparotitis and pneumosialadenitis, arises from air insufflation into the parotid gland when the intraoral pressure increases due to the following: chronic obstructive pulmonary disease, cystic fibrosis, glassblowing, horn playing, a dental procedure or as habitually self-induced means by children or adolescents to seek attention. Anatomical abnormalities, such as a patulous duct, hypertrophy of the masseter muscle, and weakness of the buccinator muscle can also be associated with a pneumoparotid.

Clinical manifestations usually include swelling, pain, tenderness, and erythema in the parotid region. A pneumoparotid may occur as a transient or recurrent event. In recurrent pneumoparotid cases, its course is not completely benign as it may give rise to sialectasia, recurrent parotitis and even subcutaneous emphysema. CT is the most useful modality for diagnostic purposes, especially if there is a small amount of air in the parotid gland [Fig. 25]. US and MR sialography are also valuable tools.
Treatment completely depends on the cause of the pneumoparotid. In an isolated case, only reassurance and prophylactic antibiotics are needed (22).

Summary

Although parotid gland disorders are uncommon in children, many diseases may affect the parotid gland. Imaging modalities, such as US, CT and MRI help evaluate and diagnose parotid gland lesions. Knowledge of the imaging findings is necessary for a specific diagnosis in an adequate clinical setting and as a guide to therapy.

References