Parapharyngeal Space Lesions

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ABSTRACT
Lesions in the parapharyngeal space are rare and difficult to diagnose and treat. They can arise within the parapharyngeal space or extend secondarily from the surrounding neck area. Differentiation of a parapharyngeal space lesion from a surrounding neck space lesion is essential for differential diagnosis and surgical approach. This pictorial essay discusses imaging features of some common parapharyngeal space lesions.

Key Words: Abscess; Glomus tumor; Neurilemmoma; Pharyngeal diseases; Vascular malformations

INTRODUCTION
The parapharyngeal space is a deep-seated space of an inverted pyramid shape extending from the skull base to the greater cornu of the hyoid bone. It is difficult to examine clinically. Differentiation of a parapharyngeal space lesion from a surrounding neck space lesion is essential for differential diagnosis and surgical approaches. Computed tomography (CT) and magnetic resonance imaging (MRI) are the imaging modalities of choice; ultrasonography is less useful for deep-seated lesions.

ANATOMY
The parapharyngeal space is divided into two compartments by a fascia, which extends from the styloid process to the tensor veli palatini (also known as the tensor-vascular-styloid fascia) into the anterior and posterior compartment. The fascia contains the ascending palatine artery and vein. The parapharyngeal space is surrounded by several other spaces of the neck: the pharyngeal mucosal space (medially), retropharyngeal space (posteromedially), and masticator and parotid spaces (laterally). The prestyloid...
compartment includes the branches of the mandibular division of the trigeminal nerve, internal maxillary artery, ascending pharyngeal artery, pharyngeal venous plexus, and minor / ectopic salivary gland, whereas the poststyloid compartment includes the cranial nerves IX to XII, internal carotid artery, internal jugular vein, cervical sympathetic chain, and glomus body.

INFECTIOUS OR INFLAMMATORY LESION
Most infections in the parapharyngeal space either arise from the palatine tonsil or are odontogenic in origin, followed by the submandibular gland and mastoid. On CT, cellulitis appears as fat stranding with fluid density, whereas abscess has a low-attenuation necrotic, pus-filled centre with a thick, irregular enhancing rim. Restricted diffusion is seen on MRI. Other features include intralesional gas pocket and trans-spatial configuration (Figure 1).

NEOPLASTIC LESION
Primary parapharyngeal space tumours (such as neurogenic tumours) are characterised by a fat plane separating the lesion from adjacent neck spaces. Most neoplastic lesions involving the parapharyngeal space are extension from tumours in the surrounding neck spaces, with displacement of the parapharyngeal fat. For tumours arising in the parotid, masticator, carotid, pharyngeal mucosal and retropharyngeal spaces, the parapharyngeal fat are displaced anteromedially, posteromedially, anteriorly, posterolaterally and anterolaterally, respectively. Secondary neoplasms from surrounding spaces include nasopharyngeal, tongue, and maxilla malignancies, parotid and submandibular gland tumours, lymphomas, glomus tumours, lipomas, and nasopharyngeal angiofibromas.

Neurogenic Tumour
Neurogenic tumours are the most common neoplasm in the poststyloid parapharyngeal space and the second most common neoplasm in the prestyloid parapharyngeal space. Most of these tumours are schwannomas followed by neurofibromas. Malignant nerve sheath tumours are rare and highly aggressive. Most neurogenic tumours arise from the trigeminal nerve in the poststyloid parapharyngeal space and the vagus nerve in the poststyloid compartment. Solitary neurofibroma is typically a well-defined oval or fusiform low-density lesion, with minimal contrast enhancement. Solitary neurofibroma may be indistinguishable from a schwannoma (Figure 2). Plexiform neurofibromas are poorly circumscribed, locally invasive, trans-spatial lesions with low density.

Salivary Gland Tumour
Salivary gland tumours involving the parapharyngeal space arise either from the deep lobe of the parotid gland (salivary rests within the prestyloid compartment) or the minor salivary glands of the pharyngeal mucosa. Pleomorphic adenoma (Figure 3) is the most common salivary gland neoplasm and appears as an ovoid lesion of soft tissue attenuation. It is typically homogeneous when small, but shows areas of low attenuation when large, indicating cystic degeneration or seromucinous

Figure 1. Ludwig’s angina complicated with abscess formation: (a) Axial unenhanced computed tomography showing an extensive soft tissue swelling at the supraglottic larynx (arrow) and the adjacent neck spaces, with the endotracheal tube in the narrowed and displaced airway. (b) Axial contrast-enhanced computed tomography showing a rim-enhancing fluid collection in the right submental (black arrow), submandibular (white arrow), and parapharyngeal (arrowhead) spaces; trans-spatial involvement is a characteristic feature of a neck abscess.
Pleomorphic adenomas can occur in any age-group but most commonly in those aged 40 to 50 years. Malignant tumours such as adenoid cystic carcinoma or mucoepidermoid carcinoma are uncommon. Malignant tumours have irregular, ill-defined margins with heterogeneous contrast enhancement and bony destruction.

Glomus Tumour
Glomus tumours are ovoid lesions with well-defined margins showing intense contrast enhancement (Figure 4). Their marked vascularity accounts for the homogeneous avid contrast enhancement. Carotid body tumours typically cause splaying of the internal carotid artery and external carotid artery, whereas
Glomus vagale tumours typically result in anteromedial displacement of the internal carotid artery without widening of the carotid bifurcation. A ‘salt and pepper’ appearance on MRI is characteristic of glomus tumour owing to tiny foci of haemorrhage and flow voids within the lesion.

**Lymphoma**

Primary malignant lymphomas of the parapharyngeal space are rare. On CT, lymphomas appear as circumscribed homogeneous lesions isodense to muscle, with mild-to-moderate contrast enhancement, and may display necrosis or calcification after treatment. Lymphomas are typically less infiltrative and cause relatively little bone erosion compared with carcinomas and most sarcomas. Involvement of the Waldeyer’s ring is an important clue to the diagnosis, as the imaging features of lymphomas are quite non-specific.

**Lipoma**

Lipomas are the most common benign mesenchymal tumours, with 15% of them occurring in the head and neck region. There is a bimodal peak of presentation in children and those in the fifth and sixth decades of life. The presence of pain raises the suspicion of malignant transformation. Lipomas are homogeneous lesions with density similar to subcutaneous fat and without contrast enhancement (Figure 5). Thus, the margin of the lesions may not be easily distinguishable from the normal parapharyngeal fat.

**Nasopharyngeal Angiofibroma**

Juvenile nasopharyngeal angiofibromas are rare and benign but locally aggressive, vascular tumours. They account for 0.5% of all head and neck tumours and occur almost exclusively in males and usually during adolescence. Juvenile nasopharyngeal angiofibroma appears as a hyperdense mass epicentred within the sphenopalatine foramen, which is widened and typically bowing the posterior wall of the maxillary antrum anteriorly (Holman-Miller sign). There is avid contrast enhancement due to its high vascularity. On MRI, hypointense flow voids represent enlarged tumour vessels (Figure 6).

**Secondary Malignancy from Adjacent Spaces**

Neoplastic infiltration of the parapharyngeal space by malignant tumours has been reported. The most common primary malignancy is nasopharyngeal carcinoma, especially in Southeast Asia. Other malignancies include oropharyngeal carcinoma, parotid gland, and maxillary malignancies (Figure 7). Tumours of the skull base such as meningiomas or chordomas can also extend into the parapharyngeal space. By observing the direction of displacement or infiltration of the

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Figure 4. Glomus jugulare: (a) Axial unenhanced T1-weighted magnetic resonance imaging (MRI) showing an isointense mass (arrow) involving the right parapharyngeal and carotid spaces, with multiple intrallesional serpiginous flow voids (arrowhead). (b) Axial unenhanced T2-weighted MRI showing a high-signal-intensity mass (outlined by arrows) with internal flow voids. (c) Coronal enhanced T1-weighted fat-suppressed MRI showing a hypervascular mass (outlined by arrows) extending to the right skull base, with the epicentre at the right jugular bulb. Dilated right external carotid arterial branches (arrowhead) are supplying the highly vascularised mass. (d) Right anterior oblique projection of the right external carotid artery by injection digital subtraction angiography showing intense tumour staining (arrow) centred in the right skull base region, with dilated external carotid artery branches. Early venous drainage into the right internal jugular vein (arrowhead) is noted.
parapharyngeal space and displacement of the internal carotid artery and internal jugular vein, the lesion can be localised in one of the neck spaces.

**VASCULAR ANOMALIES**

Vascular anomalies are rare in the parapharyngeal space and include haemangiomas and low-flow vascular malformations, such as lymphatic malformations and venous malformations (Figure 8).

**Lymphangioma**

Lymphatic malformations, including lymphangiomas (Figure 9), usually occur in children. Only approximately 10% of lesions are initially present in early
adulthood. They appear as a trans-spatial low-density lesion with no perceptible wall enhancement. Mixed lesions with a prominent vascular component may show variable degrees of enhancement. Lymphatic malformations are benign with no malignant potential. Recurrence is usually due to incomplete surgical excision.

CONCLUSION
Clinical assessment of the parapharyngeal space is
difficult. Understanding the radiological features of different disease entities in the parapharyngeal space is essential for accurate radiological diagnosis.

REFERENCES