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## Case Report

# Unusual CT and MR Findings of Inflammatory Pseudotumor in the Parapharyngeal Space: Case Report

Keiko Nakayama, Yuichi Inoue, Tsunemasa Aiba, Kinuko Kono, Kenichi Wakasa, and Ryusaku Yamada

**Summary:** Unusual MR and CT findings of an inflammatory pseudotumor in the parapharyngeal space of a 73-year-old woman are reported. The mass was hypointense on T1- and T2-weighted images and demonstrated ring enhancement after contrast medium injection. Punctate calcifications were scattered at the periphery. Inflammatory pseudotumors in the parapharyngeal space are rare, and only three cases have been reported. The possible pathogenesis and varieties of inflammatory pseudotumors are discussed.

Inflammatory pseudotumors (IPTs) are soft-tissue masses of unknown etiology, which comprise inflammatory cells, histiocytes, and fibroblasts. They are histologically benign, but locally aggressive, and sometimes clinically and/or radiologically mimic malignant tumors. These lesions commonly affect the lung and orbit but are more rare in the head and neck, and they are encountered occasionally in the paranasal sinus, larynx, oral cavity, tonsils, thyroid gland, parotid gland, and lacrimal gland (1). The presence of IPTs in the parapharyngeal space is particularly rare, and only three cases have been reported (1, 2). Unusual CT and MR imaging features of a case of IPT in the parapharyngeal space are presented, and the possible pathogenesis of this IPT is discussed.

## Case Report

One year before being seen at our institution, a 73-year-old woman was admitted to another hospital for vertigo. A CT scan revealed a mass in the right parapharyngeal space. The patient had caught a common cold and noticed right retromolar swelling, and she also noted swallowing discomfort and dysphasia. A local physician prescribed her antibiotics and recommended that she consult an ear, nose, and throat physician, but the patient did not follow this advice. According to her, the swelling of the right submandibular area did not appear to increase in size.

The patient was referred to our institution for further evaluation. Her medical history was not significant. On physical

examination, a hard and movable mass was palpable along the medial border of the right mandibular ramus. Hematologic examination revealed no abnormality suggestive of infection (white blood cell count, 2800 per mm<sup>3</sup>; C-reactive protein, 0.1 mg/dL). Findings from a tuberculin skin test and a cytoplasmic antineutrophil cytoplasm antibody test were negative. On MR imaging, a spherical mass approximately 6 cm in diameter was noted in the right parapharyngeal space, and it displaced the pharyngeal mucosa medially, the pterygoid muscles anteriorly, the internal carotid artery laterally, and submandibular gland inferiorly (Fig 1A–C). The parapharyngeal fat was obliterated. On T2-weighted images, the mass was extremely hypointense and showed a hyperintense ring peripherally. On T1-weighted images, the mass was hypointense and there was a ringlike region of hyperintensity, which appeared inside the hyperintense ring on T2-weighted images. After intravenous infusion of gadopentetate dimeglumine, T1-weighted images showed moderate peripheral enhancement, which corresponded to the hyperintense ring seen on T2-weighted images.

Transoral biopsy was performed, which disclosed hyalinized fibrosis. On a CT scan after biopsy, the mass was demonstrated as an ill-defined, slightly hypodense mass with punctate calcifications at the periphery. Also noted within the mass was a small amount of air, which was probably introduced at biopsy. No cervical lymph node enlargement was recognized (Fig 1D).

Surgical excision of the mass was performed via a transcervical approach with a transverse incision at the level of the hyoid bone. The right internal jugular vein was atrophic. The mass was grossly encapsulated, and its cut surface appeared pale yellow. The mass, which was adhered tightly to the right internal carotid artery and the skull base, could not be completely removed. Histologic examination of the surgical specimens demonstrated granulation tissue containing foreign-body giant cells, abundant hyalinized fibrosis, collagenous deposits, marked infiltration mostly by lymphocytes, and fibrohistiocytic proliferation (Fig 1E). In the peripheral portion of the mass, a moderate number of vessels were present in the inflammatory infiltrates (Fig 1F). Psammomatous bodies were not observed. Special stains and cultures did not detect microorganisms. The pathologic diagnosis was IPT. After surgery, oral steroids were given for a month, but the residual mass remained unchanged in size.

## Discussion

The term pseudotumor is a confusing and ambiguous designation, and one used for a broad category of tumorous proliferation believed to be reactive rather than neoplastic. Fibrosing pseudotumors and tumefactive fibroinflammatory lesions appear to represent the chronic stage of IPT (3, 4). The pathogenesis of IPT is unknown. However, it is considered an immunologic host reaction to many inciting agents, including infectious agents, microorganisms, adjacent necrotic tissue, neoplasms, foreign bodies, and some kinds of tissue

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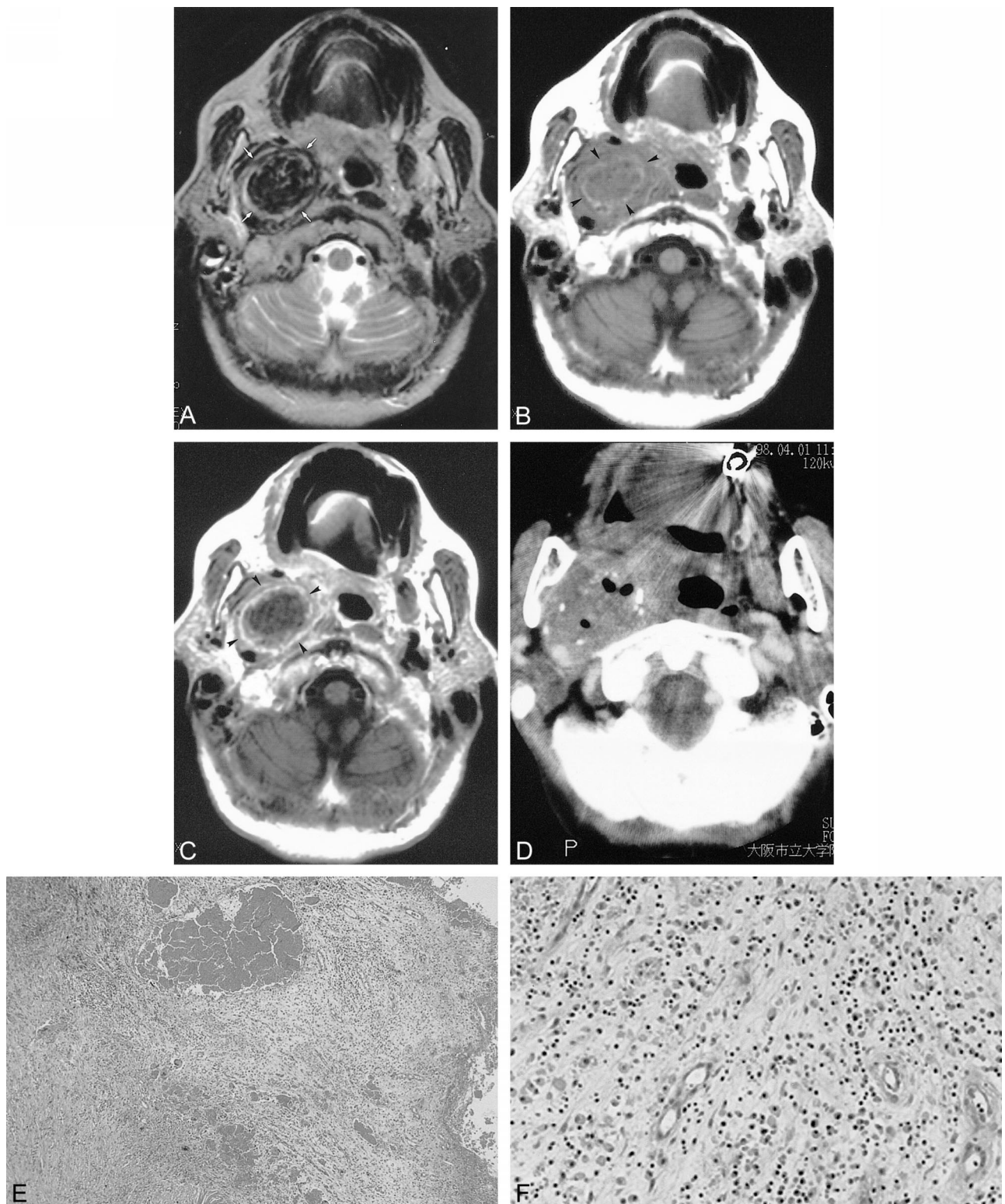


FIG 1. A 73-year-old woman with IPT of the parapharyngeal space.

A, Axial T2-weighted MR image at 5000/102/2 (TR/TE/excitations) reveals a well-circumscribed, mixed, but markedly hypointense mass in the right parapharyngeal space. A ringlike hyperintense area (white arrows) in the circumferential portion of the mass was noted.

B, Axial T1-weighted image at 600/16/2 shows a well-margined, hypointense mass associated with a peripheral ringlike, high-signal-intensity area (black arrowheads). The right pterygoid muscles are displaced anteriorly.

C, Axial T1-weighted image at 600/16/2 after intravenous injection of gadopentetate dimeglumine shows moderate enhancement (black arrowheads) in the peripheral portion of the mass, corresponding to the hyperintense ring on T2-weighted images.

D, Contrast-enhanced CT scan obtained after biopsy shows a well-defined hypodense mass scattered with punctate calcifications at the periphery. Note several air bubbles within the mass, probably induced at biopsy.

E and F, Microphotographs of the surgical specimen (hematoxylin and eosin stain) reveals granulation tissue containing giant cells, abundant hyalinized fibrosis, collagenous deposits, marked infiltration of mostly lymphocytes, and histiocytic proliferation (E, original magnification  $\times 30$ ). A moderate number of the vessels are present in the inflammatory infiltrates in the peripheral portion of the mass (F, original magnification  $\times 150$ ).



injury. Chemical mediators, such as interleukin-1, that are produced mainly by macrophages have a variety of local and systemic effects (1). Locally, they stimulate proliferation of fibroblasts, extravasation of neutrophils, and activation of precoagulants. These chemical mediators might play important roles in localization of the inflammatory stimulus, leading to granuloma formation. The most important factor in IPT formation is not the inciting agent but the way these responses develop.

The diagnosis of IPT is generally made after exclusion of detectable fungi or bacteria. However, exaggerated response to uncertain unknown microorganisms also appears to initiate the formation of IPT, since microorganisms might escape detection because of technical limitations or elimination by host defense or antibiotics. These pseudotumors have various histologic patterns, which suggests that they are not a single entity but a conglomeration of various entities. Coffin et al (5) classified basic histologic patterns of IPT into three categories: 1) myxoid, vascular, and inflammatory areas resembling nodular fasciitis; 2) compact spindle cells with intermingled inflammatory cells resembling fibrous histiocytoma; and 3) dense platelike collagen resembling a desmoid or scar. The findings in our case appear to be consistent with transitional patterns between types 2 and 3. Calcifying fibrous pseudotumor is a newly recognized, uncommon benign lesion characterized by densely hyalinized fibrous stroma with lymphoplasmacytic infiltrates and psammomatous or dystrophic calcifications (6). The mass in our case had some similarities to a calcifying fibrous pseudotumor, but most of the previously reported cases of this type of growth were in infants or young adults.

In the literature, the formation of IPT has been presumed, although not established, to be related to various factors, including cocaine abuse (1), extravasation of thorium dioxide in previous direct-punctured cerebral angiography (7), chronic inflammation (1), and Epstein-Barr virus infection (8). However, in most cases of IPT, the etiology remains unexplained, and no inciting factor could be determined for our patient. Tonsillitis was not present when the patient was admitted to our institution. According to the patient, she felt swallowing discomfort and dysphasia and was treated with antibiotics 1 year before admission. At that time, she might have had tonsillitis, which would have irritated the mucosa and stimulated chemical mediators, with consequent development of an initial change of IPT.

The unique feature of our case is that the mass showed particularly marked hypointensity on both T1- and T2-weighted images and demonstrated peripheral ring enhancement after injection of gadopentetate dimeglumine. This characteristic low signal intensity most likely reflected relative loss of free water and mobile protons within the fibrotic regions. The region of ring enhancement on contrast-enhanced MR images that corresponded to the

ringlike hyperintense area on T2-weighted images was, we speculate, not totally fibrosed and still had inflammatory change with sufficient numbers of water protons, as demonstrated with histologic study (9). We suspect that these circumferential regions with active inflammation might give rise to fibrosis and produce a slow-growing, concentric mass. A recent report of IPT in the head and neck region presented a different picture. Han et al (3) described five cases of fibrosing inflammatory pseudotumors. These masses were located near the skull base with skull base invasion and were relatively hypointense on T2-weighted images; after contrast injection, diffuse enhancement and intracranial dural enhancement were observed adjacent to the lesions in all cases (3). Hypointensity on T2-weighted images is the only similarity in imaging findings between our case and their cases. Our case might represent an extreme version of the fibrosing inflammatory pseudotumor described by Han et al, but because the other imaging findings and clinical manifestations were so different, we question this possibility.

The differential diagnosis of parapharyngeal hypointense masses on T2-weighted images includes tuberculous and fungal infections, miscellaneous granulomatous diseases such as Wegener's granulomatosis, hypercellular malignant tumors, melanotic melanoma, and amyloidoma. Schwannoma and salivary gland tumors, when they show low signal intensity on T2-weighted images, should be included in the differential diagnosis. Since tuberculoma and fungal granuloma are usually hypointense on T2-weighted images and occasionally contain calcification, the possibility of these conditions could not be excluded merely on the basis of imaging findings in our patient. Wegener's granulomatosis commonly demonstrates other clinical manifestations and usually produces less well-defined infiltrating masses. The granulomatous lesions of Wegener's granulomatosis, particularly in the chronic stage, are occasionally hypointense on T2-weighted images, simulating the malignant tumor (10, 11). A positive titer for cytoplasmic antineutrophil cytoplasm antibody is a diagnostic criterion. Hypercellular malignant neoplasms might be difficult to exclude because malignant neoplasms, especially in the parotid gland (12), nasopharyngeal carcinoma, and some types of malignant lymphoma (13) involving the skull base are, in our experiences, often hypointense on T2-weighted images. Stable free radicals within melanin pigment are paramagnetic and effect the shortening of T1 and T2 relaxation times. Melanotic melanoma, where melanotic cells consist of more than 10% of tumor cells, exhibits a specific pattern of imaging findings (hyperintense with cortex on T1-weighted images, hypointense on T2-weighted images) (14). Amyloidoma, a localized mass of amyloid characterized by the deposition of insoluble fibrillar proteins, is the rarest form of amyloidosis and shows mixed signal intensity on T2-

weighted images, presumably because of nonuniform deposition of amyloid protein. Cases of amyloidoma of the gasserian ganglion (15) and the skull base (16), which were hypointense on T2-weighted images, have been reported. Schwannoma and salivary gland tumors are the most common tumors developing in the parapharyngeal space. Schwannoma, which is usually high in signal intensity on T2-weighted images, might occasionally present as a low signal intensity mass because of melanotic components (17). In such cases, the mass is expected to be high in signal intensity on T1-weighted images. If anterior displacement of the internal carotid artery is present, neurogenic tumor such as schwannoma should be considered. Salivary gland tumors, such as benign mixed tumors, are generally high in signal intensity on T2-weighted images but have been reported to be low in signal intensity as a result of calcifications and fibrosis (18). These low signal areas, however, are focal and appear to be quite different from those in our case. In addition, solid components of benign mixed tumors are usually enhanced on contrast-enhanced MR imaging.

### Conclusion

We report a case of IPT in which the unique findings of marked hypointensity on T1- and T2-weighted images and peripheral ring enhancement on contrast-enhanced studies were demonstrated. When an extremely hypointense mass in the parapharyngeal space is encountered on T2-weighted MR images, clinicians should include an unusual IPT, such as that found in our patient, in the differential diagnoses.

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