Radiologically Unusual Presentation of Cholesterol Granuloma in the Sphenoid Sinus

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Introduction

Cholesterol granuloma is a histopathological diagnosis with features of cholesterol clefts, foreign body giant cells, and macrophages filled with hemosiderin pigments. It is commonly found in the mastoid or petrous apex, but the involvement of paranasal sinuses is very rare. Radiologically, cholesterol granuloma show typical findings of hyperintense signals on both T1- and T2-weighted images on magnetic resonance imaging (MRI). We report two cases of cholesterol granuloma in the sphenoid sinus, which were first misinterpreted as mucoceles due to unusual MRI images.

Key Words
Cholesterol granuloma · Magnetic resonance imaging · Mucocele · Sphenoid sinus.

Case

Case I

A 67-year-old male patient had experienced lightheadedness, sometimes leading to syncope. Brain CT evaluation showed a mass lesion in the sphenoid sinus, for which he was referred to our clinic. The patient had no nasal trauma history but had undergone Caldwell-Luc operation due to chronic sinusitis during childhood. The patient had no nasal or visual symptoms. Endoscopic examination showed no mass or abnormal findings in the nasal cavity.

PNS CT revealed a 2.8-cm, non-enhancing, expansile lesion with soft tissue density in the left sphenoid sinus. The roof and floor of the sphenoid sinus were intact, but thinning...
of the bone was noted on the lateral wall (Fig. 1). On MRI, a similar sized expansile lesion showed T1 hypo-intensity and heterogeneous T2 hyper-intensity, suggesting a mucocele (Fig. 2).

Endoscopic sphenoid sinusotomy was performed via the transethmoidal approach. The anterior wall of the sphenoid sinus bulged out and was opened widely with various endoscopic instruments. The sphenoid sinus was filled with viscus yellowish-brown material. All contents were removed, and the area was irrigated with saline. Partial bony erosion of the sphenoid sinus lateral wall confirmed preoperative CT results. Fortunately, cerebrospinal fluid (CSF) leakage was

Fig. 1. Paranasal sinus CT images from patient 1. A 2.8-cm, non-enhancing, expansile lesion with soft tissue density in the left sphenoid sinus. The roof and floor of the sphenoid sinus were intact, but thinning of the bone was noted on the lateral wall. Soft tissue density window (A). Bone density window (B).

Fig. 2. PNS MRI images from patient 1. A 2.5-cm, expansile lesion in the left sphenoid sinus, with low signal intensity on T1-weighted images (A: axial, C: coronal) and high signal intensity on T2-weighted images (B: axial, D: coronal). PNS: paranasal sinus.
not observed during the operation. The surgical specimen was submitted for pathologic review. Interestingly, the pathologic result revealed scattered fragments of acellular proteinaceous material, cholesterol clefts, and aggregation of histiocytes, suggesting cholesterol granuloma (Fig. 3). The patient has been in follow-up for one year after surgery, and no recurrence has been noted.

Fig. 3. Pathologic review showed scattered fragments of acellular proteinaceous material, cholesterol clefts, and aggregation of histiocytes, suggesting cholesterol granuloma (A: ×40, B: ×100).

Fig. 4. PNS MRI images from patient 2. A 4-cm, expansile lesion in the sphenoid sinus, with low signal intensity on T1-weighted images (A: axial, C: coronal) and high signal intensity on T2-weighted images (B: axial, D: coronal). PNS: para-nasal sinus.
Case 2

A 49-year-old patient visited our clinic with symptoms of abrupt reduction in visual acuity accompanying three months of mild headache. The patient had a preoperative visual field defect with no lesions on the fundus according to ophthalmologic examination. The patient had no history of nasal trauma or surgery. MRI evaluation showed an expansile cystic mass in the sphenoid sinus. The mass measured about 4 cm in length and showed hypo-intensity with brain parenchyma on T1WI and high signal intensity on T2WI, suggesting a mucocele (Fig. 4). Endoscopic sphenoid sinusotomy was performed to remove the mass. The posterior wall and the roof of the sphenoid sinus were eroded by the mass, but there was no sign of CSF leakage. The surgical specimen was reviewed by a pathologist and was diagnosed as a cholesterol granuloma. The patient’s visual field defect recovered a short time after the surgery. The patient had chronic headaches postoperatively for six months, but CT evaluation revealed a clear sphenoid sinus without recurrence. Four years has passed since the operation, and the patient’s headaches have calmed, and no recurrence has been noted.

Discussion

Clinical manifestations of cholesterol granuloma are usually nonspecific and variable depending on the site of origin. PNS involvement can cause various symptoms such as facial pain, swelling, headache, diplopia, loss of visual acuity, exophthalmos, nasal obstruction, rhinorrhea, or meningitis.1,2,5,7-9

The pathogenesis of cholesterol granuloma is still unclear but is thought to be caused by disturbed ventilation, impaired drainage, and hemorrhage.10 Following ventilatory obstruction and lack of drainage of the pneumatized mastoid or sinus bone, air is reabsorbed inside the obstructed cavity, and negative pressure is created, causing hemorrhage or exudation. Previous operations or trauma may result in similar conditions.

Foreign body reactions toward blood, including its products and cholesterol particles from erythrocyte cell membranes, result in cholesterol crystals. Cholesterol crystals are insoluble, causing precipitation and subsequent formation of granulation tissue.11 Mucoceles and cholesterol granulomas share similar pathogenesis. However, Milton, et al.12 has reported that, after obstruction of the natural ostium of the sinus, cholesterol granuloma accompanies hemorrhage, while mucocele can occur without hemorrhage.

Differential diagnosis of cholesterol granuloma includes mucocele, cystic schwannoma, meningioma, paraganglioma, and cephalocele. Cystic schwannoma (T1-iso or hypointense, T2-hyperintense) and cephalocele (T1-hyperintense, T2-hypointense) can usually be excluded by characteristic imaging findings13,14,15; however, it may be difficult to differentiate cholesterol granuloma from mucocele based solely on CT analysis because both appear as expansile lesions with soft tissue density and thinning or erosion of adjacent bones. On MRI, cholesterol granuloma is known to show high signal intensity on both T1- and T2-weighted images because of the paramagnetic effect of methemoglobin. In contrast, mucocele shows low signal intensity on T1-weighted images, helping to differentiate it from cholesterol granuloma. However, in some cases of mucocele including inspissated proteinaceous materials or internal hemorrhage may occasionally show high signal intensity on TIWI, misleading to the diagnosis of cholesterol granuloma, demanding pathologic confirm for differentiation.16,17

In our cases, the content of the surgical field was filled with viscous fluid with necrotic debris and it was like a mucocele. Shirataki, et al.18 histopathologically classified cholesterol granuloma into three groups depending on the amount of cholesterol clefts, hemorrhagic foci, or various cells. We assumed that if the portion of protein material is less, or long time has passed for degradation of the methemoglobin, cholesterol granuloma can show iso- or hypo intensity in MRI findings as the preoperative imaging.

PNS mucoceles are epithelium-lined and mucus-filled cystic masses resulting from obstruction of sinus ostium and maintaining drainage/ventilation through surgical excision of the capsule may be the ideal treatment theoretically.19 However, total excision of the cyst wall of cholesterol granuloma is not necessary due to the absence of epithelial lining and maintaining long-term patency of the drainage is essential to prevent recurrence.20

REFERENCES

6) Gray WC, Saleman M, Rao KC; Haliz MA. Cholesterol granuloma