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Case Report

Cholesterol Granuloma as a Late Complication of Endoscopic Sinus Surgery

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ABSTRACT

Introduction: To date there are five reports referring to cholesterol granuloma of the sphenoid sinus. This is the first case where cholesterol granuloma is presented as a late complication after successful removal of a mucocoele through functional endoscopic sinus surgery (FESS) and associated with convergence insufficiency.

Case Report: A 67-year-old carpenter presented with binocular diplopia and frontal headache. A mucocoele of the left sphenoid sinus was removed endoscopically leading to the resolution of his symptoms. Eight months later he presented with similar symptoms and findings. Following a revision FESS, cholesterol granuloma was diagnosed.

Discussion: Haemorrhage within the sphenoid sinus, obstruction in the sinus ostium and fibrous tissue formation may explain the postoperative formation of cholesterol granuloma. Convergence insufficiency could be attributed to mechanical failure or denervation of eye muscles.

Conclusion: Cholesterol granuloma should be included in the differential diagnosis, when recurrence of a sphenoid sinus mucocoele is suspected.

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Introduction

Cholesterol granuloma is a cystic lesion consisting of cholesterol clefts, foreign body giant cells and macrophages filled with hemosiderin. Granuloma formation has been suggested in association with haemorrhage within an obstructed bony cavity. Resorption of gas in the obstructed cavity is thought to create a relative vacuum that leads to blood vessel rupturing in the dilated mucosa. Anaerobic haemolysis results in the formation of cholesterol crystals from red cell membranes, which in turn act as irritants that induce granulocyte chemotaxis and foreign body giant cell formation. This inflammatory granulomatous reaction is responsible for bone destruction frequently observed in

radiological imaging. In contrast to mucocoeles no epithelial tissue can be identified [1-3].

Cholesterol granuloma of the sphenoid sinus is a rare entity. To date there are five relevant reports referring to the sphenoid sinus (Table 1) [3-7]. In all of them, cholesterol granuloma was diagnosed as a primary pathology, while investigating atypical symptoms such as headache and light-headedness. In three of them it has been associated with compressive optic neuropathy [4, 6, 7]. This is the first case where cholesterol granuloma is presented as a late complication of functional endoscopic sinus surgery for the removal of a mucocoele of the sphenoid sinus, associated with convergence insufficiency. Relevant clinical implications are discussed.

Table 1: Review of the relevant literature.

Study	Symptoms	CT findings	MRI findings	Bone erosion	Aetiology
Kang <i>et al.</i> (2008) [30]	Hemifacial pain, headache, toothache	Lesion in the right sphenoid sinus that extended to the right infratemporal and pterygopalatine fossae.	Hyperintense on both T1- and T2-weighted images	Yes	Primary Coexistent aspergillosis was not considered as a

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			A high T1 and low T2 nodule was seen at the inferior portion of the mass lesion		causative factor by the authors
Hwang <i>et al.</i> (2009) [4]	Compressive optic neuropathy	Not reported/performed	Hyperintense on both T1- and T2-weighted images	Yes	Primary
Neyt <i>et al.</i> (2009) [5]	Intermittent headache	Opacification of the sphenoid sinus	Not reported/performed	Not reported	Primary
Ahmed <i>et al.</i> (2012) [6]	Compressive optic neuropathy and headache	Not reported/performed	Hyperintense on T1-weighted and isointense on the T2-weighted image with hypointense areas	Yes	Primary
Kim <i>et al.</i> (2015) [7] (two cases)	Light-headedness	Non-enhancing, expansile lesion with soft tissue density	T1 hypo-intensity and heterogeneous T2 hyper-intensity	Yes	Primary
	Compressive optic neuropathy	Not reported/performed	Hypo-intensity on T1 and high signal intensity on T2 weighted images	Yes	Primary
Present study	Headaches and convergence insufficiency	Hyperdense lesion situated on the upper and posterior wall of the sphenoid sinus and upper half of clivus.	Hyperintense on both T1- and T2-weighted images	Yes	Late FESS complication

CT: Computerized Tomography; MRI: Magnetic Resonance Imaging; FESS: Functional Endoscopic Sinus Surgery.

Case Report

A 67-year-old carpenter presented in August 2015 with a monthly history of binocular diplopia and frontal headache. Ophthalmologic examination reported visual acuity at 10/10 in the left eye (ipsilateral to the sphenoid sinus lesion) and 9/10 in the right eye. No exophthalmos or extraocular motility disorder were noted, and diplopia was attributed to convergence insufficiency. The patient’s past medical history included a surgical excision of a benign tumor of the bladder 5 years ago and he was not on any regular medication. Computerized tomography (CT) revealed a hyperdense cystic lesion situated on the upper and posterior wall of the left sphenoid sinus, extending to the upper half of clivus, causing their erosion and remodelling. Erosion of the left carotid canal wall was also observed (Figure 1).



Figure 1: Preoperative computerized tomography (CT) and magnetic resonance imaging (MRI) revealed a hyperdense cystic lesion situated in the left sphenoid sinus, causing bone erosion and remodelling.

In magnetic resonance imaging (MRI) the lesion presented with high signal intensity in both T1 and T2 weighted images. The patient underwent endoscopically an uneventful wide sphenoidectomy and drainage of the cyst. Also, a right middle antrostomy was performed. He

had a normal post-operative recovery and was discharged 7 days later improved. The pathology report referred to chronic inflammatory process, while the wall of the cyst was lined by pseudostratified ciliated epithelium. These findings were compatible with mucocoele. Patient had an outpatient follow-up appointment in one-month time. He was asymptomatic and there was no evidence of recurrence.

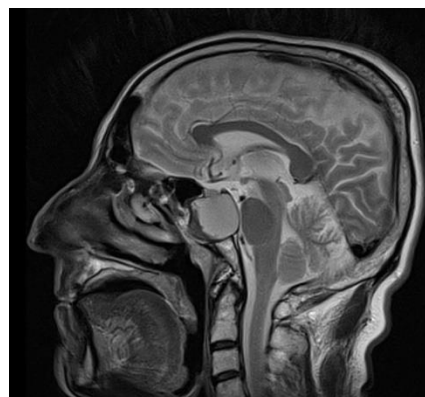


Figure 2: Eight months after the first operation MRI revealed a high signal intensity and gadolinium-enhanced lesion occupying the sphenoid sinus in T1 weighted images.

The patient missed the following appointments and 8 months later he presented with the same symptoms (binocular diplopia, convergence insufficiency and headaches). CT and MRI revealed a cystic lesion with the same characteristics. MRI revealed a high signal intensity and gadolinium-enhanced lesion occupying the sphenoid sinus in T1 weighted images (Figure 2). In T2 weighted images the lesion presented also with high signal intensity. Endoscopy revealed granulation tissue formation, although the opening to the sphenoid sinus was still visible. A recurrence of the known mucocoele was suspected. The patient underwent a revision FESS including fibrous tissue removal, sphenoidectomy (Figure 3), removal of the anterior wall of the cyst and marsupialisation of the rest of the cyst. Evidence of a yellowish discharge was noticed during the drainage of the cyst.

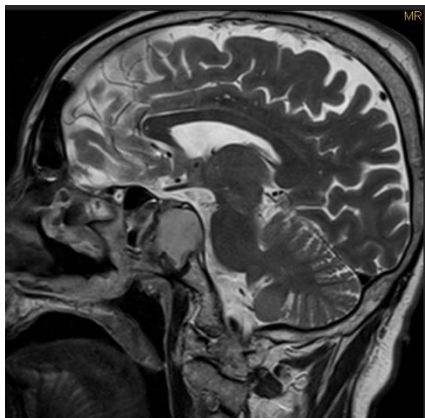


Figure 3: Intraoperative pictures presenting a cystic lesion in the sphenoid sinus. Granulation tissue around the opening has been removed.

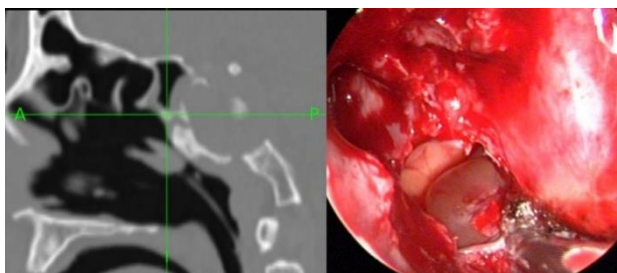


Figure 4: A-C) Cholesterol granuloma: A granulomatous reaction to numerous cholesterol crystals (empty needle-shaped spaces) [red arrows]. Multinucleated giant cells [arrowheads] and epithelioid macrophages surround the clefts (calcification/green triangle). [Hematoxylin-Eosin, **A)** 20x magnification; **B)** 100x magnification; **C)** 200x magnification].

The access of the sphenoid was improved by supplementary posterior ethmoidectomy. Patient's symptoms were improved again, and he was discharged on the 5th post-operative day. In the second specimen, granulomatous reaction was diagnosed, along with numerous deposits of cholesterol crystals. No epithelial cells were identified, and the diagnosis of cholesterol granuloma was made (Figure 4). Patient attended his follow up appointments in a month time, 2, 3, 6 months and one year later and he is free of symptoms with no evidence of recurrence.

Discussion

Cholesterol granuloma is more common in the temporal bone and associated to middle ear disease. It is rare but not exceptional in the paranasal sinus cavities. The most common location is the frontal sinus (60% of reported cases), followed by maxillary (34.1%) and ethmoid (3.7%) sinuses [1]. Cholesterol granuloma of the sphenoid sinus, on the other hand, is very rare. Bone erosion can be noted in most of the cases and given the anatomical relationship of the sphenoid sinus with important structures, severe or even life-threatening complications may occur. Compressive optic neuropathy seems to be the most common (Table 1) [1]. Sinus obstruction is also one of the main pathogenetic mechanisms involved in the formation of mucocoeles [2].

Apart from the similar pathogenetic mechanisms, mucocoeles and cholesterol granulomas seem to share similar radiological characteristics. Cholesterol granulomas demonstrate high signal intensity on T1 weighted images due to the paramagnetic effect of methemoglobin and high signal intensity on the T2 weighted images as a result of the granulation of the paranasal sinus [3]. This was also true for the present case. However, in cases where protein material is less, or degradation of a large part of the methemoglobin has been performed, cholesterol granuloma can show iso- or hypo intensity in MRI [7, 8]. A mucocoele is also described as a lesion with high signal intensities at MRI T1 and T2 weighted images, due to its high protein content [9].

In previous reports lesions in the sphenoid sinus that were finally diagnosed as cholesterol granulomas were only apparent after radiological imaging was performed in order to investigate symptoms such as headache and compressive optic neuropathy (Table 1). No notable endoscopy findings were reported, with the exception of Neyt *et al.* who reported the presence of a polyp in the respective sphenothmoidal recess (Table 1) [5]. This is the first case where cholesterol granuloma is presented as a late complication of FESS. Although removal of a mucocoele is not usually related to noteworthy haemorrhage, in this case a combination of post-surgical haemorrhage within the sphenoid sinus, obstruction in the sinus ostium and fibrous tissue formation seem to have contributed to the pathogenesis of cholesterol granuloma.

This is also the first case where cholesterol granuloma has been associated with convergence insufficiency. Convergence insufficiency is a binocular vision disorder, which is typically characterized by exophoria aggravated at near, remote near point of convergence and/or decreased positive fusional convergence at near. These are responsible for a variety of symptoms such as double vision, eyestrain, headaches, blurred vision, and loss of place while reading or performing near work. The pathophysiology of convergence insufficiency is uncertain and controversial. Although it is actually a misalignment of the eye muscles, the implication of a mechanical failure or denervation of eye muscles has not been supported in the literature. Most authors tend to support that the underlying aetiology is head trauma, endocrine disorders, drug intoxication or anxiety neurosis, but in most patients no ocular, neurological, systemic or psychological etiological factors are identified [10].

Conclusion

Cholesterol granuloma should be included in the differential diagnosis, when a recurrence of a sphenoid sinus lesion is suspected. As a late complication of FESS cholesterol granuloma may further perplex a revision surgery because of the bone erosion that it may provoke in a surgical field which is already compromised from the preceding pathology and surgical acts. The association of convergence insufficiency with the development and treatment of sphenoid sinus lesions might also deserve further investigation, since the pathophysiology of this entity is still under investigation.

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