Cholesterol Granuloma of the Maxillary Sinus Encountered during Floor Augmentation Procedure: A Case Report

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ABSTRACT

Background: Cholesterol granuloma (CG) is a foreign-body reaction to the deposition of cholesterol crystals. Its occurrence in the paranasal sinuses is very rare.

Purpose: This report describes a new case of maxillary sinus CG discovered incidentally during sinus-floor augmentation for dental implant placement in a 60-year-old female patient.

Materials and Methods: The preoperative clinical and radiological examinations revealed a normal maxillary antrum with no evidence of sinus pathology. After lateral osteotomy, a dark-green, viscous soft tissue mass appeared through the thin mucous membrane inside the sinus. Enucleation and curettage of the sinus contents including the sinus membrane were performed for histopathologic analysis. The augmentation and implant placement procedures were postponed.

Results: Histopathologic analysis showed several fragments of granulation tissue containing diffuse cholesterol clefts surrounded by mixed chronic inflammatory cell infiltrate including plasma cells and lymphocytes. These features were compatible with the diagnosis of CG. The patient was followed up for 3 months after the first procedure, and a second attempt of sinus augmentation and dental implant insertion was then carried out. The inserted dental implants were followed up for 6 months without any complications.

Conclusions: CG of maxillary sinus can be an incidental finding. For this reason, the final diagnosis can only be achieved after examination of the material under the microscope.

KEY WORDS: cholesterol granuloma, implants, maxillary sinus, sinus-floor augmentation

INTRODUCTION

Cholesterol granuloma (CG) is a histological term describing a granulomatous tissue reaction to cholesterol crystals precipitation. Although occasionally reported in different body sites such as the mandible,[1] orbital bones,[2] liver,[3] kidney,[4] brain,[5] breast,[6] testis,[7] and peritoneum,[8] CG develops most commonly in the temporal bone in association with chronic middle-ear disease. It is extremely rare in the paranasal sinuses, and, when they are involved, the maxillary sinus tends to be the most commonly affected.[9] The clinical and radiographic features of CG in the maxillary sinus (CGMS) are nonspecific and may mimic the more common allergic and inflammatory sinus diseases. This makes the diagnosis of CGMS rarely anticipated preoperatively and largely dependent on postoperative histopathologic examination. Microscopically, CG is characterized by the presence of multiple cholesterol clefts surrounded by foreign-body giant cells, foamy histiocytes, plasma cells, lymphocytes, hemosedrin deposits, and evidence of old and recent hemorrhage.[9] The exact mechanism for development of CG is not well understood; however, hemorrhage into a cavity with poor drainage with the

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DOI 10.1111/j.1708-8208.2009.00151.x

accompanying precipitation of cholesterol crystals and subsequent foreign-body reaction is the most favored theory.[9]

The occurrence of CGMS was first reported in 1978 by Graham and Michaels.[10] Since that time, only 42 documented cases of maxillary sinus involvement were reported in the English literature (Table 1). This report describes an unusual case of CGMS with no clinical or radiological features to suggest sinus pathology.

CASE REPORT

A 60-year-old woman attended the maxillofacial clinic at The University of Jordan Hospital, seeking dental implants. The patient had no history of chronic diseases. She had her upper-right posterior teeth extracted because of caries 5 years ago and, at present, has no complaints related to the extraction area. The patient was a nonsmoker and has no parafunctional habits. Intraorally, the patient had a fair oral hygiene and several missing teeth. The upper-right posterior alveolar ridge was severely resorbed but clinically normal. Clinical examination and a panoramic radiograph revealed normal maxillary sinus. The treatment plan was to restore the missing upper-right posterior teeth with dental implants inserted simultaneously during sinus-floor augmentation due to the severe ridge resorption. The sinus was accessed by osteotomy of the lateral wall, and its lining mucosa was elevated as usual. A dark-green, viscous soft tissue mass appeared through the thin mucous membrane inside the sinus. The decision was to perform enucleation and curettage of the sinus contents including the sinus membrane and to postpone the augmentation procedure and dental implant insertion. The contents of the sinus were sent to the histopathology laboratory.

Histological examination showed several fragments of granulation tissue containing diffuse cholesterol clefts surrounded by mixed chronic inflammatory cell infiltrate including plasma cells and lymphocytes. Multiple foreign-body type multinucleated giant cells with ingested foreign material and cholesterol were identified (Figure 1). Hemorrhagic areas, hemosiderin-laden macrophages, and small fragments of respiratory epithelium were seen as well. These features were compatible with the diagnosis of CG. One week postoperatively, the patient recovered normally, and the wound healed uneventfully.

The patient was followed up for 3 months after the first procedure, and, as clinical and radiographic examination revealed no abnormalities, a second attempt of sinus-floor augmentation and dental implant insertion was carried out. The sinus was approached the same way, but, as the regenerated membrane was thick, it was difficult to inspect the sinus contents. The inserted dental implant was followed up for 6 months without any complications.

DISCUSSION

First reported by Graham and Michaels in 1987,[10] CG is rare in the maxillary antrum. As shown in Table 1, CGMS commonly affects men more than women (male-to-female ratio of 3 : 1), particularly those in their 40s (mean 40.5 years; range: 14–70 years). A predilection toward Caucasian race was observed, suggesting the presence of genetic and geographic factors contributing to the development of CG.[9] The left antrum was more commonly affected than the right one, and bilateral involvement was rare. Among the 43 reported cases including the current case, only two involved both sides.[9,19]

The clinical and radiographic features of CGMS are nonspecific, and, therefore, the preoperative diagnosis of CGMS is rarely suspected. Clinically, patients affected by CGMS generally reported vague and nonspecific symptoms. Nasal discharge, nasal obstruction and congestion, postnasal drip, facial pain and headache, and otalgia were the most common reported symptoms (see Table 1). Other less common symptoms including foul smelling, cheek swelling, and epistaxis were also reported. However, a clear golden-yellow rhinorrhea and the appearance of a clear yellow fluid when antral washout is performed were reported to be good specific evidences for the presence of CGMS.[9] Interestingly, in the present case, the patient reported no symptoms, and the diagnosis of CGMS was an incidental finding. Asymptomatic CGMS was reported in only one previous case.[10] However, opacity of the sinus in that case was seen radiographically in comparison with no radiographic findings in the present case. This may suggest that the lesion was still in an early phase to cause any clinical or radiological changes. As with the clinical features, the radiographic findings of CGMS are also generally nonspecific and cannot be differentiated from allergic or inflammatory sinus diseases.[21] Most common changes are antrum opacification and cystic appearance,

TABLE 1 Features of Reported Cases of Maxillary Sinus Cholesterol Granulomas

Authors	Year	Age	Sex	Clinical Presentation	Radiographic Features	Follow-Up
Graham and Michaels[10]	1978	33	M	Painful cheek	Shadow in inferior part	4 months, NR
≈	1978	33	M	Incidental finding	Opacity	4 years, NR
≈	1978	41	M	NOB	Opacity, cystic lesion, thin wall of bone	NA
≈	1978	33	M	Redness and itching of eyes	Opacity	NA
≈	1978	27	M	NOB, yellowish ND	Opaque left antrum, fluid level in right antrum	3 months, NR
Hellquist et al.[11]	1984	64	F	Recurrent nasal polyps	Opacity	11 years, NR
≈	1984	54	M	NOB, foul-smelling ND	Opacity	3 years, NR
≈	1984	27	M	Cheek swelling	Cystic lesion with bony destruction	NA
Milton and Bickerton[12]	1986	56	F	Otalgia	Opacity, STM, and partial wall destruction	NA
≈	1986	39	M	Otalgia and discharge	Opacity	11 years, NR
≈	1986	35	M	Facial pain	Shadow in inferior part	NA
≈	1986	41	M	Right NOB, fullness of both ears	Expanded	2 years, NR
≈	1986	31	M	PND, ND	Opacity	1 year, NR
≈	1986	45	F	PND, NOB, otalgia	Opacity	2 years, NR
≈	1986	39	M	Facial pain, headache	Deformed, cystic lesions with bony partition	NA
≈	1986	33	M	Redness of eyes	Opacity	NA
≈	1986	27	M	NOB, ND, headache	Bilateral antral lesions	NA
Gatland et al.[13]	1988	70	M	Cheek swelling	STM, ballooning out with expansion	2 years, NR
Gunes et al.[14]	1988	34	M	Pain above the eyes, eyes watering	Cystic lesion	NA
Rath-Wolfson et al.[15]	1993	14	F	Nasal mass, NOB	Opacity	3 years, NR
≈	1993	24	F	Nasal mass, NOB	Opacity	2 years, NR
≈	1993	70	F	Headache, PND	Opacity	2 years, NR
Erpek and Ustün[16]	1994	35	M	Headache, NOB	Cystic lesion, opacity	NA
Dilek et al.[17]	1997	37	M	Headache, NOB	Opacity	NA
Kunt et al.[18]	1998	28	M	Pain below the eyes	Cystic lesion	6 years, NR
≈	1998	34	M	Pain above the eyes, eyes watering	Bilateral cystic lesions	2 years, NR
≈	1998	34	M	NOB, pain above the eyes	STM with erosion of medial wall	3 years, R
≈	1998	61	M	NOB, PND, headache	Cystic lesion	2 years, NR
≈	1998	26	M	Headache, PND, epistaxis	Opacity, mass with wall destruction	1 year, R
≈	1998	50	M	Headache, PND, NOB	Cystic lesion	6 months, NR
Xu and Jin[19]	1998	38	M	NOB, ND, headache	STM	NA
≈	1998	45	F	NOB, headache	Cystic lesion	NA
Sarioglu et al.[20]	2001	58	M	NOB, headache, PND	Opacity	NA
Leon et al.[21]	2002	38	M	Frequent headache	Opacity	NA
Kikuchi et al.[22]	2002	52	F	Orbital pain	STM	NA
Chao[9]	2005	42	M	Blood-tinged sputum, golden-yellow ND	Cystic lesions	14 months, NR
≈	2005	56	F	Blood-tinged sputum, foul smelling	Cystic lesions, bilateral	2 months, NR
Bella et al.[23]	2005	63	F	Pain, PND, NOB	Mass destroying the lateral nasal cavity wall	1 year, NR
Ramani et al.[24]	2006	42	M	Headache and nasal congestion	Opacity with mucosal thickening	NA
Marina and Gendeh[25]	2006	NA	NA	Resembling sinusitis	Cystic lesions, bilateral	NA
Ko et al.[26]	2006	34	F	NOB, facial pain	Opacity, STM	3 years, NR
Almada et al.[27]	2008	22	M	Swelling, pain, and NOB	Opacity with bone expansion and erosion	NA
Present case	2008	60	F	Incidental finding	No radiographic changes	6 months, NR

NA = not available; ND = nasal discharge; NOB = nasal obstruction; NR = no recurrence; PND = postnasal drip; R = recurrence; STM = soft tissue mass.

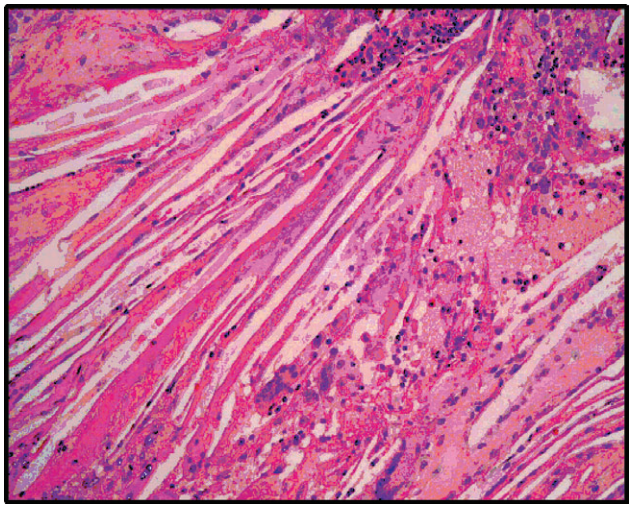

Figure 1 Histopathologic features of cholesterol granuloma; microscopic examination of the obtained tissue revealed multiple cholesterol clefts surrounded by granulation tissue and foreign-body giant cells.

while other less common features include bone expansion and erosion.[16] CT scanning usually reveals nonspecific findings. However, MRI was reported to be more accurate in the diagnosis of CGMS because of its characteristic findings of increased signal intensity in both T1 and T2 weighted images surrounded by low-intensity peripheral zone. These features are characteristic and sufficiently distinctive to allow differentiation from other expanding lesions.[21] The marked increase in the signal intensity in T1 and T2 weighted images can be attributed to the paramagnetic effect of hemoglobin breakdown products derived from microhemorrhages around cholesterol crystals.[21] However, histological examination remains the "gold standard" for the definitive diagnosis of CGMS. The findings of abundant cholesterol clefts surrounded by granulation tissue and foreign-body type giant cells and mixed chronic inflammatory cell infiltrate in addition to localized old and recent microhemorrhages are characteristics.

Regarding the pathogenesis of CG, it has not yet been clarified. Most authors highlighted the importance of disturbed ventilation, inadequate drainage, and hemorrhage into bony cavity as the factors responsible for the development of CG.[9] It seems that the interactive effect of these factors contributes to cholesterol crystals precipitation and subsequent granuloma formation. Poor ventilation of normally aerated bony cavity will lead to decrease in the atmospheric pressure; this will induce mucosal edema with breakdown of mucosa and blood vessels. Products originating from these events are thought to be the main source of cholesterol. Cholesterol needs to precipitate as crystals to initiate the localized inflammatory reaction that eventually form CG.[17] Cholesterol is also relatively insoluble and needs time to dissociate from lipoprotein complexes and precipitate as crystals. Slow drainage of the sinus will provide the time needed for cholesterol to dissociate and precipitate as crystals that will initiate the granulomatous response and granuloma formation.[17] Therefore, it seems that CG is an end product of a chronic inflammatory process leading to hemorrhage in a closed cavity or space.

The prognosis of CGMS is good; only two cases of recurrence were reported so far (5%, 2/41).[20] The benign features of the lesion combined with its low recurrence rate indicate that complete surgical excision, either through Caldwell-luc or endoscopic approaches,[22] is the recommended treatment. It is unlikely that this lesion will affect the prognosis of the inserted implant in the present case.

In conclusion, CG of maxillary sinus can be an incidental finding, and we cannot rely on clinical and radiological features for the definitive diagnosis of CG. Diagnostic features of CG are nonspecific and can be mistaken for the more common sinus diseases. For this reason, the final diagnosis can only be achieved after examination of the material under the microscope.

REFERENCES

1. Hirshberg A, Dayan D, Buchner A, Freedman A. Cholesterol granuloma of the jaws. Report of a case. Int J Oral Maxillofac Surg 1988; 17:230–231.
2. Loeffler KU, Kommerell G. Cholesterol granuloma of the orbit – pathogenesis and surgical management. Int Ophthalmol 1997; 21:93–98.
3. Rubinstein A, Brenner S. Idiopathic lipogranulomatosis of spleen and periaortic lymph nodes with non-caseating granulomas of the liver. Hum Pathol 1982; 13:1133–1135.
4. Nast CC, Cohen AH. Renal cholesterol granulomas: identification and morphological pattern of development. Histopathology 1985; 9:1195–1204.
5. Morioka T, Fujii K, Nishio S, et al. Cholesterol granuloma in the middle cranial fossa: report of two cases. Neuroradiology 1995; 37:564–567.
6. Osada T, Kitayama J, Nagawa M. Cholesterol granuloma of the breast mimicking carcinoma: report of a case. Surg Today 2002; 32:981–984.
7. Lin JI, Tseng CH, Marsidi PJ, Bais VC. Cholesterol granuloma of right testis. Urology 1979; 14:522–523.

8. al-Amer AF, Walia HS, Madda JP. Cholesterol granuloma of the peritoneum. Can J Surg 1990; 33:410–413.
9. Chao TK. Cholesterol granuloma of the maxillary sinus. Eur Arch Otorhinolaryngol 2006; 263:592–597.
10. Graham J, Michaels L. Cholesterol granuloma of the maxillary antrum. Clin Otolaryngol Allied Sci 1978; 197:155–160.
11. Hellquist H, Lundgren J, Olofsson J. Cholesterol granuloma of the maxillary and frontal sinuses. ORL J Otorhinolaryngol Relat Spec 1984; 46:153–158.
12. Milton CM, Bickerton RC. A review of maxillary sinus cholesterol granuloma. Br J Oral Maxillofac Surg 1986; 24:293–299.
13. Gatland DJ, Youngs RP, Jeffrey IJ. Cholesterol granuloma of the maxillary antrum. J Otolaryngol 1988; 17:131–133.
14. Gunes HA, Almac A, Canbay E. Cholesterol granuloma of the maxillary antrum. J Laryngol Otol 1988; 102:630–632.
15. Rath-Wolfson L, Talmi YP, Halpern M, Levit I, Zohar Y, Gal R. Cholesterol granulomas of the maxillary sinus presenting with nasal obstruction. Otolaryngol Head Neck Surg 1993; 109:956–958.
16. Erpek G, Ustün H. Cholesterol granuloma in the maxillary sinus. Eur Arch Otorhinolaryngol 1994; 251:246–247.
17. Dilek FH, Kiris M, Ugras S. Cholesterol granuloma of the maxillary sinus. A case report. Rhinology 1997; 35:140–141.
18. Kunt T, Ozturkcan S, Egilmez R. Cholesterol granuloma of the maxillary sinus: six cases from the same region. J Laryngol Otol 1998; 112:65–68.
19. Xu W, Jin X. Cholesterol granuloma of the maxillary sinus: 2 cases report. Lin Chuang Er Bi Yan Hou Ke Za Zhi 1998; 12:549–551.
20. Sarioglu S, Pabuççuoglu U, Arzu Topal N. Cholesterol granuloma and aspergilloma of the maxillary sinus. Eur Arch Otorhinolaryngol 2001; 258:74–76.
21. Leon ME, Chavez C, Fyfe B, Nagorsky MJ, Garcia FU. Cholesterol granuloma of the maxillary sinus. Arch Pathol Lab Med 2002; 126:217–219.
22. Kikuchi T, So E, Ishimaru K, Miyabe Y, Abe K, Kobayashi T. Endoscopic sinus surgery in cases of cholesterol granuloma of the maxillary sinus. Tohoku J Exp Med 2002; 197:233–237.
23. Bella Z, Torkos A, Tiszlavicz L, Iván L, Jóri J. Cholesterol granuloma of the maxillary sinus resembling an invasive, destructive tumor. Eur Arch Otorhinolaryngol 2005; 262: 531–533.
24. Ramani P, Murugesan K, Chandrasekar T, Anuja N. Cholesterol granuloma of maxillary sinus. Int J Oral Maxillofac Surg 2006; 35:1063–1065.
25. Marina MB, Gendeh BS. Bilateral maxillary sinus cholesterol granuloma: a rare entity. Med J Malaysia 2006; 61:226–228.
26. Ko MT, Hwang CF, Kao YF, Lui CC, Huang CC, Peng JP. Cholesterol granuloma of the maxillary sinus presenting as sinonasal polyp. Am J Otolaryngol 2006; 27:370–372.
27. Almada CB, Fonseca DR, Vanzillotta RR, Pires FR. Cholesterol granuloma of the maxillary sinus. Braz Dent J 2008; 19:171–174.