Case Reports

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Fenestration is a logical and effective treatment for a large primordial cyst with cholesterol granuloma: a case report

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Abstract

A cholesterol granuloma (CG) is characterized by the presence of cholesterol crystals that cause a chronic granulomatous reaction in an enclosed space. It occurs most commonly in the head and neck region, particularly in the middle ear. Although CGs in the maxilla have also been reported, odontogenic cysts in conjunction with CGs in the maxilla are very rare. We herein present a case of a 72-year-old man who developed a large primordial cyst with a maxillary CG that extended into the maxillary sinus, nasal cavity, and infraorbital region, causing left-sided facial swelling and discomfort. We successfully controlled the symptoms and reduced the size of the lesion using the treatment approach for a common odontogenic cyst: fenestration followed by complete excision. This case suggests that fenestration is an effective technique to treat odontogenic cysts with CGs. Although the mechanisms underlying the pathogenesis and growth of CGs are still unknown, our report highlights a potential therapeutic approach for these lesions.

Keywords

Fenestration, cholesterol granuloma, odontogenic cyst, maxillary sinus, surgical excision, case report

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Introduction

A cholesterol granuloma (CG) is a histological lesion that causes a chronic granulomatous reaction in an enclosed space. The reaction is characterized by cholesterol crystals that form secondary to the deposition of hemosiderin and other blood products.[1] The lesion is histopathologically defined by the presence of giant cells, plasma cells, lymphocytes surrounding cholesterol clefts, and hemosiderin deposits.[2,3] Obstructed drainage and impaired ventilation are thought to be significant etiological factors of CGs.

CGs may occur in several areas of the body, including the brain, sella turcica, mastoid process, breast, lungs, and kidneys.[1] The most commonly affected area is the head and neck region, particularly the middle ear.

Previous reports have indicated that the presence of CGs and hemosiderin is strongly correlated in various odontogenic cystic lesions, most of which are inflammatory cysts. In contrast, noninflammatory cysts reportedly have fewer CGs.[4–6]

It is thought that trauma or previous surgery may cause blood products to be deposited in an enclosed space and eventually develop into a CG, but most cases do not have a clear history. Some authors have suggested that the presence of a CG might be involved in the growth of the lesion.[7,8]

We herein report a rare case of a large primordial cyst associated with a maxillary CG. Fenestration was effective in reducing the size of the lesion and eliminating it.

Case report

A 72-year-old man consulted our department because of a 2-month history of left-sided facial swelling and discomfort. The patient was a nonsmoker with no specific medical history and no previous facial trauma or surgery. On visual inspection, we also observed apraxia of eyelid opening, redness of the infraorbital region, and left-sided nasal obstruction. Intraoral examination revealed palatal swelling and parchment crepitation (Figure 1(a), (b)).

On orthopantomography, we found that the left maxillary sinus floor was extended downward; however, there was no destruction of the left maxillary alveolar bone (Figure 1(c)). Non-contrast computed tomography (CT) revealed a swollen, demarcated, and osteolytic lesion extending from the left maxilla into the maxillary sinus and further into the nasal cavity and orbit (Figure 1(d), (e)). The CT image indicated that the content of the lesion was a liquid of uniform concentration. Magnetic resonance imaging (MRI) showed intrinsic T2 high-signal intensity within the lesion to the same extent seen in the CT scan (Figure 1(f), (g)), also confirming its liquid content of uniform concentration and clear demarcation.

Fine-needle aspiration of the palatal swelling showed dark brown liquid contents. According to the cytologic analysis, the aspirated content comprised only histiocytes with phagocytosed blood components or hemosiderin. This finding suggested that the lesion was a cystic lesion with hemorrhage. After the fine-needle aspiration, the patient experienced a reduction in nasal obstruction and facial discomfort.

A fenestration procedure was performed under intravenous sedation. We approached the lesion through the vestibule of the left side of the maxilla, made a bone window, and removed the cyst wall as a biopsy specimen.

The biopsy specimen comprised cholesterol crystals and inflammatory granulation tissue. At 1.5 months after fenestration, the size of the cystic lesion had significantly decreased; however, the volume of the lesion had not decreased at 3 months after fenestration (Figure 2). We did not anticipate that the lesion would further decrease

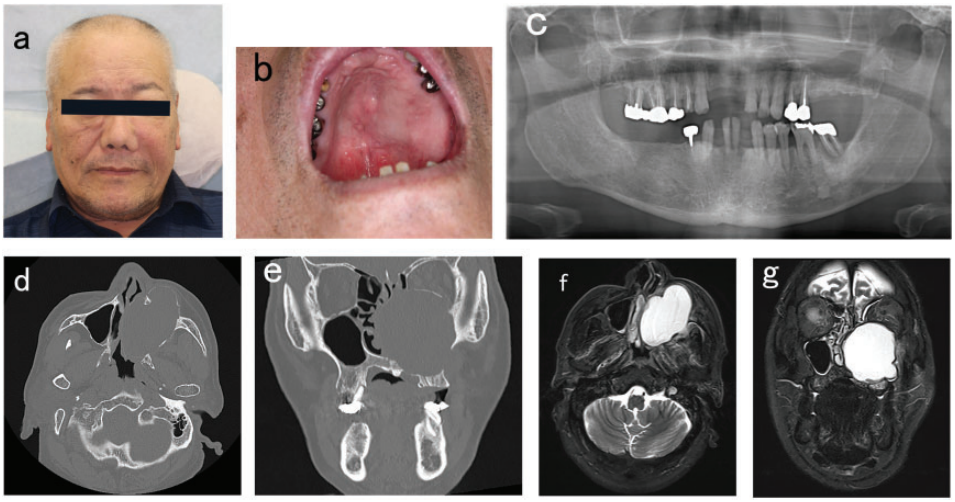

Figure 1. (a, b) Facial and intraoral photographs. (c) An orthopantomogram showing the left maxillary sinus floor extended downward. There was no destruction of the left maxillary alveolar bone. (d) Axial and (e) coronal views of computed tomography showed the lesion extending from the left maxilla into the maxillary sinus and further into the nasal cavity and orbit. Visibly, the content of the lesion is a liquid of uniform concentration. (f) Axial and (g) coronal views of magnetic resonance imaging showed intrinsic T2-weighted high signal intensity in the lesion extending from the left maxilla into the maxillary sinus and further into the nasal cavity and orbit. Visibly, the content of the lesion is a liquid of uniform concentration.

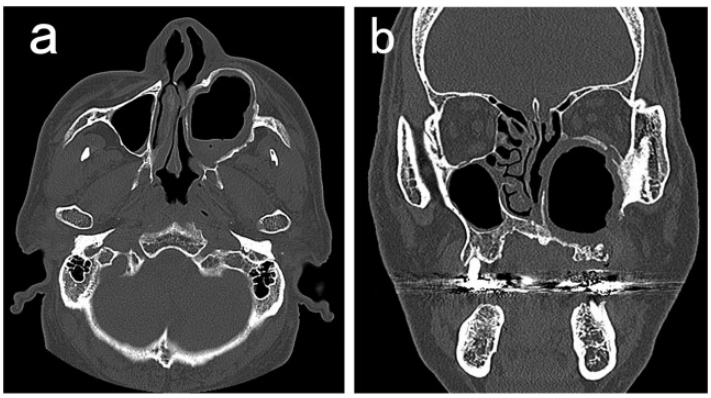

Figure 2. Computed tomography images 3 months after fenestration showing that the volume of the lesion had significantly decreased. (a) Axial view and (b) coronal view.

in volume; therefore, we completely resected it from the vestibule of the left maxilla through a fenestration site in a manner similar to the Caldwell–Luc procedure under general anesthesia 3 months after performing the fenestration (Figure 3).

The pathologic analysis of the resected lesion suggested that that the lesion was a CG and a cyst wall with cicatrices (Figure 4). The cyst wall was lined by non-keratinizing stratified squamous epithelium and pseudostratified ciliated

columnar epithelium. It was considered to be odontogenic epithelium because of the palisading basal layer. There was no dental hard tissue associated with the lesion; therefore, we diagnosed it as a primordial cyst. We assumed that development of the CG was associated with growth and development of the cystic region.

At 12 months after surgical resection, the orbital floor was decompressed and there was no apparent recurrence of the lesion (Figure 5).

The reporting of this study conforms to the CARE guidelines.[9]

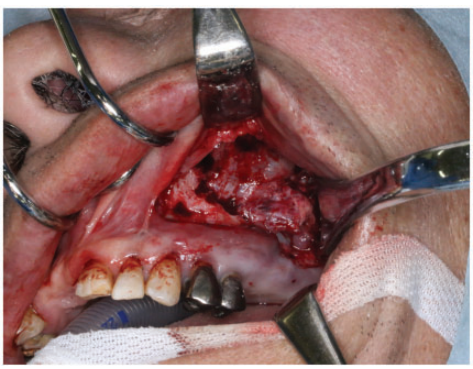

Figure 3. Intraoperative photograph.

Discussion

In the head and neck region, CGs rarely occur in the mid-face region and maxillary sinus. However, more than 50 cases of CGs in the sinus were reported in the English-language literature from 2005 to 2016.[10] The most subjective symptoms of CGs are proptosis, orbital pain, headaches, nasal obstruction, and rhinorrhea.[11,12]

The clinical features of CGs in the maxilla, including those of the maxillary sinus, are similar to the features of other cysts and inflammatory diseases of the maxilla and mandible, such as odontogenic keratocysts, ameloblastomas, and any other cyst.[10] The diagnosis of CG is mainly based on clinical observation and diagnostic imaging.[13] The differential diagnoses of CG include other odontogenic cysts and tumors in the maxilla that are difficult to diagnose using diagnostic imaging. MRI of CGs reveals well-defined lesions with high signal intensity on T1- and T2-weighted images. However, it is difficult to confirm that such a lesion is a CG based only on MRI because it is similar to other cyst-like lesions.

One report in the literature described a recurrent maxillary ghost cell odontogenic carcinoma with a CG of the maxillary sinus

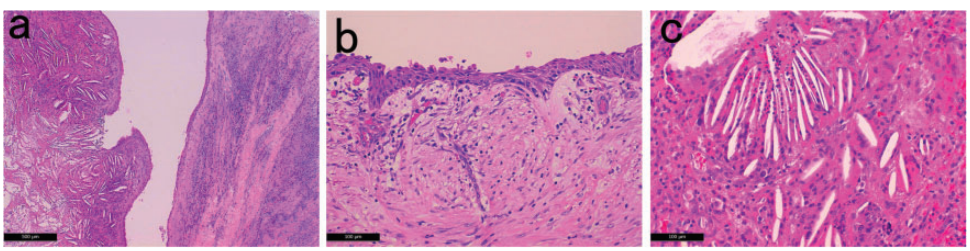

Figure 4. Histopathological findings with hematoxylin–eosin staining showed that the lesion was a cyst wall comprising fibrous tissue containing numerous cholesterol clefts. (a) Cholesterol granuloma and cicatrized cyst at low magnification under hematoxylin–eosin staining (scale bar: 500 μm). (b) The cyst wall was lined with non-keratinizing stratified squamous epithelium, and odontogenic features were present, such as hyperchromatic basal cells and a palisading basal layer under high-magnification hematoxylin–eosin staining (scale bar: 100 μm) and (c) The presence of foreign body giant cells around the cholesterol crystals indicated a region circumscribed by granulation with vascularity and hemorrhage under high-magnification hematoxylin–eosin staining (scale bar: 100 μm).

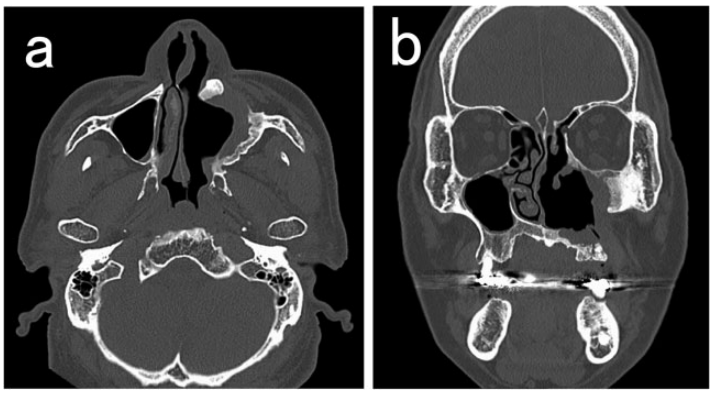

Figure 5. Computed tomography images 12 months after surgical resection showing that the lesion had been completely resected and that there was no apparent recurrence. (a) Axial view and (b) coronal view.

diagnosed with a calcifying epithelial odontogenic tumor.[14] Ghost cell odontogenic carcinoma has a high rate of recurrence, although it is a rare malignant tumor. Therefore, achieving a correct pathologic diagnosis is critical in determining whether a lesion is a malignant tumor, benign tumor, or other cystic lesion.

Considering the mechanism of CG development,[15] the maxillary sinus, which is surrounded by mucosa and is a largely closed cavity, is considered to be an environment in which CGs can easily develop. However, actual reports of CGs occurring in the maxillary sinus are rare.

Notably, several reports have described CGs with sinus polyps.[16,17] An antrochoanal polyp is a polyp of the maxillary sinus that extends to the choana through the sinus ostium. A polypoid mass in the maxillary sinus can be removed using endoscopy; similarly, there are reports of CG removal by endoscopic sinus surgery.[11,18] A polypoid mass such as an antrochoanal polyp might increase the pressure in the nasal cavity in the presence of abundant blood flow within a confined space. Although a single CG lesion and polyp-forming lesions in the maxillary sinus have been reported, our case involved an odontogenic cyst with a CG that extended into the maxillary sinus.

Among odontogenic cysts, there are a few reports of odontogenic cysts with CGs; however, reports of noninflammatory odontogenic cysts with CGs extending into the maxillary sinus are very rare.[1] Odontogenic cysts, such as dentigerous cysts, odontogenic keratocysts, and radicular cysts, contain cholesterol crystals. The presence of cholesterol clefts was historically considered a characteristic of odontogenic cysts, but this is now considered nonessential.[4,6] The cholesterol crystals are dissolved during tissue processing, and hematoxylin and eosin staining of paraffin sections shows the needle-shaped empty spaces formerly occupied by the cholesterol crystals; these are called cholesterol clefts and are observed in the cyst wall and cavity. It is thought that these cholesterol crystals may act as a stimulus, triggering a foreign body-type giant cell response, especially in inflammatory odontogenic cysts.[4–6] In odontogenic cysts, cholesterol is thought to be derived from erythrocytes[4]; however, if the only source of the cholesterol is the membrane of the erythrocyte, the supply would be insufficient. Therefore, it is thought that cholesterol is supplied by plasma lipids, as in the case of the

extracellular matrix in atherosclerosis. Additionally, because foamy macrophages are also present in odontogenic cysts, cholesterol is also thought to originate from these cells.[4,6]

In a previous report, among six cases of CGs occurring in the wall of a noninflammatory odontogenic cyst, three were dentigerous cysts and the others were an ameloblastomatous calcifying odontogenic cyst and calcifying odontogenic cyst.[7] However, in our patient, the CG was present in a primordial cyst, which is a noninflammatory odontogenic cyst. The coexistence of a CG and primordial cyst has never been reported (Table 1).

In previous reports describing the growth rate of CGs, it was suspected that CG formation in the wall of a cyst could work as a driving force for growth of the cyst with an inflammatory background.[7,8] The authors of one report suggested that perlecan, which is a basement membrane-type heparan sulfate proteoglycan, and low-density lipoprotein become localized in the cyst wall of immature granulation tissue and induce the expansion of a cystic lesion.[8] Low-density lipoprotein becomes oxidized in the extracellular space and is phagocytosed by macrophages. These lipid-laden macrophages then rupture and release free cholesterol into the extracellular space, where it crystallizes. The cholesterol crystals become lodged in inflammatory granulation tissue and induce further inflammatory reactions in the cystic wall.

In the present case, CT showed that the lesion extended from the left maxilla into the maxillary sinus and further into the nasal cavity and orbit. We did not examine the size of the lesion by serial imaging studies, and we cannot estimate the rate of enlargement because we do not know when the lesion occurred. However, we cannot deny the possibility that the lesion became enlarged because of the effects of

Table 1. Reported cases of cholesterol granulomas associated with odontogenic cysts in the maxillofacial region.

Authors	Year	Age (years)/ Sex	Site	Characteristics	Associated lesion	Treatment
Lee et al.[23]	2010	68/Male	Left anterior to posterior mandible	Cystic lesion	Dentigerous cyst	Resection of hemimandible
RamanPreet et al.[6]	2012	43/Male	Left posterior mandible	Cystic lesion	Dentigerous cyst	Surgical excision
Aparna et al.[24]	2013	68/Female	Right posterior mandible	Cystic lesion	Ameloblastomatous calcifying odontogenic cyst	Surgical excision
Kamboj et al.[7]	2016	45/Male	Right posterior maxilla	Cystic lesion	Calcifying odontogenic cyst	Surgical excision
Kamboj et al.[7]	2016	38/Female	Right posterior mandible	Cystic lesion	Dentigerous cyst	Surgical excision
Kamboj et al.[7]	2016	47/Male	Left posterior mandible	Cystic lesion	Dentigerous cyst	Surgical excision
Present case	2022	73/Male	Left posterior maxilla	Cystic lesion	Primordial cyst	Fenestration and surgical excision

cholesterol crystals in the cyst wall, as reported in the past.

For our patient, we chose fenestration before surgical excision because fenestration could relieve the enclosed environment and release the pressure within the lesion.

For any large odontogenic cyst, fenestration, decompression, and marsupialization are typically effective conservative surgical techniques.[19,20] Maxillary cysts have a lower reduction rate than mandibular cysts.[19] However, fenestration is an effective approach for large cysts in the maxilla because it does not affect the recurrence rate.[20]

In the present case, the size of the lesion significantly decreased after fenestration and biopsy. Fenestration is an effective approach to reduce the size of most if not all cysts, such as unicystic ameloblastoma, odontogenic keratocyst, and any other cystic lesion.[20]

Although there are a few reports on the recurrence of CG,[2,21] complete removal of the CG tissue is necessary to prevent its recurrence.[3] Surgical excision with curettage is a highly effective method of CG removal because it provides a low rate of recurrence without excessive bone removal.[1,3,21,22] CGs in the maxillary sinus have been excised using the Caldwell–Luc procedure or endoscopic endonasal surgery, and irrespective of the approach, its recurrence rate has been consistently low.[12]

Curettage or excision of the surrounding tissue can further reduce the risk of recurrence, but extended resection is often limited because of the structure of the surrounding tissue or the esthetic outcome, especially in the head and neck region. In the present case, which involved an odontogenic cyst with a CG, excision using the Caldwell–Luc procedure was performed and no recurrence was seen.

In conclusion, we treated an odontogenic cyst with a CG, which is thought to be related to the expansion of the lesion, that had largely extended into the maxillary sinus. We were able to control the size of the lesion after fenestration. Because fenestration can relieve pressure, it was considered a logical and effective first approach given the growth principles of CGs. When treating a large odontogenic cyst with a CG, we recommend that fenestration be considered as the first-choice treatment.

Ethics

Ethics approval was not required because of the nature of this study (case report).

Informed consent

The patient provided written informed consent for treatment and for publication of this case and his data for scientific purposes.

Declaration of conflicting interest

The authors declare no conflict of interest.

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